

Drinking water safety

Guidance to health and water professionals



WARNING!

Do not drink, cook or wash your tap water may be contaminated.

We will let you know when your water

- Do not drink your tap water
- Do not use your tap water for washing, bathing, cleaning teeth or preparing food
- Boiling will not purify the water
- We will make other water supplies available to you nearby
- You can still

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Water supplies are back to normal

Please run yo
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WARNING!

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your tap water may be contaminated.

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- You can still
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- You can s

WARNING!

**Do not drink
Do not cook**

your tap water may be contaminated.

We will let you know when your water is back to normal

- Do not drink your tap wa
- Do not use your tap water for cleaning teeth, washing wounds or preparing food
- Boiling will not purify the water
- Tap water may be used for general washing, bathing, toilet flushing
- We will make other water supplies available to you

Drinking Water Safety

Guidance to health and water professionals



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Table of Contents

Foreword	1
Introduction	3
How is drinking water quality regulated?.....	3
The legal framework – Drinking Water Inspectorate	3
The legal framework – Health Protection Agency	4
The legal framework – public water supplies	5
The legal framework – private water supplies	8
The legal framework – local authorities	8
Wholesome drinking water	9
Drinking water testing	9
The safety of drinking water	10
What if something goes wrong?.....	12
Protecting the public when something goes wrong.....	15
Notable learning points from significant incidents	18
Nature of the warning advice	18
Dissemination of warning advice.....	20
Provision of alternate supplies	21
Public information about drinking water quality	23
Improving drinking water quality	23
Consumer complaints	24
Other UK drinking water regulators	25
How do we control new and emerging issues approach and rationale?	25

Drinking Water Research	25
Drinking Water Quality and Health Research Programme.....	26
Annex 1: The Incident Assessment letter from the Drinking Water Inspectorate on the loss of supplies from Mythe water treatment works in July 2007.....	27
Annex 1 continued: Legal Advice to the Cabinet Office given during the Mythe Incident.....	47
Annex 2: The effectiveness of the drinking water quality regulations.....	49
Annex 3: Drinking Water Hazards.....	53
Annex 4: Drinking Water Safety Plan Methodology	69
Annex 5: Example of a notice issued by DWI to a water company	74
Annex 6: Content of Notifications about Drinking Water Quality Events	79
Annex 7: Examples of warning advice notices provided to consumers by water companies.....	81
Annex 8: Advice on precautions to be taken by the immunocompromised individual in relation to boil water notices.....	96



Foreword

September 2009

In 2007 there was a major water supply incident involving the loss of water supplies to 160,000 properties in Cheltenham, Gloucester, Tewkesbury and a large part of rural Gloucestershire due to the waterworks being inundated with flood water. The assessment of this incident by the Drinking Water Inspectorate (DWI) is reproduced at Annex 1. Subsequent to this, and other incidents, national level discussions between DWI and the Health Protection Agency (HPA) led to an agreement to prepare and publish joint guidance to health and water professionals in support of drinking water quality risk assessments and the issuing of consumer protection advice.

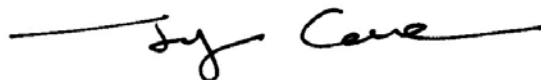
In developing this guidance we recognised the need to set out for health professionals the structure and legal framework of the water industry in England and Wales, and to describe the arrangements in place for securing the quality and safety of drinking water on a day-to-day basis. It is against this background that consultants in communicable disease control, and other health professionals, may be called upon to give public health advice to the water industry and local government on consumer protection in relation to a water supply incident. We also felt that this information would provide health professionals with useful context to the publication, *Drinking Water*, that they receive each year from the Chief Inspector setting out the annual results of drinking water tests and documenting the learning from water quality incidents.

This guidance document closely follows the structure of *Drinking Water Standards and Science*, published in 2005 by DWI and made available through the Internet and public

libraries, to inform the public how drinking water is regulated, safeguarded and improved where necessary. It is intended that DWI will keep the internet version of this guidance document under regular review and notify all water and health professionals of any updates.

In their day-to-day role, water quality scientists in the water industry work closely with health professionals in the HPA and local authorities. We consider the maintenance of sound working relationships to be very important to the delivery of effective and timely responses to water quality incidents and emergencies. In our opinion, this guidance, together with Regulation 27 Water Supply Risk Assessments (based on WHO Water Safety Plan Methodology), should form the basis of regular dialogue at local level to develop collective knowledge, understanding and trust.

In the preparation of this guidance it has been uppermost in our mind that the safety of drinking water in England and Wales is something the public is able to take for granted, because the day-to-day water supply arrangements in place are comprehensive and demonstrably based on sound science with a fully transparent system of independent scrutiny and appropriate sanctions in place. Accordingly, this guidance contains nothing new and we do not believe that its adoption will require any special action to be taken by the water industry or health professionals over and above its incorporation into existing training regimes, and its inclusion in water supply and public health operating and emergency management procedures.



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Drinking Water Inspectorate



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Chief Advisor
Health Protection Agency

Introduction

This document has been developed jointly by the Drinking Water Inspectorate (DWI) and the Health Protection Agency (HPA). It is intended to inform consultants in communicable disease control (CsCDC) and other health professionals about the structure and legal framework of the water industry in England and Wales. It also explains when and how CsCDC are likely to be called upon to give health protection advice about drinking water quality to the water industry, local authorities, consumers and DWI.

How is drinking water quality regulated?

The particularly important features of the drinking water quality legal framework are highlighted in this document. A paper demonstrating the effectiveness of the regime since its inception in 1990 can be found in Annex 2.

The legal framework – Drinking Water Inspectorate

DWI is the drinking water quality regulator for England and Wales. It was formed in 1990 on the privatisation of the water industry. It is part of the Department for Environment, Food and Rural Affairs (Defra), but its Chief Inspector is appointed by the Secretary of State for Environment, Food and Rural Affairs (in England) and the National Assembly for Wales, and acts independently of government. The overarching objective of DWI is to maintain public confidence in the safety and quality of public water supplies through the exercise of its powers of reporting, audit, inspection, enforcement and prosecution. In addition, drinking water Inspectors are scientists/engineers with considerable water supply and water quality monitoring experience, therefore DWI also has a role in providing government with advice on water supply and quality matters.

The regulatory framework for water supplies in England and Wales is set out in the Water Industry Act 1991 (the 1991 Act). The 1991 Act was amended by the Water Act 2003. The Act defines the powers and duties under which DWI operates and also the duties of water companies and licensees. Under the 1991 Act the authorities

responsible for regulating the quality of public supplies are the Secretary of State for Environment, Food and Rural Affairs (in England) and the National Assembly for Wales. DWI's website <http://www.dwi.gov.uk> holds the relevant legislation.

The legal framework – Health Protection Agency

The HPA is an executive non-departmental public body (NDPB) of the Department of Health created by the Health Protection Agency Act of 2004. The agency exists 'to help protect the health of everyone in the United Kingdom' and its functions specified in the Act include, among others, 'the protection of the community against infectious disease and other dangers to health' and 'the prevention of the spread of infectious disease'. The Chairman and members of the HPA board are appointed by the Secretary of State for Health and the devolved administrations. To exercise its functions, the Agency may engage in and commission research, obtain and analyse data, provide laboratory, technical and clinical services and provide training in areas covered by its functions. In practice this translates into providing advice and information to the public, professionals and government on health protection issues, based on scientific and health protection expertise. The HPA Act imposes a duty on both the Agency and other bodies to co-operate in the exercise of the HPA's functions.

The full text of the act can be found at http://www.opsi.gov.uk/acts/acts2004/ukpga_20040017_en_1 and the functions of the HPA in sections 1 to 4.

The HPA delivers its functions at local level through 27 Health Protection Units staffed by consultants in communicable disease control, epidemiologists, nurses, scientists and administrative staff.

Although the HPA is a United Kingdom body, health protection is structured differently in each of the devolved administrations.

In Wales, health protection is delivered by the National Public Health Service for Wales (NPHS) which provides the resources, information and advice to enable the Welsh Assembly Government, Health Commission Wales, Local Health Boards, local authorities and NHS Trusts to discharge their statutory public health functions.

Similar arrangements exist for Scotland and Northern Ireland. In Northern Ireland, the health protection function is delivered by the regional Health Protection Service of the Public Health Agency and in Scotland by Health Protection.

The legal framework – public water supplies

Under the 1991 Act a public water supply is one provided for the purposes of drinking, washing, cooking or food production by a statutorily appointed water company.

A licence can also be granted to a water company to supply water in part of another water company's supply area. This is known as an 'inset appointment'. Under the 2003 Act, non-domestic customers who use at least 50 Ml/year of water in a set of premises are able to purchase water from either their existing water company or from a licensed water supplier. There are two kinds of licence: a retail water supply licence (the holder can buy and sell water) and a combined licence (the holder can introduce its own source of water into the network, as well as buying and selling water). Licences are under the control of Ofwat, the economic regulator for the water and sewerage industry in England and Wales. Ofwat's main purpose is to set water prices (bills) and to ensure the water companies are adequately financed to meet their duties. The quality of water resources (groundwater, rivers, streams, lakes, raw water reservoirs) is regulated by the Environment Agency (EA), a non-departmental public body of the Department of Environment, Food and Rural Affairs and an assembly-sponsored body of the National Assembly for Wales. All three water regulators (DWI, Ofwat, EA) have separate duties, but they co-operate over matters of common interest through Memoranda of Understanding. More information can be found at <http://www.environment-agency.gov.uk/> and <http://www.ofwat.gov.uk/>

In 2009, the structure of the water industry in England and Wales consisted of ten water and sewerage undertakers, 12 drinking water only undertakers and three other regulated water companies, as shown in the map below. General facts and news about the water industry can be found on the website of Water UK (<http://www.water.org.uk>), the national water industry body.

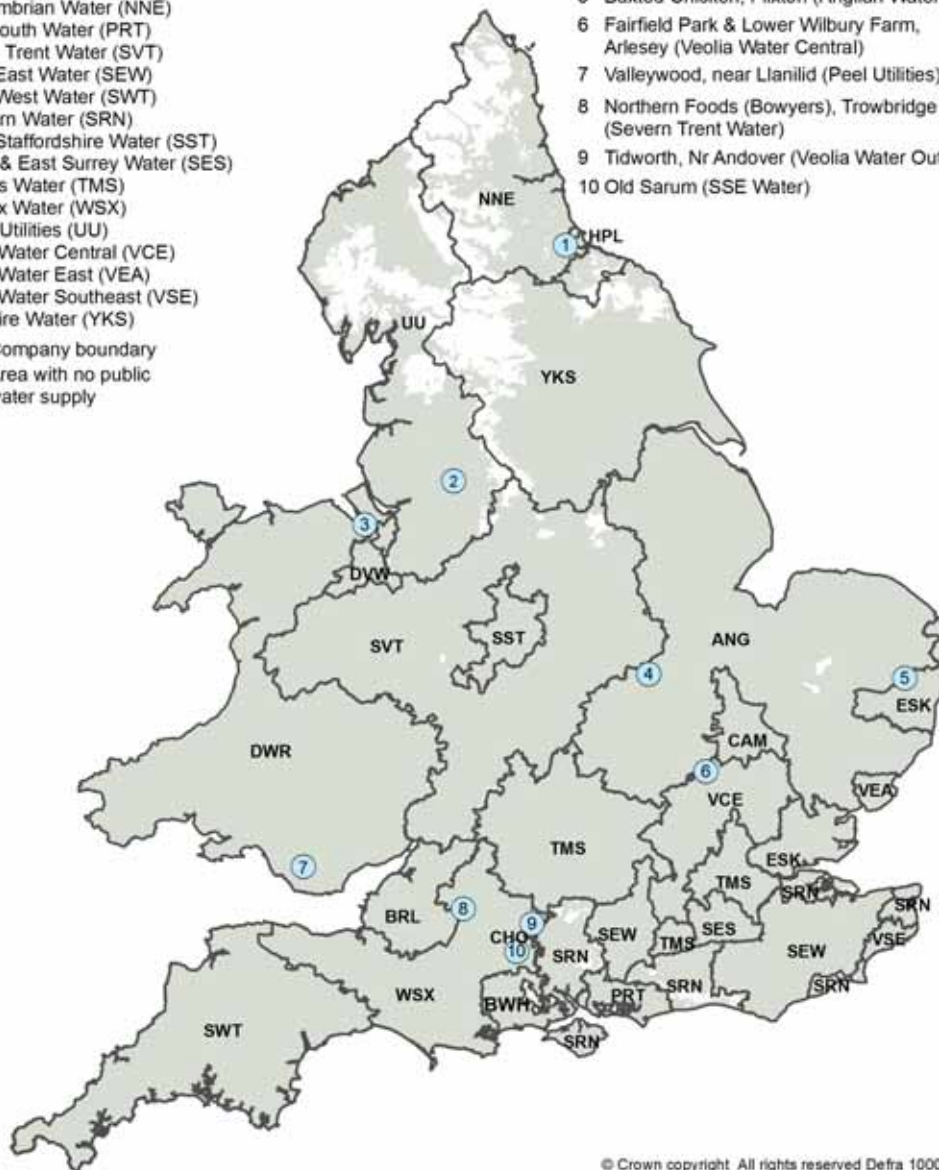
Key

- Anglian Water (ANG)
- Bournemouth & West Hampshire Water (BWH)
- Bristol Water (BRL)
- Cambridge Water (CAM)
- Cholderton District Water (CHO)
- Dee Valley Water (DVW)
- Dŵr Cymru Welsh Water (DWR)
- Essex & Suffolk Water (ESK)
- Hartlepool Water (HPL)
- Northumbrian Water (NNE)
- Portsmouth Water (PRT)
- Severn Trent Water (SVT)
- South East Water (SEW)
- South West Water (SWT)
- Southern Water (SRN)
- South Staffordshire Water (SST)
- Sutton & East Surrey Water (SES)
- Thames Water (TMS)
- Wessex Water (WSX)
- United Utilities (UU)
- Veolia Water Central (VCE)
- Veolia Water East (VEA)
- Veolia Water Southeast (VSE)
- Yorkshire Water (YKS)

- Company boundary
- Area with no public water supply

Key

- Inset appointments
- 1 Wynyard Business Park, Nr Wolveston (Hartlepool Water)
 - 2 Media City, Salford (Peel Utilities)
 - 3 Shotton Paper Works, Shotton (Albion Water)
 - 4 Long Croft Rd & Priors Hall, Corby (Independent Water Networks Limited)
 - 5 Buxted Chicken, Flixton (Anglian Water)
 - 6 Fairfield Park & Lower Wilbury Farm, Arlesey (Veolia Water Central)
 - 7 Valleywood, near Llanilid (Peel Utilities)
 - 8 Northern Foods (Bowyers), Trowbridge (Severn Trent Water)
 - 9 Tidworth, Nr Andover (Veolia Water Outsourcing)
 - 10 Old Sarum (SSE Water)

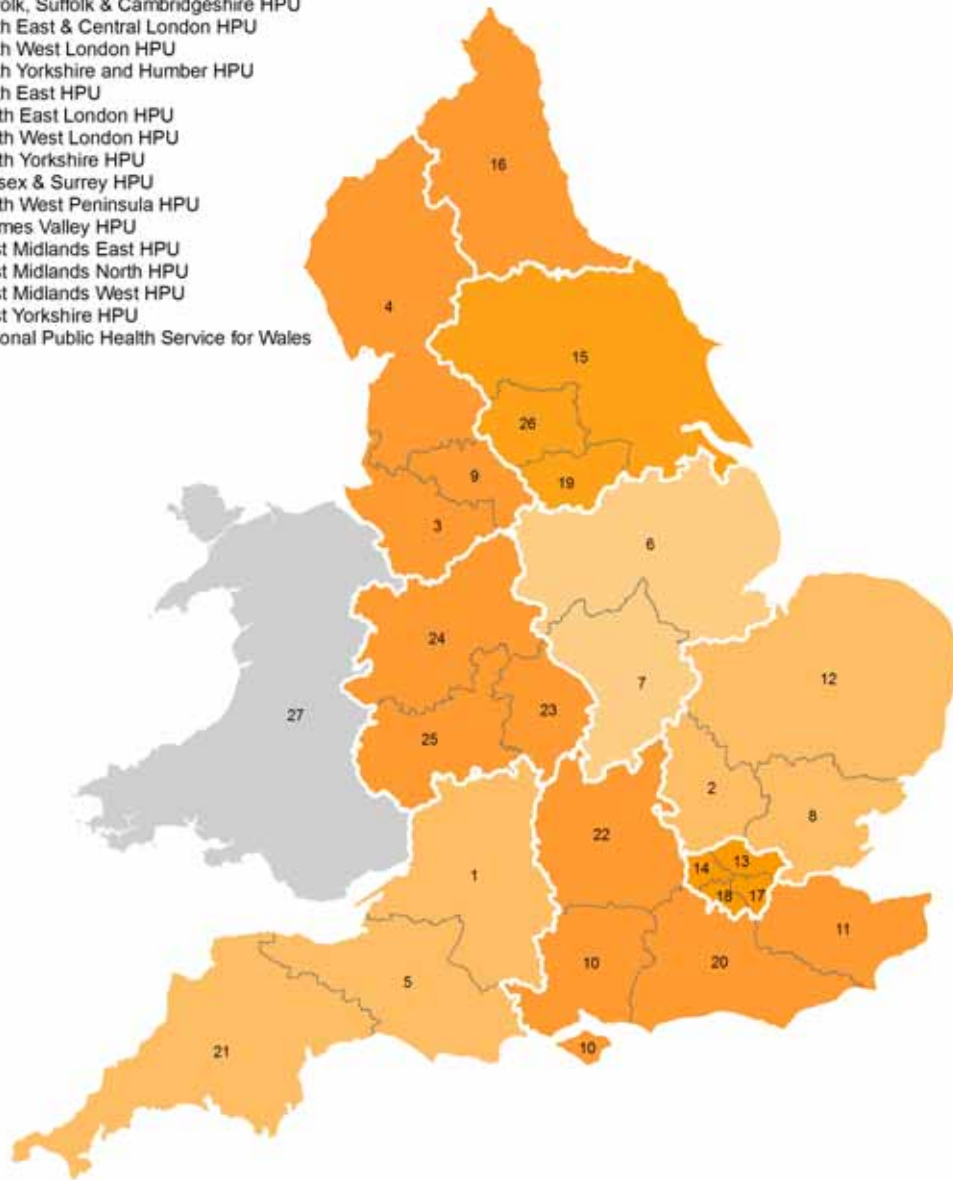


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Boundaries for Health Protection Units within the HPA

Key

- 1 Avon, Gloucestershire & Wiltshire HPU
- 2 Bedfordshire & Hertfordshire HPU
- 3 Cheshire & Merseyside HPU
- 4 Cumbria & Lancashire HPU
- 5 Dorset & Somerset HPU
- 6 East Midlands North HPU
- 7 East Midlands South HPU
- 8 Essex HPU
- 9 Greater Manchester HPU
- 10 Hampshire & Isle of Wight HPU
- 11 Kent HPU
- 12 Norfolk, Suffolk & Cambridgeshire HPU
- 13 North East & Central London HPU
- 14 North West London HPU
- 15 North Yorkshire and Humber HPU
- 16 North East HPU
- 17 South East London HPU
- 18 South West London HPU
- 19 South Yorkshire HPU
- 20 Sussex & Surrey HPU
- 21 South West Peninsula HPU
- 22 Thames Valley HPU
- 23 West Midlands East HPU
- 24 West Midlands North HPU
- 25 West Midlands West HPU
- 26 West Yorkshire HPU
- 27 National Public Health Service for Wales



The legal framework –private water supplies

The 1991 Act defines water supplies that are not provided by statutorily appointed water companies as private water supplies. Private water supplies are highly variable in their circumstances and size. About one per cent of the population rely on a private supply and most of these are in rural and remote parts of the countryside. However, many more people will have some contact with private water supplies as these can be used in the manufacture of certain foods and beverages, and serve various public buildings such as hospitals and hotels or, more commonly, campsites and leisure parks.

The quality of private water supplies is the responsibility of local authorities through implementation of the Private Water Supplies Regulations 1991. These regulations are being updated by Defra and will be replaced by the Private Water Supplies Regulations in 2009 (England) and 2010 (Wales)¹. The drinking water standards which are applied to private supplies are the same as those for public supplies, but for the smallest public supplies much more emphasis is placed on risk assessment and risk mitigation rather than very occasional monitoring. The role of DWI in respect of private supplies is to provide expert technical advice to local authorities, ensuring consistency of interpretation of drinking water legislation. In future, the DWI will be responsible for collecting information from local authorities about private water supplies and reporting this annually alongside information about public water supplies. The regulations and guidance will be available on the DWI website. For the majority of CsCDC, their most common involvement with drinking water is likely to be giving health protection advice to a local authority in respect of a private water supply.

The legal framework – local authorities

The 1991 Act places responsibility on local authorities for checking the safety and sufficiency of all water supplies in their area. For public water supplies this means that local authorities must have effective working arrangements in place with all water companies and licensees who supply water in their area.

¹ Anticipated dates for implementation. The regulations will be called the Private Water Supplies Regulations (2008) in England and Private Water Supplies (Wales) Regulations 2009 in Wales.

Wholesome drinking water

By law (the 1991 Act), drinking water must be wholesome at the time of supply. Wholesomeness is defined by reference to drinking water quality standards and other requirements set out in the Water Supply (Water Quality) Regulations 2000 (as amended) which apply in England and the Water Supply (Water Quality) Regulations 2001 (as amended) which apply in Wales. These regulations are available on the DWI website (www.dwi.gov.uk). Many of the standards come from the 1998 European Drinking Water Directive which came into force fully on 25 December 2003. The Directive focuses on those parameters of importance to human health, but it also includes others that relate to the control of water treatment processes and the aesthetic quality of drinking water.

The Directive allows Member States to set additional or tighter national standards to secure the good quality of drinking water already achieved and to prevent it from deteriorating in the future. More information on the Directive standards is given in Annex 3 together with information about other substances that may be found in water and waterborne pathogens.

Drinking water testing

Water companies have a duty to collect samples and test these for each of the substances and organisms (known as parameters) in the regulations. Approximately 2.5 million tests are carried out each year at consumers' taps, service reservoirs and treatment works. Companies must make the results of this testing available to their customers on request. The Inspectorate's role is to carry out independent checks to ensure this testing is being carried out to a high standard of quality control, for example laboratories are accredited through the United Kingdom Accreditation Service (UKAS) to the standard recognised for drinking water (DWTS), or follow recognised methods of water analysis, such as those published by the Standing Committee of Analysts (SCA) or the British Standards Institute. In respect of testing drinking water, the work of drinking water Inspectors is aimed at providing public reassurance that the robustness and integrity of water company results is beyond question. DWI does not routinely test drinking water, although it has the power to commission independent tests if there is a compelling public interest reason for doing so.

Water companies are required to provide DWI with full details of their annual monitoring programme in advance and the results of these tests are subsequently transferred electronically to DWI on a month by month basis. DWI publishes a summary of the results of a water company's monitoring annually on its website and in the form of a CD sent to each local authority and to each CCDC of the HPA/NPHS.

Local authorities must also have in place robust arrangements for taking and analysing samples from private water supplies. They do not have their own laboratories so, generally, local authorities will use an accredited laboratory of a water company and, to a lesser degree, may send samples to a public analyst or NHS/NPHS/HPA laboratory. Local authorities are able to charge private water supply owners and users for monitoring their water supply. There is no legal requirement on local authorities to sample public water supplies, but some have done so traditionally and most will take samples when acting to resolve a water quality problem within a public building or in respect of social housing.

The safety of drinking water

The regulations make specific provisions for drinking water safety and require water companies to implement a risk management (water safety plan) approach to water production and distribution as recommended by the World Health Organisation (2004 WHO Guidelines for Drinking Water Quality). See Annex 4 for more information on the latest authoritative guidance from WHO on Water Safety Plan methodology.

Water companies are required to have adequate water treatment in place, informed by a regulatory, raw water monitoring programme. They must disinfect all water before supplying it and, where necessary, subject the water to sufficient preliminary treatment to prepare it for disinfection. As a minimum this must ensure that the turbidity of water is $<1 \text{ NTU}^2$ prior to disinfection. The method of disinfection is not set out in law, but DWI require water companies to document their disinfection policy generally and to define this in documents and through written procedures for each treatment works.

² NTU is the abbreviation for Nephelometric Turbidity Units, a measure of the cloudiness of water.

For every treatment works and associated water supply system, water companies have to carry out and keep up-to-date a risk assessment to establish whether there is a significant risk of supplying water that would constitute 'a potential danger to human health'. Reports on these risk assessments are submitted to DWI and are subject to audit and enforcement action where necessary. Potential danger to human health is a term which derives from the Drinking Water Directive. In practice, in the UK, this term is understood better as a potential risk to public health generally. It is not a consideration of the medical needs of a particular individual. Likewise, the risk assessment is concerned with the human population. There is no requirement to assess the risk to pets, livestock or fish.

As well as covering microbiological, chemical and radiological hazards, regulatory risk assessments also cover other physical and organisational hazards which may result in a failure of the water supply (no water) or consumers rejecting the water for aesthetic reasons. Where an unacceptable risk is identified, water companies must put in place an urgent programme for mitigation and control, including, where necessary, short, medium and long-term improvement measures. DWI requires water companies to communicate effectively about their risk assessments with key stakeholders and this means that CsCDC and local authorities will be briefed on, and consulted about, each specific risk assessment for water supplies in their areas. Through these consultations, CsCDC have the opportunity to become familiar with the local water supply arrangements, to ask questions and satisfy themselves that it fully takes account of the public health needs of the local community. If a CCDC is not satisfied in this respect they should raise their concerns directly with DWI. The water company will be able to provide the name and contact details of their company Inspector who is the first point of contact within DWI for enquiries about a particular water supply. DWI has the power to issue notices directing a water company to take certain actions in respect of its risk assessments and any such notices are copied to the CCDC and local authority. An example template can be seen in Annex 5.

Other water safety requirements of the regulations include the fact that water companies must treat water to make it less aggressive towards lead and copper plumbing where this has been shown to be a problem with a specific water supply. There are also regulatory controls over the chemicals and materials of construction that water companies are permitted to use. DWI operates a national approvals system for chemicals and materials of construction, and the published list of approved chemicals and products is available on the DWI website. The Chemical Hazards and Poisons

Division (CHaPD) of the HPA provides toxicological advice to DWI in respect of decisions about the approval of materials.

Water undertakers that fail to adequately treat and/or disinfect their water supplies, or fail to take action in respect of their risk assessments, or who use unapproved chemicals or materials, may have committed a criminal offence. DWI Inspectors carry out independent technical audits of company records and sites to ensure that operational and management procedures are robust. If deficiencies are identified, DWI has the power to take enforcement action to require improvements to be made. DWI will notify the relevant local authority and CCDC of any such action.

It is not uncommon for a drinking water quality problem to be due to the condition of building water systems rather than the distribution system owned and operated by the water company. Water companies have powers (the Water Fittings Regulations 1999) to inspect premises to ensure the public water mains are protected by backflow devices or other means from any possibility of contamination from water used in industrial processes, wastewater or any private supply. Water companies have a programme of regular inspections of high risk building water systems in place and will carry out inspections in response to unexplained consumer complaints.

Water companies adhere to stringent hygiene procedures to ensure that none of their employees or contractors is allowed to work in restricted water supply areas if they are suffering from an infectious disease that may be waterborne. Water Hygiene training courses are delivered through Energy and Utility Skills. The course emphasises awareness of individuals' responsibilities towards the potable water supply and verifies that the employee has demonstrated an appropriate level of knowledge and awareness with regards to hygiene issues.

What if something goes wrong?

Section 70 of the 1991 Act makes it a criminal offence for a water company to supply water that is unfit for human consumption. However, the Act provides a defence for the water company if it can show that it had no reasonable grounds for suspecting that unfit water would be consumed, or it had taken all reasonable steps and exercised all due diligence to ensure that water was fit for human consumption on leaving its pipes. It is a regulatory duty on water companies to notify DWI of any event which has the potential to give rise to a significant risk to public health or otherwise cause consumers concern directly (appearance of water) or indirectly (adverse media comment). It is also a

regulatory duty for such events to be notified to local authorities, the CCDC (HPA in England, NPHS Wales) and the Consumer Council for Water. Others, including consumers, journalists and whistleblowers, can also make DWI aware of any actual or potential event.

Inspectors will assess the significance of all notified events on a risk-based approach. Where necessary, they will investigate and take enforcement action which may include initiating proceedings or issuing a caution or notice. In addition to the offence of supplying water unfit for human consumption in the Act, it is also a criminal offence for a company to fail to comply with Regulation 26 (adequate treatment and disinfection of water) or Regulation 31 (use of only approved chemicals and materials).

When conducting their investigation, Inspectors will gather evidence in the form of technical and management information from the company and through interviews of relevant persons, including members of the public, contractors, consultants and advisors, potentially including local authority and HPU staff. Inspectors are trained in, and follow, Police and Criminal Evidence Act (PACE) procedures. DWI publishes its findings and recommendations in the form of an Incident Assessment Letter (IAL) and copies of these are provided to the CCDC, local authority and Consumer Council for Water in the affected area.

Should an incident be very serious, for example a sizeable population without water for an extended period, or if an outbreak of mains water-related illness occurs or is suspected, then the water company will set up an Incident Management Team (WCo-IMT) tasked with issuing any short-term health protection warning to consumers and carrying out the necessary work to restore the water supply to normal. The WCo-IMT will include a senior scientist, whose role is to liaise with the CCDC and the local authority (environmental health team), to share all the scientific and technical information necessary to complete the health risk assessment that is needed to decide upon the need for health protection advice to be issued to consumers.

The water industry has arrangements in place to enable the rapid analysis of a range of contaminants that may result from the deliberate contamination of water supplies. The contractual arrangements are overseen by DWI and analysis can only be initiated by a DWI Inspector at the request of a named contact within a water company³.

³ For further details please see the paragraph referring to the 'Call off Contract' which is covered in the section '*Nature of the Warning Advice*'.

The Inspectorate also funds research into rapid analytical methods to support this contract.

If an outbreak of illness is confirmed, the HPU will convene its own Incident Management Team (HPA-IMT) under the chairmanship of the CCDC. In such cases the water company will continue to have its own WCo-IMT and there will be cross representation and close working. If a major emergency is declared, the HPA, as a 'category 1 responder', will implement its Incident and Emergency Response Plan. The water company will participate in the wider multi-agency emergency response and recovery work as a 'category 2 responder' as set out in the Security and Emergency Measures Direction (SEMD) under Section 208 of the Water Industry Act 1991, which is the water industry specific element of the Civil Contingencies Act Emergency Response and Recovery Guidance that supports the Civil Contingencies Act 2004.

One of the HPU's responsibilities in its HPA-IMT is to carry out a health risk assessment including detailed descriptive epidemiology and analytical epidemiology. This will involve a detailed questionnaire and, in the case of a microbiological contamination incident, is likely to include a case control study. For chemical contamination incidents a different approach may be required, including detailed descriptive and analytic epidemiology.

After an outbreak, traditionally the HPA-IMT has published a report of the case control study and any lessons learned. It is very important that if this is done, the report confines itself to the health study and does not include details about the water supply or its management, because these matters will be investigated and reported upon by DWI. It should be noted that the DWI report on an incident usually takes the form of an IAL which will be sent to all the parties involved in the incident and will describe its findings, actions and conclusions. If the incident investigation leads to the initiation of proceedings in court, the DWI assessment letter will be issued only when the case had been concluded. It is recommended that the Chair of the HPA-IMT establishes direct contact with DWI when the HPA-IMT is first formed, to establish effective routes of ongoing communications throughout the work of the HPA-IMT. It was a recommendation of the Third Report of the Expert Group on Cryptosporidium in Water Supplies (the Bouchier Report) published in 1998, that any report by an HPA-IMT be submitted to the Chief Inspector so that DWI can issue guidance to the water industry in respect of any key learning points on the water supply aspects.

Up-to-date contingency plans should be maintained by all parties likely to be involved in Incident Management Teams and their validity should be rehearsed from time to time. Should an incident escalate into an area or regional emergency, it is likely the police will institute a Strategic Coordinating Group (SCG) or Gold Command, on which both the water company and the HPA will be represented. Scientific and technical input to help decision making will be provided by a Scientific and Technical Advisory Cell (STAC) and will usually be chaired by the CCDC. It will report directly to the Gold Commander. It will be important that lines of communication between the water company and the HPA are established and that upwards communication of advice is provided at the local level. At national level, if the scale of the incident warrants it, the Civil Contingencies Secretariat may institute national response plans including regular meetings of the Civil Contingencies Committee (CCC) and the establishment of a Scientific Advisory Group for Emergencies (SAGE). For water emergencies, DWI would normally be invited to be a member of SAGE. Good communication between the STAC and the SAGE will be essential.

Protecting the public when something goes wrong

Due to the nature and complexity of operational activities involved in the supply of drinking water, water companies will take a number of actions to protect public health, such as the provision of advice to consumers, some examples of which are described below. On many occasions the company should, and will, notify health protection specialists (CsCDC) and local authority staff (EHOs) as part of this process. The purpose of this notification is to provide CsCDC and EHOs the opportunity to provide medical/public health advice to the company that is pertinent to the local community affected. However, the responsibility for issuing warning notices to consumers and providing alternative water supplies (rezoning, tankers, bowsers and bottles) rests, at all times, with the water company. An example of the notification template generated by DWI and circulated upon notification of an event affecting the quality or sufficiency of drinking water is provided in Annex 6.

As a matter of routine day-to-day water supply operations, temporary precautionary advice is issued by water companies to householders in the form of letters, leaflets or warning notices. The public is familiar with, and is therefore responsive to, such advice coming from their water supply company. Water bills sent to customers provide a number to ring to report a problem with the water supply and this information is also

published in telephone directories. Most water companies have a website which provides this information and which also provides a further route of contact for the public. Listed below are the typical situations where precautionary advice is issued, together with details of how this is done, who is involved and why.

Planned work on the water supply: advance notices are delivered to each building in the affected streets. The notice will give details of the work, particularly the timing of any shut down of the supply. For example, it may advise that water may be discoloured when the supply is restored and what to do if this does not clear on flushing the mains tap.

Unplanned disruption to the water supply: typically caused by a burst main. Customers ringing their water company will be given advice, often through a recorded message set up for particular post codes. The water company will notify the local authority and CCDC of any disruption which is likely to be protracted (i.e. difficult to repair) or attract adverse media comment (i.e. traffic congestion) or affect a large number of homes and businesses. Companies have direct arrangements for providing alternate supplies by tanker, bowser and bottles to priority customers such as hospitals and schools.

Adverse routine test result – single household: samples are taken at random from consumers' taps every day of the year. Adverse results are notified straightaway by the laboratory to the water company, the company will assess the risk to the consumer and arrange to collect further samples and will give advice to the householder about precautions to be taken until the cause of any problem has been identified. This advice is given verbally in the first instance, it may be to flush the tap before drawing water, or to boil the water before use, or not to use the water. In the latter case the water company will usually provide an alternate supply of water for drinking in the form of bottles.

The water company will notify the local authority and CCDC of the adverse result and the action being taken.

Consumer water quality complaint – single household: companies have risk assessment procedures in place to ensure that a water quality scientist is notified of any call from a customer attributing illness to the water supply, or reporting an objectionable taste or discolouration. If the problem is not clearly linked to a known operational problem, advice will be given over the phone and arrangements will then be made to either inspect the plumbing or collect samples or both. The water company will notify the local authority and CCDC of any adverse results. Customers reporting illness will be advised to

see their GP. If it is clear that the person has been diagnosed with a water-related illness (e.g. cryptosporidiosis) the CCDC will be notified straightaway.

Adverse sample result or some other type of problem affecting several properties or streets: during the investigation of an adverse result or consumer complaint at single household (see above), it may become evident to a water company that there is a risk of contamination of the wider water supply, typically as a result of an illegal cross connection or inadequate back flow arrangements or spillage of chemicals. In these situations the company will issue precautionary boil water or do not drink notices to several premises or streets as a precaution. Examples of these notices are given in Annex 7. The water company will provide alternate supplies in the same way as it does for an unplanned disruption (see above). When the situation is resolved, water companies will deliver a second notice to say that the water supply has been restored to normal.

The water company will notify the local authority and CCDC of the situation and the action being taken.

Adverse sample result or some other type of problem affecting a water treatment works or a service reservoir/water tower: the water company will establish an Incident Management Team for any event involving an actual or potential risk to the water supply from a strategic water asset. All relevant local authorities and CsCDC will be notified by the water company and advised of the immediate actions being put in hand. The company will make arrangements at this time for a meeting (or conference call) with CsCDC to discuss the risk assessment and the need for the public to be issued with precautionary advice.

In a large scale event, the hazards posed by issuing a wide scale warning notice need to be balanced carefully against the nature of the water supply incident. Experience has shown that it is often preferable to implement enhanced health surveillance of the affected community instead of issuing a warning notice. Each situation has to be judged on its merits, taking into account local knowledge and whether or not water supplies can be returned to normal quickly or an alternate piped supply provided (by rezoning). If a decision is taken to issue boil water or do not drink advice, the basis for lifting the advice must be agreed at the same time. Experience has shown that significant problems can arise if the criteria for lifting the notice have not been decided when it is first issued.

The responsibility for issuing warning notices and providing alternative water supplies (rezoning, tankers, bowsers and bottles) rests at all times with the water company.

Local authorities have responsibility for decisions about the continued operation of premises manufacturing or serving food and drink, and for public buildings such as schools and leisure centres. The CCDC is responsible for initiating contingency arrangements for hospitals and other health services. All responding agencies should ensure that only a common agreed form of public advice in the form of, for example, Frequently Asked Questions (FAQ) is provided to their staff in call centres or placed on websites.

Notable learning points from significant incidents

Two aspects of issuing warning advice to the public have proved problematic on more than one occasion in the past: the nature/type of the warning given and the provision of alternate supplies. The advice which follows draws not only on problematic incidents, but also those that were well managed.

Nature of the warning advice

When deciding on the advice to be given there is a choice to be made between one of three types of warning message:

- Boil before Use for drinking and food preparation (BWA).
- Do not use for Drinking or Cooking (DND).
- Do not use for Drinking, Cooking or Washing (DNU).

Whereas a BWA notice causes inconvenience in the home and can be disruptive to certain businesses (food and drink retailers and manufacturers) and public buildings (health care premises), the water industry has substantive experience of the practical aspects which are manageable and the public is familiar with the concept. By contrast, a DND notice poses a more significant challenge to a water supplier due to the need to make 100 per cent provision of alternative water supplies for drinking and cooking. These logistical problems are magnified and further compounded in the case of a DNU notice because of the hygiene issues implicit in restricting the public's access to piped water for showering and bathing. Furthermore, the public is unfamiliar with water restrictions of this nature and on a large scale, and a far wider range of businesses will be affected.

It is recommended that DNU notices are reserved for use only in those circumstances where there is unequivocal evidence of persistent contamination of the water supply with a substance (or radioactivity) at a level where short-term exposure is known to give rise to adverse health effects in the otherwise healthy population, and measures to restore the water supply to normal are likely to be protracted (weeks, rather than hours or days). Generally, the type of circumstances when a DNU notice might be considered are those where there is a major chemical pollution incident which cannot be contained by the water supplier through stopping abstraction at the treatment works and/or the contamination has entered the treated water distribution system and the extent of the contaminated water cannot quickly be identified and contained/removed.

Another relevant scenario would be where the contaminant cannot be detected by a change in appearance, taste or smell of water (meaning consumers would not be alerted to the problem and thus unlikely to take avoiding action without being warned).

In most water quality incidents, therefore, the decision about which warning notice to issue is a choice between a BWA and a DND. Where there has been a loss of supplies due to a failure of an asset, the water supplier will be able to access records of water fittings inspections and identify whether there are any premises in the affected area classified as high risk in terms of potential to cause water contamination due to back flow or back siphonage. All high risk premises are routinely inspected and checked to ensure adequate back flow protection is in place. Furthermore, a back flow incident is limited in scale impacting only on adjacent premises and streets in the immediate vicinity of the back flow site. Accordingly, a BWA notice (not a DND notice) is the most appropriate one to use in 'loss of supply' incidents. As with DNU notices, the use of a DND notice should be reserved for those situations to safeguard against exposure to chemicals at a level where short-term exposure is assessed as being likely to give rise to adverse health effects.

The above guidance relates to the general public and in any incident it is always important to separately consider the need to issue specific and different advice for vulnerable or sensitive users. This should always be done through pre-arranged communication routes and professional networks, e.g. by local authorities for food manufacturers/retailers, by CCDC through GPs or other established medical networks. Water suppliers have standing arrangements in place for notifying dialysis patients and for alternative supply arrangements for hospitals. CsCDC and local authorities will want to have standing arrangements in place for communicating with other vulnerable groups and other types of health and social care premises. Current advice for the immunocompromised is contained in Annex 8.

In support of reaching a decision about the most appropriate warning message, the water industry has access to a number of dedicated resources; the UKWiR Toxicity and Microbiology Database and the Call off Contract. The former is jointly funded by the water industry and DWI and contains useful, pertinent facts on a wide range of substances and pathogens identified as potentially being involved in a water quality incident. In an incident, the water company will be able to provide content from the UKWiR database to the CCDC. The information will give details of occurrence, potential adverse human health effect levels (known as SNARLS), methods of water analysis and methods of removal by water treatment. The Call off Contract is an arrangement put in place and managed by DWI, whereby in an emergency or a security event a water company can access timely sophisticated analysis for chemicals, toxins and organisms outside the range of routine capability of water testing laboratories. Specialists in the HPA and wider government are involved with DWI in the ongoing development of the facilities and resources inherent in the Call off Contract.

Dissemination of warning advice

Consumers expect to receive and obtain information about their water supply from their water supplier. Every household and business or public premise receives details of how to contact their water supplier with their water bill. However, people who live in social housing may pay their water bill through the general rates and may not receive a bill directly. It is important, therefore, for local authorities to have plans in place to assist the water company by making social housing managers aware of any warning advice and generally take steps to facilitate its dissemination to residents and to publicise the water company telephone and website contact details.

The water company is best placed to identify the area affected by any water supply incident. This will be done using a variety of tools, e.g GIS systems, customer and postcode databases. As a general principle, at the outset of any incident, the water company will err on the side of caution and overestimate the size of the affected area. This is because water supply arrangements can be complex, for example, there can be more than one pipe and supply serving a single street. Also, the water company is often able to quickly rezone an area of supply providing alternative safe supplies by means of pipes. Most water companies will place a description of the affected area by postcode on their website and all water companies will set up a recorded telephone message service which recognises the postcode of the caller and advertises the incident information to all callers. CsCDC and local authorities should make sure that warning communications issued by them for vulnerable or sensitive groups of water users direct

people to the water company for information about the affected area. It is very important to understand that this information is likely to change during the course of an incident. It is not recommended that CsCDC or local authorities prepare their own or separate notices or descriptions of affected areas. Public facing health services and organisations such as NHS Direct should also be advised to direct people to the water company as the single definitive source of information.

Whereas the water company will deal with issuing advice to the general public and will also handle calls from consumers seeking clarification of the affected area or additional information, it is the role of the CCDC to make contact information available to the water company to facilitate the referral of anyone who is reporting illness symptoms. This will be a non-public HPU or PCT telephone number for water company use only. It is also the role of the CCDC to assist the water company in modifying its standard pre-prepared Frequently Asked Questions (FAQ) and Answers to take account of unique or specific features of the incident. The jointly agreed FAQ will be provided to water company call centre staff and can be issued to other organisations that may be called by the public, e.g. local authorities, NHS Direct. Every effort should be made to ensure that a common script is used by all organisations in their call centres and on their websites.

Provision of alternate supplies

When there is an extended loss of water supplies or a DND/DNU notice is issued, water companies will provide alternate supplies by several methods depending on the nature and scale of the incident:

- Bottled water.
- Static tanks or mobile tanks (known as bowsers) and tankers.
- Rezoning (introduction of water from a different source into the piped network).

When bottled water is supplied by a water company in place of a piped supply they must comply with the Water Supply (Water Quality) Regulations 2000/2001, as amended in 2007. Some commercially available bottled waters may not be suitable for making up feeds for

infants due to their mineral (salt) content and all bottled water, like tap water, must be boiled and then cooled prior to use for infant feeds. Water companies have standing arrangements in place for the provision of alternate supplies by means of bottles or containers and compliance with the relevant regulations will be covered by documented procedures and within the contractual arrangements with third parties.

The water industry has mutual aid arrangements in place for the mobilisation of tankers and static tanks. Static and mobile tanks and tankers will be clearly marked with a permanent notice at the draw off point to warn users that the water must be boiled before use. While such water supplies will be from a safe source and water companies have strict hygiene arrangements in place for the tanks and tankers themselves, there is no control over the hygienic status of the containers used by the public for collecting water from the draw off point or for storing it within the home. The standing boil water advice therefore safeguards against these hygiene risks.

When static and mobile tanks are deployed they will be refilled by the water company using tankers on a regular basis and their locations publicised. The tanks are designed to be as vandal proof as possible, however it is not unknown for the public to attempt to damage or remove these tanks. Local authorities have a role to play in the selection of sites and promotion of monitoring the security of static tanks by, for example, local community groups, neighbourhood watch schemes etc.

The Security and Emergencies Direction issued by the Department for Environment, Food, and Rural Affairs (Defra) indicates that water company plans should aim to commence the distribution of water by alternative means as soon as possible after the failure has occurred. The amount to be provided should be at least ten litres of water per person per day to all those affected within the first 24 hours of an undertaker becoming aware of an incident and this supply should be maintained until the piped supply is restored.

While undertakers must plan for ten litres per person per day in accordance with the notification, there may be emergencies where logistical problems prevent this being achieved in the first 24 hours. It is also recognised that for a major incident, the ten litre requirement may not be achievable until the numbers affected are reduced to a level within the Local Response Plan.

If the incident is more protracted and piped water is not available for drinking, cooking or washing, the target amount of water to be supplied will be increased. Defra will issue guidance on this additional planning target in the near future. In these protracted

circumstances, additional advice will need to be provided to the public regarding sanitation. The HPA will lead in the provision of this advice to the public.

Public information about drinking water quality

Up until the 2007 Amendment Regulations there was a regulatory requirement on water undertakers to supply all local authorities within their area with an annual report on drinking water quality in a specified format. This is no longer the case, because DWI publishes summaries of water company results with a commentary about the significance of the information for the benefit of consumers, businesses, local authorities, health professionals and other regulators. The latest drinking water quality test results for each water company are summarised on the DWI website and the annual report on CD is sent to every HPU and local authority in England and Wales. Water companies are still required by the regulations to provide information on drinking water quality on request to any person. This has to be free of charge for information on the zone in which the person resides, but a charge can be made for information on wider areas of supply.

Water companies and CsCDC should maintain good liaison and there should be at least an annual meeting of the water companies, local authorities and CCDC to exchange information, but CsCDC are also welcome to contact DWI at any time for any information on drinking water quality.

Improving drinking water quality

The regulations require water companies to investigate the cause of each adverse test result. They are also required to investigate when they believe there is a likelihood of failure at some time in the future. Companies can apply for authorisation on a temporary basis to supply water that does not meet one of the drinking water standards.

DWI will assess the company's information and this assessment will include the views of the local CCDC, but it is DWI's responsibility to decide if an authorisation should be approved or, where appropriate, take enforcement action enabling the company to bring about the necessary improvements so that standards are met in a timely and cost effective way.

A short-term departure from a standard does not mean that drinking water is unsafe during the time period set for the improvements to be carried out by the water company. This is because standards are set with a wide margin of safety, drawing on international expert consensus (World Health Organisation Drinking Water Guidelines) and taking into account a lifetime's consumption of drinking water. Nonetheless, before agreeing to a departure from a standard, DWI will seek evidence that the water company consulted with the local HPU and CsCDC.

Consumer complaints

If a consumer believes there is something wrong with the drinking water in their home or workplace they should contact their water company or, in the case of a private supply, their local authority environmental health department. Water companies can arrange for tests to be done or check that plumbing arrangements are correct and comply with the Water Supply (Water Fittings) Regulations 1999. Companies will advise consumers of the action to be taken or, if required, will take enforcement action to secure improvements in plumbing. If the consumer considers that the water company did not deal with their drinking water quality concerns appropriately they can ask DWI to look into the matter on their behalf.

If the complaint is about another aspect of the water service, such as water charges or pressure, consumers should take the matter up with the regional branch of the Consumer Council for Water⁴.

If the water quality concern is about the quality of a water course or water body, the query should be directed to the Environment Agency. The Environment Agency deals with the protection of the environment and regulates water abstraction and discharges to the water environment.

⁴ The Consumer Council for Water (CCWater) represents water and sewerage consumers in England and Wales. It took over from WaterVoice on 1 October 2005. Their website at <http://www.ccwater.org.uk> holds more information on their role

Other UK drinking water regulators

There are equivalent organisations to the Drinking Water Inspectorate in Scotland (the Drinking Water Quality Regulator) and Northern Ireland (the Drinking Water Inspectorate for Northern Ireland). Each has their own regulations and legal responsibilities, but these are almost identical to those applying in England and Wales. The main difference is that there are only single, state owned water suppliers in Scotland and Northern Ireland.

How do we control new and emerging issues approach and rationale?

In addition to meeting the numerical standards specified in the regulations, to be considered 'wholesome', drinking water must not contain any micro-organism or substance at a concentration which would (on its own or in combination with another micro-organism or substance) constitute a potential danger to human health.

Where micro-organisms or substances not specified in the regulations are identified, their potential danger to human health is assessed on a case-by-case basis. This will involve water companies discussing their findings with CsCDC and EHOs to determine the significance for the local community, in particular are there any specific groups of individuals who may be more susceptible to the potential effects? Where the presence of certain substances may be potentially more widespread (for example in environmental sources of drinking water), or where an emerging issue is considered more significant, DWI may issue national guidance to the water industry. This guidance is based on national advice from the Health Protection Agency (e.g. CHapD or the radiological protection division). It is circulated to all water suppliers, and published on DWI's website.

Drinking water research

On behalf of the Government, (Defra) DWI manages the national Drinking Water Quality and Health Research Programme (DWQH). The research supports Defra and Welsh Assembly Government policy on the quality and regulation of water supplies and

enables the UK to contribute to the international evidence base for drinking water quality regulations and standards.

Drinking Water Quality and Health Research Programme

Electronic copies of the final reports of all Drinking Water Quality and Health (DWQH) research projects are available on DWI's website (www.dwi.gov.uk).

Executive summaries are also posted on the Foundation for Water Research (FWR) website (www.fwr.org) which also provides access to other reports concerning complimentary components of the European Commission's Framework Programmes.

Jointly DWI and HPA have designated certain individuals as national advisors on the health aspects of drinking water within HPA. Continual dialogue exists between these advisors and DWI staff responsible for scientific evidence on current and emerging issues. Additionally, the DWQH research programme manager co-ordinates formal horizon scanning meetings to identify emerging issues for inclusion in the programme. These discussions involve representatives from across government, other UK drinking-water regulators and organisations, such as UKWIR (UK Water Industry Research), HPA, EA, independent experts, and others.

Annex 1: The Incident Assessment letter from the Drinking Water Inspectorate on the loss of supplies from Mythe water treatment works in July 2007



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Ref. 36-10-9-197

14 March 2008

Dear Mr. Burraston

DRINKING WATER QUALITY INCIDENT – LOSS OF SUPPLIES TO PARTS OF GLOUCESTERSHIRE, JULY AND AUGUST 2007

1. Introduction

1.1 The purpose of this letter is to inform you of the conclusions and recommendations arising from the Inspectorate's assessment of the incident involving the loss of supplies to parts of Gloucestershire in July and August 2007 following the flooding of the Mythe Water Treatment Works.

1.2 When notified of an incident, the Inspectorate assesses the Company's reports and other information gathered in the course of its investigation and advises on the way in which the incident was handled and whether any statutory requirements were contravened. The Company notified the Inspectorate of this incident on 22 July 2007. As part of the Inspectorate's investigation five visits to Mythe Water Treatment Works were made by (Deputy Chief) Inspectors. Information was obtained also from other agencies involved in responding to the emergency. All information gathered during the course of this investigation was technically assessed by Inspectors and their conclusions and recommendations are set out below.

2. Overview of the incident

2.1 The Mythe Water Treatment Works (WTW) is located near to Tewkesbury, Gloucestershire, on the bank of the River Severn close to the confluence with the River Avon. It supplies approximately 160,000 properties in the towns of Cheltenham, Gloucester, Tewkesbury and across a large part of rural Gloucestershire. The treatment process consists of clarification, filtration, ozonation, passage through Granular Activated Carbon (GAC) and chlorination. Treated water is then pumped to Hewletts service reservoir (SR) which supplies Cheltenham; and to Churchdown SR which supplies the remaining areas. These large strategic service reservoirs in turn feed a total of 22 smaller service reservoirs serving the wider parts of the distribution system.

2.2 Historically, the treatment works site has been inundated by flood water on a number of occasions, most notably in 1947, but the operation of the works has never previously been lost due to flooding. These historic floods were predominantly caused by a rise in the level of the River Severn. On this occasion the main source of flood water was the River Avon. The Company's Flood Emergency Response Plan for the site detailed the heights at which flood water might breach defences and the actions to be taken (predominantly sandbagging buildings and turning the power off). Previous flood events had developed slowly because of the size of the flood plain but on this occasion the flooding was rapid due to exceptional rainfall over a short period of time. In the two days immediately preceding the event, approximately three months rainfall occurred causing both the River Severn and the River Avon to flood simultaneously. The flood water reached a maximum height greater than the predicted 1 in 150 year's level.

2.3 On Saturday 21 July the flood water levels around Mythe WTW rose to a level which indicated that the operational site was at risk of flooding and in response the Company initiated their Flood Emergency Response Plan. Predictions from the Environment Agency up to 2330 hours that day were that the water level would remain

just below the level that would flood the operational site. However, at midnight that forecast was revised and the indications were that by 0700 on 22 July the water level would peak at a height that would result in the site being flooded.

2.4 Operational staff acted immediately to carry out a controlled shutdown of the works including isolating all electrical supplies. The decision for the site shut down and evacuation at 0600 on 22 July was primarily made on Health and Safety grounds but also to safeguard assets as much as possible. There were no other works performance or water quality reasons for the shut down of the works.

2.5 At this point in time supplies to consumers were maintained via the service reservoirs which were filled to normal levels (Hewletts SR was 84% full and Churchdown SR 64% full). This equates to 36 hours of normal consumer demand, however press reports at 09:00 on 22 July reporting the potential loss of water supplies was followed immediately by unprecedented demand as evidenced by flows measured in the distribution system in the subsequent 2-3 hours. Flows exceeded the capacity of the meters. The documented exceptional demand led to a quicker than predicted emptying of Churchdown SR which occurred at around 18:00 on 22 July. These circumstances meant that the supplies to some consumers would have failed before this time. By Monday 23 July approximately 70,000 properties in the Tewkesbury and Gloucester areas were without mains water and by 24 July 140,000 properties, now including Cheltenham, were without a piped water supply. Severn Trent Water implemented a number of methods in parallel to provide alternative supplies of water to these consumers which included bowsers, tankers and bottled water.

2.6 Because of the flooding, the Mythe WTW site could not be accessed safely until Wednesday 25 July when the flood water had receded sufficiently for a full assessment of the damage to be carried out in accordance with a detailed plan drawn up during the intervening time period. Eight out of the ten separate stages of the water treatment and pumping process were found to be inoperable, in particular, all of the electrical motors and control panels required stripping down to their component parts and removing from site for drying and repair. From a site visit at this time, the Inspectorate is satisfied that the controlled shut down of Mythe works was unavoidable and essential and that the Company's inability to maintain water supplies was due to electrical issues, in particular, critical pumps and control systems were not operable.

2.7 On Friday 27 July the Company was able to bring on line an alternative piped water supply to approximately 10,000 properties in Tewkesbury utilising an existing (but previously untested) mains link from Strensham WTW. However, this alternative supply

provision depended on the operation of valves which were located within the Mythe WTW site, therefore the timing of bringing this alternative supply into use was dependent on gaining safe access to Mythe WTW site. The Inspectorate is satisfied that given the location of the key valves this operational action could not have commenced early than Wednesday 25 July. However, as explained in paragraph 2.9, there was interference by Gloucestershire Primary Care Trust (PCT), acting through the Strategic Coordinating Group (Gold Command) in the timing of the valve operations and this meant there was a delay in this alternative water supply being made available to consumers. In parallel the Company also assessed the feasibility of providing a variety of other theoretical alternative piped supplies. However, for engineering reasons none of these could be implemented more quickly than the schedule for reinstatement of Mythe WTW. The Inspectorate is satisfied that the Company correctly assessed that the quickest practicable means of restoring piped water supplies was the reinstatement of the Mythe supply in accordance with the scheduled plan in place. It is noted that other supporting arrangements were successfully put in place in collaboration with other water companies; for example, Welsh Water was able to reduce the volume of treated water drawn from the Severn Trent Water distribution system.

2.8 Following repairs to the electrical assets at Mythe WTW, the Company immediately initiated operations to start up the treatment plant. The full water treatment system at Mythe is a complex eight stage process which has developed over time with advanced processes such as granular activated carbon (GAC) filtration and dosing of ozone having been added more recently. In order to safely commission the works the Company anticipated potential problems (such as air-locks in the in-process pipework which had the potential to extend the duration of the commissioning process) and took the decision to by-pass the advanced processes and to initially commission and operate only the conventional processes. As is the case with the commissioning of any water treatment works, the plan was for gradual reinstatement of each of the processes (coagulation, filtration and chlorination) to around 50% of works capacity with regular quality checks at critical control points. The Inspectorate attended the site to independently verify that commissioning was occurring in accordance with this plan. It was observed that a number of the automatic process control systems were not operable, however, the Inspectorate was satisfied that there were temporary arrangements in place, which were basic in nature, but functional and producing the necessary minimum operational information required for operation of the plant. The Inspector on site made a number of suggestions to assist the operators in their commissioning duties and to check that the risks inherent in the abnormal operating situation were fully understood and capable of being managed. Once stable treatment

process conditions were obtained, flow was increased and the works began to feed treated water into supply under manual control. This treated water began to refill Churchdown and Hewletts SRs on Saturday 28 July. The reinstatement of the works to a minimum acceptable and safe operational status by the Company was well resourced and went to plan without any major unforeseen problems or avoidable delays. I **commend** the operational engineers and scientists (and supporting contractors) involved for their dedicated professionalism in the execution of these tasks under very difficult circumstances.

2.9 Because the distribution system (mains and service reservoirs) was empty, water supplies to consumers could only be restored on a sequential, phased basis to safeguard against mains bursts or air locks which, if these had occurred, would have caused additional supply interruptions potentially extending the time that some consumers went without a supply of piped water. It is recognised that the recharging of an empty distribution system is not a straightforward procedure and it can only ever proceed according to the engineering of the system. The Company informed the Inspectorate of its recharge plan which was accompanied by a comprehensive programme of monitoring. The Inspectorate was satisfied at that time that the proposed arrangements were consistent with good practice and fully commensurate with the assessed risks and the nature of the water supply configuration. Unfortunately, and subsequent to the Inspectorate's verification of the plan, the Company failed to execute the valve operations in accordance with the planned timescales. The Company has reported that the cause of the delay in restoring treated water supplies was a requirement imposed by the wider Strategic Coordinating Group (Gold command) that an information leaflet giving health advice had to be delivered to all households prior to the operation of valves by the Company. A Principal DWI Inspector has independently investigated the cause of this interference in the execution of valve operations by the Company. She carefully reviewed relevant parts of the official gold command incident records obtained from Gloucestershire Police. The following extracts are illustrative of the entries found in the relevant parts of these official records: *until such time as this information (public health leaflet) has been transmitted to as large a community as possible the valve is not to be opened..... A leaflet has been produced by the PCT.....the information is critical to avoid the risk of illness brought about by consuming water that is not fit for human consumption.* Her findings were assessed by the Chief Inspector of Drinking Water who concluded that there was substantial evidence to show that the decision as to the timing of the operation of the valves to restore an alternative piped water supply was interfered with by others and this is in direct conflict with the statutory duties of a water company to provide piped water supplies (together with any appropriate advice to

consumers). I **conclude**, therefore, that the Company did not restore supplies to consumers as quickly as it could or should have been able to do. The Inspectorate has considered separately how this situation came about and how it may be prevented in the future (see paragraph 7.3). I **recommend** that the Company amends its Crisis Management Procedures to clearly reflect the fact that the Company should lead on all matters regarding drinking water supply operations and whilst it is recognised that the Company is required to consult with all relevant persons in such incident situations, it is however the water company that is licensed and competent to operate.

2.10 In accordance with incident management procedures, the Company put in place a dedicated water quality science team to support the incident management team. In addition to adjusting the routine statutory water quality monitoring programme for those water supply zones impacted by loss of supplies, this water quality team drew up and resourced a comprehensive programme of water quality checks for restoring supplies (both the reinstatement of Mythe works and the refilling of the distribution system). The monitoring plan was necessarily engineering led, designed on the principle of following the water through the system, and consisted of three phases. Phase One related to Mythe treatment works (raw water, in-process water and treated water). Tests were carried out to inform the re-commissioning of the works and to verify that relevant drinking water quality standards were met from the time that water was first supplied from the works and on an ongoing basis. Phase Two related to testing of the treated water at each of the service reservoirs once they had filled to a level that enabled operation of the sampling facilities. This was to verify that there had not been any breach in the integrity of these parts of the distribution system and that emptying/refilling operations had been carried out in a way that had not caused significant disturbance of any reservoir sediments. Phase Three involved tests that were to commence once water from the service reservoirs had advanced to each of the individual district metered areas serving consumers' premises. Samples taken in this phase were obtained from taps in consumer premises. Approximately 23,000 tests were carried out on samples collected between 24 July and 7 August. The programme of water quality testing was made available to the Inspectorate in advance and the test results were provided by the Company to the Inspectorate on a daily basis as they became available from the accredited drinking water laboratories providing analytical support to the incident. On the basis of satisfactory test results, on Friday 3 August, the Company informed consumers that the water supplies could be used for all purposes subject only to a precautionary 'Boil Water' notice. This advice replaced that issued previously by the Strategic Coordinating Group (Gold command) which warned consumers not to drink the water. When the entire water quality sampling programme

was complete the Company lifted the Boil Water Notice on 7 August. I **commend** the Company for the comprehensive water quality checks that were undertaken in support of this incident.

3. Actions taken by the Company

3.1 General

3.1.1 In line with established procedures the Company formed an Incident Team by 0200 on Sunday 22 July, followed by the setting up of a Crisis Management Team shortly afterwards. Later that day additional teams were set up to manage various work-streams including the provision of alternative water supplies to consumers, recommissioning of Mythe WTW and re-introduction of water to the distribution system. A representative of the Company also integrated into Gold Command at Police Headquarters in Gloucester.

3.1.2 I **note** the Company's Final Report recognises that the Company's incident and crisis teams did not have sufficient understanding of civil emergency command processes nor had they rehearsed such a large scale incident in recent times. I **further note** that training for such events and the need to deploy staff to Gold Command not directly involved in managing the incident, has been identified. From its own engagement with the Company during the incident, the Inspectorate concurs with the Company's conclusions. Whilst the Company rapidly established an effective process of communication with the Inspectorate, this was initially set up on a very narrow view based on the Company's understanding of the Inspectorate's day to day regulatory role. The Company did not take into account the Inspectorate's duties in a drinking water emergency (the Chief Inspector of Drinking Water is appointed as the Technical Advisor on drinking water supply and quality matters to the Secretary of State). Accordingly in the first few days of the emergency, the Inspectorate was engaged full time in proactively acquiring and interpreting information from the Company on behalf of Defra officials and ministers. I **recommend** that the Company amends its procedures and trains its staff in such a way as to ensure that in any future similar incident the Company is able to feed operational information into the wider communication processes within government which are essential when an incident threatens to become an emergency.

3.2 Alternative supplies

3.2.1 Late on Saturday 21 July, when it became apparent that there may be a loss of supplies from Mythe WTW, approximately 20,000 properties in the Gloucester area were transferred on to a different piped water supply derived from Mitcheldean WTW. As a result of this prompt action these properties did not suffer any loss of supply throughout this incident. I **commend** the Company for this prompt action which meant that supplies were maintained to a significant number of consumers residing to the west of Gloucester.

3.2.2 By 03:35 on 22 July the Company started tanker operations to supply treated water from Strensham WTW to Hewletts service reservoir, a strategic asset in terms of supplying water to Cheltenham. I note from the Company's reports that it was not possible to tanker supplies to the other strategic service reservoir site (Churchdown) because access to this site is unsafe for large vehicles due to its narrow access road. I am **critical** of the fact that the Company, being aware of these access issues to a major reservoir complex, had not taken appropriate action previously as a matter of good practice to facilitate full site access. Although the Company state that the number of tankers required to make a meaningful impact on availability of water to consumers would have made the operation untenable on this occasion I **recommend** that the Company reviews access at each of its strategic sites to ensure it is suitable for all operational purposes. Churchdown SR ran empty at approximately 18:00 hours on Sunday 22 July. For hydraulic reasons, some consumers in areas fed by this reservoir will have begun to experience supply problems before this time. Supplies from Hewletts SR were sustained for a further 48 hours. On 24 July this supply also failed due to the exceptional demand mentioned in paragraph 2.5 above.

3.2.3 On Friday 27 July the Company completed operations to supply parts of the Tewkesbury area from Strensham WTW. I **note** that this was a complex operation which had not been tested and involved water flowing in a direction counter to normal operations. In addition, the operations could not proceed until access to Mythe WTW was regained on 25 July because of the location of critical valves. Once implemented, this arrangement allowed piped supplies to be restored to about 10,000 properties. I **recommend** that the Company fully documents this alternative supply arrangement to facilitate its future use and I **further recommend** that the Company considers whether it can make permanent engineering improvements that would address the problem that arose with the accessibility of the critical valves.

3.2.4 The Strategic Coordinating Group (Gold Command) pressed the Company to devise other piped supply options. In response the Company undertook work to explore theoretical options. The key feasibility criteria for these options were a minimum volume of 20 MI (megalitres) per day capable of being deployed rapidly and continuously through temporary pipes of a defined capacity. On 25 July the Company explained to Gold Command that there were no such options. The Company provided information on the options it had considered and ruled out. These included links to supplies from Cwmbran (Dŵr Cymru Welsh Water), Purton (Bristol Water), Wessex Water, Thames Water, Strensham (Severn Trent) and Trimpley (Severn Trent). None of these options met the criteria in terms of either volume of water or logistics for transport (pipes, tanks etc). I **note** that the above mentioned activity drew on the resources of the Company at a time when its priority statutory duty was the restoration of water supplies from Mythe and the delivery of well understood alternative interim supply arrangements. I **recommend** that the Company researches and documents all feasible alternative piped supply arrangements for each of its treatment works and strategic service reservoirs to create “standing” information to be made available with minimal use of resources to efficiently meet the information requests of any future Gold Command structure. The Company’s emergency preparedness should anticipate the questions that may come from other agencies. I also **recommend** that all standing information in company incident and emergency resource manuals should be accompanied by Q and A style documents written in non technical terms to serve the needs of this audience.

3.2.5 From 05:30 Sunday 22 July the Company initiated the deployment of bowsers to the areas that had lost supply. Company records show that 900 bowsers were required to supply the affected area. The Company stores bowsers throughout their region as a dispersed county or strategic stock. These bowsers are not stored in a ‘ready to use’ state and therefore require cleaning, disinfecting and filling before deployment. I **conclude** that this arrangement was the rate limiting step in deploying bowsers. The first bower was available in Gloucester at 17:15 on 22 July. Within the water industry there are a number of alternative approaches to stocking bowsers such as ‘bag and tag’ – a process of preserving and identifying pre-cleaned bowsers for rapid deployment. I **suggest** that the Company works with the rest of the industry to ensure that it can achieve best practice relating to stocking of bowsers in a ready to use state. I note that in the ‘Key Recommendations’ section of the Company’s Final report there are two recommendations relating to bowsers and their deployment. The first includes reviewing deployment and management of bowsers in particular investigating the potential for the use of technology to track bowsers and monitor content. The second

relates to participating in a national discussion about the potential for central storage of items such as bowsers and generators for use nationally. I **concur** with these recommendations.

3.2.6 As well as mobilisation of their own supply of bowsers, the Company contacted other water companies, invoking established mutual aid arrangements, to procure the necessary number of additional bowsers from other sources. On Friday 27 July the Company contacted the Inspectorate to discuss the potential use of approximately 100 bowsers that had been sourced from outside of the water industry, and which did not have approval for use under Regulation 31 of the Water Supply (Water Quality) Regulations 2000. Regulation 31 relates to the approval of materials and products to ensure that any used by water companies do not contaminate drinking water or affect its quality. The Company was able to provide the Inspectorate with relevant information enabling the immediate issue by the Inspectorate of a Regulation 31 approval for a limited time period of 30 days. At the peak of the event over 1400 bowsers were deployed. Various logistical problems were encountered in the deployment and refilling of these bowsers, for example size of tankers (some being too large for access roads to some housing estates). In addition there were instances of the well recorded issue of theft and vandalising of bowsers. The Inspectorate obtained evidence that bowsers clearly sourced from the water industry (and thus stolen) were being advertised by members of the public for sale on the e-bay auction website during the incident. In this context I welcome the Company's proposal to look at the potential for using remote monitoring devices. I **suggest** that the Company works with the water industry and other agencies responsible for security and civil order to ensure that in any future similar incident the risk of anti-social behaviour is promptly accepted and acted upon collectively by all relevant agencies to establish deterrent strategies within the affected communities from the outset. I am **satisfied** that the Company had reasonable physical precautions in place to prevent casual vandalism, it being recognised that there is little a water company can do by itself to safeguard its bowsers on the street against more determined abuse or attack. The bowsers remained in place until Friday 3 August when piped water supplies recommenced. Thereafter bowsers were withdrawn on a phased basis as piped water returned to the various geographical locations.

3.2.7 It is standard practice within the water industry that all bowsers bear permanent fixed notices with appropriate clear advice to consumers to boil water drawn from bowsers before use. This standard precaution is aimed at informing consumers of the need to safeguard against contamination introduced inadvertently by them when drawing off water into household containers and during subsequent storage and use in

the home or work place. The Inspectorate obtained evidence that this arrangement was not understood by the other agencies involved in the Strategic Coordinating Group (Gold command). During the course of its investigation the Inspectorate obtained photographs showing how paper copies of the PCT advice leaflet had been attached to bowlers alongside, or obscuring the permanent water industry notice. The Inspectorate considers that this action was not conducive to maintaining public confidence in the alternative water supply as evidenced by calls to the Inspectorate during the incident. I **suggest** that the Company works with the rest of the water industry to ensure that all local health professionals have a full understanding of the standard hygiene precautions and practices of the water industry which have been well tested over time as being fully effective.

3.2.8 During the incident the Company implemented its procedures such that priority public buildings such as hospitals, prisons and other key users of water were provided with drinking water from other water treatment works via tankers to their own on-site storage tanks. These arrangements generally worked well although, as noted in paragraph 3.2.4. above, the Company could have been more pro-active in communicating to the wider multi-agency audience at the outset that these arrangements were in place and had been activated. I **recommend** this topic be catered for in the preparation of standing documentation to facilitate improved communications in any future similar incident.

3.3 Recovery of Mythe WTW

3.3.1 As discussed above, on Saturday 21 July the Company implemented the Flood Emergency Response Plan for Mythe WTW. When it became clear that the works would flood, the operators took prompt action to carry out a controlled shut down of the works and isolate the electrical equipment. I **commend** staff for the prompt action taken and for continuing to take action despite predictions that the water wouldn't reach a sufficient level to flood the site. These early planned steps by the operators contributed significantly to the timely recovery of the works following the receding of the flood water.

3.3.2 Limited access to the site was gained on Tuesday 24 July. Pumping out of the flooded basements was initiated so that damage could be assessed.

3.3.3 Full access to Mythe WTW was gained on Wednesday 25 July and a comprehensive assessment of damage carried out. Eight of the ten main treatment and pumping processes had damaged equipment with 40 critical assets requiring repair. In particular, much of the electrical equipment needed to be removed, dried and re-

installed. However, because of the isolation of the electrical equipment prior to flooding, most equipment, control panels etc. were recoverable.

3.3.4 In parallel to recovering the treatment processes, a semi-permanent flood barrier was erected around the site which was completed by Sunday 29 July. This provides protection from flooding to a height approximately 1m above the maximum height of the flood waters during this incident.

3.3.5 The treated water storage and contact tanks on site were emptied, cleaned and disinfected ready for use. A post-incident follow up site visit by a Deputy Chief Inspector on 17 August found that the area immediately above these underground tanks appeared to have been significantly damaged during construction of the flood barriers. However, it was not possible to determine whether the damage was superficial or more substantial and indeed whether this would have resulted in any structural damage to the tanks underneath. I therefore **recommend** that the Company carries out an internal inspection of the contact tanks and the treated water tank at the earliest opportunity.

3.3.6 Risk assessments were undertaken for re-commissioning each stage of the treatment process. On Saturday 28 July the clarification and filtration processes were re-started, with water being run to waste initially and then, once the quality was satisfactory (and the performance of the temporary final disinfection process established and verified), fully treated water was pumped to Churchdown and Hewletts service reservoirs.

3.3.7 Between 28 July and 6 August remaining equipment was repaired and the Granular Activated Carbon (GAC) filters were gradually re-commissioned. On 6 August ozone and permanent chlorination dosing and control systems were restored with most systems running under automatic control. During the visit to site on 17 August, the Deputy Chief Inspector concluded that *'In general the site was operating satisfactorily. Although some processes were still in manual or not in full auto operation; process control, monitoring and general water quality were satisfactory'*.

3.3.8 Information provided by the Company indicates that, although there were no standby generators at either Mythe WTW or Strensham WTW at the time of the incident, there is a strategic contract in place to provide emergency power generators to a site within 4 hours. During this incident there was a high probability that power to the site would be lost following the flooding of the local switching station at Walham. Although a failure of the local power supply was not the cause of the shut-down of Mythe WTW, I **recommend** that the Company undertake a company-wide review of its power supply arrangements and contingencies for all of its strategic water supply assets.

I understand that the Company currently has three temporary generators at Mythe WTW which are sufficient to power the site should the local power supply fail. I would be grateful to learn whether this arrangement is to be made permanent.

3.3.9 The Inspectorate's careful review of relevant records and post-incident publications has revealed how the management of this incident was made more problematic because agencies engaged in responding to the emergency lacked an essential basic knowledge of water supply arrangements. Although peripheral to this incident investigation, the Inspectorate considers it important to address one matter commented upon publicly during the emergency, namely the matter of whether or not the Company could or should have supplied raw or untreated water by means of pipes for toilet flushing purposes.

(1) The supply of raw or partially treated water from Mythe works was ruled out as an option in the early stages of the incident; the design of water treatment plants is such that the supply of raw water is increasingly either impossible or difficult; this situation is not just a technicality of the design of modern automatic control systems, it is a very desirable in-built feature because supplying raw water poses a recognised serious risk to public health and is thus contrary to law (it is a criminal offence for a water company to supply water that is not adequately treated and disinfected).

(2) even if during this incident it had been possible technically for the Company to supply households as a temporary measure with raw or partially treated water, to do so would have created a second and potentially much more serious and long lived incident. To reinstate a normal water supply afterwards, the Company would have had to put in place complex and disruptive logistical arrangements to clean out and disinfect the whole of the distribution system. Long-term boil water notices and frequent shut-offs would have been required to facilitate this. It is well documented that compliance by consumers with warning notices is always below 100% and diminishes significantly over time. All this means that introducing raw or untreated water into distribution pipes and then into household plumbing carries with it an unacceptably high risk of the spread of waterborne disease.

3.4 Distribution system recovery

3.4.1 A dedicated Distribution Recovery team was set up on Wednesday 25 July within the overall Incident Management structure.

3.4.2 Recovery was planned in eight phases to enable the sequential filling of the service reservoirs, the trunk mains and then the remainder of the distribution system.

There were a number of uncertainties within the plan and each of these was covered by relevant risk assessments.

3.4.3 Close liaison was maintained with the Mythe Recovery Team so that water was produced at a restricted rate of flow that could be accommodated by the relevant pipes being filled. Initially water was directed to the strategic service reservoirs. Valves on the outlets of these reservoirs were shut. The aim was to open these valves once operational levels of water had been achieved in the reservoir. However, there was a delay due to the requirement imposed by the Strategic Coordinating Group (Gold Command) that a health and safety advice leaflet was delivered to consumers prior to the operation of valves. The Company sought advice from the Inspectorate and the advice given by the Chief Inspector of Drinking Water was that there was no valid reason to delay restoring supplies to consumers because appropriate monitoring was in place. When the Company did open the reservoir valves this allowed the downstream system to fill up to closed district meter area (DMA) valves. At this stage only a few communities would have seen the start of a return of their water supply. The final stage of restoration of water supplies was brought about by the opening of the district valves to allow water to flow into each of the local pipe networks. The rate of progress of water throughout each DMA to reach each community could not be fully predicted as this is dictated not just by the network configuration but also by the pattern of consumer demand (once water reappeared at taps). The Company followed a controlled and prudent DMA Recharge Plan, whereby water was supplied to the first phase of consumers on Friday 28 July, taking about a day from start to finish, and the last phase was completed on Tuesday 1 August. The majority of the ongoing work by the water company related to localised valve operations to flush out air locks and to remedy localised disturbance of mains deposits in streets where this occurred.

3.4.4 I note that in the Company's final report it records that this event was the first one when a Scientific and Technical Advisory Cell (STAC) had been created during an incident in its area of supply. Although the Company was represented on both the Health Protection Agency's national STAC and the regional STAC established by the Gloucestershire Primary Care Trust (PCT), the various roles and responsibilities of these groups and participants, and the interface between them and the Strategic Coordinating Group (Gold command) were not clearly defined. The Inspectorate was not initially invited to advise the work of either STAC, however, when the national STAC convened one of its members familiar with the Inspectorate and its statutory role, contacted the Chief Inspector of Drinking Water and requested participation. Subsequently the Inspectorate participated in the national STAC and provided authoritative technical

water supply advice. However it was unclear to the Company (and the Inspectorate) how the national advice was being applied at regional level. The Inspectorate understands that the Health Protection Agency is leading a lessons learnt activity in respect of STAC arrangements. I **welcome** this initiative and I **recommend** that the Company incorporates future guidance from the Health Protection Agency on the operation and purpose of STACs into all relevant company procedures.

3.4.5 The sampling programme carried out by the Company followed a clear plan provided to the Inspectorate in advance. This measured water quality at all key points and for appropriate parameters. All results were communicated to the Inspectorate for independent review. A total of 1500 samples were collected and analysed as part of the Company's process of restoring supplies to normal.

3.4.6 Gloucestershire Primary Care Trust acting through the Strategic Coordinating Group (Gold command) determined that a 'Do Not Drink' notice was required for all piped supplies from 27 July to Friday 3 August. This advice was changed subsequently by the Company when it issued a standard water industry 'Boil Water' Notice between 3 August and 7 August. The 'Boil Water' notice was lifted by the Company to all consumers on 7 August. The Company's decisions relating to its own notices were based on standard industry risk management practices supported by the satisfactory results of testing and knowledge of the water supply. The Inspectorate **notes** that after water supplies were restored to normal some local NHS hospitals delayed re-instating the use of mains water supplies until 1 September. It is understood that this occurred as a consequence of a decision by the Gloucestershire Primary Care Trust at local level to impose a regime of water testing for hospital wards. The Inspectorate considers the situation which arose in respect of these health care premises to be most unusual.

4. Contraventions of the Water Supply (Water Quality) Regulations

4.1 The standards within the Water Supply (Water Quality) Regulations apply to piped water provided to consumers for domestic purposes such as cooking, drinking, food preparation or washing. During the period 22 July to 7 August there were variously no piped water supplies, piped supplies with a 'Do Not Drink' notice or piped supplies with a 'boil water' notice. Therefore the period for which it is relevant to consider any contravention of the regulations is that which occurred after a piped water supply had been restored and the boil water notice lifted on 7 August.

As an aid to the management of the incident the Company undertook about 23,000 tests. It is noteworthy that, given the duration and extent of the loss of supplies, the impact on water quality was negligible. In the early phase of restoration of supplies a

very small number of tests at consumers taps were positive for E.coli (15) and Enterococci (11). These are findings that would be expected in any large survey of testing consumer tap samples under such operating circumstances. There were also some elevated values recorded for Iron (32), Manganese (10), Turbidity (11), Aluminium (4) and Colour (1). The levels detected were within the expected and normal range for a typical operational event such as a burst main. Sophisticated chemical analysis did not find any evidence of ingress of contaminants such as petroleum or other undesirable organic substances.

4.3 A small number of samples taken on 8 and 9 August demonstrated exceedences of the Aluminium (max 1160ug/l), Iron (max. 4060ug/l), Manganese (max 430ug/l) and Turbidity (19.3 NTU) standards in the Water Supply (Water Quality) Regulations 2000, these primarily relate to disturbance of mains deposits. Repeat samples were satisfactory and when assessed in the context of the incident I am satisfied that these are unlikely to recur.

5. Notification

5.1 The Company notified Gloucestershire Primary Care Trust (PCT), Worcestershire PCT, Warwickshire PCT, Cotswold District Council, Wychavon District Council and Stroud District Council of this incident on 22 July 2007. I therefore **conclude** that the Company met the requirements of Section 35(8) of the Water Supply (Water Quality) Regulations 2000. Regular updates were also provided throughout the event.

5.2 The Inspectorate was notified on 22 July 2007 and the Company subsequently submitted reports and further information by the agreed dates. I therefore **conclude** that the Company met the notification and reporting requirements of Section 7 of the Water Undertakers (Information) Direction 2004.

6. Water unfit for human consumption

6.1 It is possible that some consumers may have rejected their water supply for drinking, cooking and bathing when supplies were first restored. The Inspectorate obtained a witness statement from one consumer who lived in Quedgeley, Gloucester who suffered skin discomfort (itching and a rash) after taking a shower on either 29 or 30 July when the water supply returned. This consumer had run taps to waste for ten minutes before showering. The symptoms lasted for 4 days. The consumer described the water supply on first use as *“the water was cloudy but otherwise I didn’t smell or notice anything else different to normal”*. When considering whether consumers rejected the water supply, the Inspectorate has taken into account other relevant

factors beyond the control of the Company. Stagnant water within household plumbing systems if not flushed to waste may have contained elevated levels of plumbing metals. Also air entrained in water as pipes under mains pressure refilled will have been released by the action of turning on taps causing temporary cloudiness.

6.2 The above mentioned consumer provided information pointing to another possible reason for rejection of water, namely, an inability to access a source of timely advice and reassurance. The above mentioned consumer had received an advice letter identified on the first page as being issued by Gloucestershire Primary Care Trust. This advice letter bore no contact phone numbers and no postal or web address for contact purposes, the consumer assumed it came from Severn Trent and visited their website to seek additional contact numbers. After various fruitless attempts to obtain specific advice on the relevance of her symptoms from the water company (using the customer services billing number on a recent water bill), the consumer then contacted the Health Protection Agency via their website (www.hpa.org.uk), she was then forwarded on to the Drinking Water Inspectorate. By then the consumer had also contacted NHS Direct because this was the only phone number contained within the body of the text of the health leaflet. The consumer stated *“They (NHS Direct) were unaware that their contact details had been put in the advice leaflet and the advisor said she’d refer it to a higher level and would call me back. NHS called me back. They reiterated guidelines Severn Trent had given them....she (the NHS advisor) was unable to provide advice on how to treat my symptoms.....she told me to contact my GP”*. I **conclude** therefore that it is probable, given the lack of contact information, that the advice leaflet itself may have contributed to some degree to the rejection of the water supply by this consumer and it is reasonable to assume that other consumers will have responded in a similar fashion. I **recommend** that the water company ensures that in all future incidents it retains full responsibility for the preparation and issuing of advice to its customers on any precautions they need to take regarding use of the water supply and that warning notices conform to best practice regarding content and contact information (see paragraph 7.3.). I **further recommend** that the Company takes steps to ensure that important consumer warning advice can be placed promptly and prominently on its website in any future similar incident.

6.3 The Health Protection Agency’s health surveillance did not identify any other consumer reports of symptoms of illness potentially linked to the loss of water supplies from Mythe WTW. However, as has been recorded in other previous flood incidents, it is inevitable that many people were made anxious and experienced elevated levels of stress with varying consequences for themselves and their family. Under these

circumstances, it would be surprising if consumers had not been caused to have some doubts about the quality of their tap water supply when it returned, especially given the Do Not Drink advice issued by Gloucester Primary Care Trust. The issuing of this type of warning notice is a very rare occurrence. It is a type of warning notice designed for use by the water industry only in very exceptional circumstances where there is an identified risk that a water supply system has, or may have, been the subject of serious accidental or deliberate chemical contamination.

6.4 I **conclude** therefore, that there is a lack of sufficient reliable evidence that water unfit for human consumption was supplied by the Company through its pipes and following careful consideration of all circumstances surrounding this incident, I **conclude** there are no grounds for the Inspectorate to proceed with a prosecution under Section 70 of the Water Industry Act 1991.

7. Other Matters

7.1 A copy of the Flood Emergency Response plan for Mythe WTW was provided to the Inspectorate during our investigation. I note that the document provided was not dated nor marked as 'uncontrolled'. The document provided for the Loss of Strensham WTW was also not a 'controlled' document. I **suggest** that the Company implement a proper document control system for such procedures.

7.2 Mythe WTW has been identified as one of several treatment works where the majority of consumers cannot receive water from any other source. Strensham WTW and Mitcheldean WTW can supply a small proportion of the required water which, under normal circumstances, would be sufficient to maintain supplies for 24 hours. I **recommend** that the Company considers making improvements to the resilience of the alternative supply arrangements for consumers served by Mythe WTW.

7.3 The Inspectorate has had discussions at national level with the Health Protection Agency regarding the rationale for the use in this incident of a Do Not Drink notice to consumers. It is understood that in the early stages of the incident some health advisors were very concerned about a hazard known as back-flow/back-siphonage. This hazard was perceived as posing a significant risk that required mitigation. Additionally the opinion was expressed that there was a significant risk of flood water entering underground water pipes in flooded streets and properties. It would appear that the decision to issue a Do Not Drink notice was not informed by 1) An understanding and appreciation that routine day to day water operations are not risk free and 2)

Knowledge of the back-flow/back-siphonage protection regime in place (The Water Supply (Water Fittings) Regulations 1999) together with the records held by the water company relating to inspections of plumbing systems in premises in the area affected by the incident. At the time of setting up the DMA recharge plan the Company provided information to the Inspectorate to show that high risk premises in the area were few in number and had been inspected to ensure appropriate back-flow prevention arrangements were installed. Accordingly measures to mitigate a street level back-flow event were already in place and the back-flow/back-siphonage risk should have been regarded as being minimal. As regards the hypothetical pipe ingress risk, flooding of streets is a fairly common occurrence and ingress of flood water into buried pipes is not only unlikely from an engineering point of view but it has never been recorded as a cause of a drinking water contamination event in the manner envisaged. After very careful consideration of the rationale underpinning the decision to issue a Do Not Drink notice I **conclude** that there was no sound basis for the issuing of such a notice in connection with this incident. Furthermore, and in light of the observations made in paragraph 6.1 above I **conclude** that consumers would have benefited more if as part of the DMA recharge plan they had been received a standard “routine” notice of the type used by all water companies whenever planned work are undertaken on the mains network. Such advice warns consumers to expect cloudiness due to air and/or discolouration due to mains deposits and advises on the flushing of taps until the water runs clear before use. Following national discussions the Inspectorate and the Health Protection Agency have agreed to prepare and issue joint guidance on the subject of consumer warning notices.

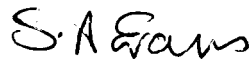
7.4 A copy of this letter has been sent for information to, Martin Hurst, Director of Water, DEFRA; Peter Jiggins, Water Supply and Regulations Division, DEFRA; Richard Wood, Water Supply and Regulations Division, DEFRA; Rowena Tye, Scientific Advisor at the Office of Water Services (OFWAT), Sir James Perowne, Chair of Consumer Council for Water (Midlands); Pat Troop, Chief Executive, Health Protection Agency; Professor Nigel Lightfoot, Chief Advisor to the CEO, HPA; Pamela Taylor, Chief Executive, Water UK; Regina Finn, OFWAT; Colin McLaren, Drinking Water Quality Regulator for Scotland; Randal Scott, Drinking Water Inspectorate for Northern Ireland; Ronnie Alexander, Chief Environmental Health Advisor, Welsh Assembly Government; Natalie Howes, Climate Change and Water Division, Welsh Assembly Government;. Dr Ruth Wain, Gloucestershire Primary Care Trust (PCT); Dr Ash Bannerjee, Worcestershire PCT; Dr Madhu Bardhan, Warwickshire PCT; Dr Shona Aurora, Cotswold and Vale PCT; Ray Brassington, Cotswold District Council; Steve Jordan, Wychavon District Council; Phil

Park, Stroud District Council; Tim Perrin Forest of Dean District Council; David Steels, Tewkesbury District Council; Mick Coates, Malvern Hills District Council;

A copy is also available by contacting the Drinking Water Inspectorate on 0207 270 3370 or dwi.enquiries@defra.gsi.gov.uk

7.5 I look forward to receiving a response to each of the recommendations by 11 April. Your response should also include details of any other actions taken or planned by the Company.

Yours sincerely



Sharon A Evans

Deputy Chief Inspector (Operations)

Annex 1 continued: Legal Advice to the Cabinet Office given during the Mythe Incident

To Cabinet Office



DRINKING WATER INSPECTORATE

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DWI Website: <http://www.dwi.gov.uk>

[guardians of drinking water quality](#)

31st July 2007

Q. Who is responsible for sign off that water is safe to drink?

A. Severn Trent Water is responsible for carrying out the monitoring and making the information available to the Drinking Water Inspectorate who are responsible for carrying out an independent assessment of the information.

The Legal Position

1. Under **section 68 Water Industry Act 1991** (WIA), Severn Trent Water is under a statutory duty to supply **wholesome** water for domestic use or commercial food production purposes. This duty is enforceable by the Secretary of State, ultimately by Court order. For Severn Trent Water, wholesomeness is defined in **Regulation 4 of the Water Supply (Water Quality) Regulations 2000**. These regulations, including the definition of wholesomeness, implement the EC Drinking Water Directive for public water supplies. Under these regulations, Severn Trent has a wide range of monitoring and other obligations which are also enforceable by the Secretary of State, ultimately by Court order.

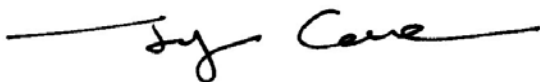
2. Loss or damage caused by a failure of Severn Trent Water to supply wholesome water for domestic purposes could result in a **civil claim from damages** by consumers. Supply by Severn Trent Water of water **unfit for human consumption** is also a criminal offence under **section 70 WIA**.

3. The Secretary of State's functions in relation to the above (i.e. drinking water quality and sufficiency) are performed by the **Chief Inspector of Drinking Water** and expert **inspectors** appointed by Secretary of State under **section 86 WIA**. This includes being able to obtain relevant information on drinking water quality. It is a criminal offence under **section 207 WIA** for Severn Trent Water **knowingly or recklessly to supply false information under, or for the purposes of, the WIA**. The Chief Inspector and her statutory inspectors have additional functions specific to their appointments which include the Chief Inspector being able to institute and carry out prosecution proceedings in the name of the Chief Inspector.

How does the Inspectorate exercise its powers and provide guidance to the water industry?

4. The Water Undertakers (Information) Direction 2004 requires water companies to notify the Inspectorate of any event which by its nature has affected or is likely to affect the quality or sufficiency of water supplied by it. The Direction also requires companies to provide additional information at specified time periods in a format determined by the Inspectorate (recognising that each incident will be unique).

5. The Inspectorate has issued guidance to water companies as to the reporting requirements of the Direction. The most recent guidance document "Drinking Water Inspectorate – Guidance on Notification of Events" was issued to water companies via DWI Information Letter 12/2004 on 12 November 2004



Professor Jeni Colbourne MBE

Chief Inspector of Drinking Water

Annex 2: The effectiveness of the drinking water quality regulations

The following paper authored by Professor Jeni Colbourne, Chief Inspector of Drinking Water and Dr Annabelle May, Inspector, Drinking Water Inspectorate explains recent changes to the regulatory framework to incorporate risk assessments.

Regulatory risk assessment roll-out for England and Wales

Drinking water quality regulation in England and Wales is based around self monitoring by water suppliers accompanied by validation of that monitoring by the water quality regulator, the Drinking Water Inspectorate.

ANNABELLE MAY and **JENI COLBOURNE** look at how the regulatory framework was recently extended to incorporate risk assessments as a means of implementing the WHO Water Safety Plan approach.

Since the privatisation of the water industry in England and Wales in 1989, drinking water quality regulation has been founded on the 'self regulation' model. To enable self regulation to work in the context of an industry intrinsically linked to the protection of human health required the setting up of robust systems of independent scrutiny, putting the quality of drinking water beyond question in respect of public confidence.

The water industry in England and Wales was privatised after a long history of inadequate funding under a public regime. In order for privatisation to take place, a comprehensive regulatory regime was established comprising three regulators – the Drinking Water Inspectorate (DWI), the Water Services Regulation Authority (Ofwat) and the Environment Agency (EA). The DWI regulates drinking water safety and quality and therefore is responsible for verifying whether human health is being protected through the industry's compliance with regulatory requirements, including the standards set in the EU Drinking Water Directive, as well as holding water companies to account when things go wrong.

The DWI has 27 technically qualified inspectors and offices in central London. In addition, they have ten support staff managing information and data systems. This makes a total complement of 37 staff regulating a water industry made up of 25 utilities plus a small but increasing number of new entrants (licensees and inset appointments) collectively delivering water supplies to 99% of the population of England and Wales (53,635,479) via 1224 water works, 4522 service reservoirs and 338,546 km of water mains (2007 figures). The total cost of running the regulatory body is

approximately £3 million (\$4.2 million) annually which includes a research budget of £800,000 (\$1.12 million) managed on behalf of the Department for Environment, Food and Rural Affairs, the part of government with responsibility for water. The DWI is a lean organisation because it prioritises its work where it is most beneficial to the public interest. For this regulator, public confidence in drinking water, compliance with the EU Drinking Water Directive and the protection of human health are its key objectives.

Self regulation

The drinking water quality laws and regulations are set out in primary legislation in the form of the Water Act 1991 (as amended by the Water Act 2003) and in secondary legislation in the form of the Water Supply (Water Quality) Regulations 2000 (England) and 2001 (Wales) (Amendment) Regulations 2007. In addition there are 'Directions' issued to the industry which are made under the Act. Through this legislation, the DWI is afforded a complete range of regulatory powers extending from advice and guidance, the making of recommendations, through to enforcement and prosecution. These powers have all been exercised by the DWI since its creation, although the pattern of use has changed over time. One model for using regulatory powers is depicted in Figure 1, with cooperation, negotiation and discussion being the most frequently used. These are collectively known as 'soft regulation' which, if successful, negate the need to use 'harder' regulatory tools, with prosecution being reserved for use only in the most serious of circumstances. Guidance on best practice is developed in collaboration with industry, thereby ensuring that the industry has full

ownership of operational matters.

Self monitoring is the foundation of the regulatory process adopted in England and Wales. The drinking water regulations set out in detail the duties of water companies in respect of how, when and where to test the quality of public drinking water supplies. Many of these requirements derive from the European Drinking Water Directive. The legislation requires water companies to report all water quality test results on a month by month basis to the DWI. So, how does DWI approach the task of being confident that these results are accurate?

To rely on self monitoring, there must be systems of checking that the legislation and guidance have been followed consistently by the industry. As well as auditing all water company laboratories, including those that are outsourced, DWI uses a technique known as vertical audit which targets a set of randomly selected samples on a regular basis. The 'vertical audit' is akin to establishing a chain of evidence, checking that scheduled samples were in fact taken at the scheduled place and time in the correct manner and then transported correctly to the laboratory, stored and tested according to recognised standards of analytical technique with appropriate quality control and finally reported openly via the company's information system. At each step, records and other evidence are scrutinised and best practice suggestions are made, or on finding a deficiency, formal recommendations backed up by enforcement if necessary. The DWI through this process does not therefore have to take samples of public water supplies itself and the monitoring costs are borne by the water suppliers and recovered as part of the price charged to customers.

When a result of a test exceeds the standard for a parameter under the self

Figure 1: The Enforcement Pyramid for the England and Wales based on the Ayres and Braithwaite (1992) model



regulation regime the water company must take action. Equally, any other operational event that may have an impact on drinking water quality or supply must be reported. The duty to rectify a quality problem is imposed upon the company with the actions being reported to the regulator. The onus is thus on the company to provide evidence that the action taken was appropriate, timely and that the remedy will reduce the risk of any recurrence of the problem. The regulator's role is to assess the company's action independently and, where necessary, to require additional or further action.

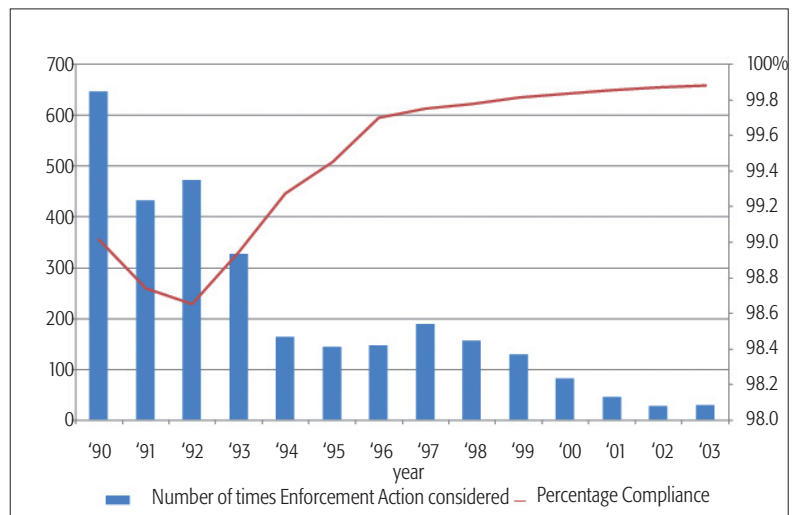
Self regulation has not resulted in any lessening of regulatory powers, rather it has focussed the use of enforcement powers where they are most needed to effect a permanent improvement in drinking water quality. Evidence that water quality has improved can be seen in the pattern of use of enforcement powers. Over time this has changed – in the first year of DWI operation, enforcement action was considered 648 times whereas 14 years later it was only necessary on 29 occasions (Figure 2).

The economic regulation of the water industry has been much studied and written about. The regime of self regulation of drinking water quality feeds into the water price review process of the economic regulator, Ofwat, by identifying the component parts of the Drinking Water Quality investment programme which is part of water companies' five year business plans. Before the start of each five year period companies have to specify their plans for achieving compliance with drinking water standards where there is a risk of failure. The companies have to produce evidence of the need for schemes such as quality data and other technical information as set out by DWI. If certain criteria are met, the DWI will make the scheme a 'statutory' duty on the company. Ofwat concerns itself then with the cost of delivery, not the justification, for each scheme when setting companies' price limits. The important aspect of the self regulation regime is that it is the water companies that own their improvement programmes within the context of their business plans, thereby ensuring that compliance with standards and therefore protection of public health is at the heart of the business.

Risk assessment

Changes were made to the drinking water regulations in 2007 to clarify and strengthen the duties of water companies to adequately treat and disinfect water before it is supplied to

Figure 2: Number of times enforcement action considered by DWI relating to supply zones and percentage compliance with drinking water quality standards



consumers, and to introduce new provisions related to risk assessment and risk management. The essence of these new provisions is for companies to carry out a comprehensive risk assessment of each of their water supply systems from catchment to tap, identifying hazards, quantifying any associated risk and instigating risk mitigation measures. The new regulations require that further action must be taken if risk mitigation is insufficient to address the identified risk. As well as providing companies with an opportunity to demonstrate that mitigation measures are robust, a sound risk assessment and risk management process serves as due diligence in the event of an incident occurring. From the point of view of the regulator, risk assessment is a regulatory tool which is comprehensive and capable of dealing with all types of hazards, not just those which are regulated for by means of standards and monitoring. For example, the lack of an adequate power supply poses a risk to drinking water quality, but it is one that cannot be controlled by testing.

By introducing a regulatory requirement for companies to carry out risk assessments, the UK government formalised its adoption of the Water Safety Plan (WSP) approach as its policy for the provision of safe drinking water. In 2004, the World Health Organisation (WHO) published its third edition of the Drinking Water Guidelines (the Guidelines) which advocated 'Water Safety Plans' as 'the most effective means of consistently ensuring the safety of a drinking water supply... through the use of a comprehensive risk assessment and risk management approach that encompasses all steps in water supply from catchment to consumer.'

The DWI supported the launch of the Guidelines and advocated the approach encouraging all companies to adopt WSP principles. This informal cooperative approach, which took place over a period of about three years, enabled DWI and the industry to collectively gather the evidence

required to underpin the policy recommendation and resultant change to regulations to incorporate a risk assessment and risk management approach. The first formal Risk Assessment Reports for all of water supply systems in England and Wales were submitted by companies to DWI by 1 October 2008.

One of the overarching principles of WSPs is that they are unique to the management system of the water supplier, therefore, no one reporting format was prescribed, rather a set of minimum information requirements were published by the DWI. A key requirement was that companies must declare any significant risk identified and the action(s) the company had or will put in place to mitigate that risk in the short, medium and long term.

Almost 800 risk assessment reports were submitted to DWI covering all treatment works and their associated supply systems within England and Wales. Initially, each report was independently checked by DWI for completeness in respect of the minimum information requirements and a check was made that all water assets (treatment works, service reservoirs and water supply zones (distribution systems)) had been risk assessed. The quality of these reports varied greatly, sometimes this was due to a misinterpretation of the information (reporting) requirements, but in other instances it reflected the quality of the WSP from which the company was extracting the information.

All deficiencies were highlighted in an initial written response to companies, along with a deadline for resubmission. Although assessment of the reports was a complex and resource intensive process because of the variations in detailed methodology, even at this early stage it is evident that the reports have provided the regulator (DWI) with valuable evidence to support its own parallel 'better regulation' changes to the way in which it exercises its day-to-day regulatory functions. The reports and the information they contain are now being embedded into DWI databases

and operating procedures for compliance assessment, audits, inspections and enforcement.

The medium to long term improvements identified as required in Risk Assessment Report Action Plans have been included in the business plans of companies submitted to Ofwat for inclusion in the next five-yearly water price review (PR09 investment programme) where they fit Ofwat's criteria for funding. Those components of the action plans which do not qualify for funding in this way still have to be carried out by the companies as part of regulatory compliance. To ensure that all components of the action plans are delivered, DWI has the power to serve a 'Notice' on a company specifying the control measures to be carried out, and by when, to mitigate the identified risks. In this way there is therefore no possibility of an identified risk of supplying water that would constitute a risk to human health falling outside the delivery responsibility of the companies.

Additionally and importantly the WSP approach recognises that there can be a wide range of different types of effective control measures, and investment in water treatment is not the only or necessarily desirable solution. In many instances, the documented control measures are improvements in catchment control, monitoring, the performance and maintenance of existing assets, and enhancements in competence of staff. Through the application of water safety plan methodology in a regulatory framework, companies have been able to more clearly identify, document and communicate actual and potential risks, and commit openly to delivery of appropriate cost-effective mitigation measures using a process fundamentally owned by each company. This ownership, understanding and communication by the water supplier is central to the task of consistently delivering safe drinking water in a way which maintains public confidence.

Overall, the regime of self regulation of drinking water quality together with its link into the system of economic regulation of the industry has produced a framework that has enabled water companies to achieve and maintain a steady and affordable improvement in drinking water quality. The regime has kept the costs of drinking water regulation (and the financial cost to the consumer) to a minimum, by avoiding duplication of drinking water quality testing and targeting action on the basis of risk, and thus achieving the greatest benefit to public health. ●

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Annex 3: Drinking water hazards

The drinking water quality standards are set out in statute in the Water Supply (Water Quality) Regulations 2000 (as amended) which apply in England and the Water Supply (Water Quality) Regulations 2001(as amended) which apply in Wales. The same, or very similar, standards are set out in equivalent regulations in Northern Ireland and Scotland. Most of the standards are those set out in the European Drinking Water Directive and are derived mainly from the recommendations of the World Health Organisation (WHO). There are also some national standards. Each regulated substance or organism is known as a parameter. As well as setting standards for each parameter, the regulations state how often each one should be tested for and where the samples for testing should be taken. About one-third of samples are taken from consumers' taps and the rest are taken from treatment works or treated water storage reservoirs. The parameters and standards are described below. Anyone wishing to find out more about how each standard is derived can do so by accessing the published WHO expert opinion (www.who.int). When the regulations are revised there is full public consultation by Defra Water Supply and Regulation Policy Division. This was last done in 2007.

Microbiological standards

To protect public health there are microbiological standards which have to be met at each treatment works and treated water service reservoir or water tower.

Microbiological tests are also undertaken on consumer tap samples. The significance of individual test results for each microbiological parameter at each location varies and a single positive result does not necessarily mean that water is unsafe to drink. Other information is required to assess water safety. Each of the standards is listed below:

***Escherichia coli* and Enterococci** are bacteria present in the gut of warm-blooded animals. They should not be present in drinking water and, if found, immediate action is required to identify and remove any source of faecal contamination that is found. The standard is 0 per 100ml.

Clostridium perfringens is a spore-forming bacterium that is present in the gut of warm-blooded animals. The spores can survive disinfection. The presence of spores in drinking

water in the absence of *E.coli* and Enterococci indicates historic or remote faecal contamination that requires investigation. The standard is 0 per 100ml.

Coliform bacteria are widely distributed in the environment often as a result of human or animal activity, but some grow on plant matter. Their presence in a water supply indicates a need to investigate the integrity of the water supply system. The standard is 0 per 100ml.

Colony Counts are general techniques for detecting a wide range of bacteria, the types and numbers being dependent on the conditions of the test. These counts, if done regularly, can help to inform water management, but they have no direct health significance. The standard is 'no abnormal change'.

Health-based chemical standards

Health-based standards for chemical parameters are set using a precautionary approach and on the basis of a lifetime's consumption of water and taking into account other exposure through routes other than drinking water (e.g. food). Just because a standard has been set for a substance does not mean that it is present in drinking water. The vast majority of the regulated chemicals are never found in drinking water in England and Wales at levels approaching or exceeding the standards. Others may occur only in very specific or local circumstances which are described below. A common situation is leaching from fixtures and fittings or pipework within a specific building water system.

The chemical parameters for which prescribed concentrations or values are specified in the Water Supply (Water Quality) Regulations 2008 (as amended 2007) are:

Acrylamide monomer is not normally found in drinking water. It is produced in the manufacture of polyacrylamides occasionally used in water treatment. Its presence in drinking water is limited by control of the product specification. The standard is 0.1 µg/l.

Antimony is rarely found in drinking water. Trace amounts can be derived from brass tap fittings and solders. The standard is 5 µg Sb/l.

Arsenic occurs naturally in only a few sources of groundwater. Specific water treatment is required to remove it. The standard is 10 µg As/l.

Benzene is present in petrol. It is not found in drinking water, but it can migrate through underground plastic water pipes if petrol is spilt in the vicinity. Some bottled waters and soft drinks which include sodium benzoate as an ingredient have been reported as containing benzene. The standard is 1 µg/l.

Benzo(a)pyrene is one of several compounds known as polycyclic aromatic hydrocarbons (PAHs). Their source in drinking water is as a result of deterioration of coal tar which was used to line water pipes up until the early 1970s. Due to extensive water mains refurbishment and renewal it is now rare to detect this substance in drinking water. The standard is 0.01 µg/l.

Boron in surface water sources comes from industrial discharges or from detergents in treated sewage effluents. It can be present in partially desalinated seawater when this is used to supplement drinking water supplies. Concentrations found in drinking waters are generally very low. The standard is 1 mg B/l.

Bromate can be formed during disinfection of drinking water as a result of a reaction between naturally occurring bromide and strong oxidants (usually ozone). It may be generated in the manufacture of sodium hypochlorite disinfectant. Exceptionally, groundwater beneath an industrial site can become contaminated with bromate. The standard is 10 µg BrO₃/l.

Cadmium is rarely detected in drinking water and trace amounts are usually due to dissolution of impurities from plumbing fittings. The standard is 5 µg Cd/l.

Chromium in drinking water comes from the coatings on some taps and plumbing fittings. The standard is 50 µg Cr/l.

Copper in drinking water comes mostly from copper pipes and fittings in households. In general, water sources are not aggressive towards copper, but problems very occasionally occur on new housing estates or in new installations. These 'blue water' events can be avoided by good plumbing practices. The standard is 2 mg Cu/l.

Cyanide is not normally present in drinking water, but could be present in surface water as a result of a specific industrial contamination incident. The standard is 50 µg CN/l.

1,2-Dichloroethane is a solvent that may be found in groundwater in the vicinity of industrial sites. Where necessary it can be removed by special water treatment. The standard is 3 µg/l.

Epichlorhydrin can be found in trace amounts in polyamine water treatment chemicals. Its presence in drinking water is limited by control of the product specification. The standard is 0.1 µg/l.

Fluoride occurs naturally in many water sources, especially groundwater. It cannot be removed by conventional water treatment, so high levels must be reduced by blending with another low fluoride water source. In addition, some water companies are required by the local health authority to fluoridate water supplies as a protection against tooth decay. No adverse health effects are anticipated at levels of fluoride at, or below, the drinking water standard. Fluoridation of water is a Department of Health policy. The standard is 1.5 mg F/l.

Lead very occasionally occurs naturally in raw waters, but the usual reason for its presence in drinking water is lead plumbing in older properties. If the water supply has a tendency to dissolve lead then water companies treat the water to reduce consumer exposure. The permanent remedy is for householders to remove lead pipes and fittings. The standard is currently 25 µg Pb/l. A stricter standard of 10 µg Pb/l will apply from 2013 onwards.

Mercury is not normally found in sources of drinking water in the UK. The standard is 1 µg Hg/l.

Nickel occurs naturally in some groundwater and, where necessary, special treatment can be installed to remove it. Another source of nickel in drinking water is the coatings on modern taps and other plumbing fittings. The standard is 20 µg Ni/l.

Nitrate occurs naturally in all source waters although higher concentrations tend to occur where fertilisers are used on the land. Nitrate can be removed by ion exchange water treatment or through blending with other low nitrate sources. The standard is 50 mg NO₃/l.

Nitrite is sometimes produced as a by-product when chloramine (a mixture of chlorine and ammonia) is used as the essential residual disinfectant in a public water supply. Chloramine is the residual disinfectant of choice in large distribution systems because it is more stable and long-lasting. Careful operation of the disinfection process ensures that levels of nitrite are below the standards of 0.1 mg NO₂/l in water leaving water treatment works and 0.5 mg NO₂/l at consumers' taps.

Pesticides – organochlorine compounds (aldrin, dieldrin, heptachlor, heptachlor epoxide) are no longer used in the UK because they are persistent in the environment.

They are very unlikely to be found in drinking water. The standard for each compound is 0.03 µg/l.

Pesticides – other than organochlorine compounds are a diverse and large group of organic compounds used as weed-killers, insecticides and fungicides. Many water sources contain traces of one or more pesticides as a result of both agricultural uses mainly on crops and non-agricultural uses, mainly for weed control on highways and in gardens. Where needed, water companies have installed water treatment (activated carbon and ozone) so that pesticides are not found in drinking water. The standard is 0.1 µg/l for each individual substance and 0.5 µg/l for the total of all pesticides. Water companies must test for those pesticides used widely in their area of supply. Pesticide monitoring thus varies according to the probability and anticipated nature of contamination.

Polycyclic aromatic hydrocarbons is a group name for several substances present in petroleum-based products such as coal tar. The standard is 0.1 µg/l for the sum of all the substances (see Benzo(a)pyrene listed above for more information).

Selenium is an essential element and a necessary dietary component. Amounts in drinking water are usually well below the standard of 10 µg Se/l.

Tetrachloroethane and Trichloroethene are solvents that may occur in groundwater in the vicinity of industrial sites. Where necessary they are removed by specialist treatment. The standard is 10 µg/l for the sum of both substances.

Trihalomethanes are formed during disinfection of water by a reaction between chlorine and naturally occurring organic substances. Their production is minimised by good operational practice. The standard is 100 µg/l.

Vinyl chloride may be present in plastic pipes as a residual of the manufacturing process of polyvinyl chloride (PVC) water pipes. Its presence in drinking water is controlled by product specification. The standard is 0.5 µg/l.

National chemical and physical standards

The European Drinking Water Directive (DWD) recognises that Member States can set additional standards and the UK has decided to retain national mandatory standards for several parameters set in the original 1980 DWD that have become additional monitoring parameters in the 1998 DWD. Most of the standards are set on the basis

that higher levels may make the water unacceptable to consumers on the grounds of taste, odour or appearance.

Aluminium occurs naturally in some source waters. It is removed from drinking water by conventional water treatment (coagulation and filtration). Aluminium sulphate and polyaluminium chloride may be used as water treatment chemicals at some water treatment works. The standard is 200 µg Al/l.

Colour occurs naturally in upland water sources and is caused by natural organics which are characteristic of these catchments. It is removed by conventional water treatment. The standard is 20 mg/l on the Pt/Co scale.

Iron is present naturally in many water sources. It is removed by water treatment. Some iron compounds are used as water treatment chemicals. However, the most common source of iron in drinking water is corrosion of iron water mains. The standard is 200 µg Fe/l.

Odour and Taste can arise as a consequence of natural substances in surface waters, particularly between late spring through to early autumn. Water treatment with activated carbon or ozone will remove these natural substances. The standard is described as acceptable to consumers and no abnormal change in odour or taste.

Sodium is a component of common salt (sodium chloride). It is present in seawater and brackish groundwater. Some water treatment chemicals contain sodium. Concentrations in drinking water are extremely low, but some water softeners can add significant amounts where they are installed in homes or factories. The standard is 200 mg Na/l.

Tetrachloromethane is a solvent that may occur in groundwater in the vicinity of industrial sites. Where necessary it is removed by specialist water treatment. The standard is 3 µg/l.

Turbidity is a measure of the cloudiness of water. It can arise from disturbance of sediment within water mains. The standard at consumers' taps is 4 NTU (see also turbidity at treatment works below).

Additional monitoring parameters

In addition to the drinking water standards, water companies are required to test for additional indicator parameters to assist them with good water supply management and the control of drinking water quality. Some of these parameters have a European guide value set for the purpose of triggering an investigation of the water supply.

Ammonium salts are naturally present in trace amounts in most waters. Their presence might indicate contamination of sanitary significance and they interfere with the operation of the disinfection process. The guide value is 0.5 mg NH₄/l

Chloride is a component of common salt. It may occur in water naturally, but it may also be present due to local use of de-icing salt or saline intrusion. The guide value is 250 mg Cl/l.

Conductivity is a non-specific measure of the amount of natural dissolved inorganic substances in source waters. The guide value is 2,500 µS/cm.

Hydrogen Ion (pH) gives an indication of the degree of acidity of the water. A pH of 7 is neutral; values below 7 are acidic and values above 7 are alkaline. A low pH water may result in pipe corrosion. This is corrected by adding an alkali during water treatment. The guide value is a range between 6.5 and 9.5.

Sulphate occurs naturally in all waters and cannot be removed by treatment. The guide value is 250 mg SO₄/l.

Total Indicative Dose is a measure of the effective dose of radiation the body will receive from consumption of the water. It is calculated only when screening values for gross alpha or gross beta (radiation) are exceeded. The guide value is 0.10 mSv/year.

Total Organic Carbon represents the total amount of organic matter present in water. The guide value is 'no abnormal change'.

Tritium is a radioactive isotope of hydrogen. Discharges to the environment are strictly controlled and there is a national programme of monitoring surface waters. The guide value for drinking water sources is 100 Bq/l.

Turbidity measurement is an important non-specific water quality control parameter at water treatment works because it can be monitored continuously on line and alarms set to alert operators to deterioration in raw water quality or the need to optimise water treatment. The standard at treatment works is 1 NTU.

Other pathogenic organisms

There are a wide range of pathogenic organisms capable of causing adverse human health effects if they are introduced into drinking water supplies. Contaminated water can be the source of large outbreaks of disease, however, for the majority of waterborne pathogens there are other equally important sources of infection, such as person to person contact and food. The human health effects caused by waterborne transmission vary in severity from mild gastroenteritis to severe and sometimes fatal diarrhoea, dysentery, hepatitis, typhoid fever, cholera, cryptosporidiosis and giardiasis. Most waterborne pathogens are introduced into drinking water supplies in human or animal faeces, they do not grow in water and infection is initiated in the gastrointestinal tract. However, some are environmental organisms that grow in water and soil, and can cause opportunistic infections through other routes of transmission, such as inhalation leading to respiratory infections (legionellosis) or infections at sites as diverse as skin and brain (*Naegleria fowleri*).

For an exhaustive global list of fact sheets on pathogenic organisms potentially associated with water-related infections see Chapter 11 of the WHO Guidelines for Drinking Water Quality (http://www.who.int/water_sanitation_health/dwq/guidelines/en/). Set out below is a summary of the subset of pathogenic organisms of direct relevance to waterborne transmission in the context of UK private and public water supplies.

Bacterial pathogens

Aeromonas species

These occur widely in water, soil and food, and are capable of growth in water distribution systems. They are capable of infecting open wounds and septicaemia can occur in immuno-compromised persons. The presence of aeromonads in drinking water is generally considered a nuisance rather than a health hazard. The organisms are detected by colony counts and controlled by good water supply distribution management and hygiene practices.

Campylobacter species

These are one of the most important causes of acute gastroenteritis worldwide. *Campylobacter jejuni* is the most frequently isolated species from patients with acute diarrhoeal disease. As few as 1,000 organisms can cause infection and most infections

occur in infants and young children. Wild and domestic animals, especially poultry, wild birds and cattle, are important sources, other sources include domestic pets and contaminated food and drinking water, including meat and unpasteurised milk. Control of drinking water transmission relies on the protection of raw water sources from animal and human waste, adequate disinfection and protection of stored water from animal and bird faeces.

Escherichia coli pathogenic strains

Most *E.coli* strains are present in large numbers in the normal gut flora of humans and animals. A few strains can cause serious disease (bacteraemia, urinary tract infections, meningitis) in other parts of the body and some cause acute diarrhoea.

These enteropathogenic *E.coli* are identified on the basis of virulence factors and the most well known in the context of waterborne transmission are the enterohaemorrhagic *E.coli* (EHEC), particularly serotypes O157:H7 and O111. As few as 100 organisms can cause infection and up to seven per cent of cases develop a potentially fatal haemolytic uraemic syndrome (HUS) characterized by acute renal failure due to production of two enterotoxins simultaneously. Control of drinking water transmission of pathogenic *E.coli* is the same as that for other *E.coli*, namely raw water protection from faecal waste, adequate disinfection and protection of stored water.

Legionella

Although all *Legionella* species are potentially pathogenic for humans, *Legionella pneumophila* is the major species responsible for legionellosis which occurs in two clinical forms; legionnaire's disease, a pneumonia, and Pontiac fever, a milder respiratory infection. *Legionella spp* are common in surface waters and moist soils, and they grow in warm conditions in the range of 25 – 50 degrees centigrade. Transmission is via inhalation. Control focuses on building water system design and maintenance through minimising the production of water aerosols and limiting growth conditions by keeping cold water cold and hot water hot. Most large waterborne outbreaks have been linked to cooling towers which are poorly maintained, whereas sporadic infections are more commonly linked to hot water systems in large buildings.

Mycobacteria

The non-tuberculous or atypical strains are natural inhabitants of water environments. They can give rise to a range of diseases involving the skeleton, lymph nodes, skin and soft tissue as well as respiratory, gastrointestinal and genitourinary tracts. They are a major cause of disseminated infections in immunocompromised patients and a common

cause of death in HIV positive persons. Only two species have been reported in tap water, *M.kansasii* and *M.avium* complex. Water-related infections due to the latter have been attributed to unfiltered water supplies and *M.kansasii* has been found in domestic showers and hospital water systems in the Netherlands and UK respectively. The organisms are more resistant to disinfection with chlorine than other bacteria, such as coliforms, therefore control relies on treatment by filtration and effective management of distribution systems to minimise growth conditions and maintenance of a persistent level of residual chlorine.

Pseudomonads

These are common environmental organisms with similar characteristics to Aeromonads (see above). *Pseudomonas aeruginosa* is capable of growing on specific construction materials used in building plumbing systems, swimming pools and spas. Exposure to high numbers in water in the latter settings can cause folliculitis (rashes) and ear infections, and the organism can infect wounds and give rise to septicaemia and meningitis in the immunocompromised patient. Control is through the use of suitable approved materials in the design of pools, spas, plumbing systems and water mains. Incidences of high numbers of the organism in packaged waters has been associated with complaints of taste and odour, and this has resulted in a monitoring standard of <1 per 250ml being set for bottled waters. Bottled water regulations can be found at <http://www.food.gov.uk/foodindustry/guidancenotes/foodguid/waterguidance>. There is no equivalent standard for public water supplies due to the fact they are not normally in packaged form.

Salmonella spp

All *Salmonella* species cause either gastroenteritis, septicaemia, enteric/typhoid fever and a carrier state in previously infected persons. Typically diarrhoea is accompanied by fever and abdominal pain which is self-limiting, but infection with *S.typhi* and *S paratyphi* (typhoid strains) is more serious and can be fatal. Waterborne typhoid fever outbreaks have devastating public health implications. The typhoid strains are restricted to humans, but others such as *S.typhimurium* and *S enteritidis* occur in a wide range of livestock, including poultry. Contamination has been detected in many foods and milk, and these pathogens gain access to water sources from sewage discharges, livestock and wild animals. Control measures involve protection of raw water from animal and human waste, adequate disinfection and protection of stored water from animal and bird faeces.

Shigella spp

These cause serious intestinal diseases mostly in young children, including bacillary dysentery. Only 10 – 100 organisms are required to cause infection resulting in severe watery diarrhoea, abdominal pain and fever. A milder self-limiting disease is caused by the *S. sonnei* strain. The organisms are restricted to humans and higher primates with most cases of shigellosis occurring in the institutional setting due to poor sanitation. Prevention of waterborne outbreaks is important due to the severity of the illness caused and control is by protection of raw and treated water from human waste combined with adequate disinfection.

Toxic Cyanobacteria

These are photosynthetic bacteria that share some properties in common with algae, hence they are commonly known as *blue green algae*. However, there are many which are not blue green and can range in colour from yellow to brown and red. Cyanobacteria are common in the environment occurring in soil, sea water and freshwater. Sunlight and warm weather stimulate growth especially in stagnant waters or low flow conditions and in the presence of high nutrient levels (eutrophic waters). Some will form floating surface blooms or scums, others stay mixed in the water column or are bottom dwelling (benthic). Their public health significance derives from the ability of some species to form toxins. At least 13 toxin producing species have been identified and each toxin has specific properties with distinct concerns, including liver damage, neurotoxicity and tumour production. Acute symptoms after exposure include gastric disorders, fever and irritations of the skin, ears, eyes, nose and throat. Cyanobacteria do not multiply in the body and hence they are not infectious. Control relates to source water abstraction management and the minimisation of algal blooms together with prevention of direct recreational contact with algal blooms and by excluding light from stored water tanks.

Vibrio spp

Non-toxigenic strains are widely distributed in water environments, but toxigenic strains occur in water less often because they are generally limited to humans, although they have been found inside aquatic organisms like crustaceans and algae. The prevalence of *V. cholerae* declines notably in colder waters (below 20 degrees centigrade). Illness symptoms are due to the production of the cholera enterotoxin. The majority of those infected do not develop illness, however those who do will experience characteristic 'rice water stools' and suffer severe dehydration and loss of electrolytes which is fatal without treatment. High numbers of organisms are required to cause

infection, therefore person to person contact is not the main cause of spread and serious outbreaks are due to poor sanitation and ingestion of faecally contaminated food and water. Control is by protection of raw water from human waste, adequate disinfection and protection of stored water.

Viral pathogens

Viruses associated with waterborne transmission are predominantly those that infect the gastrointestinal tract and are excreted in human faeces (enteric viruses). As a group, viruses can cause a wide variety of infections and symptoms involving different routes of transmission, sites of infection and routes of excretion. It is worthy of note that viruses responsible for respiratory infection can be discharged in faeces and contaminated water may therefore be a route of transmission through aerosols and droplets. It is also thought that polyomaviruses excreted in urine and linked to long-term health effects have the potential for waterborne transmission. An important issue for control of waterborne transmission is the fact that viruses generally survive better in water, particularly in cold climates, than bacterial indicator organisms. Consequently, satisfactory indicator test results do not preclude the presence of viruses. Another important factor to be considered is the greater resistance of viruses to disinfection compared to bacteria.

Adenoviruses

Infections by Adenoviruses have been linked to consumption of contaminated food and drinking water, although person to person spread through shared utensils and contaminated surfaces in the institutional setting is the more common source of outbreaks of gastroenteritis. Eye infections have been linked to the sharing of towels and goggles when swimming. These viruses consist of double stranded DNA and generally do not grow in cell culture, therefore detection relies on polymerase chain reaction (PCR) techniques. Control is made problematic because human adenoviruses are exceptionally resistant to disinfection, especially UV light irradiation. Protection of raw and treated water is therefore very important to control risks from drinking water supplies.

Astroviruses

These are single stranded RNA viruses detected in environmental samples by PCR techniques. They cause self-limiting gastroenteritis in young children and infected individuals excrete large numbers of the virus in faeces, hence the viruses will be present in sewage. Person to person spread in day care, home settings and institutions is common. Contaminated food and water may be an important route of transmission. Control measures are the same as for Adenoviruses although UV maybe more effective.

Caliciviruses

Caliciviruses are single stranded RNA viruses which include the genera Norovirus (Norwalk like viruses). The human caliciviruses are a major cause of acute viral gastroenteritis in all age groups. Symptoms include nausea, vomiting and abdominal cramps. Less than half of those infected present with diarrhoea and some have a fever. Known as winter vomiting disease the symptoms are relatively mild and self-limiting, however the high attack rate denotes a low infectious dose. Since the virus is excreted in faeces it will occur in domestic waste water as well as contaminated food and drinking water. Numerous water-related outbreaks have been documented in relation to recreational water, ice, water on cruise ships, other drinking waters and shellfish harvested in polluted estuarine waters. Control measures relate to the protection of raw and treated water from faecal contamination and adequate disinfection.

Enteroviruses

These are a wide group of viruses which include poliovirus, coxsackievirus, echovirus. They are the smallest viruses and consist of a single stranded RNA genome. Many can be detected in environmental samples by cell culture. Enteroviruses are all excreted in the faeces of infected individuals and are therefore the most numerous viruses in sewage and sewage polluted waters, however the predominant route of transmission is by person to person contact and inhalation. Control measures relate to the protection of raw and treated water from faecal contamination and adequate disinfection.

Hepatitis A

This is highly infectious and the infecting dose is low. Like other enteric viruses, Hepatitis A virus enters the gastrointestinal tract by ingestion where it infects epithelial cells and then enters the bloodstream to reach the liver where it can cause severe damage in around ten per cent of adult cases. There is a long incubation phase of around 30 days followed by a characteristic onset of symptoms, such as fever, malaise, nausea, anorexia

and eventually jaundice. The evidence for waterborne transmission of Hepatitis A is well documented and stronger than it is for all other viruses. Food borne outbreaks are also relatively common. Travel of people from areas with good sanitation to those with poor sanitation is associated with a high risk of infection, as is drug abuse. Control measures relate to the protection of raw and treated water from faecal contamination and adequate disinfection.

Hepatitis E

This is similar in its effects to Hepatitis A, however, the incubation period for infection is longer and there is a high mortality rate in pregnant women. Currently cases and outbreaks are rare in the UK. Control measures are the same as Hepatitis A above.

Rotavirus

These are double stranded RNA viruses some of which infect humans while others are specific to animals. They are not grown readily in cell culture, but can be detected in environmental samples by PCR techniques. Human rotaviruses are the most important single cause of infant death in the world. The virus infects cells in the villi of the small intestine and disrupts sodium and glucose transport. Person to person transmission and inhalation are the important routes of spread, however, both water and food borne outbreaks are documented. Rotavirus may be more resistant to conventional disinfection techniques than other viruses. Control measures are the protection of source and treated water from contamination by human faecal wastes, and careful attention to adequate treatment and disinfection of drinking water prior to supply to consumers.

Protozoan pathogens

Protozoa and helminths are common causes of human and animal infection which present real challenges for control because most produce cysts, oocysts or eggs that are extremely resistant to disinfection and survive for long periods in the environment.

Acanthamoeba

This is a free living amoebae common in water and soil. Under unfavourable conditions it develops a dormant cyst capable of withstanding extremes of temperature (-26 to 56 degrees C). Cases of acanthameobic keratitis, a painful infection of the cornea, have

been associated with the use of tap water in preparing solutions for washing contact lenses.

It is a rare disease but may lead to impaired vision, blindness and loss of the eye. Since the cleaning of contact lenses is not considered to be a normal domestic use of tap water, control is through the purchase and use of proprietary, sterile, lens cleaning solutions.

Cryptosporidium

This parasite has a complex life cycle which causes a self-limiting, but unpleasant, diarrhoeal illness in humans and animals. It forms oocysts which are shed in faeces in very high numbers. The main route of infection is by person to person spread and by direct contact with farm animals and pets. However, outbreaks due to faecally contaminated drinking water are now widely documented. As few as ten oocysts can lead to infection. The oocysts are very resistant to chlorine, therefore control is achieved by source protection, filtration and disinfection with UV irradiation.

For information on *Cryptosporidium* in drinking water see <http://www.dwi.gov.uk/pubs/bouchier/index.htm> for further details

Giardia

Giardia is a protozoa which colonises the gastrointestinal tract of humans and some animals forming a thick walled cyst which is shed intermittently in faeces. It causes diarrhoea and malabsorption in the small intestine. Illness is generally self-limiting, but can be chronic, lasting over one year, in otherwise healthy people. As few as ten cysts are required for infection. The cysts survive for months in water. Person to person contact is the commonest route of transmission between children. Although more resistant to disinfection with chlorine than bacterial pathogens, unlike *Cryptosporidium*, chlorination can be used as a control measure together with filtration and source water protection.

Naegleria fowleri

This is a free living amoboflagellate distributed widely in the environment which forms resistant cysts under unfavourable conditions. It causes primary amoebic meningoencephalitis in healthy people by entering the brain through penetration of the olfactory mucosa. The disease is acute and patients often die within ten days before diagnosis. Cases are rare, but occur every year. *Naegleria* are thermotolerant and found in warmer waters such as hot springs and swimming pools or spas. Infection is contracted by exposure of the nasal passages to contaminated water and thus

predominantly associated with recreational water uses. Control is by means of water temperature (below 25 degrees C) and the maintenance of a stable and effective residual chlorine level of at least 0.5 mg/l.

Other chemicals

Perfluorooctane sulphonate (PFOS) and perfluorooctanoic acid (PFOA)

These may be present in the environment and water sources as a consequence of their historic use as fire fighting foams. DWI has issued guidance based on HPA advice on trigger levels for monitoring and notification in respect of both these substances (DWI Information Letter 05/2007).

NDMA

N-nitrosodimethylamine (NDMA) is a by-product of industrial processes that use nitrate and/or nitrite and amines. It can also be formed during sewage treatment and during water treatment as a disinfection by-product. It is generally accepted as being a genotoxic carcinogen. DWI has issued guidance based on HPA advice on trigger levels for monitoring and notification in respect of this substance (DWI Information Letter 09/2009).

Annex 4: Drinking Water Safety Plan Methodology

A manual describing how to develop and implement a WSP in clear and practical terms has been published by the World Health Organisation and it is freely available on the WHO website at

http://www.who.int/water_sanitation_health/publication_9789241562638/en/index.html

This is the most up-to-date and authoritative guidance to those seeking to understand the risk assessment process inherent in Water Safety Plans. Contributors and funders were the Drinking Water Inspectorate, United Kingdom; the Australian Agency for International Development; the Water and Sanitation Regulatory Agency, Portugal; the Ministry of Health, Labour and Welfare, Japan; the Environmental Protection Agency, USA; the Swedish International Development Cooperation Agency; and the Federal Ministry of Health, Germany.

The contents page of the manual and the introduction are reproduced below



Contents

- Overview of the modules
- Module 1. Assemble the WSP team
- Module 2. Describe the water supply system
- Module 3. Identify hazards and hazardous events
- Module 4. Determine and validate control measures, reassess and prioritise the risks
- Module 5. Develop, implement and maintain an improvement/upgrade plan
- Module 6. Define monitoring of the control measures
- Module 7. Verify the effectiveness of the WSP
- Module 8. Prepare management procedures
- Module 9. Develop supporting programmes
- Module 10. Plan and carry out periodic review of the WSP
- Module 11. Revise the WSP following and incident

Introduction

“The most effective means of consistently ensuring the safety of a drinking-water supply is through the use of a comprehensive risk assessment and risk management approach that encompasses all steps in water supply from catchment to consumer. In these Guidelines, such approaches are called water safety plans (WSPs)”.

Purpose of the Manual

The words above open Chapter 4 of the Third Edition of the WHO Guidelines for Drinking-water Quality (2004) and capture the philosophy of the WSP approach. The chapter describes the principles of the WSP approach rather than being a guide to their practical application. The aim of this Manual is to provide that practical guidance to facilitate WSP development focusing particularly on organized water supplies managed by a water utility or similar entity.

Points to consider when developing and implementing a WSP

The aim of a WSP is very straightforward:

To consistently ensure the safety and acceptability of a drinking water supply.

The development and implementation of the WSP approach for each drinking-water supply is as follows:

- Set up a team and decide a methodology by which the WSP will be developed;
- Identify all the hazards and hazardous events that can affect the safety of a water supply from the catchment, through the treatment and distribution to the consumers’ point of use;
- Assess the risk presented by each hazard and hazardous event
- Consider if the controls or barriers are in place for each significant risk and if these are effective
- Validate the effectiveness of controls and barriers
- Implement an improvement plan where necessary
- Demonstrate that the system is consistently safe
- Regularly review the hazards, risks and controls
- Keep accurate records for transparency and justification of outcomes

This systematic nature of the WSP strategy should never be lost or forgotten during implementation. The great advantage of the WSP strategy is that it is applicable to ensuring the safety of water in all types and sizes of water supply systems no matter how simple or complex. The WSP approach should be considered as a risk management strategy or umbrella which will influence a water utility’s whole way of working towards the continuing supply of safe water. Significant risks that are not currently controlled need to be mitigated. This may involve short-, medium- or long-term steps for improvement. **The WSP approach should be dynamic and practical and not merely another operating procedure.**

It should not be viewed as a vehicle for generating bureaucracy and paperwork. If it just ends up as a rarely-used folder labelled ‘WSP’ on a shelf, it is almost certainly not an effective approach.

There is no one way to undertake the WSP approach. The text in this Manual shows how the strategy can be implemented, with examples showing what has been effective for some water utilities. What is important is that the WSP approach fits in with the way a utility is organized and operates, otherwise it will not be accepted within the organization. Developing the WSP approach may show that certain ways of working introduce, or do not properly control risks, in which case the utility should alter its way of working. It should not alter its way of working just to comply with a recommendation from a manual or to reflect another utility's methodology.

Implementation of the WSP approach requires both financial support and encouragement from senior management within a utility. There will be financial and resource requirements and these need to be addressed at the outset but there should also be the understanding that proper implementation of the **WSP approach can save money** and better target resources in the longer term.

It is important that the WSP team has adequate experience and expertise to understand water abstraction, treatment and distribution and the hazards that can affect safety through the supply system. For small utilities, additional external expertise may be helpful. The team is vital to getting the WSP approach understood and accepted by everyone connected with water safety in the utility and those outside.

A WSP cannot be done solely as a desk study. It must involve site visits to confirm the knowledge, information and schematics available to the utility. Site visits need to include input from those who work at the sites or within catchments and have detailed local knowledge that may not have been captured within the utility's records. Assessment, updating, compiling or rewriting standard operating procedures is an integral part of the WSP strategy. Ideally, all procedures should be labelled as part of the WSP strategy or way of working which helps to gain recognition and acceptance across the utility.

The water utility will take the lead in the WSP approach but it should not do this in isolation. It is a prime purpose of the WSP approach to identify that others have responsibilities towards ensuring the safety of water and for them to work with the water utility on risk reduction. Examples are agriculture and forestry workers, landowners, industry, transport, other utilities, local government and consumers. It is probably not necessary for representatives of all organizations to be included in the WSP team but they should be part of a communication network and aware of the impact of their contributions to the WSP effort. It is important that the WSP is subject to regular external independent audit. This will retain the confidence of all stakeholders.

There can be a tendency for the identification of hazards to be limited to thinking about those direct inputs to the water supply system impacting microbial and chemical parameters, as these are important in terms of compliance with water quality standards. However, the approach to ensure safe water must go much wider, with consideration of aspects such as potential for flood damage, sufficiency of source water and alternative supplies, availability and reliability of power supplies, the quality of treatment chemicals and materials, training programmes, the availability of trained staff, service reservoir cleaning, knowledge of the distribution system, security, emergency procedures, reliability of communication systems and availability of laboratory facilities all requiring risk assessment. This list is by no means exhaustive. **If a water utility**

considers that some of these areas fall outside of its WSP approach, then it does not have a comprehensive WSP strategy and has not fully understood the concept.

The obvious controls for identified risks are physical barriers or processes within water treatment plants such as filtration and disinfection, but consideration and assessment of controls needs to be much wider. Agreements with farmers and industry on chemical usage, livestock controls, use only of trained staff, pumping regimes, visual inspection, auto-shutdown or turnout, audit of, or quality agreements with, chemical suppliers and plant manufacturers, could all be considered controls as long as they can be validated as effective and monitored to demonstrate that they continue to provide protection. Again, this list is by no means exhaustive. **Starting out on the implementation of the WSP approach does not mean that every existing control has to be re-validated but it does require the robustness of existing data and reports to be evaluated.**

It is important to assess risk before and after its control (or mitigation) where this exists because this will demonstrate that each hazard has been recognized and its control assessed for effectiveness. The risk assessment is likely to highlight a great many risks that are not considered significant to the safety of the water supply system. It is important, though, that all risks are clearly documented and understood by the utility. Even **more important is the need to prioritize and quickly put in place an improvement programme** where significant risks are identified.

Not all risks can be easily assessed using a methodology (e.g. a 'semi-quantitative' risk matrix), where a risk is estimated in terms of likelihood of the hazard occurring, and severity of the consequence should the hazard occur. Some risks do not lend themselves to be assessed via narrow definitions of likelihood (e.g. estimated occurrence is 'monthly') or consequence (e.g. estimated severity is 'moderate' public health impact). For example, potential negative feedback from consumers regarding issues that may not have a significant impact on health may be viewed as a significant risk to a utility's reputation and therefore should be addressed for the WSP. Sometimes, it may be more appropriate to assess risk in a simplified format (e.g. 'significant', 'non-significant' or 'uncertain') based on a group decision. **Whatever method is used, it is imperative that the risk assessment methodology is sufficiently clear and detailed to allow consistency.** This is a particular concern for a large utility, where the risk assessment is likely to be undertaken by many different people.

The complexity of the risk assessment depends on the complexity of the water supply system. Sophisticated water treatment equipment and processes viewed as controls for safe water production introduce their own potential hazards to a water supply system which will require detailed risk assessment. For example, an ozone and granular activated carbon system introduced as a control for organic contamination could generate hazards such as ozone emissions, bromate formation, biofilm growth, taste problems and contamination after regeneration. **The WSP approach needs to be included from the planning stage of any improvements or new arrangements for a water supply system.**

Compliance monitoring is an important part of the verification process to show that the WSP is working. It will show whether water at the point of compliance, which is often the consumers' tap, is meeting water quality standards; it does not make the water safe because by the time the

results of compliance monitoring are available the water will have been drunk and used for other domestic purposes. Validation, to show that controls are capable of mitigating risks, and operational monitoring, to demonstrate that they continue to work effectively, are much more important tools in ensuring the safety of water because they focus on the processes that make water safe. **Operational monitoring is an integral part of the WSP approach.**

Overcoming complacency

Many elements of the WSP approach are already incorporated in existing water utility good operating practice. However, fully implementing the WSP will require all utilities to take a fresh look at everything that can affect the safety of water. **Nothing should be taken for granted.** If barriers are in place and producing water of acceptable quality, is this because they are robust or through luck? The water utility that has no incidents or near misses and consumers that are happy with their safe water supplies is fortunate indeed, or maybe it is lacking the procedures and assessment it needs to identify problems. Open and transparent implementation of the WSP approach will increase the confidence of consumers and all other stakeholders in the safety of water supplies. Developing a WSP is not an end in itself, but a means to an end. A WSP is only useful if it is implemented and revised.

Annex 5: Example of a notice issued by DWI to a water company

DWI has the power to issue notices directing a water company to take certain actions in respect of its risk assessments and any such notices are copied to the CCDC and local authority for the affected area. An example template follows.



guardians of drinking water quality

DRINKING WATER INSPECTORATE

Room M01, 55 Whitehall
London SW1A 2EY

Direct Line: 0300 068 6413
Enquiries: 0300 068 6400
Facsimile: 0300 068 6401

E-mail: milo.purcell@defra.gsi.gov.uk
DWI Website: <http://www.dwi.gov.uk>

[Date]

[Water company contact
Water company
Address 1
Address 2
Address 3]

Your ref
Our Ref [IPD ref]

Dear Water company contact,

**THE WATER SUPPLY (WATER QUALITY) REGULATIONS 2000 (AMENDMENT)
REGULATIONS 2007: NOTICE UNDER REGULATION 28(4)**

1. Under the Water Industry Act 1991, water undertakers and licensed water suppliers are obliged to ensure that water supplied to premises for domestic or food production purposes is wholesome and that there is no deterioration over time in the quality of such water from that water source(s).
2. *[Opening paragraph to explain reason for use of this Notice –to include details of the receipt of a Regulation 28 report etc e.g. The Secretary of State has received a report from [COMPANY NAME] dated [] stating that there is or has been a significant risk of supplying water that would constitute a potential danger to human health from [SITE/SYSTEM]].*
3. Please find attached a Notice made under Regulation 28(4) of the above Regulations requiring [COMPANY NAME] to take the steps specified in this Notice.

Yours sincerely,

Milo Purcell

Deputy Chief Inspector



guardians of drinking water quality

**THE WATER SUPPLY (WATER QUALITY) REGULATIONS 2000 (AMENDMENT)
REGULATIONS 2007**

NOTICE UNDER REGULATION 28(4)

[WATER COMPANY: SITE]

Reference Number: [XXX]

[Site, Supply System & Reg. 28 Report Reference: [XXX]

Improvement Programme Database Reference number – [XXX]

**THE SECRETARY OF STATE FOR ENVIRONMENT, FOOD AND RURAL
AFFAIRS:**

1. has received a report from [WATER COMPANY] (the “**Company**”) dated [XXX] (the “**Report**”) which states that there is or has been a significant risk of supplying water from [SITE or SYSTEM] that would constitute a potential danger to human health.
2. gives Notice that the Company is required, in order to mitigate the risk, in accordance with Regulation 28(4)¹:

(a) to maintain the existing operational measures set out in the Report (see pages [x] to [x]) until [XXX] and as specified below:

- i. [] until [XXX]
- ii. [] until [XXX] etc.

(b) to [review, revise and/or] make operational such measures as are specified below, by the date specified below:

Short term measures*

- iii. *[Review/Revise]** the following short-term measures by [XXX]:
 - *[list the measures];*
- iv. Make operational by, and maintain until, [XXX] the short-term measures identified in (iii) above;

¹ *Please note, the Notice need not impose all of the above requirements (2)(a)-(e) in each case automatically - only such requirements as are appropriate in each case should be inserted. However, it is likely that requirements (a), (c), (d) and (e) plus (b) (excluding the wording “Review / Revise” in italicised square brackets above) will appear in most notices. Clearly, it may only be necessary to require the Company to “review and revise” measures in specific situations (e.g. if there are already some measures in place to review/revise).*

* *Delete as applicable.*

Medium term measures*

- v. *[Review/Revise]** the following medium-term measures by [XXX]:
 - *[list the measures];*
- vi. Make operational by, and maintain until, [XXX] the medium-term measures identified in (v) above;

Long term measures*

- vii. *[Review/ Revise]** the following long-term measures by [XXX]:
 - *[list the measures];*
- viii. Make operational by, and maintain until, [XXX] the long-term measures identified in (vii) above;

(c) to audit whether the measures have been effective by such means as specified below:

- ix. Define a strategy for auditing the effectiveness of the above measures by [XXX];
- x. Implement the audit strategy outlined in (ix) until [XXX].

(d) not to supply water for regulation 4(1) purposes from [SITE or SYSTEM] [unless the conditions specified below are satisfied] : and

- xi. [] by [XXX];
- xii. [] by [XXX] etc.

(e) to provide the following information in such time and manner as specified below to enable monitoring of progress:

- xiii. Provide a report at monthly intervals on [XXX];
- xiv. Review the risk assessment for [SITE or SYSTEM] as required by Regulation 27(4) and subsequently submit a revised Regulation 28 report (in accordance with Regulation 28(1)) from time to time); and
- xv. Submit a satisfactory completion report by [XXX].

* *Delete as applicable.*

Please be aware that breach by the Company of this Notice may result in an enforcement notice, breach of which may itself attract a penalty. *[Further, breach of condition (2(d)) shall constitute a criminal offence liable to a fine on conviction]*².

This Notice may be amended or revoked by notice from the Secretary of State at any time.

Signed by authority of the Secretary of State,

Jeni Colbourne

Chief Inspector

[DATE]

DWI ref

² *Note 2 - Insert this wording only if the Notice contains condition 2(d) i.e. if it prohibits the supply of drinking water unless specified conditions are satisfied.*

Annex 6: Content of Notifications about Drinking Water Quality Events

Set out below is the template used by DWI Inspectors when contacted by a water company making the initial notification of a water quality event. The text in italics indicates the nature of the information that DWI expects the company to provide as a minimum at the outset of an event. This is the type of information that a CCDC can expect to be provided with by a water company when they first contact a CCDC with a view to obtaining health advice. Typical additional questions that a CCDC may want to ask the water company to enable a health risk assessment to be made are listed below.

DWI Water Quality Event Notification Template

Company	<i>Water supplier making the notification and responsible for the affected water supply, if more than one water company is affected by a water quality event then each one will notify their particular circumstances</i>
Name of event	<i>Water company description of the event which will be used throughout the management and subsequent investigation of the event, usually takes the form of nature/location descriptor, e.g. burst trunk main in Essex Road, Islington</i>
Person making the notification	<i>Name of water company person making the notification and responsible for ongoing updates</i>
Date and time of notification	<i>Time/Date when DWI Inspector received notification</i>
Time/Location of event	<i>Time when company first became aware of an event and the location of the assets first affected, e.g. works, reservoir, street</i>
Nature of event	<i>Water company description of what has happened, typically a description of the impact, e.g. discoloured water and low pressure complaints from consumers; report received from Environment Agency of dead fish one mile upstream of abstraction intake at N works; sample result from X location with a result of Y etc etc</i>
Population affected	<i>Estimate of population resident in the water quality zones potentially affected by the event, together with names of the water quality zones.</i>
Likely cause(s)	<i>Water company initial assessment of the cause of the event, e.g. third party damage to a water main; illegal discharge from a factory into the River X etc etc</i>
Action taken to inform/protect consumers	<i>Details of:</i> <ul style="list-style-type: none"> ● <i>advice issued to consumers, e.g BWA notice</i> ● <i>alternative supplies provided</i> ● <i>any customer call centre/website tape recorded message</i>

Action being taken to rectify the situation	<i>Details of the action already taken and planned to restore the water supply to normal</i>
LAs/HAs informed?	<i>Name of person notified in the relevant local authorities and the Health Protection Unit of HPA/NPHS and the nature of any advice provided and/or any conference calls/meetings arranged</i>
Level of publicity	<i>Details of any media awareness</i>

Additional information that may be required to support a health risk assessment by CCDC

1. Description of affected water supply from source to tap, in particular, details of source water (surface, ground), water treatment in use and/or proposed either temporarily/permanently, treated water storage (service reservoirs, towers, tanks, tankers, bowsers, bottles), distribution mains (details of planned or unplanned work and nature of materials if work on mains involved), nature of building (public, private, social care, office, factory etc) including any high risk premises in respect of back flow prevention inspection.
2. Nature of any actual or suspected contaminants (chemical, biological, radiological) and concentration of any contaminant/organism, including details of samples already taken and samples planned to be taken.
3. Historic water quality testing data (should also refer to drinking water, annual report by DWI if the event relates to a known or ongoing problem).
4. UKWiR or WHO information about the contaminants/organisms.
5. Technical information about any loss of, or proposed changes to, water treatment, including disinfection at works, also details of addition of chlorine to the network or service reservoirs (DWI is the source of advice on approved treatment chemicals, treatment performance and operational best practice).
6. For incidents at a works or a service reservoir, an estimate of the time required for the contaminants/organisms to pass through the water supply system under normal operating conditions and, where relevant, any remedial measure, such as removing assets from supply, rezoning or high velocity flushing, which may affect these time estimates (the water industry and the Environment Agency have time of travel models for river pollution incidents).

Annex 7: Examples of warning advice notices provided to consumers by water companies

The following pages provide illustrations of the communications that water companies providing public supplies proactively send to consumers in areas where drinking water quality is affected by an incident. Examples provided include 'Boil water' notices, 'Do not drink' notices, 'Do not use' notices and also 'All clear' notices used to inform consumers of the return of normal supplies. Also included are examples of letters suitable for single household advice.

Letter TYPE 1 – Precautionary Boil Advice:



Date: _____

Drinking Water Quality At Your Property

Dear Customer,

The samples that we recently collected from your drinking water tap were not of the quality we would normally expect from our mains supply. **As a precaution, we therefore advise you to boil all mains water used for:**

- **Drinking**
- **Preparing or Cooking Food**
- **Cleaning Teeth**
- **Provision of Drinking Water for Pets**

CAUTION: Allow boiled water to cool before use

Bringing the water to the boil is sufficient for the above purposes (for example, by using an electric kettle).

However, you may still use your mains water supply as normal for washing, bathing and toilet facilities.

As a further safeguard measure, the tap and surrounding sink area should also be cleaned with a mild bleach solution.

A member of the Water Quality Team will contact you shortly with more information. Alternatively, please contact our Customer Centre on **0845 9200 800** and ask to speak to a member of the Water Quality Team.

Please remember that all Thames Water employees carry identity cards with photographs. If you are not sure about the identity of callers please check that they are genuine by contacting our Customer Centre.

Yours faithfully,

Letter TYPE 2: Precautionary Do not Drink or Cook Advice:



Date: _____

Drinking Water Quality At Your Property

Dear Customer,

The samples that we recently collected from your drinking water tap were not of the quality we would normally expect from our mains supply. **As a precaution, we therefore advise you not to use your mains water supply for:**

- **Drinking**
- **Preparing or Cooking Food**
- **Cleaning Teeth**
- **Provision of Drinking Water for Pets**

Thames Water will provide bottled water for the above purposes.

However, you may still use your mains water supply for washing, bathing and toilet facilities.

A member of the Water Quality Team will contact you shortly with more information. Alternatively, please contact our Customer Centre on **0845 9200 800** and ask to speak to a member of the Water Quality Team.

Please remember that all Thames Water employees carry identity cards with photographs. If you are not sure about the identity of callers please check that they are genuine by contacting our Customer Centre.

Yours faithfully,

Boil water before use until further notice



Your water supply may be contaminated. Please listen to your local radio station for information and talk to your neighbours to ensure they are aware of this advice. We will notify you when your water supply is back to normal.

We apologise for the inconvenience -

If you need more information please call us on:

0845 9200 800

You can contact Thames Water 24 hours a day, 365 days a year. All calls are charged at local rates. We record all our calls to ensure that we always give you a quality service.



BOIL WATER BEFORE DRINKING



USE ONLY COOL BOILED WATER FOR PREPARING OR COOKING FOOD



USE ONLY COOL BOILED WATER FOR CLEANING TEETH



USE ONLY COOL BOILED WATER FOR YOUR PETS OR LIVESTOCK



STORE BOILED WATER IN A COVERED CONTAINER IN THE FRIDGE



TAP WATER CAN BE USED TO WASH/BATH



TOILET FLUSHING IS NOT AFFECTED



SHOULD IT PROVE NECESSARY, ALTERNATIVE SUPPLIES WILL BE AVAILABLE NEARBY. PLEASE HELP THE ELDERLY/DISABLED



Do not drink or use water for cooking until further notice



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DO NOT DRINK



DO NOT USE FOR PREPARING OR COOKING FOOD



DO NOT USE FOR CLEANING TEETH



DO NOT USE FOR PETS OR LIVESTOCK



TAP WATER CAN BE USED TO WASH/BATH



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SHOULD IT PROVE NECESSARY, ALTERNATIVE SUPPLIES WILL BE AVAILABLE NEARBY. PLEASE HELP THE ELDERLY/DISABLED



Do not use your water supply until further notice



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DO NOT DRINK



DO NOT USE FOR PREPARING OR COOKING FOOD



DO NOT USE FOR WASHING/BATHING OR CLEANING TEETH



DO NOT USE FOR PETS OR LIVESTOCK



TOILET FLUSHING IS NOT AFFECTED



SHOULD IT PROVE NECESSARY, ALTERNATIVE SUPPLIES WILL BE AVAILABLE NEARBY. PLEASE HELP THE ELDERLY/DISABLED



Your water supply is now safe to use



Local health agencies have agreed that the recent precautions are no longer necessary

We apologise for the inconvenience -
If you need more information please call us on:

0845 9200 800

You can contact Thames Water 24 hours a day, 365 days a year. All calls are charged at local rates. We record all our calls to ensure that we always give you a quality service.



Our recent tests have shown that your water supply is totally safe for everyday use





We are trying to get your water supplies back to normal as quickly as possible. We apologise for the inconvenience.

Please listen to your local radio station for information.

Please check that your neighbours understand what they have to do.

For more information please phone

0845 746 2200

WARNING!



Do not drink your tap water without first bringing it to the boil and letting it cool



Do not use unboiled water for preparing food or cleaning your teeth.



You can still use tap water for washing and bathing without having to boil it



You can still use tap water for general household purposes and toilet flushing

Boil water before use

your tap water may be contaminated.

We will let you know when your water is back to normal.



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- Do not drink your tap water
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- Boiling will not purify the water
- We will make other water supplies available to you nearby
- You can still use your water to flush the toilet

Do not drink, cook or wash your tap water may be contaminated.

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United Utilities
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ROYAL MAIL

POSTAGE PAID GB
HQ 11117

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- Do not use your tap water for cleaning teeth, washing wounds or preparing food
- Boiling will not purify the water
- Tap water may be used for general washing, bathing and toilet flushing
- We will make other water supplies available to you nearby

Do not drink

Do not cook

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We will let you know when your water is back to normal.



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X اگلی اطلاع آئے تک ٹکے پانی پیئے، دانت صاف کرنے، کھانا پکانے یا پختہ صاف کرنے کے لئے استعمال مت کیجئے۔ آپ کو پانی بھی کچھ کچھ دیکھو دیکھو، نہانے اور بیتھنا لگائے۔ غسل کرنے کے لئے استعمال کر سکتے ہیں۔

X ڈٹو آف سے پانی ٹی پیٹ، سچ ساڈ ورن، ہاٹا سٹاٹوٹ ساں سبھاں ٹی پوٹ لڑھی ٹیٹو، ڈیک ٹا ورتو سا ڈیک ٹیس ڈوواں ورتن لڑھی سٹیمپا ٹوواں ساںساں! ڈوواں آہم پڑھاہی، ٹراٹوٹ اہو ڈولس ورنن لڑھی ٹیٹا ورتن ساہوے رو۔

X ہرکڑھی ٹیکڑٹھی نا آاڈھاا اہوڈ ٹوٹاٹور اہنی باڈکن نا، اہنی ٹیٹا ہوڈ ماڈلکن نا، ڈاواں کراڈکن نا اڈھاا کڑڈھن ڈرکن نا! ڈلے اہنی ٹیٹا ڈاڈ-ڈوہ، ڈاکن-آہڈ ڈوڈ اڈر ڈوٹلن و ٹراٹوٹ ڈراہ کراڈو پارڈکن!

X آاگو نوٹیس مللنے تک کڑپھا ڈس نلکے کے پانی کو پینے، دانت صاف کرنے، خانا پکانے یا اڈھااں کو ڈونے کے لیا ڈرہماال ن کرے! آاپ ڈس پانی کا پڑوہ ساہماڈ ڈونے، نہانے اور ڈاڈلےٹ پلش کرنے کے لیا کر سکتے ہں!

X آاپنے سڑپنا آاپھاواں ن آاڈے ٹواں سڑھی نلہناں پالہیو پلہا، آاپنا اڈانے ساڈ کڑپا، آاڈلڈ ٹیٹار کڑپا ڈے ڈلہما ڈووا ماڈے ڈپڈوہ کڑڈو نڈی، نڈلہا-ڈوواہما اڈنے ڈوپلےڈٹماں ڈکڈھ کڑپا ماڈے نلہناں پالہیو ڈپڈوہ کڑی شڈو ڈو۔



For more information please phone
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CC/4/06

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For more information please phone
0845 746 2200

CC/4/06

WARNING!



X Do not drink Do not cook
your tap water may be contaminated

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ROYAL MAIL

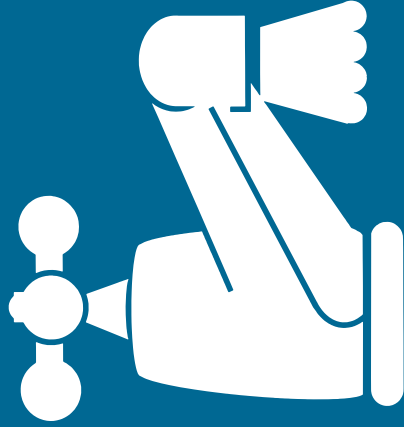
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ROYAL MAIL

POSTAGE PAID GB
HQ 11117



IMPORTANT



Our tests have shown that your water supply is not contaminated.

The Health Protection Agency and Environmental Health Department of your local authority agree that the recent precautions are no longer necessary.

**Water supplies
are back to
normal**

Please run your taps to make sure that fresh water is drawn through your system before using it.

We apologise for the inconvenience.

**For more
information
please phone**

0845 746 2200

BACK TO NORMAL



 **Water supplies are now back to normal**
your tap water is not contaminated

 **你的用水供應已經回復正常，近來的預防措施已不須繼續了。**

 **آپ کے گھر کا پانی اب بالکل صاف ہے۔ پہلے والے احتیاطی اقدامات اب ضروری نہیں۔**

 **उत्पादक पाठकी गुठ ठीक रें गिआ रै। मँसुरा सावधानीआं लैठ सी गुठ लेंस नहों।**

 **अब आपकी पानी की सप्लाई वापिस सामान्य हो गई है। हाल में ली गई सावधानियों की अब कोई आवश्यकता नहीं है।**

 **आपનાર ਪਾਨਿਰ ਸਾਈਇ ਖਾਤਮਿਕ ਅਵਸ਼ਠਿ ਫਿਰੇ ਏਸੇਓ। ਸਖ਼ਤਿ ਖੋ ਸਤਰਕਤਾਉਲੋ ਅਵਲਖਨਾ ਕਰਕੇਨੇ ਸੇਠਲੋ। ਸੋਨੇ ਚਲਾਰ ਆਰ ਸਰਕਾਰ ਨੇਇ।**

 **આપના પાણીનો પુરવઠો ચલેતા મુજબ ચાલુ થઈ ગયો છે. અગાઉ આપેલી ચેતવણીને અસરરચવાની હવે જરૂર નથી.**



For more information please phone

0845 746 2200

Annex 8: Advice on precautions to be taken by the immunocompromised individual in relation to boil water notices.

Following the publication of the Report on Cryptosporidium in Water Supplies (Bouchier 1998) a working group of medical specialists produced an update to the advice in the report for the immunocompromised which clarified which groups of immunocompromised patients are at particular risk of cryptosporidiosis. The working group advised that anyone whose T cell function is compromised should boil and cool all their drinking water, whatever its source, tap or bottled or filtered. Boiled cooled water should also be used to make ice cubes. The groups whose T cell function is compromised include those with HIV who are immunosuppressed, children with severe combined immunodeficiency (SCID), and people with specific T cell deficiencies such as CD40 ligand deficiency, also known as Hyper IgM Syndrome.

It would be for Chief Medical Officers to identify whether there is a need for this guidance to be elaborated on.

Chapter 8 of the Bouchier Report entitled Advice to the Immunocompromised Individual is reproduced in full below for reference purposes.

8 Advice to the immunocompromised individual

8.1 Introduction

8.1.1 *Cryptosporidium parvum* is a highly infectious protozoan parasite responsible for cryptosporidiosis in humans and many animals. *C. parvum* oocysts discharge sporozoites which then attach to and replicate in the intestinal epithelium, causing changes in electrolyte handling (Griffiths et al 1994). The initial attachment of the parasite to host cells is a pre-requisite for the pathophysiological events in infection (Joe et al 1998). Immunocompetent individuals experience a transient diarrhoea, while those with impaired immunity, such as AIDS patients, are unable to clear the infection and severe diarrhoea (McGowan et al 1993) and cholangitis (Forbes et al 1993) may result. Cryptosporidiosis in the immunocompromised subject often results in a chronic life-threatening gastroenteritis with a high mortality (Flanigan et al 1992; Blanshard et al 1992).

8.1.2 Immunocompetent hosts respond to infection with antibody production and the secreted antibodies appear to reduce parasite numbers in the intestine. Nevertheless,

antibodies to *C.parvum* do not seem to be able to protect AIDS patients from heavy parasite burdens (Goodgame 1996) and it seems likely that cell-mediated immunity is important for recovery from *C.parvum* infection. In HIV-infected patients there is a clear relationship between disease severity and CD4 counts (Flanigan et al 1992; Blanshard et al 1992). However, in many other conditions which result in impaired immunity the outcome and severity of cryptosporidial infection has not yet been identified clearly. For example *C parvum* was identified recently as an important pathogen in boys with the hyper-immunoglobulin M (hyper-IgM) syndrome (Hayward et al 1997). Several other host defence factors are also thought to contribute to *C.parvum* immunity, including the cytokines IFN-g and IL12. It is not surprising therefore that infection by *C.parvum* could readily occur in several primary and secondary immunodeficiency states (Cosyns et al 1998).

8.1.3 The following advice is aimed at immunocompromised individuals. This includes HIV infected persons and other patients immunocompromised as a result of conditions such as: hypo- or agammaglobulinaemia, hyperimmunoglobulin M syndrome, severe combined immunodeficiency, leukaemia (especially during aplastic crises); or as a result of therapy with immunosuppressive drugs, who may wish to take independent action to reduce the risk of waterborne cryptosporidiosis and may choose to take the precautions recommended below.

8.2 Prevention of exposure

8.2.1 Until an effective therapy for *C.parvum* is available, informing immunocompromised patients of potential exposure risks to *Cryptosporidium* may be the most useful course of action. They should be educated and counselled about the variety of ways *Cryptosporidium* can be transmitted. Modes of transmission include:

contact with infected adults and nappy-aged children;
contact with infected animals;
drinking contaminated water;
contact with contaminated water during recreational activities; and
eating uncooked food and food (such as fruits and salad) that has been washed with contaminated water.

8.2.2 *Cryptosporidium* may be spread by the faecal-oral route of transmission. Person-to-person and animal-to-person transmission has long been recognised (Fayer and Ungar 1986). Soil contaminated with human or animal faeces and the water that drains through it to rivers, streams and shallow underground wells are also potential sources of

cryptosporidial infection. Immunocompromised persons should avoid contact with human and animal faeces. They should be advised to wash their hands after contact with human faeces (eg after nappy changing), after handling pets and after gardening or other contact with soil. They should avoid sexual practices that may result in oral exposure to faeces (eg oral-anal intercourse).

8.2.3 Cryptosporidiosis occurs more commonly in young animals (Current 1987). Immunocompromised persons should be advised that newborn and very young pets may pose a small risk of cryptosporidial infection but generally they should not be advised to destroy or give away pets.

8.2.4 Immunocompromised persons contemplating the acquisition of a new pet should avoid:

bringing any animal that has diarrhoea into their households;
purchasing a dog or cat aged less than six months; and
adopting stray pets.

8.2.5 Immunocompromised persons should also avoid exposure to farm animals such as calves and lambs and premises where these animals are raised.

8.3 Advice on the prevention of waterborne exposure

8.3.1 *Cryptosporidium* oocysts are found commonly in natural waters. Immunocompromised persons should not drink water directly from lakes and rivers. Waterborne infection may also result from swallowing water during recreational activities. Patients should be aware that many lakes, rivers, salt water beaches and some swimming pools (Anon 1994) and recreational water parks may be contaminated with human or animal waste that contains *Cryptosporidium*. Patients should avoid swimming in water that is likely to be contaminated and should avoid swallowing water during swimming.

8.3.2 Several outbreaks of cryptosporidiosis have been linked to public water supplies. During outbreaks, or in other situations in which 'advice to boil water for drinking' is issued, bringing the water to boiling point will eliminate the risk of cryptosporidiosis. Use of submicron personal use filters (ie home/office types) may reduce the risk (Addiss et al 1996) but cannot be relied upon to eliminate it completely. Persons who opt for a personal use filter should be aware of the complexities involved in selecting appropriate products, the purchase and running costs of the products and the logistic difficulty in using them consistently. Manufacturer's instructions should always be followed.

8.3.3 The magnitude of the risk of acquiring cryptosporidiosis from drinking water in a non-outbreak situation is uncertain. As a precautionary measure, to reduce the risk of waterborne cryptosporidiosis, HIV infected persons with low CD4 counts should be advised to bring to the boil all drinking water from any source. Such individuals should always be advised to bring to the boil drinking water drawn from private domestic water supplies as these have a much higher risk than public supplies of contamination by *Cryptosporidium* and may have inadequate treatment (Clapham 1997). They should be aware that places such as campsites and remote holiday accommodation may rely on private water supplies. The limited evidence available suggests that bottled water cannot be regarded as universally safe for immunocompromised persons and should be boiled before drinking.

8.3.4 Immunocompromised persons should be advised that ice made from contaminated tap water might also be a source of *Cryptosporidium*. Ice made at home should be prepared from boiled water. Such persons should also be aware that fountain beverages served in restaurants, bars, theatres and other places may also pose a risk because these beverages, as well as the ice they contain, are made from tap water.

8.3.5 National distributed brands of frozen fruit juice concentrate are safe if the user reconstitutes them with boiled water. Fruit juices must be kept refrigerated from the time they are processed to the time of consumption; only those juices labelled as pasteurised should be considered free from *Cryptosporidium*. Outbreaks associated with unpasteurised apple cider have been reported (Mshar et al 1997). Other pasteurised beverages and beers are considered safe to drink. No data are available concerning survival of *Cryptosporidium* oocysts in wine.

8.3.6 Cryptosporidiosis in immunocompromised people often results in a chronic life-threatening gastroenteritis with a high mortality. Whilst the Group recognises that the occurrence of *Cryptosporidium* in treated water is very rare it considers that the following recommendation will minimise the risk to immunocompromised people from drinking water.

Recommendation

8.3.7 The Group recommends that all water, from whatever source, that might be consumed by immunocompromised persons should be brought to the boil and allowed to cool before use.



guardians of drinking water quality

Drinking Water Inspectorate | 55, Whitehall | London | SW1A 2EY | Tel: 0300 068 6400

<http://www.dwi.gov.uk>