

Drinking water 2016

Quarter I
January - March 2016

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A report by the Chief Inspector of Drinking Water





Drinking water 2016
Public water supplies for
England and Wales

Quarter 1
January - March 2016

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Foreword



The Chief Inspector of Drinking Water for England and for Wales regulates the quality of drinking water supplied by water companies and also carries out checks to ensure that local authorities are meeting their responsibilities for the regulation of private water supplies. The powers of the Chief Inspector and his inspectors were created by the Water Act 1989 and are set out in the consolidated Water Industry Act 1991; collectively known as the Drinking Water Inspectorate. The Act gives various powers to the Inspectorate to obtain information as part of any investigation, including the rights of entry. The Inspectorate are also able to take enforcement action, by serving Notices and directions, or by initiating prosecution proceedings in the courts.

This report intends to review the outcomes of the requirements and standards in securing compliance with the Water Supply (Water Quality) Regulations through the objectives they set. This report sets out to achieve two additional objectives from the previous annual Chief Inspector's report: Firstly,

- to produce more timely information enabling the water industry to act on learning points earlier;
- and secondly, acknowledging the changing landscape of water regulation where the focus of proactive regulation is more on risk assessment and management rather than setting the goal solely on end point compliance of parameters.

Water companies in England take and analyse their own samples as well as undertaking risk assessments. These are submitted to the Inspectorate and, together with the outcomes of investigations and enforcements, are used to manage regulatory risk while delivering proportionate regulation.

Drinking water in England and Wales comes from natural sources and treatment starts at catchment. The minimisation of pollutants requiring treatment is the objective of catchment management, with sustainable and effective treatment, disinfection, secure storage, transport and delivery at the consumers' taps using risk assessment to ensure water is safe and acceptable. The details of these stages are contained in the report with case examples.

A handwritten signature in black ink that reads "Marcus Rink". The signature is written in a cursive, flowing style.

Marcus Rink – Chief Inspector of Drinking Water

Source to tap – the assessment of risk in the water industry

Since 2008, water companies have been required to carry out risk assessments of the water supplies they provide. The objective of these assessments is to determine if water quality hazards (substances that affect the quality or appearance of the water) are present in source waters, or introduced by certain events such as treatment failures or burst water mains, and to establish how these events can be prevented from happening. These assessments start by reviewing the catchment areas where source waters are located and abstracted, including the treatment works and distributions systems operated by the company, and finally end at consumers' properties.

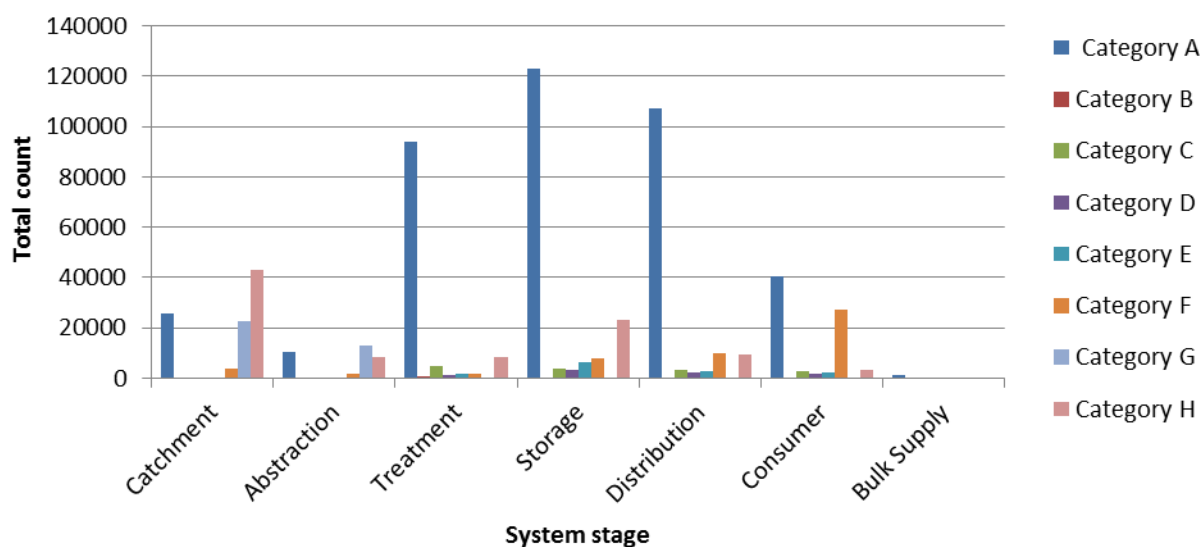
The outcomes of these assessments allow companies to identify where hazards could be prevented by taking measures such as catchment management, installing additional treatment or carrying out water mains cleaning. Companies were then required to send the outcomes of their assessments to the Inspectorate. Up until 2015, this submission of information took the form of summary reports. During 2013 and 2014, the risk assessment management project developed a common database framework enabling data to be stored, organised and readily analysed recognising the importance of risk assessments as a proactive way of securing safe and secure drinking water.

The primary advantage of the new data submission is that companies are required to map their risk assessment conclusions to the list of categories set by the Inspectorate. This enables comparison of one company's risk assessment conclusions to another, even though they may use different risk assessment methodologies. The criteria set includes categories A to H, which describe general assessment conclusions

The first submissions using this new process began in October 2015. The Inspectorate is continuing to review the data to identify where proactive action could be taken to prevent risks to health from water quality hazards and as a consequence, where regulatory action is required.

General themes identified from the risk assessment dataset confirm most hazards being controlled by mitigation measures within treatment works, at treated water storage reservoirs or in distribution rather than in catchment (Figure 1).

Figure 1 – Categories allocated to a hazard within each treatment stage



Where companies have highlighted that further measures are required, such as where category D is assigned, the Inspectorate will review the actions proposed, and determine if there is benefit in formalising work programmes into Notices. The advantages of doing this are similar to those achieved by general contracted projects. Any measures delivered by this route will benefit from the Inspectorate’s governance arrangements defining outputs (e.g. review and refine operational measures; design and build), and outcomes (a reduction in the levels of a substance in treated water).

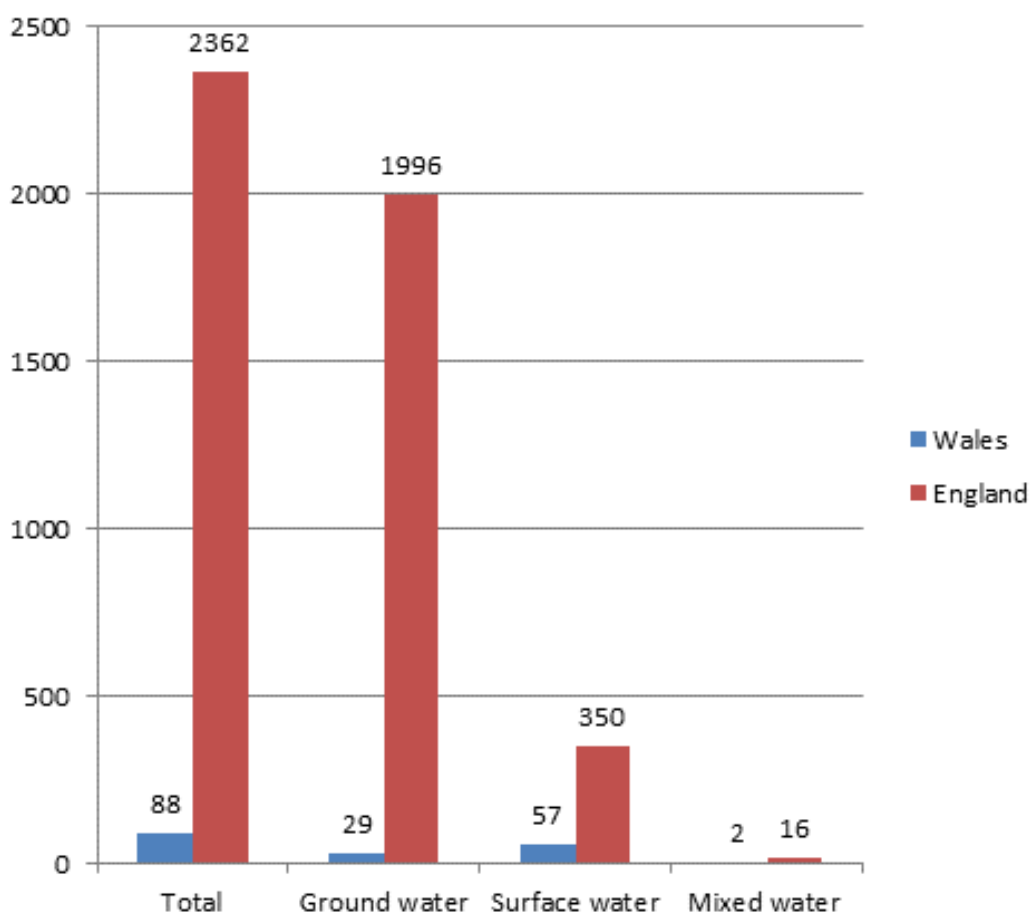
There are themes that have not directly correlated with the Inspectorate’s other datasets, one being the occurrence of discoloured water, an aesthetic property of water supplied. A standalone project was completed to analyse the risk assessment dataset, alongside the datasets of water quality sample results, water quality events and consumer contacts. The key outputs from this work were; companies being required to review their risk assessments to better reflect current performance in supply zones; enforcement in the form of legal Notices to complete remedial works; and regular liaison regarding the delivery of discolouration management plans. Reported in *Drinking water 2015*, the Chief Inspector’s report, the project will continue to focus on six companies where measures are required to regain compliance with discolouration standards or secure compliance in the long term. The outcomes of this work will continue to be reported in this series of quarterly reports.

Drinking water sources and catchment management

Drinking water in England and Wales comes from a number of sources. All supplies need to be treated before they are of a satisfactory quality to be drunk by consumers. The extent and type of treatment required depends upon the nature of the supply, its quality and any potential risks to quality that are present.

Water companies report the details of raw water monitoring points and the results of analysis of samples taken from them to the Inspectorate. There are 2,362 such points reported in England and 88 in Wales. Monitoring points take water from surface water sources, groundwater sources or sources which are a mixture of both. Figure 3 illustrates the number of monitoring points fed from each type of source and shows that England relies heavily on ground water sources whilst in Wales, supplies are more frequently drawn from surface water sources.

Figure 3: Number of abstraction points for different source types



Management of catchments used for drinking water is crucial to reducing the need to build treatment works to remove pollutants and prevent them from entering supply.

Water treatment works must be capable of treating the quality of raw water that they receive and thus treatment differs depending on source, however, as the following case study shows, raw water quality can change due to events in the catchment.

Case study - Raw water quality deterioration event affecting Cwm Dulyn works near Caernarfon, Gwynedd, North Wales.

Cwm Dulyn works is fed by Llyn Cwm Dulyn reservoir, a naturally formed glacial lake some 55m deep. It was dammed to provide the supply to the treatment works. There is rough pasture and sheep grazing on the catchment which is three square kilometres in size. The works treatment consists of a contact tank where chlorine is added, followed by pumped transfer to three pressure filters. It is then fed through a bank of two ultraviolet (UV) light reactors which work on a duty/standby basis. These are in place specifically to address the threat from *Cryptosporidium* with disinfection being achieved by the addition of chlorine in the contact tank. Following UV irradiation the water travels to a treated water reservoir which has around 24 hours of storage to feed the distribution network serving 2,461 properties.

On 11 December an analyst reported that 1,158 'fluorescing bodies' were detected in a sample collected from Cwm Dulyn treatment works upstream of the UV reactors. Such bodies are potentially indicative of the presence of *Cryptosporidium* oocysts. The filtamax cartridge to trap oocysts had been installed on 2 December and was removed on the 9 December, after 6,044 litres of water had passed through it. A second filtamax which had been put in service on 9 December was removed for fast track analysis on 11 December yielding 733 fluorescing bodies from the 2,194 litres filtered.

In response to the results the company declared an incident around 14:00hrs on 11 December. The company sent out inspectors to look at the catchment in the remaining daylight hours. The works was shut down temporarily at 16:05hrs. All works process stages were inspected for any obvious source of the contamination, none was found. The area served by the works was reduced as far as practicable in the short term. All filters were backwashed while the works was off line. The company made preparations for supplying the works by tanker. Daily sampling for *Cryptosporidium* oocysts commenced. The works was returned to service around 18:00hrs the same day.

The key works data showing UV effectiveness was assessed by the company, they noted that there had been no emergency shutdown (ESD) alarms received for UV transmissivity, UV dose, disinfection turbidity, pH, chlorine demand or chlorine contact time (for disinfection). The company was of the view that all three filters demonstrated low turbidity and these are upstream of the UV process. The company examined the UV dose applied during the event and concluded that it was within specification to deactivate any *Cryptosporidium* oocysts present.

Catchment inspections found sheep faeces at the bankside of the lake. A strand line higher than normal with other detritus present was in keeping with an increase in level of the lake that was coincident with Storm 'Desmond' which passed over the area in early December. Since the event, the company has fenced off the bank side of the reservoir to deny sheep access to it, thus reducing the challenge presented to the works.

The prevention of diffuse pollution by grazing livestock is a hazard in catchments considered to be difficult to control, however, source protection and access to the direct area are recognised controls. Companies are reminded that the concepts discussed by both Badenoch and Bouchier in their reports, still remain relevant.

The company acted promptly and engaged the local public health community well in the process of assessing the event.

Water quality at treatment works

The 1,207 water treatment works in England and Wales are sampled regularly to confirm the efficacy of disinfection. Additionally, 3,971 service reservoirs which contain treated water ready for distribution are tested to check the integrity of the system. The main parameters tested for are *E.coli* and Coliforms.

E.coli

The presence of *E.coli* indicates the presence of bacteria associated with faecal contamination. In the first quarter of 2016, there were 40,152 tests for *E.coli* carried out on samples taken from water treatment works and all were free from *E.coli*.

Coliforms

Coliforms are an indicator of environmental contamination and there were five detections of coliforms in 40,152 tests from works in Q1 2016.

In all cases, companies are required to investigate the root cause and rectify the cause.

Table 3: Q1: 2016 – Microbiological tests
The number of tests performed and the number of tests not meeting the standard

Parameter	Total number of tests	Number of tests not meeting the standard
Water leaving water treatment works		
<i>E.coli</i>	40,152	0
Coliform bacteria	40,152	5

Water companies are required to provide disinfected water to consumers and the operation of treatment works is crucial to this. The following case study illustrates one situation that led to undisinfected water entering supply.

Case study: Site failures at Sheafhouse works led to undisinfected water entering supply for over five hours.

Sheafhouse works is located in Moreton-in-marsh, Gloucestershire. Water is disinfected by the addition of chlorine, before onward supply to Longlands service reservoir and subsequently Chipping Camden water supply zone.

At 03:00hrs on 7 November there was a power failure at the site, the emergency shutdown valve at the works failed to operate resulting in undisinfected water entering the 15 inch main serving Longlands service reservoir. The shutdown valve had not been tested under power loss conditions. An alarm was received at the control room, but it was assumed that the emergency shutdown had triggered successfully, which it had not.

On realising untreated water had been released into supply, the company assessed its options and decided to flush the undisinfected water from the system using five flushing points along the main.

The post event review revealed significant failings in the company's procedures for operating the works to its own disinfection procedures, the accuracy of its mains records of consumers supplied from the 15 inch main and its understanding of how water moves between its key assets in the area. The company's reaction to the event, had unintended consequences as undisinfected water was supplied to consumers.

The company has undertaken a complete review to identify all consumers supplied from the 15 inch main. New procedures have been written to govern the operation of the works, to regularly test key valves in power loss conditions. Staff have been retrained and tested for understanding of the works operational procedures to avoid repeating the mistakes made in its previous operation and maintenance practices.

Technical audit of treatment arrangements

Technical audits are carried out in response to sites deemed highest risk from information reviewed by the Inspectorate, in response to pertinent current events, in response to information received from 'whistleblowers' and as part of a randomly generated audit programme. During January 2016 to March 2016 a total of five audit reports were sent out to companies (see Table 4), consisting of one report from an audit carried out at the end of 2015 and four audits to gather extra information about events at water treatment works and to close down a provisional enforcement Order. All of the audits were generally satisfactory and the site visits carried out in response to these events proved hugely valuable in gathering the information required to close the event down.

A theme of two of the audits was inspection of companies' UV plants following events where the company was operating UV outside the validation envelope. Generally the UV assets were in good condition, but the difficulties in defining validation criteria, has prompted the Inspectorate to organise a further series of UV audits during the coming months, to understand the status of UV within the industry. The Inspectorate is also working with Bournemouth Water to initiate industry

learning via a workshop on UV validation and general maintenance which will include presentations from UV manufacturers and feedback of industry experience.

Table 4: Audits of treatment works reported in Q1 2016

Severn Trent Water	Frankley works – audit of actions required in a provisional enforcement Order	<p>Generally satisfactory.</p> <ul style="list-style-type: none"> • Company has initiated actions to mitigate the concerns of chlorination failure at Frankley, regarding back-up systems. • Revocation of provisional enforcement Order.
Dee Valley Water	Oereg works – audit of UV and phosphate dosing following an event	<p>Generally satisfactory.</p> <ul style="list-style-type: none"> • As Dee Valley Water’s only UV plant the running and maintenance will be contracted out. • Site can be taken out of supply for four days so this helps upkeep of UV plant. • Still being commissioned but equipment looks suitable. • Phosphate dosing plant due to be installed.
Northumbrian Water	Lartington works – audit due to lack of turbidity shutdown procedure and general alarms response	<p>Generally satisfactory.</p> <ul style="list-style-type: none"> • Capital scheme in place to improve efficiency of dissolved air flotation plant. • Company required to review its risk assessment for site. • Highlighted potential lag time for back-up dosing of hypochlorite.
Southern Water	Testwood works – audit following disinfection and turbidity event	<p>Generally satisfactory</p> <ul style="list-style-type: none"> • Poor investigation into cause of the turbidity event and the company need to involve PHE for consumer impact assessment for any similar future events. • Regulatory sample point unmarked and needs replacing. • Company to confirm efficiencies of filters as audit raised concern over their cleaning.

Progress of improvement schemes

There are 341 improvement schemes that are currently underway and at the end of January 2016, the Inspectorate received 329 reports which detailed company progress against milestones. The largest proportion of the reports related to improvements at treatment works which accounted for 196 of the reports. There were 29 schemes that were closed in the first quarter of 2016 of which, 18 related to treatment works.

Water quality at service reservoirs and in distribution

When treated water leaves the treatment works it passes into the distribution network which includes treated water storage (service) reservoirs and distribution mains.

Water quality is measured at service reservoirs by sampling for *E.coli* and coliforms. There was one service reservoir where *E.coli* was detected and 16 samples from service reservoirs that contained coliforms.

Table 5: Q1: 2016 – Microbiological tests
The number of tests performed and the number of tests not meeting the standard

Parameter	Total number of tests	Number of tests not meeting the standard
Water leaving service reservoirs		
<i>E.coli</i>	50,467	1
Coliform bacteria	50,467	16

As water is drawn from service reservoirs through the mains network to consumers' taps, risks to the quality can arise from events causing loss of integrity of the network. Some of these risks occur during planned work by companies which is within their control. Two such events are described below and include learning points for the industry.

Case study – Do not drink advice given to 300 properties due to contamination from an industrial site after planned work – Poor risk assessment

In October 2015, do not drink advice was issued to approximately 300 properties in the Port Clarence area following reports of a chemical taste and odour and the subsequent detection of organic compounds in water samples taken from the area.

Within Port Clarence there are a number of industrial sites, including a tar distillation plant. The supply arrangements for this site consists of two incoming mains supplies, from the North and South. Usually the North supply is used, with the South supply isolated but able to be used in the event of the North supply becoming unavailable. Given the nature of the businesses, the continual supply of water is essential for the industrial process and for health and safety (firefighting) purposes.

In the weeks leading up to the event, the company operating the site had requested that the water company change the supply over to the South main as a nearby housing development may have caused interruptions to the North supply. The water company held discussions at the site, flushed the South main and carried out the change, opening the South main before closing the North main. As the North and South main derive from the same source, it was expected that they would be at equal pressure. However, a pressure differential did exist and when both mains were connected, mains water flowed from the North main, through the site and out into supply through the South main. Subsequent inspections of the site identified numerous contraventions of the Water Fittings Regulations, allowing contamination of the water on site. The water company had no backflow protection installed at the site.

The Inspectorate was critical that a lack of both an adequate risk assessment and backflow protection, at a site with a history of Water Fittings Regulations contraventions caused this event. A Regulation 28(4) Notice was served on the company, requiring a revised risk assessment and backflow prevention measures to be installed at the high risk industrial sites it supplies.

Water companies should consider the risks posed by industrial plants and other high risk organisations as part of their Drinking Water Safety Plans, it is expected that companies will develop programmes to inspect the highest risk premises to ensure public supplies remain protected.

Case study – Discolouration caused by planned work – Poor mains records

In October, 50 reports of discoloured water were received from residents in the Cheadle area following planned work by the local water company to connect new properties to the mains network. In order to complete the work, a single street of houses was required to be isolated, by operating valves within the network. The residents of the street were warned in advance of the work, by cards pushed through their letterboxes. The company used their GIS (geographic information system), a record of valve locations and positions, to identify the valves that required operating, during the planning of the work. The work was completed according to the plan.

Once the work was complete, the company started to receive calls reporting a loss of supply, followed by calls reporting discoloured water from an area far wider than the single street that should have been affected. Investigation after the event showed the company GIS to be inaccurate, which caused the incorrect valve to be operated when isolating

the area for the new connection. The reopening of this valve disturbed mains deposits and caused discoloured water.

It is incumbent upon companies to keep their mains records up to date and to plan work to avoid or minimise distress and concern to consumers by their poor practices.

Progress of improvement programmes

There were 22 reports received from companies in the first quarter of 2016 covering the progress of improvements to service reservoirs. In addition there were 122 reports covering work to improve the distribution network. There were 11 schemes which the Inspectorate was able to close.

The company with the largest number of schemes is Dŵr Cymru Welsh Water with 56 schemes, the largest percentage of these schemes cover improvements to zones for risks associated with discolouration (38 schemes across Wales). The Inspectorate will detail the discolouration project and outcomes during future reports.

Water quality at consumers' taps

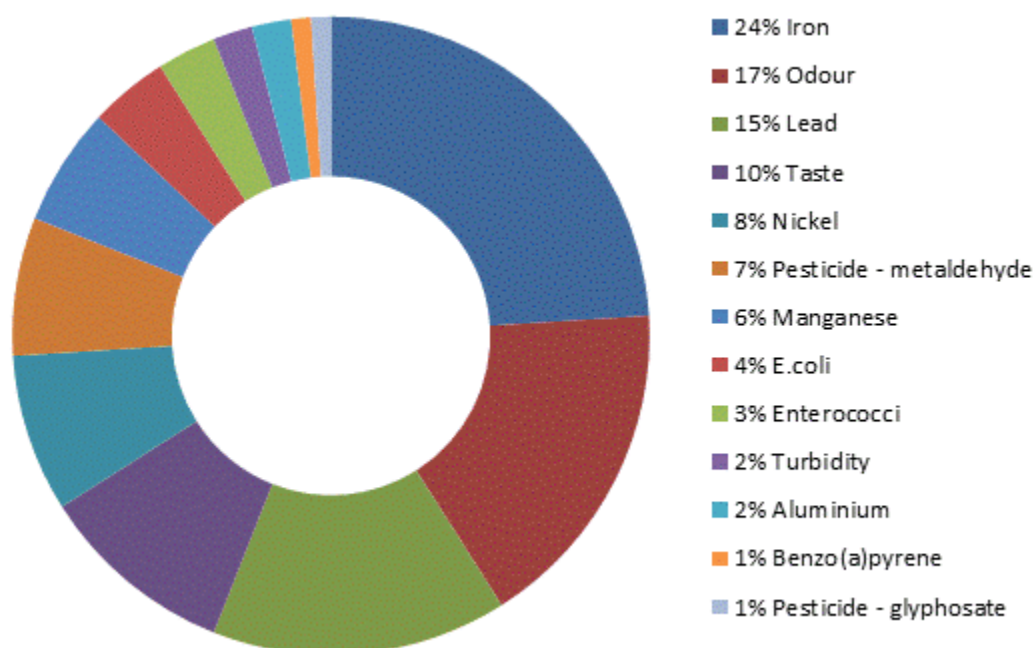
Most samples taken to assess regulatory compliance are taken from consumers' taps, and testing takes place for 51 parameters that have numerical standards. Sampling frequencies are determined by the size of the population in the water supply zone. The vast majority of samples taken complied fully with regulatory requirements.

From the total of 238,800 samples taken to demonstrate compliance with European Union or national standards, there were a total of 100 failures for 13 parameters that failed to meet the required standards in Q1 2016.

For microbiological parameters, four samples contained *E.coli* (99.99% compliance) and three contained Enterococci (99.90% compliance). With regard to chemical parameters, the lowest compliance was for metaldehyde (pesticide 99.38%), lead (99.51%) and nickel (99.78%).

Looking at the 100 failures in more detail, Figure 6 shows the proportion of failures for the 13 parameters. The detection of iron at levels above the standard was the most prevalent failure during Q1 2016. An exercise undertaken by the Inspectorate in 2015 to examine consumer contact rates for discoloured water caused by the presence of iron and manganese in the distribution network highlighted a number of zones where further work is required to remediate the cause. The Inspectorate served Notices on six companies and details are published in the annual report of the Inspectorate, *Drinking water 2015*.

Figure 6: Parameters failing in Q1 2016 – percentage of the 100 failures recorded.



Data provision

During March the Inspectorate issued two draft final enforcement orders against South East Water and Southern Water for failure to meet the requirements of the Water Industry (Suppliers' Information) Direction 2012 and wider requirements of the Water Supply (Water Quality) Regulations 2000 (2001 in Wales). The Notices were issued under section 20 of Water Industry Act 1991.

The orders were made in May following a 21 day consultation period with the companies and OFWAT and the local authorities. The orders will run for a period of one year and include measures in excess of the requirements of the direction such as;

- Implementation of a review of the company's statutory sample scheduling process, procedures, software and recording mechanisms.
- Reviews of out of service information, use of reduced flags for data.
- Periodic internal review and reporting of all aspects of sample scheduling, chain of custody information and future proofing of data reporting processes.

Both companies will report against their performance on a monthly basis.

Company-wide improvement programmes

During this quarter work has continued with United Utilities who are working with The Inspectorate on a company-wide improvement programme which spans a number of business areas including, disinfection and works improvements, service reservoir and treated and stored water integrity and improvement, training and competence etc.

The background for this work has been the serious event which occurred in 2015 and deficiencies identified as a result of a company review of its operation. The data submitted by the company as part of the regulation 27 and 28 process has been pivotal in identification of sites with unmitigated risks and hazards.

The Inspectorate has been minded to take enforcement action against a series of works and reservoirs (in the region of 90+) and the company are currently responding to draft enforcement action proposed by the Inspectorate.

There are currently draft notices for:

- Run to waste facilities at works;
- Service reservoirs – covering large number of sites relating to age of water and inspection of reservoirs;
- Site specific disinfection plans (Regulation 26) at works.

Additional Information

Drinking water 2015 – the latest annual summary published July 2016
Water company statistics for 2015
Company look up tables

All available at <http://www.dwi.gov.uk/about/annual-report/2015/index.html>

Prosecutions and cautions

<http://www.dwi.gov.uk/press-media/incidents-and-prosecutions/prosecution-record.pdf>



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