Drinking water 2016
Public water supplies for England and Wales

Quarter 4
October - December 2016
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Foreword

*Drinking Water 2016 Q4* is part of the annual publication of the Chief Inspector of Drinking Water for England and Wales. It is published as a series of quarterly reports which cover public water supplies in England and Wales.

The report sets out to develop a source to tap approach in the supply of water, developing learning points from recent data, events and company strategies. It builds upon the strategic objective of the Drinking Water Inspectorate (DWI) for safe, clean and wholesome drinking water to all consumers at all times.

This is the fourth and final Chief Inspectors report for 2016 and whilst permitting some reflection on the outcomes of 2016 as a whole, the report remains firmly focussed on key issues for the water industry and the regulator alike as they arise, with the objective of maintaining consumer confidence.

Water quality events concerning taste and odour arising from catchment often have a significant impact on consumer confidence. Companies largely remain focussed on treatment and reactive control and have moved away from profiling reservoirs and dynamic management of reservoir level draw-offs. Climate change, water resources and demand all have an effect upon the risk profile of source water. When companies consider their future resource management strategies, clear identification of water quality risks must include not just pesticides, which was the focus of CIR 2016 Q3, but also on taste and odour.

In 2016, the procurement, delivery and use of treatment chemicals became a focus of a series of audits. Nearly 30 years on from one of the most significant incidents in the water industry, there still remain clear shortfalls in the control of delivery and use of chemicals. In February 2017, transfer of sodium hypochlorite solution into a ferric sulphate tank released chlorine gas, a near repeat of an event in 2007. Whilst in both cases there was no direct effect on drinking water these incidents demonstrate the real and continuing risks which still need to be addressed by companies.

In 2016, there were no failures of *E. coli* reported from water treatment works and five *E. coli* failures in service reservoirs. In comparison with previous years, this is an improvement and continues to demonstrate the commitment by the water industry to deliver exceptionally high quality water from water treatment works and service reservoirs. I am pleased to see some excellent examples of risk management of assets driving down failures over the long term.
Across England and Wales in 2016, the most prevalent detections at the consumers’ taps were for coliforms, taste and odour, iron and lead which together accounted for 613 failures. During the equivalent period, the Inspectorate received 197 notifications of events affecting single properties. There has been a 68% increase between 2012 and 2016 of such events, and of these, 59 required the issuing of warning/advice Notices, such as boil water or do not drink Notices. The reasons for this change are difficult to determine and may reflect better responses by companies to complaints or more effective water fittings inspections. Companies are encouraged to publish their annual water fittings report to make strategic objectives, activities and subsequent outcomes available, as these are areas which continue to contribute significantly to compliance failures. While not all failures detected in tap samples are due to consumers’ plumbing, just over 24% of failures in 2016 were attributed to consumers’ domestic systems.

I am pleased to see the proactive and progressive adoption of a wider strategy by some companies for identifying hotspots where lead pipe can be targeted and replaced. Coupled to this should be a multi-objective policy of education, awareness, fittings inspection, working with local authorities and educational establishments as well as profiling phosphate dosing based upon risk. As well as being economically efficient for the company more consumers will benefit. Companies who have not considered this should do so.

This report now starts to explore the outputs of the regulatory strategies after nearly two years of implementation. These include the start of the strategic change programme where there has been focus on developing processes, procedures and more open consultation with the industry through Water UK. The change programme is also implementing the objectives of Better Regulation, through to the risk analysis of water companies, looking at risk indices and risk of regulatory failure. In this quarter I have explored some aspects of recommendations particularly relating to management of company risk assessments.

Additionally, in this report, I have focussed on some detailed analysis of data reporting by companies. This is a continuing area of interest following on from enforcement action on companies who continued to submit poor quality data. The provision of accurate data to the Inspectorate remains a cornerstone in the ability to determine regulatory compliance and, more importantly, impacts the validity of future risk analysis of companies.

Finally, in December 2016 an Information Letter was published concerning approved products for use in public water supplies in the United Kingdom. This provides information on improvements to the Secretary of State’s list
and the notice of intention to revoke approvals of some products which companies should make note of.
Chapter 1: Drinking water sources and catchment management

The Inspectorate supports the view that management of catchments is a crucial approach to reducing water treatment and the inherent costs to water companies, as well as providing wider benefits for the environment, wildlife and their habitats.

Taste and odour-catchment issues (Geosmin and MIB)
New work by Industry

The Inspectorate has welcomed the creation of an industry working group, initiated by Dŵr Cymru Welsh Water, to explore taste and odour. This group met in January 2017 in Cardiff where the Inspectorate provided an overview of, and observations on, taste and odour. Shared learning amongst companies will enable a variety of outcomes including the re-evaluation of current strategies for catchment management and also accessing specialist skills and expertise.

Water quality events concerning taste and odour constitute a proportion of all annual events (33% of compliance failures and 10% of events), during 2016. When they do occur they often have a significant impact on consumer confidence. Where events occur, rejection of water is common and the consequence can be high for a company. Figure 1 illustrates the rates of consumer contacts to water companies to report issues of taste and odour.
Figure 1: Rates per 1,000 population of consumer contacts population) for taste and odour in 2016 and the locations of exceedances.

Key
- Taste and/or odour exceedences
- 0 – 0.4
- >0.4 – 0.8
- >0.8 – 1.6
- >1.6 – 3.2
- >3.2

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Considering the overall number of taste and odour contacts in various categories across the industry, Figure 2 illustrates that these have been relatively stable at between 20,000-25,000 complaints per year. The majority of the variation seen has been a reduction in complaints about chlorine taste and odour but the level has only reduced to that seen in 2011 so overall long term progress has not been made.

**Figure 2: Contacts for taste and odour made to water companies between 2011-2016.**

In the past two years there has been an increase in the number of legal instruments reaching completion but these have not appreciably demonstrated benefit or provided evidence of the reduction of problematic taste and odour causing compounds, with many still being evident above threshold levels.

Currently, industry-wide, there are fifteen programmes of work in place based on risks identified from taste and odour. The majority of schemes are for the improvement of treatment processes such as Tamar works, Tottiford works, Northcombe (new) works (SWT) and Brede works (SRN) for the installation of secondary GAC. The companies are planning to complete this work by the end of 2019 improving the supply to over 110,000 consumers in the Brede, Baldslow and Fairlight areas (SRN) and over 440,000 consumes in parts of Devon and Cornwall (SWT).
Avoiding use of poor quality water, high in organic matter, should be the first line of defence, aided by monitoring to inform risk assessments. Monitoring should be rapid and appropriate in order to be an effective mitigation. Whilst there has been an increase in monitoring, this predominately focuses at the latter stages of treatment works. There is growing recognition of the benefits of source and through-process risk based monitoring by progressive companies, however, operational monitoring for risk analysis is not a choice for other companies. Where monitoring and understanding of raw waters is lessened, and companies rely on PAC and granular activated carbon (GAC), the early assessment of taste and odour causes may be slow and prevention of impacts on consumers impaired. Many companies remain reliant on short term reactive measures such as powdered activated carbon (PAC) dosing rather than best operational practice and management. While PAC is useful as a rapid response to unusual or unpredictable increases of problematic compounds, it is essential that raw water management with emphasis on reduction of cells/compounds throughout the treatment process is a strategic objective in the longer term.

Considering methodology, there are simple and inexpensive concentration methods available which will allow detection of single figures of algal cells as well as more complex analytical methods involving polymerase chain reactions (PCR) and genetic profiling, both of which require some level of user experience. It is a concern to the Inspectorate that these skills are progressively being lost from companies where deemed to be unnecessary and/or costly. Companies have moved away from profiling reservoirs and dynamic management of reservoir level draw-offs. Few companies now have operational teams that traverse reservoirs taking grab samples and using methods to measure transparency of water which goes towards the accumulation of data for evidence based assessment. It is acknowledged that water treatment processes have improved, particularly so in those regions with eutrophic river water sources but the reliance on treatment processes as a solution avoids the essential understanding of algal species or other causative organisms that may be challenging works and the efficacy of treatment.

Figure 3 illustrates the number of failures to meet taste and odour standards and highlights the proportion described as earthy/musty compared with all other descriptors.
Importantly, with the increase in technologies such as UV and advanced oxidation processes there is a question as to whether the process of water treatment could result in unintended consequences. There is evidence to show that such treatment for removal of complex pesticides can result in disinfection by-products. Such technology could result in some of the conditions seen at the end of a summer season and surface reservoir drain down causing algal cells to be degraded. The outcome of this would be to release problematic compounds at the latter stages of the process.

In addition to all the challenges water companies continue to face now and into the future, climate change, water resources and demand all have an effect upon a changing risk profile of source water. The summers of the early 1980 and 1990s where huge algal blooms were seen across the country have not been repeated in recent times but there is evidence from 35 years of climate, water quality and weather data that weather patterns are cyclical and this could bring back forgotten challenges for which companies must be prepared and risk assessments should cover these longer term predictions.
Chapter 2: Water quality at treatment works

During the fourth quarter of 2016, the Inspectorate has continued assessing the compliance data supplied by companies.

**Review of compliance – microbiological failures at treatment works**

**Table 4: Q4: 2016 – Microbiological tests**
The number of tests performed and the number of tests not meeting the standard

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Total number of tests</th>
<th>Number of tests not meeting the standard</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water leaving water treatment works</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>E. coli</em></td>
<td>41,686</td>
<td>0</td>
</tr>
<tr>
<td>Coliform bacteria</td>
<td>41,686</td>
<td>6</td>
</tr>
</tbody>
</table>

Reviewing 2016 Q4, there were no *E. coli* detections and six detections of coliforms in England and Wales (ANG 1, SEW 2, SRN 2, YKS 1) in samples taken at treatment works. There was, however, a presumptive detection of *E. coli* thought to be from a works which on investigation was found not to be so based on the sample chemistry. This emphasises the importance of competency to carry out tests, including sampling to ensure all data is representative of water leaving works.

In comparison with previous years, this is an improvement and continues to demonstrate the commitment by the water industry to deliver exceptionally high quality water from water treatment works into the network, (see Figure 5).
Audits of the procurement, delivery and use of treatment chemicals

In 2016, there were two sites in England and Wales where problems relating to treatment chemicals were identified. In July, the Inspectorate became aware of the overdosing of fluoride to water supplies from Anglian Water’s Barrow works. Investigations identified that the treatment chemical was supplied at a significantly greater strength than requested, due to a fault with the mixing process at the supplier’s facility. The second incident related to an increase in the concentration of manganese in supplies from Dŵr Cymru Welsh Water’s Alwen works. The supplier of ferric sulphate had made a change to the formulation of the delivered chemical, which contained increased concentrations of manganese as a by-product. While the chemical supplied remained compliant with the British Standard, its use had a detrimental effect on the treatment process. The supplier had not notified the water company of the change. In both cases, insufficient checks were in place at the chemical delivery stage.

The Inspectorate has carried out audits on this topic before and has provided guidance to the industry in a number of Information Letters. This remains a key focus ever since the incident involving the accidental contamination of the drinking water supply to the town of Camelford, Cornwall, in July 1988 through an error in the delivery. Yet nearly thirty years on in 2017 we have seen the incorrect delivery of a chemical...
resulting in a chlorine gas release. Whilst this did not affect water quality, such incidents must be a ‘never happen’ occurrence.

In the final quarter of 2016, an audit programme for the procurement, delivery and use of chemicals in the treatment process was developed to understand what risks remain in the water industry of England and Wales. The site selection was based upon the Inspectorate’s company risk profiling of companies and identification of sites that were considered to be a potential risk for chemical handling or for other identified risks of non-conformance with the regulations. A small number of additional sites were selected at random. The sites were diverse in nature from small scale ground water works through to large surface works with a variety of manned and unmanned sites selected as they often differ in procedures and practices. Fifteen sites were selected for audit across ten companies.

There were a number of areas of concern identified and some good practices, both of which are summarised for wider industry learning as follows:

**Chemical procurement**

In general, the companies audited had in place appropriate contracts with their chemical suppliers and the contractual agreements defined that the chemicals supplied should meet the appropriate British Standard, often with the appropriate BS:EN number specified or where this did not apply, appropriate requirements to comply with regulation 31 covering the use of materials in water supply. A theme arising from the audits was the apparent divide between procurement and chemical delivery procedures. At Little Eaton works (SVT), the delivery procedures were out of date and there was no requirement to check that the standards stipulated in the contract were being adhered to. Contracts for the procurement of chemicals should include quality requirements with appropriate checks in place through chemical delivery procedures. Without this companies have not met the minimum requirement for quality assurance.

Affinity Water had a programme in place for the audit of its suppliers, but the audit paperwork lacked the rigour to demonstrate full traceability of treatment chemicals to the raw materials, or to demonstrate that each product supplied was compliant with Regulation 31. Severn Trent Water was unable to demonstrate that it had carried out any recent audits of its chemical suppliers. Without appropriate systems in place to demonstrate traceability of raw materials used in the manufacture of treatment chemicals, companies will not have the ability to demonstrate that the chemicals are fit for purpose and compliant with the requirements of the
Regulations. This very requirement was specified in information Letter 05/2011.

**Chemical delivery**

**Pre-delivery quality checks**

Companies that do not have appropriate pre-delivery checks in place are completely reliant on their suppliers. It may be that companies consider such checks unnecessary or the residual risk of an error is very low. Yet if there are no audits of suppliers or procedures are poor, out of date or non-existent, then on what basis is such risk appraised? It is evident from the rejection of some deliveries and near misses that the Inspectorate is aware of, the delivery of incorrect chemicals has occurred.

Information Letter 05/2011 gave guidance to companies that they should carry out quality control assays and physical checks on the chemicals supplied where it is reasonably easy to do so to prevent delivery of inappropriate chemicals. The Inspectorate is therefore critical that a number of companies are not carrying out these checks and are in the main citing health and safety reasons for not doing so. Whilst this is the case for some companies, good practice was demonstrated by three companies during audits. South West Water retain samples for a limited time and were able to demonstrate that chemicals had been rejected based upon pre-delivery checks. South Staffordshire Water similarly had rejected chemicals based upon appearance. Inspectors observed a good system in place at Wessex Water’s Sutton Bingham works where physico-chemical tests were carried out on a range of liquid chemicals.

**Delivery points**

One of the key failings of the 1988 Camelford incident was the inappropriate use of generic padlocks for chemical delivery points which the delivery driver had acquired unofficially. The learning from this was for access to chemical delivery points to be suitably restricted and controlled. In 2016, the chemical delivery point at United Utilities’ Hurleston works was secured by a generic key suite and that the key was left in one of the locks. At Dŵr Cymru Welsh Water’s Alwen works, the chemical delivery point keys were kept in a key box in the control room, however, the key box was left unlocked such that anyone with access to the control room had access to the keys.

As a secondary mitigation, clear signage to assist those who are carrying out chemical deliveries, particularly if they are unfamiliar with a site, may avoid a similar incident to Camelford. However, signage at the Essex and Suffolk Water and Northumbrian Water sites that were subject to audit was
found to be poor with some signs faded and others, recently fixed laminated labels, not likely to withstand inclement weather.

To prevent delivery points from being used for the wrong chemical, bespoke couplings, which are available, should be used. As an example of good practice, Thames Water and Affinity Water reported that they were working with chemical suppliers on plans to provide unique couplings for the chemical being supplied. Once introduced this system should provide a robust prevention mechanism.

Delivery procedures

There are risks associated with chemical deliveries and these are still not being robustly addressed. While some companies were able to demonstrate satisfactory chemical delivery procedures, there were also examples of procedures not being followed or them being out of date.

At Severn Trent Water’s Little Eaton works, the procedures required the delivery notes to demonstrate conformance to the British and European standard, but at the point of chemical delivery this did not occur and the company accepted the delivery. For some treatment chemicals delivered in sacks, the company carried out no checks at all on the delivered chemical.

Severn Trent Water was unable to produce evidence of historical deliveries to site as the post of administrative assistant had been removed after which time the delivery notes piled up before eventually being discarded. By failing to put an alternative system in place the traceability of chemical deliveries for the site was compromised.

At Wessex Water’s Sutton Bingham site, operators were not always completing the paperwork as required by procedures. At Affinity Water’s Iver works there were no individual sign-off sheets in place and the company was unable to demonstrate that the acceptance criteria for deliveries were met.

At Essex and Suffolk Water’s Layer works, Northumbrian Water’s Horsley works and South Staffordshire Water’s Seedy Mill works the companies were unable to demonstrate traceability to approved tanker barrels as required by company procedure.

Supervised deliveries

Information Letter 12/2003 gave guidance that deliveries should be supervised throughout by company personnel. While some companies were able to demonstrate that deliveries were supervised throughout, there were examples where supervision after the tanker connection was made ceased
and the driver was left unattended. Companies should assess what risk this may pose to the delivery of the chemical since in 2017 this very situation resulted in the transfer of sodium hypochlorite solution into a ferric sulphate tank releasing chlorine gas. The root cause of this was the delivery lorry carrying multiple containers of different treatment chemicals and because of the failure to check that the delivery hose was connected to the correct bulk tank on the lorry.

**Chemical dosing**

Companies should have robust procedures in place to ensure chemical dosing is appropriately controlled at all times such that the requirements of the regulations are met. It cannot delegate these responsibilities to third parties.

At Severn Trent Water’s Little Eaton works, the sodium bisulphite dosing system was in operation but the water company had not taken ownership from the company who had newly installed it. At the time of the audit, access could not be gained to inspect the installation due to a gas leak. Companies must maintain control of chemical dosing equipment, or any equipment, that is operating at treatment works, even during commissioning periods to ensure the process is appropriate and effectively controlled by those who are responsible for producing wholesome water.

Good practice was noted Wessex Water’s Sutton Bingham works where there was good labelling of the chemical dosing lines and at Affinity Water’s Iver works the audit team was pleased to see that the company were progressing with dual containment of chemical dosing lines. At Severn Trent’s Little Eaton works the design of the drop test valves on the ferric dosing pumps was configured to allow operators to carry out the drop test without exposure to the pumps.

Meanwhile at Northumbrian Water a redundant dosing lance presented a potential pathway for contaminants into the process stream and better control of the polyelectrolyte dosing system was required. Similarly at Wessex Water there were no clear procedures on how the coagulant dose was controlled.
Specific chemical considerations

Hexafluorosilicic acid

Companies are reminded that the Code of Practice on Technical aspects of Fluoridation of Water Supplies was reissued in January 2016\(^1\). Procedures and practices should reflect the changes outlined therein.

Orthophosphoric acid

It has been noted on audit inspections that some companies have single points of failure on orthophosphoric acid dosing installations. Recent research\(^2\) shows that when phosphate dosing is stopped there is a short lived period, of less than a day, prior to lead leaching commencing once more.

Companies should review the risks associated with failures of orthophosphoric acid dosing equipment and ensure that there is sufficient redundancy or robust procedure to effect immediate repair such that public health remains protected.

Other issues observed at audit sites

NDMA and NMOR monitoring

In 2012, the Inspectorate issued guidance to the industry on research into nitrosamines in water treatment coagulants and drinking water. This was issued in information letter IL 07/2012. Companies will be aware that it is they, and not their suppliers that hold the responsibility for compliance with the regulations and so should carry out periodic checks on the concentration of N-nitrosodimethylamine (NDMA), and N-nitrosomorpholine (NMOR) as appropriate. Water companies were not, however, following the guidance on ferric based coagulants. In many cases, water companies were reliant on their supplier’s assurances that neither product would be

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\(^1\) Available at http://www.dwi.gov.uk/stakeholders/information-letters/2016/01-2016-annexa.pdf

present in the supplied product due to the means of manufacture. Neither the supplier nor the companies were testing for these substances.

Severn Trent Water had operational monitoring in place for NDMA as well as for appropriate disinfection by-products, which was welcome, but along with Essex and Suffolk Water, Northumbrian Water and Dŵr Cymru Welsh Water were unable to demonstrate any checks on the supplied coagulant for NDMA or NMOR.

Companies must ensure that they are aware or are notified of any changes to materials, however small and this should result in an update of the risk assessment.

**Compliance with British and European standards**

Compliance with British and European standards is fundamental in fulfilling the requirements of Regulation 31 and companies need to be able to demonstrate clearly that this is always the case.

A number of failings were observed in relation to demonstrating compliance with the British and European Standards. At both Essex and Suffolk Water and Dŵr Cymru Welsh Water, delivery notes referred to superseded standards. Essex and Suffolk Water and Severn Trent Water were unable to confirm, on the day of the audit, whether the salt used on site conformed to the British Standard. Some chemicals were reported as being compliant with other standards and in many cases there was no traceability to British or European Standards on delivery paperwork at all.

**Summary**

Nearly 30 years on from one of the most significant incidents in the water industry, there still remain clear shortfalls in the delivery and use of chemicals including practices which were at the root cause. These gaps have resulted in, and will continue to result in, near misses and incidents that should never ever happen. Early in 2017, a company reported the transfer of sodium hypochlorite solution into a ferric sulphate tank releasing chlorine gas. This was a near repeat of an incident in 2007 in Bovey Cross works, (SWT) where a transfer of sodium hypochlorite solution into an aluminium sulphate tank also released chlorine gas. While in both cases there was no direct effect on drinking water, these incidents demonstrate the real and current risks which need to be addressed by companies. Failure to follow best practice, Information Letters, guidance, procedures and standards as well as not dynamically assessing risk promotes poor practice and increases the risk of a significant incident happening. Those companies not giving this due regard will need to improve.
On a positive note, the audit teams identified a number of areas of good practice whilst carrying out the site audits. For example, at Northumbrian Water, a tag system is being introduced, to highlight any deficiencies observed on chemical storage facilities during site checks.

Thames Water and Affinity Water were working with chemical suppliers on plans to provide unique couplings that are bespoke to the chemical being supplied.

Again at Thames Water, at a critical works that would create supply difficulties with an extended shutdown, the company had installed two chlorine dosing streams. Each stream has two pumps (duty/duty) but the site can dose fully from one pump in an emergency.

At Wessex Water we welcome the ‘Water Smart’ initiative observed at both sites as part of the company’s wider policy to regard water as a food product and observe good hygiene.
Chapter 3: Water quality at service reservoirs and in distribution

Assessment of compliance

In Q4, there were no detections of *E. coli* at a service reservoir however there were 20 coliform detections at service reservoirs (ANG 1, DVW 1, ESK 1, SES 1, SEW 4, SVT 4, SWT 1, TMS 1, UUT 3, WSX 2, YKS 1).

The coliform detection reported by Dee Valley Water at Penybryn Service reservoir was the second detection in 2016 following one reported in August. Sutton and East Surrey Water reported a second coliform detection at Gravelly Hill Tower. Both occurrences of repeat coliform detections bring into question the quality of investigation and repair work following the initial failures as in both cases companies reported having identified and repaired potential points of ingress. The roof of Gravelly Hill Tower has now had the roof membrane fully renewed and reproofed following a patch repair after the initial failure and Penybryn service reservoir has been abandoned.

Table 6: Q4: 2016 – Microbiological tests
The number of tests performed and the number of tests not meeting the standard

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Total number of tests</th>
<th>Number of tests not meeting the standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water leaving service reservoirs</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>E. coli</em></td>
<td>51,563</td>
<td>1</td>
</tr>
<tr>
<td>Coliform bacteria</td>
<td>51,563</td>
<td>20</td>
</tr>
</tbody>
</table>

In 2016 as a whole, there were five *E. coli* failures and 107 coliform failures at service reservoirs.

A review of industry data for microbiological detections at service reservoirs between 2004-2016 showed an overall decline in reports of *E. coli* and coliforms (see Figure 7).
Figure 7: E.coli and coliform detections at service reservoirs* 2004-2016

*between 2004 and 2016, the number of service reservoirs decreased by 9% from 4,639 to 4,207

The Inspectorate has regularly reviewed company performance on microbiological failures at treatment works and uses the information to identify the need to ensure specific companies are implementing best practice in relation inspection and repair of service reservoirs.
Water quality at consumers’ taps

Assessment of compliance

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 samples taken to demonstrate compliance with a Directive or national standards, there were a total of 104 failures for 14 parameters in Q4 2016.

For microbiological parameters, four samples contained *E.coli* and one contained Enterococci. With regard to chemical parameters, the most prevalent detections were for taste and odour, iron, metaldehyde, and lead which together accounted for 88 failures (85% of the total).

Looking at the 104 failures in more detail, Figure 8 shows the proportion of failures for the 14 parameters.

**Figure 8: Directive and national parameters failing in Q4 2016 – percentage of the 104 failures recorded at taps**
Events at single properties

The Water Industry (Suppliers’ Information) Direction 2017 requires that companies report any event that gives rise to, or is likely to give rise to, a significant risk to the health of persons to whom the water is supplied and also any event associated with a water supply that is notified by the supplier to a local authority, or local or regional health board (or equivalent) under Regulation 35 of the Regulations.

During 2016, the Inspectorate received 197 notifications of events affecting single properties, ranging in nature from reported customer illness, taste and/or odour issues to the provision of warning / advice to temporarily restrict supplies. The Inspectorate has seen a 68% increase between 2012 and 2016, and of the 197 events in 2016, 59 were for the issuing of warning/advice notices, such as boil water or do not drink notices.

Table 9. Event Notifications affecting single properties – 2016

<table>
<thead>
<tr>
<th>Event Nature</th>
<th>Total events</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer concern</td>
<td>12</td>
</tr>
<tr>
<td>Cryptosporidium</td>
<td>2</td>
</tr>
<tr>
<td>Discolouration</td>
<td>6</td>
</tr>
<tr>
<td>Evidence of chemical contamination</td>
<td>28</td>
</tr>
<tr>
<td>Evidence of microbiological contamination</td>
<td>37</td>
</tr>
<tr>
<td>Illness</td>
<td>2</td>
</tr>
<tr>
<td>Issue of warning/advice</td>
<td>59</td>
</tr>
<tr>
<td>Loss of supplies/poor pressure.</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
</tr>
<tr>
<td>Risk of contamination</td>
<td>2</td>
</tr>
<tr>
<td>Taste or odour</td>
<td>35</td>
</tr>
<tr>
<td>Treatment failure</td>
<td>2</td>
</tr>
<tr>
<td>Vandalism/unauthorised access</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>197</td>
</tr>
</tbody>
</table>

Two of the most common reasons for consumers being provided with advisory notices are microbiological contamination from taps or other defects in the domestic system, (with precautionary boil advice issued) and petrochemical contamination caused by movement of fuel through the ground which has subsequently permeated supply pipes made from MDPE or polyethylene. Advice provided is not to drink the tap water until the pipe has been replaced. Where fuel contamination is present, ‘Do not drink’ advice may, in some instances, remain in place for a long time, sometimes indefinitely prior to resolution of the issue. This is an undesirable situation and companies are reminded that they have powers and duties under section 75 of the Water Industry Act 1991 to enforce remediation of
defects in private systems that cause the domestic water supply to be unwholesome.

As Regulators under the Water Industry Act 1991, companies should consider the principles of better regulation. These include being accountable, transparent and targeted. This year Wessex Water have published their water fittings annual report which covers these principles in a concise and easy to understand way. Companies are encouraged to take note of this progressive approach.

An increasing number of events associated with single properties and issuing ‘Do not drink’ advice relate to the detection of lead in tap water at levels exceeding the standard. One such event was notified by Wessex Water in the Bridgewater area of Somerset in response to a consumer contact requesting a free lead check on a property undergoing renovation. The event highlights the challenges companies face in domestic settings and illustrates an approach to successfully mitigate the health risks that lead pipes pose. Due to the renovation in progress, there was no suitable tap available for drinking purposes and the company’s sampler was obliged to take the sample from an improvised sampling point shown below (Figure 10). This is not standard company procedure, but since the consumer had requested the sample, the sampler took the sample from this point in order to meet the customer’s expectations and to help inform and trigger the free lead pipe replacement programme if required.

**Figure 10: Improvised sample point in lead pipework**
Analysis of the sample confirmed the presence of lead well in excess of the regulatory standard and consequently a precautionary ‘Do not drink’ notice was issued by the company to inform and protect the builders working at the property. Furthermore, a water fittings inspection was carried out which confirmed the observations made by the sampler. It was noted by the water fittings inspector that the property owner had not met their responsibility to notify the company of the internal works being undertaken. The fittings inspector took the opportunity to remind them of the requirements of the water fittings Regulations.

The strategy of Wessex Water for reducing consumers’ exposure to lead is a combination of phosphate dosing and whole service pipe (company and customer side) replacement. The trigger for investigation and the offer of pipe replacement was set at 10µg/l of lead but was initially reduced to 3 µg/l of lead. This approach has proved very successful for the company and around 400 services are being replaced on a reactive basis every year. The company has, however, reviewed this strategy raising the level to 7µg/l of lead for reactive replacement but moved to a wider proactive strategy of identifying hotspots where lead pipe replacement can be targeted and pipes replaced in numbers. As well as being economically efficient for the company this means more consumers will benefit from pipe replacement. Coupled to this is a multi-objective policy of education, awareness, fittings inspection, working with local authorities and educational establishments as well as phosphate dosing based upon risk. The Inspectorate is encouraged by this proactive and progressive approach to reducing the health risks posed by lead pipework and an approach that, while some companies are considering, other companies do not see quite so clearly.

Companies who do not have such a clear strategy should recognise that advising consumers not to drink their tap water is a severe measure and is unacceptable as a long-term solution. As an interim measure, investigational sampling should be conducted to determine whether running the tap for a few minutes before consuming the water reduces the lead concentration to below the PCV, and the consumer advised accordingly.

The Inspectorate has also noted that, with a number of events involving precautionary advice to individual properties, the company’s initial risk assessment has not adequately ruled out the possibility that the public supply system may be affected. For example when responding to complaints of taste and odour, some companies assume that the issue is related to one specific property without checking whether neighbouring properties are affected. Companies should ensure that a basic risk assessment is undertaken in response to any consumer contact about a drinking water quality concern in order to rule out an issue with the wider
network. This should include undertaking checks to identify any operational activities that may have caused the issue and, where appropriate, sampling neighbouring properties in addition to sampling from the complainant’s property.

The Inspectorate receives notification, periodically, of instances of blue water where there are blue disinfection blocks present in toilets within properties. It is evident that household plumbing arrangements contribute to these events and as such, the WaterSafe scheme promotes use of qualified plumbers and using a WaterSafe qualified plumber should give confidence that plumbing is carried out appropriately. The Inspectorate carried out a check of 17 of the larger water company websites to see how easily a member of the public could find out about WaterSafe plumbers through their water company website. Information was easily located on 12 of the sites but for five, information was more difficult to locate or not present. It is suggested that companies ensure that members of the public seeking an approved plumber can easily locate one through the company website.
Review of recommendations

The work of the Inspectorate frequently leads to making recommendations. Recommendations are a key tool for compliance with the water quality regulations, with the objective of improving the operation of companies. As an instrument of indirect and non-binding action these are purposeful in enhancing public confidence. For effective regulation, it is necessary for the regulator to undertake a regular evaluation of regulatory decisions, actions and interventions together with the responses made by the companies.

In the last two years, focus on the responses by companies has led to the evaluation of the risk of regulatory failure and this has started to drive the focus of inspections and evaluations to those companies at highest risk. Those companies where focus has been applied will be aware of the proactive and formalised strategy required of water company senior management. In order to provide some insight to companies on where effort needs to be focussed, the recommendations made during 2016 were reviewed.

In total, 265 recommendations were made and for the purposes of the review these were categorised into key areas.

Table 11 indicates the themes in which recommendations were made. By far the largest number of recommendations made (46%) related to management.

Table 11: Number of recommendations made in 2016

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catchment</td>
<td>12</td>
</tr>
<tr>
<td>Treatment</td>
<td>47</td>
</tr>
<tr>
<td>Storage and distribution</td>
<td>19</td>
</tr>
<tr>
<td>Sampling</td>
<td>34</td>
</tr>
<tr>
<td>Management</td>
<td>122</td>
</tr>
<tr>
<td>Communication</td>
<td>26</td>
</tr>
<tr>
<td>Training</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>265</td>
</tr>
</tbody>
</table>

Having established the majority of recommendations were in the area of management, this category was then reviewed to identify the areas that raised the most recommendations.
Table 12: Number of recommendations in the sub categories of ‘management’

<table>
<thead>
<tr>
<th>Category</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deficiencies with risk assessment</td>
<td>46</td>
</tr>
<tr>
<td>Deficiency relating to policy/procedure</td>
<td>20</td>
</tr>
<tr>
<td>Inadequate investigations</td>
<td>18</td>
</tr>
<tr>
<td>Deficiency specifically relating to maintenance and planning</td>
<td>11</td>
</tr>
<tr>
<td>Deficiency record keeping or review</td>
<td>7</td>
</tr>
<tr>
<td>Inadequate contingency planning</td>
<td>5</td>
</tr>
<tr>
<td>Inadequate training / competence of staff</td>
<td>3</td>
</tr>
<tr>
<td>Other recommendations including:-</td>
<td></td>
</tr>
<tr>
<td>Staff resource issues</td>
<td></td>
</tr>
<tr>
<td>Wilful staff malpractice/malicious actions</td>
<td>12</td>
</tr>
<tr>
<td>Lack of maintenance of equipment</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>122</td>
</tr>
</tbody>
</table>

The greatest number of recommendations related to deficiencies in risk assessment. Looking at the nature of the recommendations, there were recommendations made to update the risk assessments after an occurrence that had either not been identified on the current risk assessment, or where the risk had been identified but was assessed as adequately mitigated but in fact turned out not to be. Ten years since the legislative introduction of risk assessments it would be expected that this process should be well embedded within the management of companies and therefore should not attract proportionately so many recommendations.

There were also recommendations made to ensure that companies apply learning more widely and, where there are other sites where the same situation could arise, the company takes appropriate preventative action. Considering deficiencies in policies or procedures, recommendations covered improving procedures for responding to alarms and managing valving operations or network infusions.

Other areas where there were higher number of recommendations were ‘treatment’ and ‘sampling’. In respect of treatment, the most common recommendation related to inadequacies with the management, operation and maintenance of disinfection processes and the need for improvement of chemical dosing or procurement of treatment chemicals.

Investigative sampling also remains a concern with companies needing to improve the location, scale and timeliness of sampling in response to a water quality concern and ensuring resulting samples are properly analysed.
Further analysis of recommendations showed that most recommendations (163) arose from assessment of events, with audits and assessment of compliance data producing 45 and 42 recommendations respectively. This reflects the focus of assessments where there is already a potential breach of the regulations and the audit of areas where a risk is considered likely. As part of an assessment, Inspectors must decide the likelihood of a failure to recur and where this is the case the outcome will result in a recommendation. Companies are encouraged to analyse failures, seek to determine the cause and put into place learning to prevent a recurrence and so reduce the need for recommendations.

**Table 13: Numbers of recommendations in each category for individual companies**

<table>
<thead>
<tr>
<th>Company</th>
<th>Catchment</th>
<th>Treatment</th>
<th>Storage and distribution</th>
<th>Sampling</th>
<th>Management</th>
<th>Communication</th>
<th>Training</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>SVT</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>23</td>
<td>3</td>
<td></td>
<td></td>
<td>34</td>
</tr>
<tr>
<td>UUT</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>15</td>
<td>7</td>
<td></td>
<td>34</td>
</tr>
<tr>
<td>SRN</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>27</td>
</tr>
<tr>
<td>TMS</td>
<td>2</td>
<td>8</td>
<td></td>
<td>3</td>
<td>13</td>
<td>1</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>ANG</td>
<td></td>
<td></td>
<td></td>
<td>8</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>NNE</td>
<td></td>
<td></td>
<td></td>
<td>8</td>
<td>1</td>
<td>7</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>CAM</td>
<td>2</td>
<td>10</td>
<td></td>
<td></td>
<td>5</td>
<td></td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>DWR</td>
<td>3</td>
<td>2</td>
<td></td>
<td>1</td>
<td>10</td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>YKS</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>10</td>
<td></td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>ESK</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>8</td>
<td>3</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>VWP</td>
<td>1</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>SEW</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>AFW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>WSX</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>DVW</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>SWT</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>BRL</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>PRT</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
<td><strong>47</strong></td>
<td><strong>19</strong></td>
<td><strong>34</strong></td>
<td><strong>122</strong></td>
<td><strong>26</strong></td>
<td><strong>5</strong></td>
<td><strong>265</strong></td>
</tr>
</tbody>
</table>
Comparing the number of recommendations made across companies, Table 13 shows the numbers of recommendations in the individual categories. It is accepted that a straight comparison of numbers of recommendations across companies is not a reliable indicator of risk as companies vary in size. As part of the forward strategy, analysis of the response to recommendations and other correction factors is being used to evaluate company risk. The Inspectorate will continue to develop this strategy to promote effective regulation and provide consumer confidence.

## Regulatory issues

### Better Regulation

The government has committed to a programme of regulatory reform to ensure that regulators carry out their duties in a transparent, accountable, proportionate and consistent manner and reduce the bureaucratic burden from unnecessary or ineffective regulation. The reduction of ‘red tape’ for business is part of the Government’s strategy to boost the economy. This activity is overseen by the Better Regulation Executive who are the lead for the regulatory reform agenda across government.

The Regulators’ Code came into statutory effect on 6 April 2014 under the Legislative and Regulatory Reform Act 2006. It provides a clear, flexible and principles-based framework for how regulators should engage with those they regulate in the interest of better regulation.

All government departments and regulators are required to comply with this legislation, by considering the impact of any new measures that are introduced. The Chief Inspector had already adopted the principals of better regulation as part of the regulatory framework before this statutory duty arose, in a bid to establish transparency and openness as a regulator. For example, the Chief Inspector has aligned the annual report stages of catchment management undertakings with the requirements of other regulators, removing the unnecessary and avoidable burden of duplicated reporting. Additionally, for Regulation 31 the requirement was removed for approval of products and substances intended for disinfestation, disinfection or cleaning of water works, apparatus and distribution systems (as long as these are appropriately washed away before being returned to supply).

As a continuing part of the strategy of the Chief Inspector, there is consultation with the industry on all significant changes to legislation or guidance via Water UK. This gives the industry the opportunity to have input into new measures and to communicate the potential impacts to the
Inspectorate. The Chief Inspector welcomes active participation in consultations and encourages the industry to engage with them. The 2016 Water Supply (Water Quality) Regulations went through this process and included an impact assessment as is required under the better regulation framework.

The better regulations legislation introduced new rounds of scrutiny of regulatory provisions by internal, independent and ministerial representatives.

In light of the regulatory change the Chief Inspector has reviewed all measures (e.g. Information Letters, Guidance, Legal Instruments) implemented since the 8th May 2015 (the start of the current parliament). Details of this review were submitted to the Regulatory Policy Committee (an advisory committee of independent experts that provides external and independent challenge on the evidence and analysis presented in impact assessments) who accepted the outcome of the review.

The Chief Inspector has initiated a change program with objectives including the updating of internal procedures and processes, and an impact assessment now forms part of the process of introducing new regulatory provisions as will the additional levels of scrutiny. As part of the Inspectorate’s objective to maintain transparency in its activity, an audit trail for the decisions and assessments that go in to the introduction of new measures has been established. All regulators can be audited on this process of policy introduction.

Data Reporting

Issues highlighted by zonal samples and changes in zonal boundaries.

An exercise was carried out to investigate zonal breaches across the last three years for Inspectors to refer to when a new breach occurs. From this exercise it was clear a number of zones have changed boundary outline as well as naming and/or reference number at some point throughout this three year period. As all zonal samples must be submitted with either a grid reference or post code it is possible to plot sample results against the zones for which the sample was submitted.

Across the previous three years (2014/15/16 to November) there were 2,989 compliance breaches reported to the Inspectorate. Of these 2,317 were physically located in the zone for which they were submitted. This identified that 672 (22.5%) breaches, therefore, did not match up.
**Figure 14: Breach numbers and mismatched locations**

<table>
<thead>
<tr>
<th>Description</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total breaches Jan 2014-Nov 2016</td>
<td>2,989</td>
<td></td>
</tr>
<tr>
<td>Breaches matching compliance zone and location across three years</td>
<td>2,317</td>
<td>77.5%</td>
</tr>
<tr>
<td>Breaches not matching compliance zone and location</td>
<td>672</td>
<td>22.07%</td>
</tr>
<tr>
<td>Of which</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliance zone and location do not match</td>
<td>260</td>
<td>38.7%</td>
</tr>
<tr>
<td>Company GIS issues</td>
<td>255</td>
<td>37.9%</td>
</tr>
<tr>
<td>Correct at time of breach, zonal boundary/name change before or after breach</td>
<td>157</td>
<td>23.4%</td>
</tr>
</tbody>
</table>

Of concern are those breaches where the zone submitted in the monthly compliance data does not match the location at any point in the three years.

There are five reasons why this may be the case.

1) The grid reference supplied in the compliance data is incorrectly supplied by company;
2) The zone reference supplied in the compliance data is incorrectly supplied by company;
3) The sample was taken within the incorrect zone;
4) The GIS boundaries are incorrectly supplied by company at the start of the year; and
5) The GIS name layers are incorrectly supplied by company at the start of the year.

In some cases the breaches may be just across the boundary from the correct zone, but in other cases they are from the other side of a company’s area. This number of breaches for which the Inspectorate is not confident about the location is 260 (8.7%). If this were to be extrapolated across all zonal samples taken across the same period (4,416,935) there could be in the region of 384,273 samples where the location does not sit within the zone for which they are submitted against.
Further investigation was carried out using *E.coli* samples, as they are one of the most sampled parameters within zones. During 2016 (up to November) there were 138,726 *E.coli* samples taken in zones during 2016.

**Table 15: *E.coli* samples and match to reported zones**

<table>
<thead>
<tr>
<th>Total <em>E.coli</em> Samples taken</th>
<th>138,276</th>
<th>% of total <em>E.coli</em> samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samples matching compliance zone and location</td>
<td>135,684</td>
<td>97.8%</td>
</tr>
<tr>
<td>Samples not matching compliance zone and location</td>
<td>2087</td>
<td>2.07%</td>
</tr>
<tr>
<td>Samples not matching compliance Company</td>
<td>176</td>
<td>0.13%</td>
</tr>
<tr>
<td>Samples not in ANY zone</td>
<td>175</td>
<td>0.13%</td>
</tr>
</tbody>
</table>

The reasons samples may not be in any zone are an incorrect grid reference was provided or the sample was taken within an area designated as an area of no supply. The reason for samples not matching the compliance company is there are areas where the boundaries of neighbouring companies overlap. Companies need to work with adjacent suppliers to amend boundaries to remove overlap.

The percentage of samples not locating within the compliance zone for *E.coli* is 2.07%. Extrapolating this percentage to total zonal samples as with breaches would result in 91,430 samples being taken in incorrect zones.

Given these percentage figures it is estimated that between 91,000 and 384,000 samples have been taken in the wrong zone in 2016 alone.

With the 2017 GIS layer submission the Inspectorate will take extra care to ensure all zones are correctly labelled, there are no overlapping zones within companies, or across company boundaries. Companies will be contacted directly to correct any issues that are found. Additionally a new monthly check will be put in place to plot all zonal samples sent in to ensure the samples are being taken in the correct locations.
Figure 16: Breaches in zones 2014-2016. Mismatch between reported zone and mapped zone

Reason for Mismatch
- Red: Compliance Zone and location do not match
- Blue: Company GIS issue
- Yellow: Correct at time of breach