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Drinking water 2018

Summary of the Chief Inspector’s report for drinking water in England
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Foreword

I am pleased to publish my report on Drinking water in England for 2018. The report is the 29th published by the Inspectorate and it covers both private and public water supplies.

Drinking water 2018 provides a record of the work of the Inspectorate in checking that water companies and local authorities have taken the appropriate action to maintain confidence in drinking water quality and to safeguard public health.

In 2018, the industry figure for public water supply compliance with the EU Drinking Water Directive was 99.95% (99.95% in England and 99.97% in Wales). This figure is certainly good news and would indicate that the drinking water supply is excellent. It remains largely unchanged since 2004 but represents the high standards for compliance in England recorded since 1990.

In 2016, the Inspectorate introduced a new measure called the Compliance Risk Index (CRI), designed to allocate a numerical value to risk. Unlike Mean Zonal Compliance (MZC), it assigns a value to the significance of the failing parameter, the proportion of consumers potentially affected and the quality of the company’s response. CRI is a measure designed to illustrate the risk arising from treated water compliance failures, and it aligns with the current risk-based approach to regulation of water supplies used by the Drinking Water Inspectorate. The measure has been introduced as a common performance commitment for the Periodic Review 2019 by the Financial Regulator (OFWAT), who are responsible for setting any financial measures through agreement with companies. The introduction of CRI recognises that the level of water quality in England remains one of the best in the world and new, innovative methodology was required to focus on the few areas which matter to the water industry and consumers alike.

In 2018, for companies wholly or mainly in England, the CRI in 2018 was 3.86. This is a marginal increase on 2017 which was 3.62. In England, failures of samples to meet EU, National, and indicator standards taken at treatment works, service reservoirs and taps, all contribute to the national CRI score. The common link between the majority of these failures is they are due to just a handful of assets which present the majority of risk and contribute greatest to CRI.

In 2017, a new drinking water quality measure called the Event Risk Index, (ERI), was introduced to illustrate the risk arising from drinking water quality events which also aligns with the current risk-based approach to regulation of water supplies used by the DWI. Like CRI, it assigns a value to the significance and duration of the event, the number of consumers
potentially affected and the quality of the company’s response. Similar to CRI, the Financial Regulator (OFWAT) has made this measure available as an asset health performance commitment for PR19, should companies wish to be measured by it. The industry ERI in 2018 was 783 and was higher than the 241 recorded in 2017. This figure was due to detections of Cryptosporidium at Knapp Mill Works (Bournemouth Water), and at works serving a large populations in London (Hampton and Coppermills operated by Thames Water) and repeated coliform detections at Testwood works (Southern Water) amongst 46 events classified as serious by the Inspectorate.

In 2018, the continuing strategy of innovative regulation introduced analysis of recommendations made to companies by the Inspectorate. The basis of the Recommendation Risk index is to build upon the concept of a recommendation as a first level regulatory intervention. The objective is to encourage companies to take action themselves before the need for formal enforcement action. As part of this, and since 2016, four companies have been identified as being at a higher risk of regulatory failure, (Severn Trent Water, United Utilities, Southern Water and Thames Water).

As part of progressive and better strategic regulation, we have worked with these companies to formalise a water quality improvement strategy through transformation programmes. The programmes comprise a set of legal instruments that set out agreed actions. I am pleased to report the positive response by the companies to these programmes and the evidenced improvements.

Completed in 2018, were two successful prosecutions and two Cautions of water companies for events. United Utilities were prosecuted for two separate incidents of inadequate disinfection of water at Sweetloves works and were also Cautioned for a similar occurrence at Buckton Castle where consumers were asked to boil their water for a short period. The second prosecution was for the supply of unfit water from Cooks Castle service reservoir in the Shanklin area of the Isle of Wight. This event occurred in 2013 and only came to light through investigations by my Inspectors who discovered the event retrospectively as the company had failed to report the matter. The final Caution was due to the provision of discoloured water from Seedy Mill works by South Staffs Water. A prosecution, while completed in January 2019 has also been included in my report due the serious nature of the incident. This occurred at South Moor service reservoir (Northumbrian Water). This was an event that should not have happened. Corners were cut in carrying out the work and inadequate scrutiny did not identify this. Consumers experienced water with an unpleasant taste and odour which is likely to have been detected had adequate checks been carried out before the reservoir was put back into service.
Drinking water 2018

Summary of the Chief Inspector’s report for drinking water in England

*Drinking water 2018* is the annual publication of the Chief Inspector of Drinking Water for England and Wales. It is the 29th report of the work of the Inspectorate and presents the summary information about drinking water quality for the calendar year of 2018. It is published as a series of four quarterly reports which cover public water supplies and one report which covers private water supplies. This report is a summary of public water supplies for England.

Set out in this report are the key facts about the quality of the public water supplies in England, which is served by 27 water companies delivering supplies to over 55 million consumers. The area served by each water company is shown in Figure 2.

During 2018, Severn Trent Water and Dee Valley Water joined and reorganised their arrangements along the border between England and Wales. A new service provider formed named Hafren Dyfrdwy and covers consumers in Wales previously served by Dee Valley Water and Severn Trent Water. Severn Trent Water now covers previous Dee Valley consumers in England. Additionally, Cholderton Water now operates as a private water supply and is regulated by the local authority.

**Table 1: Key facts about public and private water supply arrangements in England**

<table>
<thead>
<tr>
<th>Public supplies</th>
<th>Private supplies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population supplied</td>
<td>Population supplied</td>
</tr>
<tr>
<td>55,581,180</td>
<td>994,000</td>
</tr>
<tr>
<td>Water supplied (l/day)</td>
<td>Water supplied (l/day)</td>
</tr>
<tr>
<td>13,638 million</td>
<td>271 million</td>
</tr>
<tr>
<td>Abstraction points</td>
<td>Approximate number of private water supplies*</td>
</tr>
<tr>
<td>2,169</td>
<td>37,261</td>
</tr>
<tr>
<td>Treatment works</td>
<td>Total number of local authorities</td>
</tr>
<tr>
<td>1,050</td>
<td>350</td>
</tr>
<tr>
<td>Service reservoirs</td>
<td>Number of local authorities with private supplies</td>
</tr>
<tr>
<td>3,773</td>
<td>284</td>
</tr>
<tr>
<td>Water supply zones</td>
<td>Water composition</td>
</tr>
<tr>
<td>1,503</td>
<td>Surface influenced supplies</td>
</tr>
<tr>
<td>Length of mains pipe (km)</td>
<td>22%</td>
</tr>
<tr>
<td>315,979</td>
<td>Groundwater sources</td>
</tr>
<tr>
<td></td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>Mains water</td>
</tr>
<tr>
<td></td>
<td>24%</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
</tr>
<tr>
<td></td>
<td>4%</td>
</tr>
</tbody>
</table>

*Note: Figures may not add up due to rounding.*
Figure 2: Companies supplying in England and Wales

1. Brough, (ZW0101), IWN
2. Media City UK, (ZM01), PWN
3. Shotton Paper, (ZC010C), ALB
4. West Raynham, (ZAW010), ICW
5. Oakham, (ZST0101), IWN
6. Broadland (ZCA0101), ICW
7. Norwich Common, Wymondham, (Z0017), SSE
8. Rutland, (ZAW0104), IWN
9. Farndon Road, Market Harborough, (Z0012), SSE
10. North Milton, (ZAW0201), IWN
11. Bishopston St. John, (ZAF0011), IWN
12. Kingsmead, Bicester, (Z0008), SSE
13. Rieszton, (ZAO10WY), ALB
14. Berryfields, (ZTV0011), IWN
15. Kingsbrook, Aylesbury, SSE
16. Chigwell, (ZB01EB), ALB
17. Great Western Park, Didcot, (Z0009), SSE
18. Hale Village, Tottenham, (Z0003), SSE
19. Kings Cross, (ZTV0201), IWN
20. Barking Riverside, Barking, (Z0011), SSE
21. Llanilid Park, Nr Bridgend, (Z0002), SSE
22. Millharbour WwZ, Tower Hamlets, (Z0028), SSE
23. Greenwich Millennium, (ZTW0401), IWN
24. Marine Wharf, Deptford, (Z0014), SSE
25. Heart of East Greenwich, Greenwich, (Z0020), SSE
26. Emersons Green, Bristol, (Z0025), SSE
27. Nine Elms, Battersea, (Z0010), SSE
28. Prince of Wales WwZ, (Z0029), SSE
29. The Bridge, (ZTV0101), IWN
30. Ram Quarter WwZ, Wandsworth, (Z0026), SSE
31. Ebbsfleet, (ZTW0501), IWN

Companies
AFW - Affinity Water Ltd
ANH - Anglian Water Services Ltd
BRL - Bristol Water Plc
CAM - Cambridge Water Company Plc
DWR - Dee County Welsh Water
ESK - Essex & Suffolk Water
HDC - Halten Dyhaby
NNE - Northumbrian Water Ltd
PRT - Portsmouth Water Plc

SBW - Bournemouth Water Ltd
SES - SES Water Plc
SEW - South East Water Plc
SNI - Southern Water Services Ltd
SST - South Staffordshire Water Plc
SVT - Severn Trent Water Ltd
SWT - South West Water Ltd
TMS - Thames Water Utilities Ltd
UUT - United Utilities Water Plc
WSX - Wessex Water Services Ltd
YKS - Yorkshire Water Services Ltd
Drinking water quality testing

Throughout 2018, water companies sampled drinking water across England to verify compliance with the drinking water regulations. Almost half of the tests were carried out on samples drawn from consumers’ taps selected at random. For monitoring purposes, company water supply areas are divided into zones. Sampling in zones at consumers’ taps is risk-based with the number of tests being higher in zones with a large population (maximum 100,000). Other sample locations are water treatment works and treated water (service) reservoirs. Collectively, the water companies carried out a total of 3,507,156 tests during 2018 and only 1,128 of these tests failed to meet one or more of the standards set down in the regulations or exceeded a screening value.

Table 3: Number of tests carried out by companies in England

<table>
<thead>
<tr>
<th>Company</th>
<th>Place of sampling</th>
<th>Number of tests per company</th>
<th>Target number of tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water treatment works</td>
<td>Service reservoirs</td>
<td>Consumers’ taps (zones)</td>
</tr>
<tr>
<td>Affinity Water</td>
<td>60,802 (93)</td>
<td>31,446 (156)</td>
<td>88,882 (89)</td>
</tr>
<tr>
<td>Albion Water</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>684 (2)</td>
</tr>
<tr>
<td>Anglian Water</td>
<td>126,122 (131)</td>
<td>85,306 (333)</td>
<td>144,930 (164)</td>
</tr>
<tr>
<td>Bournemouth Water</td>
<td>12,270 (7)</td>
<td>5,159 (20)</td>
<td>16,859 (10)</td>
</tr>
<tr>
<td>Bristol Water</td>
<td>24,532 (16)</td>
<td>47,952 (159)</td>
<td>40,615 (27)</td>
</tr>
<tr>
<td>Cambridge Water</td>
<td>13,720 (21)</td>
<td>6,202 (31)</td>
<td>8,641 (9)</td>
</tr>
<tr>
<td>Cholderton Water*</td>
<td>197 (2)</td>
<td>85 (1)</td>
<td>169 (1)</td>
</tr>
<tr>
<td>Dee Valley Water* (Eng)</td>
<td>2,328 (2)</td>
<td>125 (1)</td>
<td>1,696 (4)</td>
</tr>
<tr>
<td>Dŵr Cymru Welsh Water (Eng)</td>
<td>8,316 (7)</td>
<td>6,207 (17)</td>
<td>6,922 (10)</td>
</tr>
<tr>
<td>Essex and Suffolk Water</td>
<td>21,031 (21)</td>
<td>19,472 (99)</td>
<td>55,591 (44)</td>
</tr>
</tbody>
</table>

- Table 3: Number of tests carried out by companies in England.
<table>
<thead>
<tr>
<th>Company</th>
<th>Place of sampling</th>
<th>Number of tests per company</th>
<th>Target number of tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Water treatment works</strong></td>
<td><strong>Service reservoirs</strong></td>
<td><strong>Consumers’ taps (zones)</strong></td>
</tr>
<tr>
<td>Icosa Water</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>350 (2)</td>
</tr>
<tr>
<td>Independent Water Networks</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>2,984 (13)</td>
</tr>
<tr>
<td>Leep Water Networks</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>298 (1)</td>
</tr>
<tr>
<td>Northumbrian Water</td>
<td>38,251 (34)</td>
<td>50,596 (202)</td>
<td>71,527 (64)</td>
</tr>
<tr>
<td>Portsmouth Water</td>
<td>14,669 (16)</td>
<td>7,335 (31)</td>
<td>20,000 (13)</td>
</tr>
<tr>
<td>Scottish and Southern Energy (Eng)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>4,950 (22)</td>
</tr>
<tr>
<td>SES Water</td>
<td>12,006 (7)</td>
<td>7,276 (35)</td>
<td>17,622 (20)</td>
</tr>
<tr>
<td>Severn Trent Water* (Eng)</td>
<td>107,686 (126)</td>
<td>92,609 (469)</td>
<td>215,571 (189)</td>
</tr>
<tr>
<td>South East Water</td>
<td>68,587 (85)</td>
<td>57,683 (231)</td>
<td>81,823 (72)</td>
</tr>
<tr>
<td>South Staffordshire Water</td>
<td>23,617 (20)</td>
<td>8,242 (32)</td>
<td>34,341 (21)</td>
</tr>
<tr>
<td>South West Water</td>
<td>45,657 (32)</td>
<td>65,563 (257)</td>
<td>65,128 (32)</td>
</tr>
<tr>
<td>Southern Water</td>
<td>74,295 (84)</td>
<td>51,808 (204)</td>
<td>110,895 (74)</td>
</tr>
<tr>
<td>Thames Water</td>
<td>89,871 (97)</td>
<td>75,369 (381)</td>
<td>268,124 (252)</td>
</tr>
<tr>
<td>United Utilities</td>
<td>90,033 (77)</td>
<td>87,693 (348)</td>
<td>204,151 (228)</td>
</tr>
<tr>
<td>Veolia Water Projects</td>
<td>821 (2)</td>
<td>1,120 (6)</td>
<td>559 (1)</td>
</tr>
<tr>
<td>Wessex Water</td>
<td>49,443 (67)</td>
<td>80,576 (337)</td>
<td>45,565 (77)</td>
</tr>
<tr>
<td>Yorkshire Water</td>
<td>86,820 (54)</td>
<td>88,478 (347)</td>
<td>150,903 (65)</td>
</tr>
<tr>
<td><strong>Engand overall</strong></td>
<td>971,074 (870)</td>
<td>876,302 (3,364)</td>
<td>1,659,780 (1,342)</td>
</tr>
</tbody>
</table>

*CHO and DVW January-June 2018 only, Some SVT sites transferred to Hafren Dyfrdwy July-December 2018.

Note: Numbers in brackets reflect the number of works, reservoirs or zones operated by that company in the region in 2018. Some companies are permitted to carry out some tests on samples taken from supply points rather than from consumers' taps.
Compliance with standards

Compliance Risk Index

In 2016, the Inspectorate introduced the Compliance Risk Index (CRI), a new water quality measure. This measure was introduced to replace the current Mean Zonal Compliance (MZC) Index for a number of reasons. Amendments to the regulations, which transpose the requirements of the Drinking Water Directive, permit companies to move away from the current monitoring programme (based on sample numbers) to a risk-based monitoring methodology meaning that companies will be able to request adjustments to the sampling programme based on risk assessment. Over the next few years, as companies use risk-based monitoring to introduce or remove parameters from their schedule, this will favour a reduction of samples which are more likely not to fail, weighting the contribution to the MZC index of those that do fail. This very simple selective change reduces the ability to make direct historical comparisons with confidence at such a high level of compliance.

The Compliance Risk Index is a measure designed to illustrate the risk arising from treated water compliance failures and it aligns with the current risk-based approach to regulation of water supplies used by the Drinking Water Inspectorate (DWI). Unlike MZC, it assigns a value to the significance of the failing parameter, the proportion of consumers potentially affected and an assessment of the company response. The measure provides visibility of performance of the industry as a whole, the companies and their elements of their supply systems.

In 2018, the CRI for England and Wales was 3.87 which was a decline in performance from 3.56 in 2017. The decline shows the first indication of the index levelling out. The previous levelling out of the MZC index reflected the fact that the numbers of failures were very similar year-on-year, however, the overall CRI figure is comprised of figures representing performance at different parts of the water supply chain (treatment works, supply points, service reservoirs and zones). While the overall figure has levelled out, the profile of risk at these points has changed. In 2014, a significant contribution to CRI was from supply points, largely due to metaldehyde. The industry responded to this risk with agreed programmes of work with the DWI looking at innovative catchment and stakeholder management initiatives. The outcome reduced the number of metaldehyde failures from 133 in 2014 to 4 in 2018. This collective response to metaldehyde by the water industry is a particularly good example of excellence, by an industry, in resolving a problem which was largely outside of their control. However, in 2018 this was counterbalanced by a rise in the contribution to the supply point element of the index by
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*Clostridium perfringens*. Furthermore, there has been a year-on-year increase in the CRI element from treatment works which indicates some residual risk with these assets. Both of these factors have pushed up this year’s CRI.

Conversely, Wales continues to be challenged by repeated iron and manganese failures. This risk sits largely within networks and this should set out future national strategy.

CRI permits the unpacking of the key contributors to each element within the score to understand where the risks are arising and these can be seen in the following pie chart.

**Figure 4: CRI Profile for the industry in England and Wales**

*Figures include all failures of EU, National Standards and Indicator parameters taken at treatment works, service reservoirs and taps and used for the CRI calculation.*

In 2018, there were 1,185 failures of EU, National Standards and indicators taken at treatment works, service reservoirs and taps, all contributing to the national CRI score. The single largest contribution to CRI for the industry remains detections of coliforms at treatment works and service reservoirs, reflecting widespread risk to consumers where there are large populations supplied by treatment works. The single largest contributing factor to the CRI for coliforms at works was by Southern Water at Testwood Works, accounting for 30% of the score. There were repeated detections of coliforms between February and May 2018 and this situation was treated as an event. The site is subject to a Notice requiring
immediate short-term actions including the replacement of coverings on storage tanks and longer-term refurbishment works due for completion in 2026. For service reservoirs there were two companies contributing 50% of the CRI for coliforms, Affinity Water, (Harefield Reservoir) and Bournemouth Water, (Sway and Hightown Reservoirs). These sites are subject to recommendations requiring continuing scrutiny of the assets. Affinity Water remain a focus due to the year-on-year poor performance at service reservoirs, contributing the greatest number of failures at this asset type, in 2018, of all companies.

Figure 5: Company CRI and National CRI 2018.

After coliforms, the next largest contributor to the CRI score are detections of *Clostridium perfringens* at supply points and zones, followed by iron, trihalomethanes in zones, turbidity at works and odour accounting for over 80% of CRI. One company, (SST), is responsible for 75% of the *Clostridium perfringens* CRI score and the same company is responsible for 85% of the Trihalomethane CRI score arising from one single site, (Hampton Loade). This site is also the likely source of 55% of the contribution to the CRI for odour in its own supply area and that of a neighbouring company. Hampton Loade Works and Seedy Mill Works have been repeatedly highlighted through CRI and prior to this through serious events, most significantly in 2009 when *E. coli* was detected in Hampton Loade and in 2012, severe failures of the rapid gravity filters at Seedy Mill. As high risk sites, these issues have resulted in enforcement action covering aluminium, iron, manganese, trihalomethanes, pesticides, microbiological parameters including *Clostridium perfringens*, and,
additionally taste and odour at Hampton Loade Works. The company has been required to evaluate the existing stages of treatment at both works with the objective of complete construction, installation and commissioning of the agreed technical solution by 2024. It is unfathomable why this company permitted two deteriorating sites to reach this level of risk without planning investment ten years ago.

The single largest contributing company for iron is Dŵr Cymru Welsh Water with five failures in the top ten contributing over 20% of the CRI for this parameter. There are 38 zones subject to undertakings to reduce iron and manganese with the majority set for completion by 2027.

Further information of the specific failures can be found in the compliance section below.
Learning from compliance failures

The key water quality results for England are presented in the following tables showing the results for microbiological parameters (Table 6) and chemical and physical parameters (Table 7). A summary of the results of testing for all parameters and tables that contribute to the drinking water quality performance indices for each company can be found on the DWI website (http://www.dwi.gov.uk).

Microbiological parameters

**Table 6: Microbiological tests - The number of tests performed and the number of tests not meeting the standard**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Current standard</th>
<th>Total number of tests</th>
<th>Number of tests not meeting the standard</th>
<th>Additional information²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water leaving water treatment works</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>E.coli</em></td>
<td>0/100ml</td>
<td>166,710</td>
<td>5</td>
<td>ANH (2), BRL (1), SEW (1), SRN (1)</td>
</tr>
<tr>
<td>Coliform bacteria</td>
<td>0/100ml</td>
<td>166,710</td>
<td>56</td>
<td>AFW (2), ANH (5), BRL (1), CHO (1), DWR (1), ESK (2), NNE (2), PRT (1), SEW (4), SRN (8), SST (1), SVT (17), SWT (2), TMS (4), UUT (1), WSX (1), YKS (3)</td>
</tr>
<tr>
<td><em>Clostridium perfringens</em></td>
<td>0/100ml</td>
<td>40,709</td>
<td>21</td>
<td>AFW (1), CAM (1), ESK (2), NNE (2), SEW (1), SRN (2), SST (2), SVT (2), SWT (1), TMS (5), YKS (2)</td>
</tr>
<tr>
<td>Turbidity¹</td>
<td>1NTU</td>
<td>166,774</td>
<td>22</td>
<td>AFW (4), ANH (2), NNE (7), SEW (1), SVT (4), TMS (4)</td>
</tr>
<tr>
<td><strong>Water leaving service reservoirs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>E.coli</em></td>
<td>0/100ml</td>
<td>184,771</td>
<td>6</td>
<td>ANH (1), ESK (1), PRT (1), SRN (1), SVT (1), TMS (1)</td>
</tr>
<tr>
<td>Coliform bacteria</td>
<td>0/100ml in 95% of tests at each reservoir</td>
<td>184,771</td>
<td>78</td>
<td>AFW (7), ANH (5), BRL (2), CAM (1), ESK (3), NNE (2), PRT (1), SBW (4), SEW (6), SRN (4), SST (1), SVT (16), SWT (3), TMS (7), UUT (7), WSX (5), YKS (4). The following reservoir in the region did not meet the 95% compliance rule: AFW Harefield res. 3 West (out of service).</td>
</tr>
<tr>
<td><strong>Water sampled at consumers' taps</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>E.coli</em></td>
<td>0/100ml</td>
<td>144,481</td>
<td>20</td>
<td>AFW (3), ESK (2), SBW (1), SEW (1), SRN (1), SST (1), SVT (4), TMS (5), UUT (1), YKS (1)</td>
</tr>
<tr>
<td>Enterococci</td>
<td>0/100ml</td>
<td>11,569</td>
<td>4</td>
<td>ANH (2), TMS (1), WSX (1)</td>
</tr>
</tbody>
</table>

¹Turbidity is a critical control parameter for water treatment and disinfection.
²Annex 1 contains details of failures and sample numbers for each company for *E.coli* tests from treatment works, service reservoirs and taps and enterococci at taps.
All compliance failures are significant and are required to be investigated by the company and the company’s findings are in turn assessed by the Inspectorate. All failures contribute to the Compliance Risk Index and the significance, impact and actions taken by the company or required by the Inspectorate influence the score for each failure and guide the Inspectorate in identifying those requiring closer examination.

**E.coli at works and service reservoirs**

In 2018, *E.coli* was detected on five occasions (2 ANH, 1 BRL, 1 SEW, 1 SRN) out of a total of 166,710 tests taken from water treatment works.

Both Anglian Water failures at Glandford works in Norfolk and at Dalton Piercy works near Hartlepool occurred on the same day, but the company found no issue with the sampling or analysis that would explain the failures. At both works, subsequent sample results were satisfactory. The Inspectorate visited Dalton Piercy works in May and Glandford works in December. Despite minor issues being found with both works, investigations were unable to determine the root cause of either failure. Both works were operating within expected limits, however, the finding of *E.coli* must be considered serious particularly in the absence of a root cause. Ongoing surveillance of the works should be a minimum response to demonstrate there is no recurrent problem.

The failure at Southern Water’s Testwood works was ascribed to poor sampling facilities by the company. The sample tap was found to be dirty and on swabbing, contained black fibrous material. The Inspectorate was minded to take enforcement action, however, the company were able to demonstrate that appropriate and timely steps were being taken to resolve the issue.

There is little excuse for the poor condition of sampling facilities and companies are reminded that more specific requirements for sampling at water treatment works were made as part of the Water Supply (Water Quality) Regulations 2016 amendments in June 2018. Microbiological samples must be taken and handled in accordance with European standard EN ISO 19458 entitled ‘Water Quality – Sampling for microbiological analysis’. Further detail is given in Regulation 9 (3) and in the Inspectorate’s guidance on the regulations.

Coombe Down works was removed from supply, by South East Water, following the detection of *E.coli* in August. It was identified that the final water sample point was not positioned appropriately as the site specific disinfection policy included the off-site distribution main to the downstream service reservoir as part of the disinfection process. Companies are reminded that the final water sampling point must be downstream of all
treatment processes. South East Water’s subsequent investigation identified a number of raw water contamination risks including unsealed headworks; contamination pathways between the surface/near-surface and the water table due to the presence of chalk fissures, a soakaway, well shaft and adits and the presence of a nearby septic tank. The works remained out of supply for the rest of the year while remedial work was planned and undertaken.

Bristol Water detected coliforms and *E. coli* in September at Tetbury works. The company’s investigation determined that the most probable route for the ingress was via the seals on the access hatch. All seals on all access routes including alarm cable routes were replaced.

*E. coli* detections at service reservoirs decreased in 2018, down to six (ANH 1, ESK 1, PRT 1, SRN 1, SVT 1, TMS 1) compared to 11 in 2017.

A detection of *E. coli* at Southern Water’s Michelmersh service reservoir in September highlighted a number of failings, by the company, to take appropriate action. A previous detection of *E. coli* at this site in October 2017 did not result in an internal inspection. Instead the company attributed the failure to poor sampling facilities, which in the eleven months between failures, had not been rectified. On the second detection in September 2018, the company failed to adequately isolate the reservoir and water was supplied for three weeks due to a partially closed valve which again, was evident in October 2017, but had not been repaired. On this occasion, internal inspection revealed points of ingress and penetration by tree roots. Multiple missed opportunities, poor decision making and inaction has resulted in unnecessary risk. Companies must always take positive action on an *E. coli* failure rather than resort to excuses.

Like Southern Water, Portsmouth Water concluded that the *E. coli* detected at Whiteways Lodge reservoir was due to poor sampling facilities. In this instance the company reported an improbable root cause of contamination from foliage surrounding the sample point because the sample was taken during a period of heavy rainfall. Like Southern Water, the company failed to remove the reservoir from service for internal inspection. In this instance in lieu of poor decisions and inaction, the Inspectorate identified that stagnant water had entered supply and made recommendations for improvements.

Anglian Water removed Hempstead reservoir from supply following the detection of *E. coli* in September. The site remains out of supply pending structural repairs.
Similarly, compartment 2 of Caister reservoir was removed from supply for the rest of the year after Essex and Suffolk Water detected *E. coli* in August.

*E. coli* was detected at Severn Trent Water’s Littledean Low Level reservoir, near Cinderford in October. However, due to a communication error a different reservoir with a similar sounding name was isolated from supply. The company identified this error a day later and took steps to isolate the failing reservoir and subsequently repaired the structural defects found. The public were exposed to unnecessary additional risk on this occasion; companies should have in place robust procedures and clear, communication channels to ensure water quality issues are appropriately identified and addressed.

**Coliforms at works**

In 2018, there was an increase in detections of coliforms at treatment works from 41 in 2017 to 58 in 2018.

Assessment of company actions in response to detections of coliforms at treatment works identified the following:

A lack of control of chlorine residual at Portsmouth Water’s Lovedean Works was highlighted by a coliform detection in January 2018. The Inspectorate made a recommendation aimed at improving control of the disinfection process.

It is well known that cable access points are often left unsealed on hatches and that this contributes to failures. South East Water’s Bray Pumping Station had sites of potential ingress around hatches and cable access points on the contact tank. Also Anglian Water was recommended to improve its inspection procedures as an inspection shortly prior to a coliform detection at Welton works had failed to identify potential sites of ingress around hatches.

The Inspectorate has frequently recommended that sampling tap arrangements need to be appropriate to maintain the integrity of the sampling process and yet there were sites where samples were not taken from dedicated sampling lines; Essex and Suffolk Water’s Barsham works and South Staffordshire Water’s Crookley works. Additionally, a sample reported as taken at Wybersley Works (United Utilities) was, in fact, taken from a downstream reservoir due to the failure of a sample pump at the works. The sample should not have been reported as a works sample and should have instead been reported as a shortfall. This failure, and another at South East Water’s Bewl Works where a PLC fault contributed to a
Coliform failure lead to advice from the Inspectorate to ensure spare parts are readily accessible.

Detection of coliforms at Severn Trent’s Mossgate works and multiple detection at Strensham and Church Wilne (Severn Trent Water) and Testwood (Southern Water) resulted in enforcement action from the Inspectorate. Strensham works is undergoing substantial refurbishment and a significant proportion of Testwood works is being rebuilt.

**Coliforms at service reservoirs**

Coliform failures at service reservoirs stood at 85 in 2018 and for 26 of these, the site involved was already covered by a relevant legal instrument. For 22 detections, scrutiny of company actions by the Inspectorate resulted in the conclusion that the company had taken sufficient action for the failure to be unlikely to recur. In 19 cases, the company concerned had carried out a satisfactory investigation but no root cause could be confirmed. Recommendations or suggestions were made in 17 cases.

The following highlights some of the more significant findings. In March, coliforms were detected in consecutive samples from Affinity Water’s Harefield 3 West reservoir. This site is the leading contributor to the national CRI for coliforms in service reservoirs in 2018. It failed to meet the national standard of >95% clear samples in 2017 with three failures during that year. The site has a history of failures as far back as 2014 and 2013 with the same conclusion, that the main cause was poor turnover. The previous internal inspection on this site before 2018 was 2007 and there was no inspection based upon a rising risk profile for this site. This critical failure in securing water was highlighted in the *Drinking water 2017 - Chief Inspector’s report*. However, with all this information, Affinity Water still delayed removing the reservoir from service until April and once again concluded that the main cause was poor turnover. Following this, the reservoir remained isolated for the rest of 2018 pending network modifications. It is unfathomable why a company would knowingly retain a water quality risk for five years. The Inspectorate will continue to monitor this company’s activities in this area and the company was included in the service reservoir audit program detailed in the section *Service reservoir audit programme* with a below standard outcome.

The difficulty in removing service reservoirs from supply has been a long standing issue for the industry and all companies should have by now identified resilience measures to enable any compartment to be removed from supply at short notice should water quality issues make this necessary. The Inspectorate recommended that South East Water remove
Hollingbourne service reservoir from supply for inspection following a coliform detection in July and made the same recommendation to Thames Water when coliforms were found in a sample taken from Hampstead South service reservoir in August.

Coliform failures at South East Water's Hourne Farm and Wych Cross reservoirs in May and June respectively, highlighted difficulties in the company removing sites for internal inspection, due to availability of operational resources and repairs to other structures. At Wych Cross, all investigation samples taken proved satisfactory, however the upstream supplying reservoir Horsted Kenyes was inspected in October and ingress was observed. Remedial works included a new roof membrane. The Inspectorate also identified over twenty sites that have not been internally inspected in the last ten years, as is good practice. Following recommendations by the Inspectorate the company introduced a new policy to address these shortcomings.

Affinity Water commissioned a new water main to allow further investigations into a long-standing problem at Church Langley Tower and were recommended, by the Inspectorate, to investigate mains integrity risks and disinfection issues. The company identified mobilisation of biofilm as a potential cause and has plans to further treat the bulk imported supply from Anglian Water, to make the water more suitable for movement around its distribution systems. Biofilm growth or operator error at the supplying treatment works were identified as possible causes for the coliform detections at Bournemouth Water's Beaulieu Hill Top Tower in September. The Inspectorate made recommendations that the company completes further investigations and takes action to prevent a recurrence in both instances.

At Stanton Wick service reservoir in October, the Inspectorate recommended that Bristol Water amend their investigation procedure to include internal inspection of service reservoirs where no cause has been found. Recommendations were also made in relation to two failures at Bournemouth Water sites. Firstly, at Beaulieu RAF tower in October, the company had not demonstrated that turnover was satisfactory. The operating regime was changed to compensate for the variable demand between winter and summer. Secondly, the Inspectorate recommended further investigations into the condition of Sway reservoir following a third coliform detection in two years. Further breaches are covered by enforcement Notices in place at Hafren Dyfrdwy, Severn Trent Water and United Utilities.
**Clostridium perfringens**

*Clostridium perfringens* can be a useful indicator of either intermittent or historical faecal contamination of a groundwater source. There were 21 detections of *Clostridium perfringens* in samples taken in zones or at supply points in 2018 (AFW 1, CAM 1, ESK 2, NNE 2, SEW 1, SRN 2, SST 2, SVT 2, SWT 1, TMS 5, YKS 2) and this parameter contributes to CRI to a significant degree mainly due to detections at a supply point at Hampton Loade.

Following a detection of *Clostridium perfringens* in the final water at Hampton Loade works in June, South Staffs Water also reported the detection of *Cryptosporidium* in the final water on consecutive days. These detections coincided with a period of hot weather, high demand and an algal bloom affecting clarification and filtration performance at the works. In this instance the detection of *Clostridium perfringens* signals loss of filtration integrity and it is therefore unsurprising to detect the manifestation of such a risk by the subsequent detection of *Cryptosporidium*. This break-through of the filtration process, as a result of increased algae, not only contributed to microbiological failures but is also connected to odour and trihalomethanes detections described in following sections. This risk is wholly unacceptable where a company is entrusted with the supply of wholesome water.

Following the detections, the company reduced flow and place temporary covers over the clarifiers. The company have submitted plans to improve the treatment processes at Hampton Loade works and the Inspectorate made recommendations in relation to the management of treatment control processes and notification of health officials.

A *Clostridium perfringens* detection at Southern Water’s Sandown works coincided with a failure in polyacrylamide dosing. The company had no alarms in place to alert staff to the dosing failure and the Inspectorate made recommendations that this was rectified and considered as part of the company’s hazard review process.

The detection of this organism in a sample from South East Water’s Boxalls Lane works identified that the company were not able to fully verify the disinfection process due to the absence of chlorine monitoring equipment at stages of the process. The Inspectorate made a recommendation and a new monitor was installed. Companies should ensure that they are able to continuously verify that disinfection is achieved and are encouraged to review their disinfection policies and risk assessments to ensure that this can be demonstrated at each treatment works.
Chemical and physical parameters

Table 7 sets out the results for those chemical and physical parameters where there has been a failure to meet a European or national standard (mandatory quality standard) and any other parameter of interest.

**Table 7: Chemical and physical parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Current standard or specified concentration</th>
<th>Total number of tests</th>
<th>Number of tests not meeting the standard</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetic parameters</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– colour</td>
<td>20mg/l Pt/Co scale</td>
<td>49,647</td>
<td>0</td>
<td>AFW (7), ANH (18), BRL (1), ESK (4), NNE (1), PRT (1), SEW (4), SST (6), SVT (32), TMS (1), UUT (9), WSX (1), YKS (6).</td>
</tr>
<tr>
<td>– odour</td>
<td>No abnormal change</td>
<td>47,086</td>
<td>91</td>
<td>ANH (2), ESK (1), NNE (1), SEW (1), SRN (4), SSE (2), SVT (19), SWT (1), UUT (8), WSX (1), YKS (3).</td>
</tr>
<tr>
<td>– taste</td>
<td></td>
<td>47,009</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>Aluminium</td>
<td>200μg/l</td>
<td>45,366</td>
<td>8</td>
<td>SST (1), TMS (1), UUT (4), YKS (2).</td>
</tr>
<tr>
<td>Ammonium</td>
<td>0.5mg NH₄/l</td>
<td>45,906</td>
<td>1</td>
<td>SRN (1)</td>
</tr>
<tr>
<td>Benzo(a)pyrene</td>
<td>0.01μg/l</td>
<td>11,884</td>
<td>2</td>
<td>ESK (1), SVT (1)</td>
</tr>
<tr>
<td>Bromate</td>
<td>10μg/l</td>
<td>10,810</td>
<td>1</td>
<td>DVW (1)</td>
</tr>
<tr>
<td>Fluoride</td>
<td>1.5mg/l</td>
<td>10,330</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td>200μg/l</td>
<td>47,455</td>
<td>87</td>
<td>ANH (11), BRL (3), NNE (8), SEW (4), SRN (3), SST (2), SVT (8), TMS (12), UUT (16), WSX (2), YKS (15).</td>
</tr>
<tr>
<td>Lead</td>
<td>10μg/l</td>
<td>11,555</td>
<td>78</td>
<td>AFW (6), ANH (4), CAM (1), ESK (5), NNE (5), PRT (1), SES (2), SEW (1), SRN (1), SST (1), SVT (9), TMS (17), UUT (20), WSX (3), YKS (2).</td>
</tr>
<tr>
<td>Manganese</td>
<td>50μg/l</td>
<td>45,980</td>
<td>13</td>
<td>SEW (1), SVT (3), UUT (8), YKS (1).</td>
</tr>
<tr>
<td>Nickel</td>
<td>20μg/l</td>
<td>11,561</td>
<td>31</td>
<td>AFW (1), ANH (7), CAM (1), NNE (3), SEW (1), SRN (3), SSE (1), SVT (3), TMS (4), UUT (4), WSX (1), YKS (2).</td>
</tr>
<tr>
<td>Parameter</td>
<td>Current standard or specified concentration $^1$</td>
<td>Total number of tests</td>
<td>Number of tests not meeting the standard</td>
<td>Additional information</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------------------------------------------------</td>
<td>-----------------------</td>
<td>-----------------------------------------</td>
<td>-------------------------------------------------------------</td>
</tr>
<tr>
<td>Nitrate</td>
<td>50mg/l</td>
<td>21,666</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Nitrite</td>
<td>0.5mg/l</td>
<td>21,674</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Pesticides – total</td>
<td>0.5μg/l</td>
<td>7,754</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Pesticide – individual $^2$</td>
<td>0.1μg/l</td>
<td>201,020</td>
<td>11</td>
<td>Carbetamide AFW(1), SRN (1), Metaldehyde AFW (1), ANH (2), SVT (1), Oxadixyl SVT (3), Propyzamide ANH (1), SEW (1)</td>
</tr>
<tr>
<td>pH (Hydrogen ion)</td>
<td>6.5 – 9.5</td>
<td>50,216</td>
<td>3</td>
<td>NNE (1), SWT (1), UUT (1)</td>
</tr>
<tr>
<td>Radioactivity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross alpha $^3$</td>
<td>0.1Bq/l</td>
<td>2,068</td>
<td>191</td>
<td>NNE (1), SST (19), SVT (168), YKS (3)</td>
</tr>
<tr>
<td>Gross beta $^2$</td>
<td>1.0Bq/l</td>
<td>2,057</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Total indicative dose</td>
<td>0.1mSv/year</td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Tritium</td>
<td>100Bq/l</td>
<td>512</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Radon</td>
<td>100Bq/l</td>
<td>501</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Sodium</td>
<td>200mg Na/l</td>
<td>11,541</td>
<td>1</td>
<td>SSE (1)</td>
</tr>
<tr>
<td>Tetrachloroethene &amp; Trichloroethene</td>
<td>10μg/l</td>
<td>11,259</td>
<td>1</td>
<td>TMS (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The standard applies to the sum of the two substances</td>
</tr>
<tr>
<td>Trihalomethanes Total</td>
<td>100μg/l</td>
<td>11,900</td>
<td>4</td>
<td>SST (4)</td>
</tr>
<tr>
<td>Turbidity (at consumers’ taps)</td>
<td>4NTU</td>
<td>51,174</td>
<td>2</td>
<td>ESK (1), TMS (1)</td>
</tr>
</tbody>
</table>

Notes:

$^1$ For comparison, 1mg/l is one part in a million, 1μg/l is one part in a thousand million.

$^2$ A further 11,984 tests were done for aldrin, dieldrin, heptachlor, heptachlor epoxide, all of which met the relevant standard of 0.03μg/l.

$^3$ These are screening values to trigger action. The standard is ‘Total Indicative Dose’.

The main chemical contributors to the CRI index were iron, trihalomethanes, odour, taste, manganese and nickel.

**Iron**

Detections of iron increased from 82 in 2017 to 102, however despite this increase, there has not been an overall increasing trend over the last five years. In 40 instances, the Inspectorate concluded that the company had taken sufficient action for the failure not to recur. A further 15 failures
were already covered by a relevant legal instrument. In the majority of cases the situation was short-lived and appropriately remedied by the company concerned, however, the Inspectorate has signed companies up to legally binding programmes of work to remediate zones with longstanding high rates of consumer contacts for discoloured water and much of this work is still in progress.

Specific issues identified in 2018 are described below.

Deficiencies in the timeliness and extent of United Utilities investigations into iron failures were identified. The Inspectorate made recommendations in response.

Anglian Water’s flushing in Buckingham zone had proved ineffective and it was identified that the Wing works serving this zone regularly exceeds its own internal target of 20µg/l for iron and may be contributing to the elevated levels in its Buckingham zone. The Inspectorate recommended that the company develop a more detailed plan to address this localised issue. Also a recommendation was made that the company regularly verifies the residual iron readings from the online monitor at Saltersford works, to give confidence in the treatment works performance following a breach in the Barrowby zone.

United Utilities took action to replace a three inch cast iron main with a polyethylene one following an iron failure in its Barrowford supply zone in April.

The Inspectorate is taking further enforcement action to reduce the risk of iron failures across a number of Southern Water zones, including the Wigmore zone, where a sample exceedance was recorded.

Further investigatory work in Severn Trent Water’s, Barlborough supply zone is required after three iron failures within the last 12 months.

**Trihalomethanes**

Trihalomethanes feature in 2018 due to four failures in September, all in South Staffordshire Water’s area in the Walsall, West Bromwich (twice) and Barr Beacon zones. Detections of trihalomethanes above the standard are very rare but the common factor was again Hampton Loade works and the cause identified as a failure to remove trihalomethane precursors in the treatment process.

The company use prechlorination to control algal issues and improve the clarification process at Hampton Loade works, which supplies the area. The company relied upon analytical results from its works to manage compliance, but when the contract laboratory were unable to provide timely
results due to a problem with the analytical method, this control measure was rendered ineffective. The company did not take sufficient action to reconsider the risk to compliance and health resulting from this change in circumstances and the regulatory standard was breached. The Inspectorate is serving a Notice under Regulation 28. The Notice addresses issues with regard to trihalomethanes and disinfection by-product pre-cursors as well as taste and odour described in the next section. Companies need to remain vigilant to changing circumstances which could compromise the control measures in place and be able to dynamically review the altered level of risk, so that public health is protected.

**Taste and Odour**

Taste and odour detections constitute 14% of the CRI index and the figures vary a little from year-to-year and this is an area where there has been no reliable improving trend. In 2018, the Inspectorate investigated the apparent discrepancy between the numbers of taste failures and odour failures reported by companies to ensure that the monitoring carried out was appropriate and the number of failures were not being under-reported. Several companies were identified where this discrepancy had occurred. While for some companies, the reason for rejecting the sample for taste analysis was based upon risk to health, with others this was less clear cut. Some companies had appropriate procedures to warn consumers where there was a risk to health (e.g. DWR and NNE), others were more reliant on the laboratory staff to decide for themselves whether there was a risk to health and this was not necessarily followed up with advice to consumers (e.g. ANH and YKS). *If companies consider there may be a risk to the health of their own staff or contractors carrying out taste testing, it is incumbent upon them that they take appropriate steps to protect consumers. The Inspectorate should be notified appropriately of any event that arises as per the requirements of the Water Industry (Suppliers Information) Direction.*

In June 2018, a failure of the odour standard was reported in South Staffordshire Water’s West Bromwich zone. Investigations identified geosmin arising from raw water treated at Hampton Loade works. There was a further odour detection in the Sedgley Darlaston zone in October attributed to the same cause and in Severn Trent Water’s Willenhall and Bilston zones. This works was responsible for over half of the CRI score for odour in 2018 and contributed by far the most significant amount for this parameter. It is far from acceptable for a company to produce water which is aesthetically unacceptable and is a root cause of consumers losing confidence in tap water.
The treatment processes at the works were deemed inadequate and two Notices have been served to address taste and odour issues as well as disinfection by-products and Clostridium perfringens mentioned in previous sections. The work specified in the Notices is designed to rectify these issues and includes improving filtration, operation and monitoring in the short-term, and assessing the need for further refurbishment of the treatment process in the longer-term. This is due for completion by March 2024. Additionally a Notice was served on Severn Trent Water requiring the company to review short-term measures to mitigate risks.

Other findings from taste and odour detections:

The Inspectorate observed a lack of investigation of leachates from mains as the potential cause of failures described as ‘bromophenol’ in the Amersham/Prestwood zone operated Affinity Water and ‘acidic’ in United Utilities’ Fishmoor/Earnsdale zone, both in February. Additionally, Severn Trent Water reported five failures caused by 2,4,6-tribromophenol, one in the Spondon zone in August and four in the Shrewsbury zone in July and August. The Inspectorate recommended further investigation, and required the company to provide adequate control. Enforcement action will be considered if the issue is not resolved.

Recommendations were also made that Portsmouth Water should improve the timeliness and scope of its investigations after a ‘pencil shavings’/musty odour was detected in Northbrook Supply Zone in July. There were significant delays in establishing the material of the service pipe; limitations in the investigation of the supplying treatment works as a possible cause and a failure to reconsider the risk assessment for taste/odour as part of the investigation.

While some investigations were deficient, a thorough investigation resulted in identification of loss of media from pressure filters leading to a ‘phosphorus’ odour detected at a property supplied by South East Water’s Boxley Greensand works.

Management and use of powdered activated carbon was a factor in two instances. A recommendation was made to Southern Water to improve the short-term operation of its powdered activated carbon dosing plant to address musty odours in Rownhams-01 supply zone and United Utilities report that they are planning to trial different types of powdered activated carbon after the Inspectorate recommended the company revise its Algal Management Plan for Castle Carrock works in Cumbria after the detection of an earthy taste and odour in the downstream supply zone, in July.
As an incidental finding during the Inspectorate’s assessment of the odour failure in South East Water’s Forstal zone, it became apparent that the sampler had taken the majority of compliance samples from the same road and many from his own house, rather than the randomly selected street within the zone. This was subsequently investigated as a separate event.

**Manganese**

In 2018 there were 13 detections of manganese in England. The majority were determined unlikely to recur and in most instances, companies took appropriate action to remove mains deposits by flushing.

Two of the failures were in United Utilities zones (Chadderton and Westwood South which are zones covered by improvement notices for the company to put in place measures to reduce the likelihood of manganese failures including improving/optimising treatment facilities, removing long standing deposits of manganese from the distribution network or replacing mains.

Four failures were ascribed to elevated flows during the hot weather and while the companies took short-term measures such as flushing to prevent a recurrence, further work may be required in these zones to prevent future failures.

**Pesticide failures**

There were 11 failures of the individual pesticide standard in 2018 compared to 30 in 2017. Failures of the pesticide standard have reduced year-on-year since 2014 largely due to catchment management initiatives and the associated undertakings by companies. Companies are encouraged to maintain this momentum for the benefit of consumers rather than considering the removal of use of metaldehyde as the solution and regarding catchment management as no longer required. Other benefits have been seen from wider engagement with those whose activities can impact raw water quality.

Pesticides detected were :-

- Carbetamide AFW (1), SRN (1)
- Metaldehyde AFW (1), ANH (2), SVT (1)
- Oxadixyl SVT (3)
- Propyzamide ANH (1), SEW (1)
Carbetamide

A revised legal instrument was served on Affinity Water following a carbetamide breach in March. The company was required to construct and commission additional GAC contactors to make the pesticide removal process more effective at Iver works. The company were also unable to dose sufficient ozone to the works during this high risk period, due to poor maintenance. The Inspectorate also took action to serve a Notice on Southern Water to improve its pesticide removal processes at Burham works, near Chatham.

Metaldehyde

There were four detection of metaldehyde during 2018, all in zones covered by legal instruments. In December 2018, the Environment Secretary announced a ban on the use of metaldehyde except in permanent glasshouses from Spring 2020 following advice from the UK Expert Committee on Pesticides and the Health and Safety Executive that metaldehyde poses an unacceptable risk to birds and mammals. Sales of metaldehyde for outdoor use were permitted for 6 months with a further year allowed for stocks to be used up.

Oxadixyl

Three detections of oxadixyl in 2018 led Severn Trent Water to identify its presence in a ground water source. Blending at a downstream service reservoir reduces the concentration before it is supplied to consumers. The Inspectorate made a recommendation to move the sampling location such that it was representative of the supply to consumers.

Oxadixyl was effectively banned in 2003 and its presence in the environment is a reminder for companies to be vigilant and ensure that their pesticide monitoring suites covers the widest possible range of substances that may be present in the catchment.

Propyzamide

There were two breaches for propyzamide (ANH 1, SEW 1). The failure at Anglian Water’s Pitsford works, in March, was determined to be as a result of some of the Granular Activated Carbon (GAC) beds requiring regeneration at a time when there were unusually high concentrations of the pesticide within the reservoir supplying the works. This coincided with a period of increased river abstraction to refill the reservoir after repairs to
Drinking water 2018

the shoreline bank. The Inspectorate were critical that the company had not recognised the risk of breakthrough evident from sampling results since January. The company subsequently took action to replace carbon in absorbers. South East Water are investigating options to remove Bray works from supply should there be a recurrence of pesticide breaches at this site.

Nickel

The last two years have seen the highest number of nickel failures in the last decade. The usual cause of nickel failures is domestic fittings but despite this, companies are still expected to carry out relevant fittings inspections and provide appropriate advice to consumers. Absorption of nickel from drinking water on an empty stomach is 10- to 40-fold higher than absorption from food. Companies are required to provide appropriate advice on flushing including flushing particularly after periods of non-use, such as first thing in the morning. The Inspectorate suggested a change of advice from Anglian Water, who were advising tap replacement. This could potentially lead to a short-term increase in concentrations faced by the consumer. The company's advice was subsequently changed to replacement with a non-chrome/ non-nickel plated WRAS approved tap.

The Inspectorate also recommend that Severn Trent Water change its advice to consumers following a failure in the Bilston zone, in October. While the company provided the results to the consumer, it did not provide appropriate advice to address the risks associated with nickel, for example flushing or replacing the tap with a nickel free alternative. This is a requirement of Regulation 18 (6) and applies to any breach where the cause is due to the domestic distribution system.

Two failures, one in Yorkshire Water's Shipley/Bingley 2004 zone and at a property in United Utilities’ Oven Hill Road zone exceeded the WHO guideline value of 70 µg/l. In both cases appropriate flushing advice was given. Additionally, two failures were in properties where the water was standing for some time (cafeteria undergoing refurbishment, low use tap in shop). Again, advice on flushing was provided.

The Inspectorate served a notice, under Regulation 21, to make Southern Water use its powers to rectify numerous plumbing issues associated with a nickel failure at a primary school in its Star supply zone in June. Companies are under a duty to take action to remediate breaches in public buildings where the consumer fails to take appropriate action to rectify any identified problems themselves.
Lead

Lead failures contribute a small proportion to the overall compliance risk index because, on investigation, they are usually found to affect only one or few properties in a company’s supply area. However the Inspectorate considers that the recent developments in the views on risks to public health from lead make it worthy of comment in this report.

Failures of the 10µg/l standard stood at 80 in 2018 (78 in England and 2 in Wales), up from the 70 reported in 2017.

Considering the potential for the standard to be reduced to 5µg/l on the revision of the Drinking Water Directive, the number of samples greater than 5µg/l in 2018 were 283 (276 in England and 7 in Wales). The widespread presence of lead in some areas of pre-1970s housing stock can constitute more that 65% of the supply pipes. The detection of lead through compliance sampling does not reflect the risk to health which is suppressed by companies continuing to dose phosphate as a mitigation. This mitigation cannot be a long-term solution; companies should consider minimising lead using removal strategies, identifying high risk premises such as public buildings where young and old may access water as a priority. Companies should plan a longer-term strategy for the eventual elimination of lead in order to reduce future risks where for instance a change of supply conditions may render current mitigations ineffective. Examples might include a loss of dosing through chemical supply difficulties or a change of water type removing the phosphate coating. If in future the sector wishes to promote a strategy of chemical-free supply or move water resource to meet changing demand, not resolving this challenge now will seek to exacerbate future risk.

Of the 80 failures, 45 were determined to have been satisfactorily investigated by the company with no cause being found or were unlikely to recur. A further 19 were covered by an undertaking for lead, already in place with the company.

Inspectors were considering enforcement against two companies who had failed to use their powers under S75 of the Water Industry Act to ensure pipework was removed from public buildings where failures occurred (Anglian Water’s Mancroft zones and Portsmouth Water’s North Supply zone). Anglian Water confirmed that despite prolonged non-compliance, the property owner had confirmed the pipe was to be replaced and signs warning customers not to drink the water had been put up and bottled water supplied. Portsmouth Water replaced the communications pipe to the property however it was identified that there was a large amount of lead pipework in the property. The company served a Section 75 notice on the property owner after encouragement to act voluntarily failed to prompt rectification. The property owner satisfactorily completed the required work.
and after clear resamples a letter was issued stating that the premises was now compliant.

Eight further failures resulted in recommendations being made by the Inspectorate (SST 1, SVT 2, UUT 5).

Recommendations were made to three companies (SST, SVT, UUT). South Staffordshire Water relied on historic data rather than contemporaneous investigation to decide there was no lead at a property and United Utilities revised procedures to ensure satisfactory investigation required by Regulation 18. Severn Trent Water were recommended to recommence phosphate dosing after failures in zones where phosphate dosing had ceased. Additionally, a lead detection occurred in a United Utilities zone where there was failure of phosphate dosing equipment.

Consumer contacts

The most frequent reason consumers contact their water company reporting an issue of water quality remains discoloured water (brown, black or orange). These account for 63% of contacts across the Industry. This may arise from the disturbance of debris in the distribution mains, or from inadequate treatment of raw waters. Unsurprisingly, these tend to occur more commonly in areas of the country fed by upland surface waters.

In 2018, consumer contacts about the appearance of drinking water were almost three times as frequent in Wales than in England and this is likely to reflect the network risk of iron and manganese identified through CRI.

Figure 8: Contacts per 10,000 population for appearance concerns (all categories)
In England the trend has been for a decrease in appearance contacts although progress has all but stalled between 2017 and 2018.

Figure 9: Changes in contacts reporting appearance issues 2009-2018 (all categories)

In 2015, the Inspectorate undertook a review of discolouration contacts in areas which the 2014 Chief Inspector’s report had identified as having persistent discolouration (defined as having a level of consumer contacts that were above the industry level for the three preceding years).

The review assessed the supplying company performance and, where appropriate proposed programmes of work for AMP6 to reduce the discolouration risks in areas which showed persistent discolouration.

Over half of the contacts in 2018 were received by five companies. Figure 10 shows the trend in these companies since 2009.

Figure 10: 2009 - 2018 black brown and orange water contacts/10,000 population in top five companies
South West Water

South West Water receives by far the highest number of contacts per 10,000 population, however, this has been on a decreasing trend from 31% of all contacts in the industry in 2009 to 16% in 2018.

South West Water was identified as having areas of persistent discolouration. The Inspectorate’s review of discolouration contacts gave rise to 12 zonal Notices being issued to mitigate discolouration with a prioritised programme of network maintenance which has ensured that discolouration contacts continue to decrease in the company area.

Figure 11: South West Water 2009-2018 contacts/10,000 pop’n for black brown and orange water

The Inspectorate has served a Notice for a continued prioritised programme of network maintenance throughout AMP7. This Notice includes steps to:

- Continue with programmes of planned flushing and optimisation of treatment, investigating the need for trunk mains conditioning and maintenance of a risk based service reservoir inspection and cleaning programme;
- Carry out annual reviews to ensure prioritisation of zones for mitigation actions remain current;
- Deliver five trunk mains conditioning schemes per year on a risk based priority programme.
Northumbrian Water

The rate of black, brown or orange water contacts in Northumbrian Water has been on a decreasing trend since 2010.

Northumbrian Water was identified as having areas of persistent discolouration. The Inspectorate’s review of discolouration contacts and company plans lead to the Inspectorate deciding that the issuing of improvement Notices was not appropriate as the company had well developed plans to reduce discolouration contacts during AMP6.

The Inspectorate has continued to monitor company progress with their prioritised programme of network maintenance and this has demonstrated that the company has made good progress at reducing consumer contacts.

Figure 12: Northumbrian Water 2009-2018 contacts/10,000 pop’n for black brown and orange water

The Inspectorate have served a Notice for a continued prioritised programme of network maintenance throughout AMP7. This Notice covers 14 Teeside water supply zones and includes actions to:

- Continue with programmes of treatment optimisation, prioritised flushing of DMAS, management of strategic mains and training operations personnel to minimise disruption due to their activities on the network;
- Installation of 37km 800mm diameter main from Lartington WTW to Longnewton SR via Whorley Hill SR.
United Utilities

The rate of black, brown or orange water contacts in United Utilities shows an overall decreasing trend since 2009, however whilst there was an obvious improvement during AMP5, this trend appears to be reversed in AMP6.

United Utilities was identified as having areas of persistent discolouration in the 2015 review. In 2016 the Inspectorate issued 53 zonal Notices to mitigate discolouration with a prioritised programme of network maintenance.

While the company made some progress to reduce consumer contacts at the start of the AMP period there has been a reversal of the discolouration contacts in the recent years.

The enforcement Notices issued to the company includes steps for the company to devise a longer-term discolouration strategy for the zones which are not responding to the network improvement works that are being completed during this AMP.

Figure 13: United Utilities 2009-2018 contacts/10,000 pop’n for black brown and orange water

The Inspectorate is monitoring the progress of their programme and, on its completion, will determine if any further action is required.
Severn Trent Water

Black, brown or orange water contacts to Severn Trent Water have remained, at best, on a flat trend since 2010 – a slight increase in AMP5 appears to have been reversed in AMP6 so far although levels are still higher than in 2011.

Severn Trent Water was identified as having areas of persistent discolouration in the 2015 review. In 2016 the Inspectorate issued 20 zonal Notices to mitigate discolouration with a prioritised programme of network maintenance.

The consumer contact data shows that the company has made some recent progress in reducing the discolouration contacts following the programme of targeted network improvements. The enforcement Notices issued to the company includes steps for the company to devise a longer-term discolouration strategy for any zones which do not respond to the network improvement works that are being completed during this AMP.

Actions taken under this Notice are beginning to show an improvement in contact numbers for black, brown or orange water since 2016.

**Figure 14: Severn Trent Water 2009-2018 contacts/10,000 pop'n for black brown and orange water**
South Staffordshire Water

The rate of black, brown or orange water contacts in South Staffs Water shows the company has made some progress over the period to reduce consumer contacts however this is inconsistent with an increase in contacts seen during 2018.

Figure 15: South Staffordshire Water 2009-2018 contacts/10,000 pop’n for black brown and orange water

The Inspectorate have served a Notice for a continued prioritised programme of network maintenance throughout AMP7. This Notice covers zones fed by Hampton Loade and Seedy Mill works and includes actions to:

- Continue with programmes of treatment optimisation, network operation to minimise disinfection by products;
- Determine and deliver a prioritised cleaning of strategic mains;
- Monitor consumer acceptability contacts.
Events

In 2017, the Inspectorate introduced the Event Risk Index (ERI), a new water quality measure. This was introduced to produce a meaningful measure to quantify risk to the consuming public when there is an incident. The Event Risk Index is a measure designed to illustrate the risk arising from treated water incidents and it aligns with the current risk-based approach to regulation of water supplies used by the Drinking Water Inspectorate (DWI). Like CRI, it assigns a value to the significance of the event, the proportion of consumers potentially affected and an assessment of the company response.

In 2018 the ERI for England and Wales was 783 which was a decline in performance from 241 in 2017 and reverses a three year improving trend. However this does not reflect an overall increase in the number of events contributing to ERI since the total number of events in 2018 was 532, well within the normal limits of event numbers since 2014. What it does show is the changing profile of risk by companies and where this risk is manifested within the supply system.

Three companies were responsible for the rise in national risk in 2018. They were Southern Water, Thames Water and Bournemouth Water. The industry as a whole was not able to offset the effect on ERI for these companies, in particular the Testwood event at Southern Water. Most notable however, for a continuous year-on-year improvement over four years is United Utilities, and to a lesser extent Northumbrian Water. Portsmouth Water and Essex and Suffolk Water have both improved their performance over the last year.

Figure 16: Company and National ERI score 2018
ERI permits the understanding of where the main contribution of risk manifests, this can be seen in the pie chart (Figure 17). The largest single contributor to the Events Risk Index (ERI), accounting for over 30% of ERI was the detection of coliforms at Testwood works (SRN). The circumstances are described below along with descriptions of the other main events contributing to ERI.

**Figure 17: Main events contributing to ERI in England**

**Testwood coliform and *E. coli* detections**

Testwood water treatment works operated by Southern Water is a large surface works situated near Southampton, which abstracts raw water from the River Test. The works supplies up to 95 million litres per day to a total population of around 256,000 consumers in Southampton and the Isle of Wight, as well as an industrial supply to a local oil refinery. As such it is a critical works which lacks resilience because it cannot be removed from supply without a widespread loss of supply.

Treatment processes principally comprise coagulation and clarification, powdered activated carbon for taste and odour control, rapid gravity filtration and final disinfection with chlorine followed by contact in a purpose-designed contact tank.

The ERI reflects a number of connected detections considered to be a continuation of the same event over a number of months. Initially the
company detected coliform bacteria in a regulatory compliance sample taken 1 October 2017 which it attributed to the condition of the sampling facilities, which were replaced in November 2017. Subsequently a regulatory compliance sample taken on 21 February 2018 was found to contain *E. coli*, which is an indicator of faecal contamination. The company again attributed this failure to the new sampling facilities which, apparently, had not been fully commissioned when the sample was taken. Sampling subsequently reverted to the old sampling facilities, but then a sample taken on 14 March 2018 was found to contain coliform bacteria followed by repeated detections of coliform bacteria and *E. coli* in compliance and operational samples. The company has reported 34 confirmed microbiological failures (including four samples containing *E. coli* and one containing Enterococci) between 1 January and 15 June 2018 in the final treated water. Most of these samples were operational investigational samples, some of them large volume (one litre). During a period of no rainfall from 15 June to mid-August there were no failures but on 19 August 2018 coliforms once again began to be detected.

Repeated coliform detections, particularly where *E. coli* and Enterococci are detected in combination, must be treated as a serious failure of the treatment process and be thoroughly investigated to determine the root cause. The company has identified leakage through the roof of a storage tank as well cross-connections between the filters, both of which may have been responsible for the failures.

A Regulation 28(4) Notice was issued for this works in March 2018. This followed a technical audit undertaken in August 2017 after an event where clarification had been compromised due to loss of coagulant dosing on one of the clarifier streams. The audit identified a number of risks at the works, and the Notice requires substantial improvements to critical treatment stages, including clarification, rapid gravity filtration and process monitoring and control to address risks associated with *Cryptosporidium*, compliance with Regulation 26 (disinfection), pathogens and bacteria. The final completion date for the work is 31 March 2025.

This works had been previously identified as a risk, and continues to be so as highlighted by the ERI score. The company is unable to remove this works from supply and therefore it presents an ongoing risk to consumers. The clear priority for the company is to minimise the risk with sufficient and rapid allocation of the necessary resource, including investment to ensure public health is protected.
Knapp Mill Cryptosporidium

On 7 December 2018 the Inspectorate was notified of the detection of Cryptosporidium oocysts in final water at Knapp Mill works (Bournemouth Water). Cryptosporidium is a protozoan parasite which, if ingested in sufficient numbers and if of a species capable of human infection, may result in a diarrhoeal disease lasting about 2-4 weeks. This was last observed in Alderney Works (also Bournemouth Water) in 2015 for which the company was prosecuted.

Knapp Mill water treatment works is located in Christchurch, Dorset. The works abstracts surface water directly from the River Avon. Raw water first passes through rapid gravity filters and slow sand filters, before entering a recently commissioned UV treatment plant. Water is then dosed with chlorine and adjusted before being pumped into supply. The site supplies approximately 135,000 consumers in the local area.

UV, (Ultraviolet light), is an effective means of inactivating and rendering harmless Cryptosporidium spp, but for it to work, it must be able to be transmitted right through the water. On 29 November 2018, UV transmissivity, (UVT), reduced to 88% due to changes in raw water quality. This means the light cannot shine right through because particles in the water cause the light to be scattered, or the water is just too opaque for the UV light to kill Cryptosporidium. The association between turbidity and the detection of Cryptosporidium spp has been well documented as far back as 1990 in the Badenoch Report and is a known risk for this site and the very reason UV treatment was installed. The company is aware of this, and increased the power to the UV unit and removed a poor performing filter. However, UVT prior to disinfection was below the validated window of operation, (below which it becomes less effective), for 11 days between 2 December and 13 December. During this period, low levels of Cryptosporidium oocysts were detected in the treated water on three occasions on 5, 10 and 13 December. In order to ensure validated UV disinfection was achieved, the works flow was reduced to 10 megalitres/day per reactor and UV doses increased to meet the manufacturer’s specifications.

Following further heavy rainfall on the 15 and 16 December the UVT again dropped to below the effective level of operation on 16 December and did not rise until 28 December at 05:20. Again, during this period, low levels of Cryptosporidium oocysts were detected in the treated water on three occasions on 17, 18 and 20 December.

Overall there were seven detections of oocysts in Knapp Mill final water from 1 to 26 December 2018. The Inspectorate contacted Public Health England separately in connection with this event, who confirmed that there
was no increase in numbers of reported cases of cryptosporidiosis in the areas supplied by Knapp Mill which could be attributed to the water supply.

This site is subject to a Notice as a known risk and as part of the investigation of this event, the Inspectorate sought evidence that the terms of the Notice were being adhered to. I am disappointed to report that the company was not able to provide sufficient evidence of having met the requirements of the Notice and the Inspectorate is critical of this position. Furthermore, a number of slow sand filters were operated in excess of normal run times due to resource constraints and the disinfection policy fell short of expectations. There was no serious attempt to optimise treatment performance upstream of the UV in light of the raw water deterioration. The company has been advised to rectify these matters and provide evidence to the Inspectorate of the completion of required work and to update the site risk assessment and operational procedures.

In response, the company has installed a new UV system capable of treating water with a lower transmissivity. However, I remain critical of a company who permitted this risk to continue for an unacceptable period of time, which could have had a serious public health outcome. This works is wholly reliant on the effectiveness of the UV system, which as seen in this event may not be adequate to the challenge being faced, particularly when the treatment works is not being run to an appropriate standard.

Burham pesticides

This event occurred at the end of 2017 and continued into the beginning of 2018. At the time of reporting in the Chief inspector’s Report Drinking water 2017, this event was still under investigation. Since then the investigation has been completed and the details are provided below.

Water supplied from Burham water treatment works exceeded the regulatory limit for individual pesticides for a period of one month in December 2017 and January 2018. Samples of the final treated water taken on the 19 and 27 December 2017 contained carbetamide and propyzamide respectively, at concentrations above the regulatory limit (PCV) for individual pesticides (which is 0.1µg/l for individual compounds). All detections of pesticides in association with this event were below the Safe No Adverse Response Levels (SNARL).

Burham works is a surface works supplied from Eccles Lake which abstracts water from the River Medway. The works supplies a population of over 384,000, and the treatment processes include granular activated carbon (GAC) and ozonation for pesticide removal. The company has a programme of catchment management activities in place to reduce risks associated with pesticides, covered by a Section 19 Undertaking.
The company’s investigation established that there were elevated concentrations of the pesticides in the raw water supplying the treatment works. The maximum concentrations of carbetamide and propyzamide detected were 1.1µg/l and 0.49µg/l respectively. Further investigation established there were very high levels of pesticides in the raw water catchment with 19µg/l of carbetamide recorded in the Upper Bewl catchment. The findings were notified as a possible pollution incident to the Environment Agency.

The company’s investigation also highlighted that the activated carbon stage of the pesticide removal process was not running optimally. The treatment works has six activated carbon contactors. Two of these were not operational and a further contactor had insufficient adsorbent media. There was evidence that carbon was being lost from the adsorbers into the next stages of treatment. Due to reduced contact times with the media the treatment process did not achieve the company’s internal standard of 15 minutes Empty Bed Contact Time.

The return of additional contactors to service and the reduction in concentration of pesticide in the raw water resulted in the detection of individual pesticides below the PCV on 24 January 2018.

To prevent a recurrence the company is continuing with its catchment management aims, working with Natural England and local land owners to raise awareness of pesticide use. The company is also undertaking a refurbishment of the GAC adsorbers to restore optimal pesticide removal. This is a statutory requirement for the company by virtue of a Regulation 28 Notice previously served.

The Inspectorate was critical that the company had not continuously operated an adequate treatment process and recommended that the company reviews its operational procedures and risk assessment for the site. Of concern was the loss of adsorbant material as if this had carried over into the chlorine disinfection contact stage then this lost media may have affected disinfection whilst providing conditions likely to support microbial growth. The company was advised to inspect the contact tank and remove any GAC media found.

**Cryptosporidium and faecal indicator organisms in water supplied from Thames Water's large London treatment works**

Thames Water operates four large slow sand filter treatment works that supply the majority of London’s drinking water in the metropolitan area. Ashford Common, Hampton and Kempton Park are located in the South West of London and Coppermills is located in North East London. Each works differs in size and layout but all share the same treatment process.
system. Together these works supply around 1,900 megalitres/day to the London ring main and into supply directly via local large diameter trunk mains. These works also provide variously, bulk exports to Affinity Water, Independent Water Networks Ltd, Scottish and Southern Energy, and Essex and Suffolk Water. The combined risks of these works account for about 30% of the calculated ERI score. Due to both the population and the volume of water supplied, these works are very significant when considering water supply risks.

The raw waters supplying each works is collected from the River Thames (and, in the case of Coppermills, the River Lee) either directly or post-storage in large impounding reservoirs. The raw water contains sewage effluents and agricultural runoff, with the attendant risk to human health from pathogens and pollutants in these sources. The raw water quality is monitored for indicators of algal growth, and a dedicated biological team feeds intelligence into the works production team to allow them to operate the plants effectively when water quality challenges may present themselves in the raw waters used e.g. algal blooms, or pollution of the raw waters.

The treatment processes used at each works are as follows: Water entering the works is screened through rapid gravity “roughing filters”. These filters should, if operated correctly, reduce turbidity to 1 NTU or below. The screened water is then dosed with ozone before entering a slow sand filter bed. These usually contain a layer of granular activated carbon (GAC) sandwiched within the sand layers of each bed. Each works allows about 10% of flow to be treated via a slow sand filter which does not have a GAC sandwich. The GAC acts to remove organic pollutants such as pesticides. The water is then treated with sodium hypochlorite to achieve the works’ designed disinfection target and then is dosed with phosphoric acid for plumbosolvency control. Ammonia is then added to form a chloramine residual before entry into supply. The company has not implemented continuous turbidity monitoring at the outlet of each of its slow sand filter beds as recommended by the Inspectorate after audits of Coppermills and Hampton in 2016. The Badenoch Report, (1990) and Bouchier expert group (1998) recognised turbidity as a key factor in monitoring risk post-filtration when considering Cryptosporidium. While this was in reference to rapid gravity filters the principle applies across treatment works, is recognised by WHO as a principle indicator measure and should reasonably apply to slow sand filters. At these works turbidity is measured at the entry into the contact tank which is a combined filtrate of a number of filters. If one filter in 10 were to fail the measure would be one tenth the value of the failing filter and the risk would not be identified.

Each of the treatment works has continuous sampling for Cryptosporidium at a point after the slow sand filters and upstream of entry into the contact
tanks. However, such filters can run for days and take days to analyse meaning that the absence of a robust turbidity measurement could allow a risk to consumers to continue for a number of days before the company becomes aware. This is not an acceptable control measure.

**Coppermills Works**

There were two events reported from Coppermills when *Cryptosporidium* oocysts were detected in the final water treated water. The first event was reported on 22 December 2017 and the second was reported on 15 March 2018. Coppermills supplies over 2 million consumers.

**Ashford Common Works**

There were three occasions when *Cryptosporidium* oocysts were detected in the final treated water. The first event was reported on 2 January 2018, the second on 6 January and the third on 14 February.

Following these events a fox carcass was discovered on 13 March 2018 (reported separately to the Inspectorate), in slow sand filter bed 1 that had previously been returned to supply following a routine skim on 26 January 2018. The local vet who analysed the fox carcass noted that it had haemorrhagic diarrhoea. The company sent a faecal sample to the National *Cryptosporidium* Reference Unit, who confirmed that no *Cryptosporidium* DNA was found in the sample.

**Hampton Works**

A *Cryptosporidium* oocyst was detected at Hampton Water Treatment Works in a treated water sample collected during the period 15 to 19 January 2018. A slow sand filter technician found a deer carcass in slow sand filter bed 27 on 15 January, following drain-down of this filter for skimming. It is unknown how long the carcass had been in the filter supernatant.

**Kempton Park Works**

On 13 March the detection of the faecal indicator bacterium *Clostridium perfringens* in a sample of treated water at Kempton Park works (1cfu per 100ml) was coincidental with the discovery of a fox carcass on slow sand filter 6. The presence of this bacterium in water treated with slow sand filters can indicate issues with the operation and/or maintenance of the filters.
Cause of the Cryptosporidium Detections

The root causes of these events was not conclusively identified.

The company investigated the potential causes of the presence of Cryptosporidium oocysts and C.perfringens in water supplied from these works and identified a number of possible causes, including deterioration of raw water quality, especially during late December 2017, deficiencies with the operation and maintenance of the slow sand filters and failure of the ozonation stage.

The large areas covered by these works has made it difficult for the company to prevent animals entering the sites, but it was not conclusively proven that the presence of animal carcasses was a contributory factor.

The company informed Public Health England of all these events and there was no evidence of an increased level of illness related to the detection of Cryptosporidium in consumers supplied from these works.

Actions taken by the Inspectorate

The Inspectorate investigated all of these events and completed technical audit inspections at each of the works. A number of deficiencies were identified, in particular relating to the company’s approach to operating and maintaining the slow sand filters at the works. Slow sand filters are a critical stage for removal of particulate material and Cryptosporidium oocysts, and the company had not fully implemented recommendations made by the Inspectorate or good practice highlighted in the three Badenoch and Bouchier reports of the groups of experts on Cryptosporidium in water supplies, published in the 1990s. The Inspectorate has served a Regulation 28 Notice on Thames Water requiring improvements to the operation and maintenance of slow sand filters at each of these works. Critical actions include the installation of continuous monitoring of turbidity on the individual outlets of slow sand filter beds, with appropriate alarms and failsafe mechanisms, and the construction of secure fencing around each works to limit mammalian access to the slow sand filters.

Bratton Flemming taste and odour

Bratton Fleming and Horedown works both draw water from Wistlandpound raw water reservoir. The works supply two water supply zones in North Devon; Bratton Fleming supply zone and Horedown supply zone. The total population supplied by both works is approximately 39,000.
An increased number of earthy/musty taste and odour contacts in the area supplied by Bratton Fleming works and Horedown works (North Devon) were received by South West Water from 23 June 2018 to 18 July 2018. The earthy taste and odours coincided with elevated concentrations of 2-methylisoborneol (MIB) and geosmin being detected in the raw water and final water at both treatment works and in distribution samples.

Concentrations of both these compounds were detected at levels above published taste and odour thresholds, in samples of the raw and final waters and in consumers’ tap samples taken during this event. One sample taken from a consumer’s tap for quantitative taste and odour returned a taste result of dilution no.2, and an odour result of 3.

The company received 121 earthy/musty taste and odour contacts from consumers between 23 June 2018 and 18 July 2018.

This event is currently under investigation and the outcome will be reported in due course.

Iver and Egham Works Cryptosporidium detection

These two works are operated by Affinity Water and together they supply over 1.1 million consumers. These works are very significant as there is no opportunity to realistically supply water by any other means were there to be a major water quality incident and any boil water Notice would have a major impact upon consumers and businesses.

Iver treatment works abstracts water directly from the River Thames. The treatment works consists of ballast clarifiers, ozonation, combined GAC filtration and adsorption, chlorination and plumbosolvency control and de-chlorination. Iver provides drinking water for North West London, South Buckinghamshire and Hertfordshire. The population supplied is 920,000.

Downstream on the River Thames is Egham treatment works. Egham also abstracts directly from the river. Treatment consists of pH correction, ozone, clarification, filtration, ozone, GAC, chlorination, plumbosolvency control and de-chlorination. The treatment works supplies drinking water to a population of 290,000 in West London.

On 12 November, Affinity Water’s laboratory reported 0.005 oocysts per litre in a continuous filtration sample of the final water from Egham and 0.008 oocysts per litre in a sample from Iver. The two large volume samples covered an operational period of approximately 24hrs from 10 to 11 November 2018. Analysis of follow-up samples taken from the final treated water, storage reservoirs and distribution were satisfactory.
In response to the event, the company sent samples to the *Cryptosporidium* reference unit, reviewed the recent works performance and checked raw water turbidity and microbiology analysis which were within expected ranges. The company discussed the event with its retained public health advisor and the decision was not to issue a boil water notice, however circumstances were identified that would trigger such advice. The company notified relevant stakeholders, initiated its Emergency Response Team and carried out network modelling.

On 14 November 2018, large volume *Cryptosporidium* samples were collected from two downstream storage reservoirs and two consumer taps. The samples did not contain any oocysts. Daily reservoir and network sampling continued for the duration of the event. Had follow-up samples contained *Cryptosporidium*, the company would have had to advise consumers supplied from the works to boil their tap water before consumption.

The company’s catchment investigation has not established a definitive root cause for the *Cryptosporidium* detections, however, the most likely explanation is a short lived point source contamination on a localised section of the River Thames that affected the abstraction points of both works.

The Inspectorate observed that the maximum concentration of oocysts were higher than concentrations associated with confirmed cases of *Cryptosporidium* from other treatment works events, namely Alderney works, (Bournemouth Water) in 2015. As no conclusive root cause was identified, a residual risk remains where this event could recur and possibly with increased severity. Were it to do so, the lack of resilience at both Iver and Egham works, and the lack of alternative piped supplies that could be used to support their respective supply networks, means that neither of these works could be shut down in the event of a water quality event with a risk to public health. The only option for the company would be to issue restrictive advice to all consumers supplied. Consumers are potentially vulnerable in the absence of prompt delivery of written advice and provision of alternative water supplies. There are logistical challenges involved with delivering written advice and alternative supplies to a large population, and at such a scale, the ability of the company to deliver within an acceptable timeframe is likely not to be adequate.

Additionally, the Inspectorate was critical of failure to meet recognised good practice in the management of supernatant return as turbidity was intermittently above the maximum of 10 NTU and is not directly monitored but estimated; contrary to recommendations made by the expert panel on *Cryptosporidium*.
Recommendations have been made to review and improve supernatant control at the works, establish accurate filter turbidity monitoring as a matter of urgency and to reinstate monitors that were not operational at the time of the event. Furthermore, recommendations regarding the categories of risk allocated to Cryptosporidium were made requiring the company to carry out a review.

While the outcome of these events, fortunately, did not affect consumers in this instance, this was a very significant near miss, reflected in the ERI score. The significance of this event was raised at the most senior level within the water company to ensure there is a clear understanding of the risk to consumers and the company.

A summary of the nature, cause and duration of the 50 events with the highest ERI scores along with details of the Inspectorate’s findings are set out on the Inspectorate’s website. A listing of other events is also published. Most events notified to the Inspectorate in 2018 were of relatively short duration and the company took appropriate action to inform and safeguard consumers and liaised with other stakeholders.

For the benefit of the industry, the Inspectorate published information on events that are of wider significance, to illustrate issues that the water industry can learn from.

During 2018, the Inspectorate cautioned two companies (UUT - Buckton Castle and SST - Walsall discolouration), and completed the prosecutions of two others, United Utilities for Sweetloves and Southern Water for Cooks Castle. The circumstances that led to these prosecutions have been documented in 2018 quarterly reports.

Two further prosecutions have been competed to-date in 2019; South Moor (NNE) which has been included in this report and Coppermills (TMS), which completed just before publication and will be included in the quarter 1 report of 2019 but is mentioned for reference.

In all instances, the companies concerned pleaded guilty.

**Table 18: Cautions in 2018**

<table>
<thead>
<tr>
<th>Date of Event</th>
<th>Date of sanction</th>
<th>Nature of event</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 December 2016</td>
<td>16 August 2018</td>
<td>United Utilities: Inadequately disinfected water was supplied from Buckton Castle treatment works. Boil Water Notice issued to 43,000 consumers in and around Ashton-under-Lyne and Stalybridge.</td>
</tr>
<tr>
<td>12 October 2016</td>
<td>13 April 2018</td>
<td>South Staffs Water: Discoloured water was supplied to 71,000 consumers in and around Walsall, West Midlands following planned work at Seedy Mill treatment works.</td>
</tr>
</tbody>
</table>
Table 19: Prosecutions in 2018 and 2019 to date

<table>
<thead>
<tr>
<th>Date of Event</th>
<th>Date of sanction</th>
<th>Nature of event</th>
<th>Outcome (fine)</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 February 2017</td>
<td>10/06/2019</td>
<td>Thames Water: Coppermills Regulation 33(1) - breach of Regulation 26(1)(a) failure to disinfect water and breach of 26(4) failure to design and continuously operate an adequate treatment process</td>
<td>£80,000</td>
<td>£79,839.68</td>
</tr>
<tr>
<td>and 10 July 2017</td>
<td></td>
<td>Regulation 33(1) – breach of Regulation 26(1)(b) failure to subject water to sufficient preliminary treatment to prepare it for disinfection before treatment</td>
<td>£80,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Northumbrian Water: South Moor Service reservoir Section 70 supply of water unfit, and not following Instructions for Use - Regulation 33(3)(b).</td>
<td>£499,725</td>
<td>£32,792.65</td>
</tr>
<tr>
<td>17 December 2016</td>
<td>10/01/2019</td>
<td>Southern Water: Cooks Castle Service Reservoir, Shanklin Section 70 supply of water unfit (discoloured and highly turbid)</td>
<td>£65,000</td>
<td>£44,620.99</td>
</tr>
<tr>
<td>31 Jan-12 Feb 2013</td>
<td>Guilty plea 27/07/2018</td>
<td>United Utilities: Sweetloves works Breach of Regulation 26 (1) inadequate treatment and disinfection of water for two events.</td>
<td>£50,000 for first event</td>
<td>£54,000</td>
</tr>
<tr>
<td></td>
<td>Sentencing 10/08/2018</td>
<td></td>
<td>£150,000 for second event</td>
<td></td>
</tr>
</tbody>
</table>

Events where there are specific points of learning are summarised below.

**United Utilities**

*Failure of sample pumps leading to loss of control of disinfection*

During the first quarter of 2018, United Utilities was prosecuted for two breaches of Regulation 26(1) in failing to adequately disinfect water at Sweetloves water treatment works near Bolton, Lancashire from 31 March 2015 to 3 April 2015 and again between 19 and 22 July 2015. During the second event, 79,000 consumers in Bolton were advised to boil their tap...
water before consumption for three days. This is reported in full in CIR Q1, 2018.

Both events arose from readily preventable failures in the supervision and operation of the works and stemmed from fundamentally the same root cause, that of sample pump failures leading to the over addition of sodium hydroxide. The failures meant that the meters falsely recorded a reduced pH and thus the system increased the dosing of sodium hydroxide increasing pH beyond that required for effective disinfection.

On 30 January 2018, United Utilities pleaded guilty to supplying inadequately disinfected water from the Sweetloves water treatment works in Bolton on two occasions and were fined a total of £200,000 and additional costs of £54,000 were agreed.

These were serious failures by the company to maintain control of water treatment processes, and which have been duly recognised by the court. The company will be required to meet the drinking water quality standards in place to protect consumers in the future.

**Cooks Castle reservoir – damage to an outlet main**

In Q3 of 2018, the Inspectorate completed and reported a prosecution in relation to an event at Cooks Castle service reservoir near Sandown, Isle of Wight, that occurred in January and February 2013. The main delay in bringing forward this prosecution was the failure by Southern Water to notify the event when it occurred, in contravention of the Water Industry (Suppliers Information) Direction. Following investigation of another matter in December 2015, the Inspectorate became aware of the Cooks Castle event and the company submitted an event report in January 2016, three years after the event took place.

An investigation by Southern Water, after the event, concluded that a drilling operation caused damage to an outlet main, the ensuing leak caused landslips and joints in the inlet and outlet mains pulled apart leading to ingress into the reservoir and subsequently discoloured and highly turbid water was supplied.

Southern Water pleaded guilty to supplying water unfit for human consumption contrary to Section 70 of the Water Industry Act 1991 and was fined £65,000 and ordered to pay a victim surcharge of £240 and costs of £44,620.99.
This was a lengthy investigation which commenced in 2016 of a previously undisclosed and significant water quality incident from 2013 which was uncovered where there was a failure to protect consumers. Companies should be aware that flagrant disregard for regulatory duties and consumer protection will always result in action by the Inspectorate in the public interest.

**South Moor – Epoxy coating in a service reservoir**

The following event is described to share the learning from circumstances which led to water with an objectionable taste and odour being supplied to consumers in December 2016. The event arose following planned maintenance work at South Moor service reservoir located in Burnhope, County Durham. The service reservoir was removed from supply and the maintenance work included the application of an epoxy coating to the internal walls and soffit, which had been approved for use under Regulation 31(4).

The manufacturer’s Instructions For Use (IFU) for the application of the product were not correctly followed, the contractor appointed by Northumbrian Water removed heating and dehumidifying equipment during the early stages of the application which resulted in the build-up of
condensation on the newly applied product. The contractor’s records noted the build-up of condensation on the internal surfaces of the service reservoir during the earlier stages of curing however no further action was taken to rectify this issue. The IFU also states that daily temperature records should be kept so that the minimum cure time could be calculated and if daily temperatures are not recorded a cure period of 21 days should be used. Neither the company nor its appointed contractor kept daily temperature records and the service reservoir was cleaned prior to return to service after 19 days of curing. Failure to follow the manufacturers IFU is an offence under Regulation 33.

The event was avoidable. There was a lack of adequate site supervision and sign-off procedures to ensure the requirements of the conditions of use had been adhered to. The company failed to carry out adequate basic checks of the water quality prior to the service reservoir being returned to supply. No qualitative or quantitative taste and odour checks were carried prior to return to service. Had these basic checks been completed it is likely the taste and odour would have been noticed and the reservoir could have been prevented from being returned to supply.

Following return to service, the company received nine consumer contacts reporting objectionable taste and odours with descriptors including ‘plastic’, ‘medicine’, ‘chemical’ and ‘metallic’. Witness statements collected from consumers demonstrated that they had rejected the water on the basis of the strong taste and odour which were present.

The Drinking Water Inspectorate brought charges against the Northumbrian Water, and the company was fined £499,725.

This was an event that should not have happened. Corners were cut in carrying out the work and inadequate scrutiny did not identify this. Consumers experienced water with an unpleasant taste and odour which is likely to have been detected had adequate checks been carried out before the reservoir was put back into service. This prosecution acts as a reminder to companies of their ultimate responsibility for drinking water quality at all times. The Court has recognised the seriousness of this event.
Audits

In 2018, the Inspectorate carried out audits focusing on four themes and these covered:

- Service reservoirs and water towers (Q1)
- Groundwater audit programme (Q2)
- Surface water audit programme (Q3)
- Faecal Risks (Q4)

Audit programmes are described more fully in the quarterly report in which they first appeared, however, objectives of the programmes and the observations from audit are summarised below.

Service reservoir audit programme

Service reservoirs and water towers are integral to water supply systems across England and Wales, providing a buffer against fluctuating consumer demand and increasing resilience in the water supply network. However, as these structures age there are risks to their integrity allowing for potential contamination.

In the first quarter of 2018, the Inspectorate carried out a series of audits of service reservoirs. The full report can be found in Chief Inspector’s Report Q1 2018 but the main findings are highlighted below.

Risk Assessment

Water companies should be carrying out regular risk assessments of their service reservoir and water tower sites. The risk assessments should consider all aspects of the site’s operation that could lead to a deterioration in water quality. These risks include the condition of the structure; the environment within which it is located; weather, operational issues including turnover etc. Water companies should avoid an over-reliance on generic assessments and ensure that regular assessments of risk are fed back into a review and prioritisation process such that appropriate mitigation can take place before consumers are affected.

Risk assessments should be used to identify and drive a programme of internal inspection and these assessment should be reviewed on an appropriate frequency and updated when risks change.
Adjacent Environment

It is good practice to consider water quality risks beyond the boundaries of service reservoirs to ensure that supplies are adequately protected, too often only risks within the site boundary are considered.

Service reservoirs need to be protected from surface water runoff and contamination by animal manure in adjacent fields or from dogs on adjacent footpaths.

Figure 21: Horses in field above Service Reservoir

External Site Inspections

Inspections can identify a number of water quality risks including unwanted intruders and poor structural features leading to contamination risks.

It is not uncommon for the Inspectorate to see sites where there are breaches of fencing and use by the public of areas close to service reservoirs. The integrity of fencing needs to be maintained.
Further issues identified were trees presenting risk of root penetration, lack of knowledge of locations of valves and other assets on sites.

The Inspectorate has recommended conducting a survey of service reservoir assets against any existing schematic diagrams to confirm the location of valves and to update records where there are gaps and carry out inspections to ensure that they remain in good order.

Communication issues were identified where it was evident that those conducting external inspections and seeing through the subsequent works were not communicating with the site operations or water quality team personnel.
Some sites have issues with the integrity of roof membranes, where this is the case, and temporary measures are inadequate, the Inspectorate will consider enforcement action.

Some sites showed general neglect with rubbish left uncleared and buildings in a rundown state. Although these points present no specific risk to water quality in themselves, they do suggest that some sites receive no regular care and attention as befitting a clean water restricted area.

Reservoir flood test procedures should not introduce additional risk to water quality for example introducing pumps into reservoirs actively supplying water.

**Internal Inspections**

The Inspectorate expects companies to be carrying out internal inspections on a risk basis and there should be clear plans of how to remove each structure from supply to allow internal inspection whenever required and at the very least every ten years. Where sites are difficult to remove from supply, this risk should be incorporated within Drinking Water Safety Plans and appropriate steps should be taken to enable such sites to be removed from supply.

At some sites there were no inspection records available and it was not possible to confirm the date of last inspection or indeed any inspection. The Inspectorate expects records of internal inspections to be kept.
Vermin Risks

Sites were found with evident vermin risk. Given the involvement of vermin/animals in previous events, the Inspectorate expects companies to have a vermin control strategy in place.

Figure 24: Vermin burrows into the embankment

Site Operation and Turnover

Site specific operations manuals and schematics need to be in place and exercises to test the functionality of key valves to ensure they can be operated in emergency situations should be held.

Where assets are taken out of supply with no intention of returning them to service, they should be physically disconnected from neighbouring assets.

There still exists the practice of manually elevating chlorine dose within a service reservoir by adding sodium hypochlorite solution. It is not considered good practice under any circumstances to apply a chemical dose by such a method and is unlikely to be effective to disinfect water in-situ. It is the Inspectorate's view that there are other preferable options that offer better dose control. The Inspectorate has made this view known in its annual reports in the past and advised companies that retain this practice to examine more robust options to protect public health and to revise procedures.
Booster Chlorination

Dosing of sodium hypochlorite in the network to provide a free chlorine residual in distribution (booster chlorination) requires appropriate monitoring and control. Additionally, companies need a turnover policy for sodium hypochlorite to mitigate against an increase in disinfection by-products due to degradation of the sodium hypochlorite held in-situ for a number of weeks. Dosing points need to be chosen to ensure that there is adequate mixing.

Washouts, Drainage and Overflows

Washouts and overflows are critical components in the operation of reservoirs and towers. Overflows in particular pose a contamination risk. Companies should ensure that there is adequate protection from vermin and invertebrate contamination and have a good knowledge of the location of all drains and valves so that they can be inspected and operated when required.

Hatches

Investigations into microbiological failures at service reservoirs or water towers frequently identify issues with the integrity of hatches and seals around cables entering these water storage assets. Additionally, missing insect mesh on vents presents another opportunity for contamination.

Examples of good practice saw some companies providing brushes, portable vacuum cleaners and sodium hypochlorite spray along with training to staff to access reservoirs in a hygienic way.

Hatches need to be securely padlocked and any alarms on hatches responded to promptly.

Figure 25: Poor integrity of sample hatch
Sampling Points

Sampling points need to allow water samples taken to be representative of the water supplied from service reservoirs and towers. It is worth noting that since the audit programme, new regulations have been introduced which require sampling points to meet the requirements of ISO 5667-5 entitled ‘Water quality. Sampling. Guidance on treatment of drinking water from treatment works and piped distribution systems’.

Some issues identified were:

- Sample points not on dedicated tappings or situations such that samples cannot be taken in some operational modes.

- External contamination of exposed sample points also presents a risk of unrepresentative samples, with companies often citing environmental contamination as the cause of failures. Proper sampling kiosks need to be in place and maintained with overhanging vegetation removed.
Figure 28: Non-dedicated sample line at service reservoir

Figure 29: Clear instruction for samplers
Sampling Frequency

A review of the sampling frequency for the service reservoirs audited highlighted several occasions where water quality compliance sampling had not been undertaken in line with the requirements of Regulation 14. Samples representative of water that is leaving the reservoir are required to be taken every week from a sampling tap. Surrogate samples are not acceptable. There were several examples where this was not the case. Guidance on the requirements to comply with Regulation 14 are available on the Inspectorate’s website.

Groundwater Audit Programme

In 2018, 28 percent of water supplies across England and Wales were derived from groundwater sources. Groundwater from deep and confined aquifers is usually of good microbiological quality, chemically stable and less easily influenced by direct contamination. However, shallow or unconfined aquifers can be subject to the same contamination risks as surface water as well as by gradual permeation of pollutants.

The Inspectorate carried out a series of audits at groundwater works and reported fully in the Chief Inspector’s Report Quarter 2 2018. These audits set out to examine how these sources are protected from contamination and to ensure that the treatment processes in place were appropriate for the source. Key learning points are highlighted below.

Risk Assessment

It is an important requirement for companies to carry out risk assessments in sufficient detail so that water supplies can be adequately protected from contamination. The Inspectorate found that some companies were either not aware of the risks to sources or had not fully addressed the risks identified.

Factors that had not been considered were:

- Sewage treatment plants and cess pits identified within the catchment or on sites;
- Risks associate with pesticide use in arable catchments;
- HAZCHEM site identified in the catchment but company had no knowledge of the chemicals being used;
- Water quality risks associated with the use of turbidity overrides had not been assessed.
• A sheep shearing unit with veterinary products in the field adjacent to one of the boreholes had not been identified as part of a safety plan review carried out the day before the Inspectorate’s visit.

• Two abandoned observation boreholes at were not recorded in the Drinking Water Safety Plan and the company was not carrying out any recorded checks on these boreholes.

• Lack of consideration of retrospective knowledge. The company’s Drinking Water Safety Planning System did not capture risks identified in catchment specific plans that pre-date the introduction of the current safety planning system. There did not appear to be a structured formal review process for the groundwater sites and there was no mechanism to add newly identified risks to the safety planning system.

Source Protection

Contamination of good quality groundwater by surface ingress is a perennial risk and has been a contributory factor in several pollution and illness outbreaks worldwide. It was concerning to see a number of these risks had not been addressed on the groundwater sites visited. Companies are encouraged to reflect on the shortcomings identified below and ensure that these issues are not present at other sites. Particular attention should be paid to abandoned and observational boreholes to ensure their location and condition are known and that risks beyond the site boundary, within the source protection zones, are properly understood and documented.

Other issues identified included :-

• Potential for ingress at well covers;

• Car park with a permeable surface adjacent to borehole but at a higher level presented as risk from oil and fuel spills;

• Lack of knowledge of other associated boreholes;

• Unsecured headworks;

• Air valves on the raw water main which are not maintained and run through agricultural land;

• Unsealed headworks in chambers with potential to flood.
Water Treatment and Monitoring

As time progresses and new treatment processes are introduced companies should ensure that these developments are appropriately considered and the Inspectorate’s guidance is followed. Some deficiencies were found related to disinfection to address Cryptosporidium. In other cases, evidence that water quality does not continuously meet the requirements of the regulations had not been acted upon.

Other observations made included:

- No site-specific disinfection policy;
- Insufficient monitoring to inform investigations;
- Lack of appropriate monitoring for contamination known to be present in the catchment;
- Poor maintenance regime for monitors leading to discrepancies between readings;
- Lack of lamp breakage and containment procedure for UV lamps;
- Poorly calibrated monitors providing inaccurate readings;
- Poor maintenance of sample points.
Restricted Operations

The prevention of contamination by operators and other site visitors is of paramount importance. It is important that companies ensure that they are doing all they can to protect the public from infection caused by staff returning to work after illness and we remind companies that they should take robust steps to prevent contamination in this way. Companies should take this opportunity to review their compliance with best practice, including that laid down within the Principles of Water Supply Hygiene to ensure they can demonstrate the ongoing protection of public health that this provides.

Surface water audit programme

The third quarter audit programme considered surface water works, focussing on selected critical factors which may increase the risk profile in the provision of wholesome water if unmitigated. In an extreme circumstance, such shortcomings could give rise to a potential risk to health and should always be treated with the highest priority when considering proactive action. Broadly, these risks can be categorised into technical problems, people problems and system problems. Technical issues include the treatment processes which covers their condition, maintenance, appropriateness for the source water coupled with the monitoring technology and systems in place for critical control points, alarm set points and auto shutdowns. Culture, training and competence were also considered as a key part of the operation to avoid human error, misjudgement or lack of understanding. All of these are held together by process procedures, frameworks and risk analysis such as drinking water safety plans to maintain cohesive alignment of the whole operation.

As is shown by the findings below there are opportunities for improvement in all areas to keep the public protected, together with examples of good practice for wider industry learning.

Drinking Water Safety Plans

Regulation 28 in Wales applies to every treatment works and supply system and requires a company to carry out a risk assessment of each of its treatment works and connected supply systems in order to establish whether there is a significant risk of supplying water that would constitute a potential danger to human health.
Near Misses and Internal Audit Systems

A key part of process improvement is learning from experience and, as part of this programme, the audit teams examined whether water companies have systems in place to learn from water quality events and near misses, so that risks to health can be avoided. There were good examples and situations where improvement was required in respect of timeliness of response, dissemination of learning points across the company, prioritisation of actions, visibility of water quality risks to the company’s board and timely updates to Drinking Water Safety Plans.

Clarification and Filtration

Observations from audit included:

- Control of the clarification process limited by lack of monitoring. Lack of visibility of individual filter performance due to monitoring on combined outlets. This is poor practice and not in line with the recommendations outlined in the Badenoch and Bouchier reports on Cryptosporidium;

- Poor clarification processes leading to carry over of solids loading;

- Poor maintenance of equipment and sites with plants growing in lauders and dead fish in rapid gravity filters;

- Companies unable to demonstrate that procedures are being followed;

- Tanks overdue for internal inspection.

Disinfection

- Issues with disposal of improperly treated water, not being able to return to head of works or run to waste;

- No auto shut downs on turbidity;

- Use of inhibit timers,(which can effectively override the water quality failsafe shutdown systems, needs scrutiny and control;

- Culture of over-riding alarms at specific sites;

- Lack of understanding of high chlorine demand and lack of demonstration of minimising disinfection by-products.
Other Treatment Processes

Consideration of other treatment processes identified delayed responses to interruptions of phosphoric acid dosing. Companies are advised to review their operating and maintenance strategies for phosphate dosing to ensure the appropriate consistent dose is maintained in light of published research\(^1\) Any chemicals dosed into drinking water need to be managed and dosed in line with the instructions for use. Storage of chemicals must be suitable to prevent breakdown or conversion to other undesirable products. The storage arrangements should be physically protected from damage. Where relevant, dosing arrangements need to take into account changes in raw water quality. At some sites, it treatment chemicals were not used as directed in the instructions for use. Not complying with such instructions is a breach of Regulation 31 and is an offence.

Other Issues of Note

It has been a regular finding from audits that companies do not always consider potential contamination sources from its own assets and companies should ensure contamination risks from sewerage and water fittings are considered as part of treatment works drinking water safety plans.

At one site, the Inspectors noted the system of chemical storage tank checks to ensure that the tanks were in good condition and able to accept a chemical delivery, the positioning by the tanks themselves can also be a good prompt to carry out and record the task.

Figure 31: Good Practice. Chemical storage tank checks

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Faecal Risks Audit Programme

In the final quarter of 2018 the Inspectorate carried out a series of audits at sites where faecal risk had been identified either through company’s sampling programmes and investigations or through risk assessments provided to the Inspectorate in Regulation 28 reports. Faecal risks can manifest themselves in a number of ways, but ingress into the water supply system, particularly downstream of the disinfection stage at treatment works presents perhaps the most obvious risk.

Ingress Risks

It is not unknown for the integrity of contact tanks to be poor and prone to ingress. A higher risk is present if sites are additionally prone to flooding. It is regularly the case that companies, when challenged on ingress to contact tanks, state that the contact tanks cannot be removed from service

This issue highlights the limited resilience that is found at a number of treatment works across England and Wales. This has been emphasised in this report with some of the largest risk events occurring for this exact reason. Companies are advised to ensure that their treatment arrangements have sufficient resilience that any asset can be removed from service at short notice should a water quality issue occur. Where this is not the case, the risks should be visible in the Regulation 28 reports provided to the Inspectorate and timely actions to address the risk should be undertaken.

Other issues identified:

- Too often tarpaulins over tanks become a permanent fix;
- Internal inspection should also be scheduled at appropriate intervals. A remotely operated vehicle (ROV) survey on one contact tank identified a number of items on the tank floor that should not be there. The company are planning to decommission the contact tank.
Avian faecal contamination was observed on the roof of a service reservoir, but this fact had not been reported as part of the company’s investigation into an *E. coli* detection. Additionally, the company reported 11 air valves between the supplying works and the reservoir, none of which had been inspected as part of the investigation into the failure. Ten of the air valves were considered low risk. The one high risk valve had not been inspected as the company’s contractors could not locate it. While the majority of the air valves were found to be in a satisfactory condition,
following the Inspectorate’s recommendation to check them, three were found to contain water and two were submerged.

The location of air valves should be recorded and they should be inspected and assessed for the risk of them introducing contamination into the network after the disinfection process.

**Figure 33: Submerged air valve (left) and post remedial work (right)**

Companies are reminded of the importance of considering the risk of ingress from all sources as part of risk assessments and also as part of investigations into microbiological failures. All companies should ensure that they have appropriate risk-based methodologies in place to ensure risks related to ingress via air valves are appropriately addressed.

**Disinfection Issues**

The series of audits undertaken revealed a lack of appropriately located monitors or operational arrangements to allow for verification of disinfection, discrepancies between online and manual operator tests where reading were used to optimise coagulation and sites with no automatic failsafe shutdown. There are opportunities for companies to improve their processes by better defining the range of acceptable results for readings to confirm that their disinfection criteria are being met. All companies should now be implementing these comparative checks as outlined in Technical Guidance Note 16 of the Principles of Water Supply Hygiene. This matter will form part of future audit programmes.

Companies are reminded that it is a requirement of Regulation 26 to verify that the disinfection process is continuously effective. Companies should not rely upon inference that disinfection requirements are met. The verification should be unequivocal. In light of this finding, companies are advised to review their disinfection arrangements and ensure that the process can be verified under all circumstances and at all disinfection
sites, and that failsafe shutdown is prompt and reliable. In addition, filters were found to be operated outside of a company’s own procedures.

**Risk Assessment**

Inconsistencies were identified between a company’s risk assessment for flooding and the fully mitigated risk reported to the Inspectorate. Equally, at another site the Inspectorate considered that the frequency of *Cryptosporidium* monitoring on the raw and final water was not sufficient to verify the company’s assessment that this is a low risk.

At another site, early investigation of an *E.coli* failure missed structural issues, picked up subsequently, that should have informed the initial investigation. Companies are reminded that they should carry out their investigations in a timely manner to ensure that the risk to public health is appropriately identified and mitigated.

Failure to log activities that are identified as control measures in risk assessments undermines confidence in those control measures.

**Other Regulatory Issues**

The audits identified a lack of protection of chemical storage tanks which were left accessible to animals birds and invertebrates. Dead legs and failures to protect from backflow from shower facilities on site were also identified.

Not for the first time, the Inspectorate identified a number of examples of poor housekeeping and disrepair at a site, falling below the standards expected by the Inspectorate and impacting the level of confidence the public can expect in the operation of treatment works.

**Figure 34: Poor upkeep of works**
In summary, there were a number of risks identified by the Inspectorate in this series of audits that should be self-evident to water companies. We encourage companies to revisit sites that present risks of faecal contamination or impaired disinfection with a more critical eye to identify and rectify the root causes of these risks before they become water quality problems.
Regulatory strategies

In developing a strategy encompassing better regulation, DWI has developed a methodology to determine the likelihood of regulatory non-compliance though the analysis of the first level intervention of recommendations. Recommendations are commonly used by regulators throughout the UK and worldwide but it can be difficult to track outcomes without a formalised system of recording and follow-up. Not to act upon a recommendation by a regulator results in a weak system of control as the regulated industry will realise there are no consequences. From a company perspective, failure to act may be for a number of reasons such as lack of resources; people, money or knowledge, or simply because it is easier not to act. For whatever reason, inaction changes the risk positioning of the company to potential non-compliance with the regulations and may result in systems failures leading to events where public health may be at risk.

For the regulator this drives behaviour towards enforcement and sanction which reduces effectiveness ignoring better regulatory principles.

The Recommendation Risk assessment builds upon the concept that a recommendation is a first level regulatory intervention, the objective is to encourage companies act for themselves before the need for formal enforcement. The methodology evaluates both the seriousness of the recommendation and the quality of the response to determine a value to measure the responses by companies against the regulations. As a regulatory tool, this permits the mapping of individual companies and their relative risk of failing to comply with the regulations though behavioural aspects such as lack of competence or avoidance.

As shown below in Figure 35 companies are may be ranked by the number of recommendations produced and the outcome of the assessment as a recommendation score.

**Figure 35: Company recommendations in 2018**
It is inevitable that the number of recommendations will have some relationship to the score but it is also reasonable to assume that the number of recommendations will bear a relationship to the size of the company. The interaction between the regulator and the company should result in a proportionate number of recommendations and the expected number of recommendation may be reasonably predicted using historical data from previous years.

Analysis of this is shown in Figure 36.

**Figure 36: Observed vs Expected recommendations score**

The identification of companies performing in a way that may risk compliance with regulation requires action by the regulator. Three companies sit above the normal expected range, (SVT, UUT, SRN), and this has resulted in all being enlisted into transformation programmes which set out a framework of work across the whole business, (competencies and assets), for a company to achieve the successful delivery of wholesome water and reduce identified risks. A fourth company (TMS) whilst below the expected range is also in a transformation programme due to the type of recommendations and inaction where Inspectors consider these an ongoing risk. These scope of the transformation programmes and progress are described below.

**Severn Trent Water**

Severn Trent Water is currently coming to the end of a DWI transformation programme. This was initiated following a number of events related to treatment, process control as well as microbiological failures at treatment works and treated water storage reservoirs. This followed the identification
of the risk status of the company and investigations surrounding the Provisional Enforcement Order for Frankley issued in late 2015. Notices were issued to investigate and inspect assets, upgrade treatment and to improve management and competency.

The Inspectorate has managed this through a combination of liaison meetings at working level, as well as senior level in order to drive change. The company has made very good progress in recent years, and a number of Notices have been closed. The company is on target with the remaining Notices, and has ambitious plans to address training and competence with the construction of a company academy on their site at Finham to provide training for staff. This is due to open in 2020. However, while there was initial momentum in delivering responses to recommendations, the company were not successfully reducing the risk of regulatory failure towards the end of 2018. The transformation framework may need re-evaluation as inspections move into 2019/2020 (see Figure 37).

**United Utilities**

United Utilities entered into a transformation programme in 2016 as the highest risk company identified through the Recommendations Risk Index combined with the highest ERI at the time. This was compounded by concerns in the performance of the company in similar and coincident areas such as treatment (including control of disinfection), service reservoirs, discoloration and company management and culture.

As a wide ranging transformation programme, a number of legal instruments were issued to the company covering the following areas:

- Better algal management to improve compliance with taste and odour;
- Improved backwash handling to mitigate against risks associated with *Cryptosporidium*;
- Review and update of site specific disinfection policies;
- Installation of start-up to waste facilities to improve compliance with Regulation 26;
- Improvements to chemical dosing and monitoring;
- Service reservoirs – inspection and cleaning programme;
- Discolouration in zones.

While the company has been making progress with some elements of the transformation programme, delays have occurred with the completion of some of the programmes of work, primarily due to the freeze-thaw experienced in March 2018 and the dry weather period in the summer. This
company was particularly affected by the drought in 2018 due to the significant increase in demand by consumers. This has caused delays in the completion of capital works and in particular the company service reservoir inspection and discolouration flushing programmes. As a consequence the company was only starting to reduce the measured risk late in 2018.

Southern Water

Southern Water emerged as the highest risk company in the second half of 2017, not only in recommendations but in the increasing ERI as a result of events and Final Enforcement Orders surrounding sampling shortfalls. The enlistment into the transformation programme required focus on significant and deteriorating works which were, and continue to be an unacceptable residual risk. Three major works were identified as key risk sites and a delivery framework was drawn up in collaboration with the company. The refurbishment schemes at Otterbourne and Testwood treatment works are being delivered on schedule, however, the company must focus on getting the third major works refurbishment at Burham treatment works underway. The company approach to the Hazard Review, (HAZREV), inspections at all of its treatment works is thorough and is identifying a mixture of improvement actions, from simple maintenance tasks to complex engineering solutions. The company approach of a fully integrated review of catchment, operational and asset based hazards is noted as an example of good practice, along with applying the methodology through the development of their Water and Wastewater Risk Frameworks. This approach is welcomed and is showing real outcome improvements clearly evident in a sharp decline in the RRI to an expected level. The company must maintain this momentum but equally they will need to focus resources on delivering the required remedial measures. Where immediate or significant risks to water quality are identified, the Inspectorate will serve a Regulation 28(4) Notice to complete the required actions as necessary.

The company have completed a ‘smart networks’ trial in their poorest performing zones for discolouration. This will inform their long-term strategy for improving performance in the zones and for the deployment of smart networks elsewhere in the company operating areas. Progress with improving the inspection frequency of treated water storage assets remains on target and will deliver a decreased risk of failures of these assets. The reviewed company training programmes are now being rolled out to staff. The associated improvements in culture and training should lead to a decrease in ‘own-goal’ type events.

As a continuing strategy, each quarter of the Chief Inspector’s Report lists new Notices and undertakings which a company has entered into. This is
particularly relevant for companies in transformation programmes and wider learning. *The Chief Inspector’s Report Q2 2018* expanded on the specific Notices against Southern Water for the first half of the year. In the second half of the year Southern Water were served with eight Regulation 28(4) Notices. Two of these Notices were served for treatment works improvements, resulting from risks identified by the hazard review process discussed in the second quarter. The other six Notices were served as part of the Inspectorate’s ongoing review of discolouration performance across the industry. Six of Southern Water’s supply zones were identified as having poor performance due to high levels of customer complaints regarding discoloured water. The Inspectorate expects companies to continually review customer complaints and where performance is low, implement improvement measures.

**Thames Water**

The risk profile of Thames Water was clearly evident in the rapid rise of the RRI value from mid-2017 to mid-2018. Thames Water entered into their transformation programme at the beginning of 2018 programme for catchment hazards associated with flooding and *Cryptosporidium*, the details of this were described in the *Chief Inspector’s Report Q3 2018*. Along with turbidity, these hazards present risks associated with regulatory disinfection requirements at some of its key treatment works. Further risks associated specifically with the operation and management of the company’s slow sand filter beds at its London large process works have been identified, along with more general risks related to inadequate management and operator competency. As part of the programme, the Inspectorate has issued multiple enforcement Notices to the company, to compel suitable and timely mitigation of these risks. In addition to 14 Notices described in *Chief Inspector’s Report Q3 2018*, a second tranche of Notices has been agreed. The final quarter of 2018 saw the issuing of a further three of the five work streams of the Transformation Programme: Management of turbidity; Management of slow sand filters and Management and Competency (training and culture).

**Turbidity 28(4) Notice (all sites)**

A number of issues were identified with the company’s management of the risk from turbidity to ensure that water that is not compliant with the requirements of Regulations 4 and 26 is unable to enter supply. Particularly, deficiencies were identified with compliance with Regulation 26(6)(b)(ii) and the representativeness and verification of on-line turbidity measurements.
Slow Sand Filters 28(4) Notice

During 2017 to 2018, the Company experienced a number of events associated with the management of their slow sand filters that, despite regulatory action from the Inspectorate, continued to manifest as an ongoing risk. Consequently, the management of this type of treatment became another work stream for the company’s Transformation Programme. The resulting Regulation 28(4) Notice requires a number of actions to be completed to address the identified risks.

Management and Competency 28(4) Notice (entire company)

A reoccurring root-cause of the company’s events and recommendations received from the Inspectorate over 2017-2018, related to management (including ownership of responsibilities) and competency of personnel. This is the most difficult work stream of the Transformation Programme to address as it relates to the water quality training and culture of the organisation as a whole. Nonetheless it is also one of the most important aspects of the Transformation Programme to reduce the risk status of the company going forward and to progress the proactive management of water quality related risks. The Notice delivers a comprehensive package of measures, many of which have been put forward by the company, to address self-identified gaps in their training and culture.

As part of the regulatory strategy of transformation programmes, the Inspectorate meets with the company on a monthly basis to assess progress with remedial work, with Thames Water providing quarterly reports to the Inspectorate to demonstrate their ongoing compliance with the measures and steps specified in the Notices and outcomes are beginning to be evidenced in the RRI, (see Figure 37). The company is generally on target with key milestones such as Hazard Risk Assessment, Critical Process reviews, Gap Analysis and Action Plans and has delivered several microfiltration capital schemes for improved Cryptosporidium control measures. Some delays have occurred due to adverse weather, complications with planning permission and increased complexity in the final design solutions. The monitoring of progress against the enforcement Notice’s milestone targets by DWI is ongoing.

While there is a focus on companies where risk is evident through indices, companies may be served with Notices due to findings from other activities such as audits or event investigations for example. One such example is South East Water who were served with ten Regulation 28(4) Notices in Q4 of 2018. These Notices were served due to risks identified during the technical audit of the company’s compliance data which identified inadequate disinfection arrangements at a number of treatment works. These included sites with unsuitable post-disinfection verification and a
number of sites with residency time downstream of the final monitoring point forming part of the disinfection process.

The company was also asked to demonstrate compliance with Regulation 26(2)(b) as a result of suspected blending in contact tanks at a number of their sites. As part of learning, companies are reminded that contact tanks should not be used to provide on-site storage or for blending with other supplies, and arrangements should be in place to ensure that water from the distribution network is not able to flow back into the contact tank. Failure to do so may constitute a breach of Regulation 26(2)(b).

Further details of all legal instruments and a summary of 2018 may be seen in the following section entitled: Enforcement and Risk Assessment – 2018 Summary.

Outcome tracking of RRI may be seen in Figure 37 which illustrates the progress of companies in transformation programmes together with ongoing risk evaluation of two other example companies. These outcome measurements are carefully tracked to assess performance, identify companies who may be an increasing risk, or re-shape the programmes of those who are already within transformation programmes. As a way of showing the difference between companies who are performing less well, both Anglian Water and Welsh Water are typical of expected performance for reference.

Figure 37: Tracking the performance of companies for RRI.
Enforcement and Risk Assessment

New Legal Instruments Issued

During 2018, the Inspectorate served 81 new legal instruments;

**Table 38: New legal instruments in 2018**

<table>
<thead>
<tr>
<th>Instrument type</th>
<th>Number served</th>
<th>Company distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulation 28(4) Notices</td>
<td>71</td>
<td>1 BRL, 2 DWR, 1 ESK, 2 NNE, 7 PRT, 11 SEW, 21 SRN, 1 SVT, 16 TMS, 8 UUT, 1 YKS</td>
</tr>
<tr>
<td>Regulation 27(4) Notices</td>
<td>6</td>
<td>3 SRN, 2 TMS, 1 UUT</td>
</tr>
<tr>
<td>Regulation 21(3) Notices</td>
<td>1</td>
<td>1 SRN</td>
</tr>
<tr>
<td>Section 19 Undertakings</td>
<td>1</td>
<td>1 SRN</td>
</tr>
<tr>
<td>Section 18 Enforcement Orders</td>
<td>2</td>
<td>2 SRN</td>
</tr>
</tbody>
</table>

The high numbers of legal instruments served on Southern Water and Thames Water represent the transformation programmes on which those two companies have embarked during 2018, which were described earlier. The *Chief inspector’s Report Q3 2018* describes the seven Notices served on Portsmouth Water to improve disinfection policy and the verification of disinfection. Eight Notices were served on United Utilities for a mixture of treatment works improvements.

Closures

The Inspectorate received 51 completion reports throughout 2018 (3 AFW, 2 ANH, 1 CHO, 6 DWR, 1 HDC, 2 SEW, 4 SRN, 1 SST, 10 SVT, 2 SWT, 2 TMS, 11 UUT, 3 WSX, 3 YKS).

As part of work within the enforcement and risk assessment team in 2018 there were several significant closures for companies who were subject to transformation programmes for example Severn Trent Water who successfully demonstrated benefit from their ‘all sites’ microbiological
programmes of work. The company worked with the Inspectorate to evidence improvements made to the visibility and transparency of service reservoir cleaning and inspection and hazard identification within the water supply chain and in particular at its reservoirs and works.

**Change Applications**

38 Applications to change legal instruments were received by the Inspectorate during 2018 (1 AFW, 1 ANH, 5 DWR, 1 IWN, 1 HDC, 2 NNE, 6 PRT, 2 SBW, 1 SEW, 4 SRN, 1 SWT, 1 TMS, 7 UUT and 5 WSX).

**Milestone reports**

Companies submitted 211 milestone reports (independent of closure reports and annual progress reports) to the Inspectorate during 2018 (4 ANH, 19 DWR, 5 NNE, 7 PRT, 21 SEW, 50 SRN, 13 SVT, 5 SWT, 12 TMS, 67 UUT, 6 WSX and 2 YKS). The high numbers of milestone reports submitted by Southern Water and Thames Water are associated with the work the two companies are doing under their transformation programmes, which are described in greater detail in the *Chief inspector’s Report Q2, and Q3 2018*. The peak in milestones from United Utilities was associated with a reporting requirement in the discolouration Notices that company are working to.

**Annual Progress Reports**

Companies are required to submit an annual progress report for all improvement schemes, by the 31 January each year to reflect upon progress in the previous year. In 2018, 315 annual progress reports were submitted to the Inspectorate and assessed.

**Regulation 15 – Sampling: New Sources**

16 applications under Regulation 15 were received during 2018 (1 CAM, 4 SRN, 1 SST, 1 SVT, 4 SWT, 1 TMS 3 UUT and 1 WSX). Some companies faced supply issues during the dry weather period in the summer months and increased applications to bring new sources into supply or to return disused sources back into supply were received as a result. In order to aid companies with supply issues, the Inspectorate committed to assess these applications on a rapid turnaround which was achieved for all received. The Inspectorate expressed concern that many companies were not able to demonstrate longer-term planning for drought and increased demand.
Radioactivity waivers

During 2018, the Inspectorate received eight applications to cease regulatory monitoring for radioactivity parameters under Regulation 6 (2 CAM, 1 ESK, 1 NNE, 2 SSE, 1 SVT and 1 WSX). During 2018, the inspectorate’s legal instruments database was upgraded to incorporate waivers. This required the issue of new waiver reference numbers in some cases. Companies have been contacted individually and informed of the new reference numbers where this is the case.

Risk Assessments

During 2018, the Inspectorate received 1,120,560 lines of risk assessment data from water companies. Of these data, 688,438 lines were loaded into the Inspectorate’s database, whilst the remaining 432,122 failed the uniqueness test and were not loaded. A total of 773,260 (69%) were received during October as part of the annual resubmission. The Inspectorate issued a new data specification document in early 2019 and this guides companies on the changes needed to hazard lines and also in their review of these in order to ensure that the most current (primary record) can be accurately loaded and displayed. The October 2019 return from companies will incorporate the new changes to hazard lines and will allow a data cleansing exercise to take place.
# Annex 1

**Table x: Detection of *E.coli* and Enterococci at treatment works, service reservoirs and consumers’ taps**

<table>
<thead>
<tr>
<th>Company</th>
<th><em>E.coli</em> in water leaving treatment works</th>
<th><em>E.coli</em> in water leaving service reservoirs</th>
<th><em>E.coli</em> at consumers’ taps</th>
<th>Enterococci at consumers’ taps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affinity Water</td>
<td>0 – 10,774</td>
<td>0 – 7,861</td>
<td>3 – 9,605</td>
<td>0 – 677</td>
</tr>
<tr>
<td>Albion Water</td>
<td>0 – 0</td>
<td>0 – 0</td>
<td>0 – 24</td>
<td>0 – 8</td>
</tr>
<tr>
<td>Anglian Water</td>
<td>2 – 21,088</td>
<td>1 – 17,061</td>
<td>0 – 12,661</td>
<td>2 – 1,324</td>
</tr>
<tr>
<td>Bournemouth Water</td>
<td>0 – 1,827</td>
<td>0 – 1,032</td>
<td>1 – 1,160</td>
<td>0 – 120</td>
</tr>
<tr>
<td>Bristol Water</td>
<td>1 – 3,483</td>
<td>0 – 7,992</td>
<td>0 – 3,080</td>
<td>0 – 246</td>
</tr>
<tr>
<td>Cambridge Water</td>
<td>0 – 2,723</td>
<td>0 – 1,544</td>
<td>0 – 939</td>
<td>0 – 65</td>
</tr>
<tr>
<td>Cholderton Water*</td>
<td>0 – 32</td>
<td>0 – 17</td>
<td>0 – 5</td>
<td>0 – 2</td>
</tr>
<tr>
<td>Dee Valley Water* (Eng)</td>
<td>0 – 366</td>
<td>0 – 25</td>
<td>0 – 127</td>
<td>0 – 15</td>
</tr>
<tr>
<td>Dwr Cymru Welsh Water (Eng)</td>
<td>0 – 1,354</td>
<td>0 – 1,239</td>
<td>0 – 524</td>
<td>0 – 50</td>
</tr>
<tr>
<td>Essex and Suffolk Water</td>
<td>0 – 3,640</td>
<td>1 – 4,869</td>
<td>2 – 4,940</td>
<td>0 – 326</td>
</tr>
<tr>
<td>Icosa Water</td>
<td>0 – 0</td>
<td>0 – 0</td>
<td>0 – 16</td>
<td>0 – 6</td>
</tr>
<tr>
<td>Independent Water Networks</td>
<td>0 – 0</td>
<td>0 – 0</td>
<td>0 – 147</td>
<td>0 – 58</td>
</tr>
<tr>
<td>Leep Water Networks</td>
<td>0 – 0</td>
<td>0 – 0</td>
<td>0 – 24</td>
<td>0 – 4</td>
</tr>
<tr>
<td>Northumbrian Water</td>
<td>0 – 6,316</td>
<td>0 – 10,119</td>
<td>0 – 6,319</td>
<td>0 – 458</td>
</tr>
<tr>
<td>Portsmouth Water</td>
<td>0 – 2,531</td>
<td>1 – 1,467</td>
<td>0 – 1,854</td>
<td>0 – 107</td>
</tr>
<tr>
<td>Scottish and Southern Energy (Eng)</td>
<td>0 – 0</td>
<td>0 – 0</td>
<td>0 – 281</td>
<td>0 – 94</td>
</tr>
<tr>
<td>SES Water</td>
<td>0 – 2,119</td>
<td>0 – 1,819</td>
<td>0 – 1,791</td>
<td>0 – 169</td>
</tr>
<tr>
<td>Severn Trent Water* (Eng)</td>
<td>0 – 20,981</td>
<td>1 – 22,633</td>
<td>4 – 19,642</td>
<td>0 – 1,424</td>
</tr>
<tr>
<td>South East Water</td>
<td>1 – 11,334</td>
<td>0 – 11,541</td>
<td>1 – 5,780</td>
<td>0 – 592</td>
</tr>
<tr>
<td>South Staffordshire Water</td>
<td>0 – 3,904</td>
<td>0 – 1,640</td>
<td>1 – 3,375</td>
<td>0 – 161</td>
</tr>
<tr>
<td>South West Water</td>
<td>0 – 7,541</td>
<td>0 – 13,097</td>
<td>0 – 4,609</td>
<td>0 – 376</td>
</tr>
</tbody>
</table>
### Summary of the Chief Inspector's report for drinking water in England

<table>
<thead>
<tr>
<th>Company</th>
<th>E. coli in water leaving treatment works</th>
<th>E. coli in water leaving service reservoirs</th>
<th>E. coli at consumers' taps</th>
<th>Enterococci at consumers' taps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southern Water</td>
<td>1 – 12,261</td>
<td>1 – 10,358</td>
<td>1 – 6,506</td>
<td>0 – 531</td>
</tr>
<tr>
<td>Thames Water</td>
<td>0 – 17,109</td>
<td>1 – 18,827</td>
<td>5 – 25,584</td>
<td>1 – 1,928</td>
</tr>
<tr>
<td>United Utilities</td>
<td>0 – 14,902</td>
<td>0 – 17,922</td>
<td>1 – 18,882</td>
<td>0 – 1,797</td>
</tr>
<tr>
<td>Veolia Water Projects</td>
<td>0 – 158</td>
<td>0 – 280</td>
<td>0 – 36</td>
<td>0 – 8</td>
</tr>
<tr>
<td>Wessex Water</td>
<td>0 – 8,151</td>
<td>0 – 16,132</td>
<td>0 – 3,619</td>
<td>1 – 502</td>
</tr>
<tr>
<td>Yorkshire Water</td>
<td>0 – 14,908</td>
<td>0 – 17,696</td>
<td>1 – 12,951</td>
<td>0 – 591</td>
</tr>
<tr>
<td>Region overall</td>
<td>5 – 166,710</td>
<td>6 – 184,771</td>
<td>20 – 144,481</td>
<td>4 – 11,569</td>
</tr>
</tbody>
</table>

*CHO and DVW January-June 2018 only, Some SVT sites transferred to Wales July-December 2018.

Note: Results are shown as the number of positive tests – the total number of tests.