# Drinking water 2015

## Public water supplies in the London and South East region of England

**July 2016**

A report by the Chief Inspector of Drinking Water

# Drinking water 2015

# London and South East region of England

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*Drinking water 2015 is the annual report of the Drinking Water Inspectorate and comprises reports covering public and private water supplies.*

*Public supplies – This part describes drinking water quality in the London and South East region. The Inspectorate also publishes a series of companion reports for other regions of England (Central and Eastern, Northern, and Western regions) and a separate report for Wales.*

*Private supplies – A summary of information on private water supplies is reported for England and Wales.*

*All parts are available on the Inspectorate's website www.dwi.defra.gov.uk*

# Chapter 1: Summary

Chapter 1:

- Provides a summary of the report for the London and South East region.
- Puts drinking water quality in the region into context nationally.

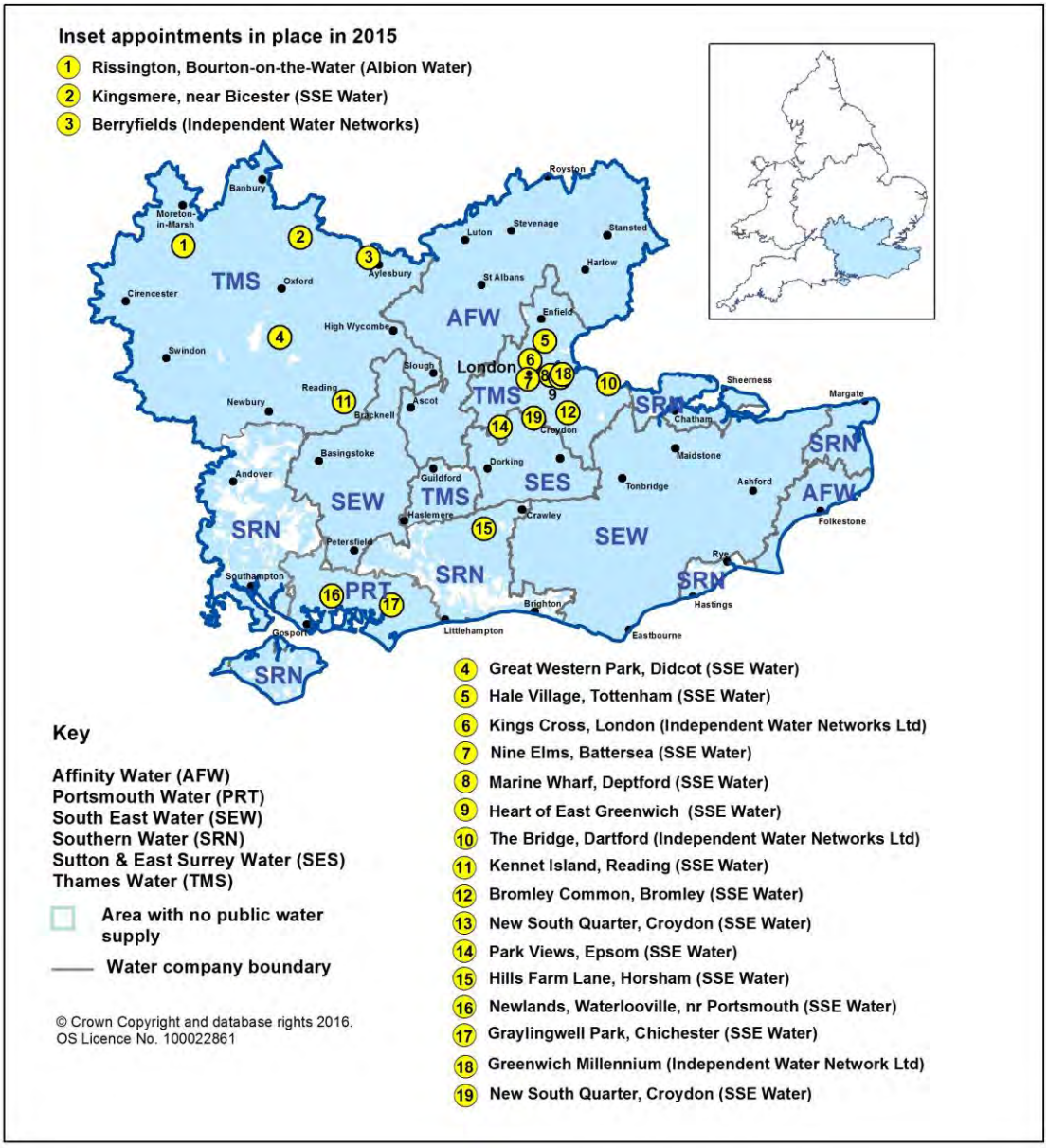
*Drinking Water 2015* is the annual publication of the Chief Inspector of Drinking Water for England and Wales. It is the 26th report of the work of the Inspectorate and presents information about drinking water quality for the calendar year of 2015. It is published as a series of seven reports, five of which cover public water supplies and two describe private water supplies. This report is about public supplies in the London and South East region of England.

Set out in this report are the key facts about the quality of the public water supplies in the London and South East region, which is served by nine water companies delivering supplies to 18,926,936 consumers. The area served by each water company is shown in Figure 1 and the organisation and nature of water supplies in the London and South East region is described in more detail in Chapter 2. There were no changes in the water supply arrangements in the region in 2015 compared to 2014.

There were changes in the number of private water supplies in the region notified by local authorities to the Inspectorate with the total increasing from 2,598 in 2014 to 2,628 in 2015. Detailed information about the regulation and quality of private supplies can be found in the separate report entitled *Drinking Water 2015 – Private Water Supplies in England.*

The quality of public water supplies in England in 2015 was very high with only 0.04% of tests failing to meet the European Union (EU) and national standards. This compares favourably to the 1.6% of failures recorded in 1991, the first year after privatisation of the water industry, when regulation of drinking water quality was first introduced. The situation in relation to the quality of private water supplies in England remains less satisfactory with 4.5% of tests failing to meet the EU and national standards in 2015. However, this figure compares favourably to the 7.5% of tests that failed in 2010, the year when new regulations implementing the EU Drinking Water Directive for private supplies were introduced.

**Figure 1: Water supply arrangements**



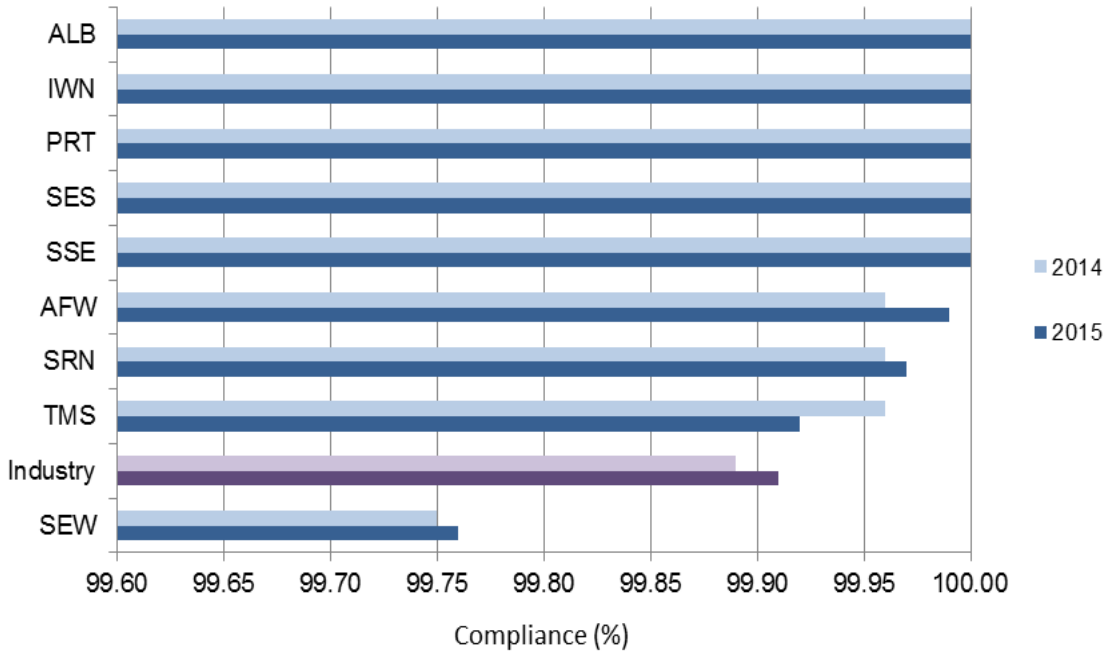

The results of testing of public supplies in 2015 demonstrated that overall the quality of drinking water in the London and South East region was excellent. The figure for compliance with drinking water standards was 99.97%, up on the regional figure in 2014 (99.96%), and above the industry average (99.96%). The Inspectorate uses a range of indices to assess the water quality performance of the companies providing public supplies. These indices[1] look in turn at water treatment (process control and disinfection indices), service reservoir integrity and network

[1] Calculation method for indices is published at http://dwi.defra.gov.uk/about/annual-report/calculating-indices.pdf

maintenance. Individual water company figures are set out in *Annex 6*. In 2015 the changes in the London and South East region were improvement in the figures for process control and disinfection: the figures for network maintenance were lower than last year and the figures for service reservoir integrity were unchanged. Nevertheless, all the indices were at or above the industry averages.

Figure 2 shows how the change in the distribution maintenance index for the region compared to the industry average. All companies showed an improvement in performance with the exception of Thames Water due to a number of iron and turbidity breaches in the zones. As a result, the region showed a decline in the index from 99.94% in 2014 to 99.92% in 2015. South East Water remains with the lowest index in the region and below the industry average. South East Water continues to have areas where there is elevated consumer contacts for discoloured water over a prolonged period. The Inspectorate issued Notices requiring South East Water to deliver the required improvements.

**Figure 2: Company performance for the distribution maintenance index**




Across the London and South East region, in 2015, there were more events affecting water quality overall (161 compared to 149 in 2014) and a continuing trend from 2013. A notable feature of events in the region in 2015 was an increase in minor and significant events, and a decrease in serious events. There were no major events in the region during 2015.

However, in 2015, in the London and South East region there were two serious events (see *Chapter 5: Drinking water quality events* and *Annex 3*)

and two exceptional circumstances where a Final Enforcement Order was served. One of these serious events was linked to the failure of a critical delivery main and the subsequent loss of supplies at Egham works operated by Affinity Water supplying consumers in Surrey and areas to the west of London. This event illustrates the failure to identify a critical stage where no mitigation existed and no supply redundancy was built in. The second serious event involves Southern Water and it is disappointing to report that the very controls put in place to mitigate risk, in this case turbidity, were able to be bypassed as works were being restarted. Elevated turbidity interferes with disinfection and often follows problems with the source or treatment processes which will itself bring inherent risks such as the presence of bacteria or *Cryptosporidium*. The Inspectorate has taken enforcement action in the form of a Final Enforcement Order in relation to the failure of Southern Water and South East Water to provide all analytical data to show they are monitoring appropriately. This is the second year where both companies have failed in this duty and details can be found in *Chapter 3: Drinking water quality testing*.

In 2015, two events occurred at large treatment works (Frankley works (Severn Trent Water) and Franklaw works (United Utilities)) which identified issues for consideration by all companies. The failure of these two treatment works highlighted the need for longer strategic planning to avoid failure to supply wholesome water to consumers at all times where there is no obvious opportunity to recover. Plans should include interconnection between works and systems, process redundancy, operation within design limits, technology and competent staff all brought together through risk assessment and mitigation. This year, companies submitted their risk assessments to the Inspectorate and it is clear that long-term asset planning for water quality will need to be a priority.

The Inspectorate, as part of its risk-based strategy, identified Severn Trent Water and United Utilities as companies where the risk of regulatory failure was considered greatest and where a risk reduction programme to support improvement through programmes of work was merited. Severn Trent Water, who were the first company to engage with the transformation programme following a number of challenging years reported in the Chief Inspector's reports of 2014 and 2013, agreed an extensive forward plan for improvement covering works and service reservoirs. The Inspectorate is pleased to report that while the process is still ongoing, the positive response by the company has shown benefits in the reduction of risk. The transformation programme for United Utilities started at the end of the year. The programme encompasses a much wider range of risks, including the need to refocus company staff on drinking water quality and repositioning the organisation as a service company to meet customer needs and expectations. The Inspectorate reminds companies that

overemphasis on a selected number of end point compliance parameters can result in failure to identify key risks throughout the supply of water, which consequently results in failure to produce a clean wholesome supply.

Local authorities across England and Wales provided case studies on the remediation of failing private water supplies. One example relating to the London and South East region can be found in *Drinking water 2015 – Private water supplies in England – Chapter 3: Improving private water supplies*.

More information and industry-wide learning points about these and other significant events can be found in *Chapter 5: Drinking water quality events* and a summary of all significant events in the region can be found in *Annex 3* of the report.

**Table 3: Water quality events in 2015**

| Nature of event | Risk assessment category (DWI) | | | | | |
|---|---|---|---|---|---|---|
| | Minor* | | Significant | | Serious** | |
| | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 |
| Central and Eastern | 119 | 129 | 59 | 48 | 5 | 4 |
| London and South East | 90 | 97 | 53 | 62 | 6 | 2 |
| Northern | 28 | 44 | 48 | 64 | 1 | 3 |
| Western | 32 | 38 | 53 | 33 | - | 1 |
| Wales | 13 | 16 | 10 | 18 | - | - |
| **Industry** | **281** | **322** | **218** | **223** | **12** | **10** |

Four events affected two or more regions in 2015 and five in 2014.
*Minor category numbers include all not significant and minor events.
**Serious category numbers include all serious and major events.

During 2015, the Inspectorate carried out 88 audits of assets, sampling arrangements and consumer complaints in England and Wales, 21 of which were in the London and South East region. In addition, the Inspectorate received reports submitted by the industry which identified risks from source to tap for all supply systems. These detailed reports are currently under review and the outcomes will be reported in the Inspectorate's new quarterly report.

When consumers are dissatisfied with the quality of their drinking water they may contact their water company. Records of the numbers of contacts received by water companies are sent to the Inspectorate each year. In the London and South East region the total number of consumer contacts to water companies about the quality of drinking water was 1.0 contacts per 1,000 population, fewer than the industry average of 1.6 contacts per 1,000 population. If the water company fails to address the consumer's water quality issue, the consumer can seek assistance from the Inspectorate. In 2015, the Inspectorate investigated 47 consumer

complaints of which 11 (3 SEW, 3 SRN, 5 TMS) were in the London and South East region.

Also, during 2015, the Inspectorate handled 297 requests for advice about private supplies from local authorities across England and Wales and 62 of these enquiries were from the London and South East region. Audit findings and consumer complaint case examples can be found in Chapter 6 and details of the work of the Inspectorate in relation to private supplies can be found in the companion report entitled *Drinking water 2015 – Private water supplies in England.*

Turning to planned improvements in drinking water quality in the region, during 2015, the Inspectorate confirmed the need for improvements at Hambledon works (TMS) to address *Cryptosporidium*, Weirwood works (SRN) to address chlorate and Kangley Bridge (TMS) to address ingress.

Companies in the region are committed to complete the planned work summarised in *Annex 4* during the AMP6 period (2015–2020) and in general all schemes in the region are proceeding in line with agreed timescales. However, five schemes (1 AFW, 2 SRN, 2 TMS) have been delayed for a variety of reasons (see *Annex 4.1*).

By way of comparison, in 2015, local authorities in the London and South East region put in place 48 improvement Notices in relation to failing private water supplies.

The requirement for companies to complete a risk assessment for every treatment works and supply system was initiated as part of the 2007 amendments to the Regulations. In October 2015, the Inspectorate completed its project for a database, which sets a commonly agreed framework for summary risk assessment reports demonstrating company compliance with the Regulations. The database collects risk information associated with catchments, treatment works, service reservoirs and zones, and lets the Inspectorate scrutinise those risks and related mitigations. The Inspectorate's assessment of the risk information and any resulting enforcement action is also visible. This key change embraces the principles of risk assessment and better regulation. The database makes information available in expectation of the transposition of Annex II of the Drinking Water Directive late in 2017. Annex II permits the variation of sampling frequencies based on the outcome of the risk assessment. Work is currently ongoing to develop the outcomes of the assessments and this will be taken into account in the risk-based response of the Inspectorate going forward.

The Inspectorate provided the water industry with technical advice on six topics to enable water suppliers to comply with the drinking water regulations. In addition, eight research projects were published by the

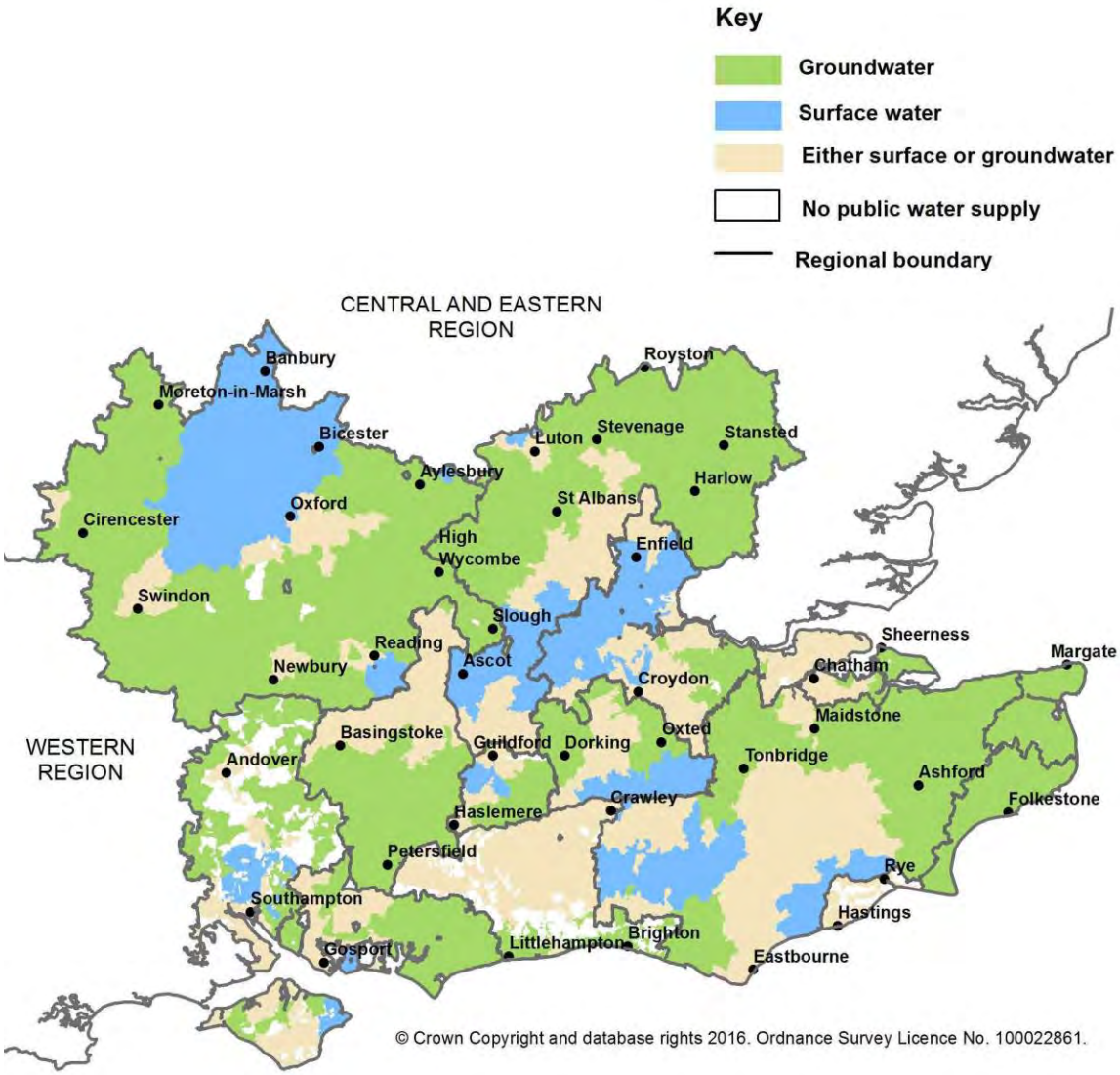
Inspectorate to develop underpinning knowledge for regulatory risk assessments. *Annex 2* lists all of the advice and research published by the Inspectorate in 2015.

# Chapter 2: Water supply arrangements

Chapter 2:

- Identifies the water supply companies in the region.
- Illustrates the water source and supply arrangements in the region.
- Provides summary figures describing the water supply assets and stakeholders.

**Figure 4: Map illustrating sources of drinking water by zone across the region**



Nine water companies supply drinking water in the London and South East region: Affinity Water (AFW); Portsmouth Water (PRT); South East Water (SEW); Southern Water (SRN); Sutton and East Surrey Water (SES); Thames Water (TMS); and three inset appointees, SSE Water (SSE), Independent Water Networks Ltd (IWN) and Albion Water (ALB).

As shown in Figure 4, Independent Water Networks Ltd supplies water to the Bridge in Dartford, Berryfields in Aylesbury, the Kings Cross development in London and the Millennium Village in Greenwich, London. SSE Water supply water to insets in Hale Village in Tottenham, London; Kennet Island in Reading; Bromley Common in south east London; Park Views in Epsom; Graylingwell Park, Chichester; Great Western Park, Didcot; Kingsmere in Bicester; New South Quarter in Croydon; Marine Wharf, Deptford, southeast London; Heart of East Greenwich, London; Hills Farm Lane, Horsham; Nine Elms, Battersea in London; and Newlands, Waterlooville, near Portsmouth. Albion Water also supplies 1,183 consumers in Upper Rissington, near Bourton-on-the-Water in Gloucestershire.

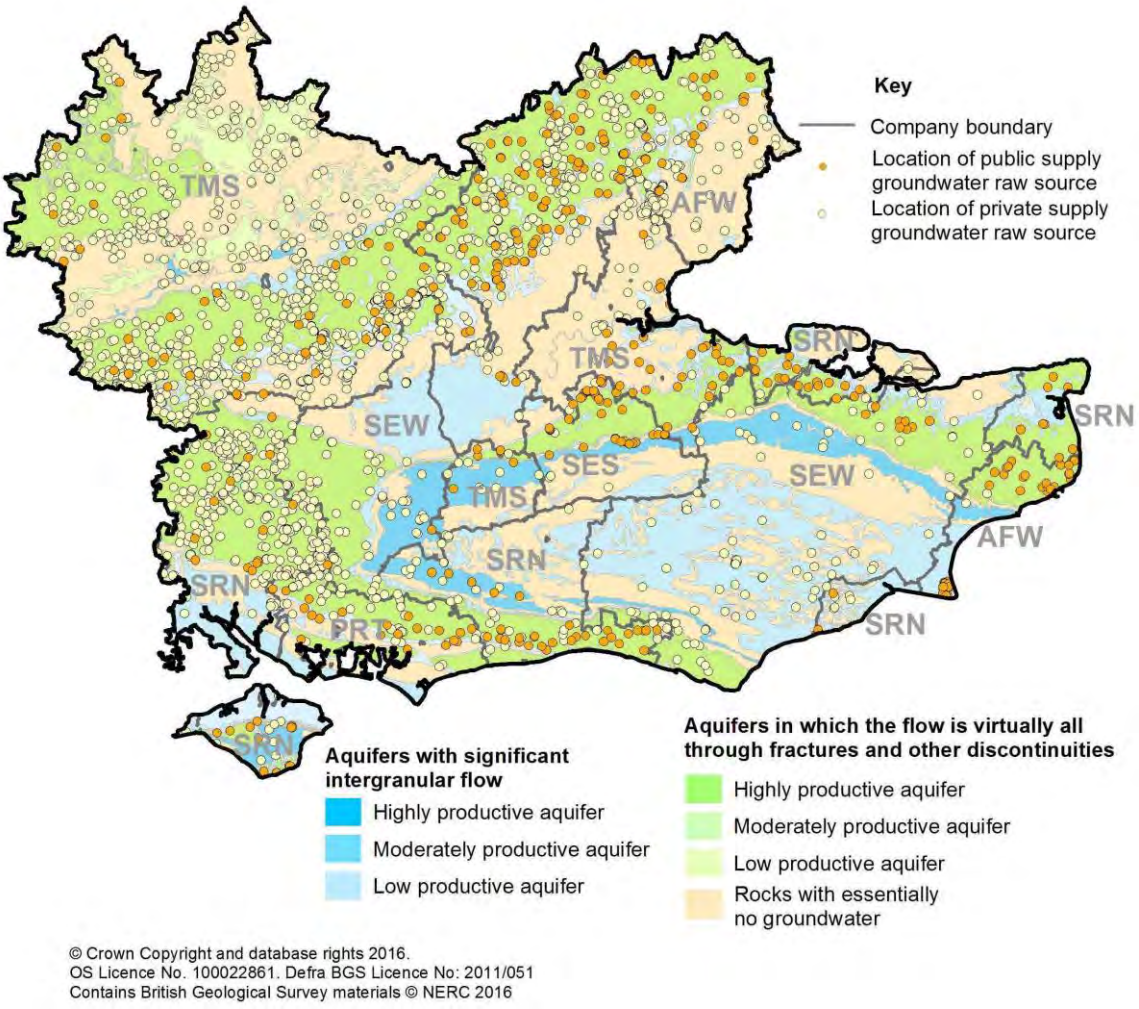
Just over one half of the water supplied in the region originates from surface water (54%) abstracted from lowland rivers such as the Thames, Eden, Cherwell, Great Stour, Itchen, Medway, Ouse, Test and the River Yar on the Isle of Wight. Most river water is held in large, raw-water storage reservoirs before being drawn off for treatment. Reservoirs like Farmoor (Oxford) and Bough Beech (Edenbridge) are strategic reserves replenished over the winter and drawn down in summer. Water is also drawn from two large, interconnected complexes of impounding reservoirs to the south west and north of London. Other reservoirs in the south of the region are Ardingly, Arlington, Bewl, Darwell, Powdermill and Weirwood.

A significant amount of the water supplied to consumers in the region, particularly those living outside London, is derived from groundwater (44%) with most boreholes drawing water from the chalk aquifers of the North and South Downs, and the oolitic limestone or greensand aquifers found across the region. South East Water abstracts from the Ashdown sandstones to supply the Weald area. In Kent, Affinity Water relies exclusively on groundwater, mostly from the chalk aquifers, with the Denge peninsular dependent on a shallow gravel aquifer.

Private water supplies in the region are widely distributed across the area, with high concentrations in the North, West and South West of the area. These private supplies are slightly more reliant on groundwater (48%) than the public supplies in the area (43%). For more information about private water supplies please refer to *Drinking Water 2015 – Private water supplies in England.*

Figure 5 illustrates the location of private and public supply groundwater abstraction points in relation to the groundwater aquifers in the region.

**Figure 5: Location of private and public supply groundwater abstraction points**






Summary facts about the drinking water supply infrastructure of the region are given in Table 6 with outline geographical and demographic information.

## Table 6: Key facts about public and private water supply arrangements in the London and South East region

| Public supplies | | Private supplies | |
|---|---|---|---|
| Population supplied | 18,926,936 | Population supplied | 137,262 |
| Water supplied (l/day) | 4,921 million | Water supplied (l/day) | 61 million |
| Abstraction points | 726 | Approximate number of private water supplies* | 2,628 |
| Treatment works | 428 | | |
| Service reservoirs | 696 | Total number of local authorities | 112 |
| Water supply zones | 528 | | |
| Length of mains pipe (km) | 81,944 | Number of local authorities with private supplies | 78 |
| Water composition | | Water composition | |
| Surface sources | 54.5% | Surface influenced supplies | 25% |
| Groundwater sources | 43% | Groundwater sources | 48% |
| Mixed sources | 2.5% | Mains water | 27% |
| | | Unknown | 0% |
| Area of supply<br>Berkshire (part), East Sussex, Hampshire (part), Isle of Wight, Kent, Surrey, Bedfordshire (part), Buckinghamshire (part), Essex (part), Gloucestershire (part), Hertfordshire, Inner London, Outer London (part), Oxfordshire, West Sussex, Warwickshire (part), Wiltshire (part) | | | |
| *Boundaries for public supplies regions are based on groupings of water company zones. Boundaries for private supplies figures are based on the closest approximation of the public supply zones. Where local authorities boundaries cross regional boundaries, the whole local authority data has been attributed to the region in which the majority of its area lies. | | | |

# Chapter 3: Drinking water quality testing

Chapter 3:

- Explains the basis of the drinking water testing programme.
- Records the number of tests carried out by water companies.
- Identifies any deficiencies in water testing and how these have been remedied.

Throughout 2015, water companies sampled drinking water across the region 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 1,183,521 tests during 2015 and only 296 of these tests failed to meet one or more of the standards set down in the Regulations or exceeded a screening value.

**Table 7: Number of tests carried out by companies in the region**

| Company | Place of sampling | | | Number of tests per company | Target number of tests |
|---|---|---|---|---|---|
| | Water treatment works | Service reservoirs | Consumers' taps (zones) | | |
| Affinity Water | 53,588 (96) | 37,255 (145) | 80,916 (80) | 171,759 | 171,917 |
| Albion Water | 0 (0) | 0 (0) | 359 (1) | 359 | 359 |
| Independent Water Networks | 0 (0) | 0 (0) | 814 (4) | 814 | 814 |
| Portsmouth Water | 11,754 (19) | 9,289 (31) | 17,464 (13) | 38,507 | 38,520 |
| South East Water | 80,888 (93) | 69,232 (239) | 77,813 (72) | 227,933 | 230,304 |
| Southern Water | 66,889 (83) | 60,302 (195) | 98,657 (74) | 225,848 | 225,967 |
| SSE Water | 0 (0) | 0 (0) | 6,477 (13) | 6,477 | 6,485 |
| Sutton and East Surrey Water | 13,220 (7) | 8,320 (32) | 16,483 (20) | 38,023 | 38,023 |
| Thames Water | 111,451 (95) | 96,556 (379) | 265,794 (251) | 473,801 | 473,966 |
| **Region overall** | **337,790 (393)** | **280,954 (1021)** | **564,777 (528)** | **1,183,521** | **1,186,355** |

Note: Numbers in brackets reflect the number of works, reservoirs or zones operated by that company in the region in 2015. Some companies are permitted to carry out some tests on samples taken from supply points rather than from consumers' taps.

The Regulations set out the parameters to be tested for by water companies. Most of the testing is for parameters with a European or national standard (Schedule 1 parameters), however, water companies are also required by the Regulations to test for other indicator parameters (Schedule 2 parameters). The Regulations also lay down how many of these tests must be done each year (Schedule 3) and the Inspectorate checks that the water companies are meeting these sample frequencies. Across the region in 2015 there was a shortfall in sample numbers.

Affinity Water (158), Portsmouth Water (13), SSE Water (8) and Thames Water (165) were unable to provide test results, (numbers in brackets), for analysis. These were due to a combination of reasons including not taking

or losing samples or following receipt by the laboratory, errors or quality failures during analysis.

However, as a continuing theme, both Southern Water (119) and South East Water (2,371) failed to provide significant numbers of test results for at least the second year in a row, despite reassurances by the company. Without all data, there cannot be a complete assessment and as a result, there is a loss of confidence in the company's performance. This necessitated the serving of Final Enforcement Orders for both companies requiring the appropriate submission of all data in the forthcoming year. Further details can be seen in *Annex 3*. Companies are reminded to meet the duties placed upon them by regulations and that senior managers should be taking steps to satisfy themselves, through regular internal reports, that the sampling programme is being actively managed and the systems are providing accurate data.

Albion Water, Independent Water Networks and Sutton and East Surrey Water had no sample result shortfalls for 2015.

In October 2015, the European Commission adopted and published replacement Annexes II and III to the Drinking Water Directive. These changes permit the option of moving away from statutory minimum frequencies of sampling for a set list of parameters, introducing a risk-based approach of determining which parameters to monitor and at what frequency. The change in frequency, removal or addition of parameters is intended to be based upon historical monitoring data from final and raw water as well as risk assessments, and will bring the advantage of companies not having to unnecessarily carry out analysis and to concentrate on controls that protect public health. The development of the Inspectorate's own risk-based methodology will help determine if the company application of these principles is being adopted. It will further seek to identify an understanding of company risk, based upon a changing dataset. The Inspectorate will communicate this changing strategy in future Chief Inspector reports.

As an additional change to the Drinking Water Directive, Annex III introduces new accepted standards for methods of analysis for microbiological parameters and changes defined performance characteristics from 'Trueness', 'Precision' and 'Limit of detection' to 'Uncertainty of Measurement'. The DWI has a programme in place for the transposition of these requirements scheduled for October 2017.

# Chapter 4: Drinking water quality results

Chapter 4:

- Provides details of tests failing to meet microbiological and chemical standards.
- Comments on the remedial action taken by the water company or the Inspectorate.

The key water quality results for the London and South East region are presented in two tables, one showing the results for microbiological parameters (Table 8), the other dealing with chemical and physical parameters (Table 12). The microbiological quality of water is discussed first. Companies report all the results of the tests on a monthly basis to the Inspectorate. A summary of the results of testing for all parameters and tables that describe the drinking water quality performance indices of each company can be found on the DWI website (www.dwi.defra.gov.uk).

## Microbiological quality

To protect public health, microbiological standards have to be met at each individual treatment works and service reservoir. The significance of the individual test results for each microbiological parameter at each location varies and a single positive result cannot be interpreted without other information. All companies are expected to follow best practice as set out in *The Microbiology of Drinking Water* published by the Standing Committee of Analysts (SCA) which can be found by visiting the website at https://www.gov.uk/government/publications/standing-committee-of-analysts-sca-blue-books.

**Table 8: Microbiological tests**
**The number of tests performed and the number of tests not meeting the standard**

| Parameter | Current standard | Total number of tests | Number of tests not meeting the standard | Additional information |
|---|---|---|---|---|
| **Water leaving water treatment works** | | | | |
| *E.coli* | 0/100ml | 49,153 | 0 | |
| Coliform bacteria | 0/100ml | 49,153 | 9 | SEW (4), TMS (5) |
| *Clostridium perfringens* | 0/100ml | 14,782 | 6 | SEW (1), SRN (1) SSE (1), TMS (3) |
| Turbidity[1] | 1NTU | 54,566 | 13 | AFW (5), SEW (2), SRN (2), TMS (4) |
| **Water leaving service reservoirs** | | | | |
| *E.coli* | 0/100ml | 51,572 | 6 | AFW (1), SEW (3), TMS (2) |
| Coliform bacteria | 0/100ml in 95% of tests at each reservoir | 51,572 | 43 | AFW (3), SEW (12), SRN (4), TMS (24)<br><br>All 1,021 reservoirs in the region met the 95% compliance rule |
| **Water sampled at consumers' taps** | | | | |
| *E.coli* | 0/100ml | 48,671 | 7 | SEW (3), SRN (1), TMS (3) |
| Enterococci | 0/100ml | 3,985 | 2 | TMS (2) |
| [1]Turbidity is a critical control parameter for water treatment and disinfection. | | | | |

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

In 2015, a total of 49,153 tests at works were carried out by all the companies across the region. *E.coli* was not detected in any samples from works, but was detected in six samples from reservoirs. By comparison, in 2014 there were seven detections from reservoirs in this region.

On detecting *E.coli*, companies are required to act promptly to protect public health. The immediate response when finding *E.coli* at a works is to sample again, and more widely, to confirm that water being received by consumers is safe. In 2015, all these additional tests gave satisfactory results in all cases and there were no subsequent *E.coli* failures or any wider events associated with these failures.

In July, *E.coli* was detected at Hale No 1 service reservoir in Hale, Hampshire, operated by South East Water. This was notified to the Inspectorate as an event (see *Annex 3*). The reservoir was removed from supply and inspected. No cause for the failure could be identified, although

the sampling facilities were identified for replacement. Following satisfactory sample results, the reservoir was returned to supply.

South East water also detected *E.coli* at the outlets of both cells of Meads service reservoir in Eastbourne, during August. The detections were notified to the Inspectorate as an event (see *Annex 3*). Both reservoirs are separate structures but hydraulically linked. In response the company removed one of the reservoirs from supply and an internal inspection identified ingress through the roof. The company were unable to remove both reservoirs from supply due to sufficiency concerns. Following repair, the other reservoir was inspected and no deficiencies were found. The contamination of the second reservoir is likely to have come from a hydraulic link between the two. An extensive sampling programme at supplying works and in the network did not detect any coliforms or *E.coli.* However, the company did find evidence of *Cryptosporidium* oocysts in the network from environmental ingress. The Inspectorate is concerned at the time taken to clean the reservoirs, which took six months to complete. The Inspectorate has put in place a legally-binding Notice to compel the company to take steps to ensure that any deterioration of water held in reservoirs is investigated in a timely and appropriate manner. The Notice details short- medium- and long-term measures to protect public health.

Also in August, *E.coli* was detected at Ashlands service reservoir in Chiddingfold, operated by Thames Water. This was notified to the Inspectorate as an event (see *Annex 3*). The failure was attributed to ingress and problems with the sampling facilities that have since been remedied and all subsequent results from this site have proved satisfactory.

*E.coli* was detected at Saltwood reservoir number 2 in Paddlesworth, operated by Affinity Water, in September. This was notified to the Inspectorate as an event (see *Annex 3*). Coliforms were previously detected in 2012 (no.1 cell) and 2014 (no.2 cell) from this reservoir. Inadequate sampling facilities were determined to be the most likely cause. These have since been upgraded.

Thames Water detected *E.coli* at Shalbourne B reservoir, in Bedwyn, which they notified to the Inspectorate as an event (see *Annex 3*) in December. The failure was attributed to poor sampling facilities on site, which have since been replaced.

None of these detections are repeats of 2014 *E.coli* detections.

**Table 9: Detection of *E.coli* and Enterococci at treatment works, service reservoirs and consumers' taps**

| Company | *E.coli* in water leaving treatment works | *E.coli* in water leaving service reservoirs | *E.coli* at consumers' taps | Enterococci at consumers' taps |
|---|---|---|---|---|
| Affinity Water | 0 – 5,977 | 1 – 7,451 | 0 – 8,859 | 0 – 601 |
| Albion Water | 0 – 0 | 0 – 0 | 0 – 12 | 0 – 4 |
| Independent Water Networks | 0 – 0 | 0 – 0 | 0 – 42 | 0 – 14 |
| Portsmouth Water | 0 – 2,008 | 0 – 1,548 | 0 – 1,793 | 0 – 116 |
| South East Water | 0 – 11,486 | 3 – 11,554 | 3 – 5,473 | 0 – 566 |
| Southern Water | 0 – 9,794 | 0 – 10,047 | 1 – 6,489 | 0 – 555 |
| SSE Water | 0 – 0 | 0 – 0 | 0 – 156 | 0 – 52 |
| Sutton and East Surrey Water | 0 – 2,094 | 0 – 1,664 | 0 – 1,728 | 0 – 160 |
| Thames Water | 0 – 17,794 | 2 – 19,308 | 3 – 24,119 | 2 – 1,917 |
| **Region overall** | **0 – 49,153** | **6 – 51,572** | **7 – 48,671** | **2 – 3,985** |

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

## Coliform bacteria at works

Testing for coliform bacteria gives reassurance that water entering supply was treated adequately to remove bacterial and viral pathogens. Repeated occurrences of coliform bacteria in samples from the same works in one year are thus of concern and require action to be taken. In 2015, this situation did not occur at any of the 428 works in the region.

In April, South East Water detected coliforms at Arlington treatment works near Eastbourne, Kingston treatment works near Derringstone, Cramptons Road treatment works in Sevenoaks and at Shellbrook works, in Ardlingly, West Sussex. In all cases, the company investigations did not attribute a cause. Instead the company, in response to the cluster of coliform bacteria detections, undertook an internal audit of the sampling and laboratory facilities. The audit identified minor deficiencies, but no cause for the coliform detections. However, Kingston treatment works has a legally-binding Notice in place to install microfiltration for improved turbidity compliance; Arlington, a site where *Cryptosporidium* was detected in 2012 and 2014, and at the time of detection, there was elevated turbidity (this site has UV disinfection installed and automatically runs to waste on

elevated turbidity); and Shellbrook had a coliform detection in 2013 where the company identified damage to the roof membrane from an inspection in 2012. The company has since completed work to allow this contact tank to be bypassed for repair.

Thames Water detected coliforms at Bishops Green works (near Greenham) in December. Coliforms were previously detected at this site in 2011, 2012, and 2014 where there were problems with the sample point, ingress into the pump chamber and in the contact tank. In 2014, the company identified the roof membrane required replacing, in 2015 pooling of water was found on the roof and the company has not as yet replaced the membrane. The Inspectorate took enforcement action in the form of a Regulation 28 Notice, to ensure the required work was completed to a satisfactory time scale.

Companies are reminded to continually update risk assessments responding to developing risks early and subsequently escalating information so that senior management are clear about the need to improve planned preventative maintenance and scheduled work as a priority.

Thames Water detected coliforms at four other works during 2015 where the company failed to identify a cause and where coliform failures have not occurred before or since. In one instance, Brantwood treatment works, in Croydon, Surrey, during April, the company were unable to remove the contact tank for four months for logistical supply reasons. Companies are expected to proactively plan network contingency to ensure water quality is not compromised in the effort to maintain supply.

The Inspectorate has noted that coliform bacteria were found in nine samples from treatment works in the London and South East region during the year. This information will be taken into account during the Inspectorate's risk-based programme of technical audit.

### *Clostridium perfringens*

This organism is a spore-forming bacterium that is exceptionally resistant to unfavourable conditions in the water environment, such as extremes of temperature and pH, and disinfection processes such as chlorination and ultraviolet light. It is a normal component of the intestinal flora of up to 35% of humans and other warm-blooded animals. These characteristics make it a useful indicator of either intermittent or historical faecal contamination of a groundwater source or the performance of a surface water filtration plant. The detection of any *Clostridium perfringens* should trigger an investigation by the water company.

In 2015, out of 14,782 samples taken in the region, six did not meet the specified value (1 SEW, 1 SRN, 1 SSE, 3 TMS).

Thames Water detected *Clostridium perfringens* at Kempton Park treatment works, in Hanworth, Middlesex, in January and February. The February detection was reported to the Inspectorate as an event (see *Annex 3*). The company were able to confirm suboptimal performance of the slow sand filtration process. In response the company implemented continuous monitoring for *Cryptosporidium* and have installed additional turbidity monitors throughout the works, in order to improve control and monitoring.

South East Water detected *Clostridium perfringens* at Bray treatment works, near Maidenhead during February. The works was taken out of supply. An inspection identified ingress through the roof to wall joints of the contact tank. The works remained out of supply until remediation was completed.

*Clostridium perfringens* were detected on three other occasions, (1 SRN, 1 SSE, 1 TMS) where companies were unable to determine a root cause. This information will be taken into account during the Inspectorate's risk-based programme of technical audit.

## Turbidity at works

Turbidity is a measure of how much light can pass through water and indicates the 'cloudiness' of water. Turbidity may be caused by either inorganic or organic particles suspended in the water. At a treatment works turbidity is an important critical control in relation to determining whether raw water has been adequately prepared for disinfection. Turbidity standards are set at two points in the water supply chain, at treatment works and at consumers' taps. The following discussion focuses on the results of samples taken at treatment works where the standard is 1NTU. The results of turbidity testing at consumer taps can be found in the *Maintaining water quality in distribution* section.

### Groundwater works

Where turbidity arises in groundwater it is usually as a consequence of disturbance of inert clay or chalk particles, but it can also arise from the oxidation and precipitation of certain inorganic substances like iron and manganese when air is introduced into the water by pumping. If the groundwater is under the influence of surface water then the cause of turbidity may be particles with adherent biological matter, which may contain pathogens.

Irrespective of origin, turbidity can interfere with the efficiency of disinfection. Turbidity is therefore a critical control measure that should be

validated at a groundwater works by continuous on-line monitoring of raw water with alarms set to ensure that action is taken to guarantee that turbidity is <1NTU at all times. Where a risk from *Cryptosporidium* has been identified in relation to a groundwater source and its catchment, then companies should be carrying out monitoring of the raw water and this should be taken into account when determining the nature of the risk and the sufficiency of the control measures.

Table 10 illustrates the potential groundwater *Cryptosporidium* risk in the region and compares it to the actual *Cryptosporidium* risk in 2015. Out of a total of 519 groundwater raw water abstraction points where data were submitted, 193 were subjected to risk-based monitoring for *Cryptosporidium* and the risk was verified by positive oocysts detections at only ten abstraction points serving the following treatment works Eastergate, Westergate (PRT); Elmer (SES), Hazards Green, Boxley Greensand (SEW); Carisbrooke (SRN); Dorney/Taplow, Haslemere, Speen, Watlington (TMS). One of these groundwater works exhibited a turbidity value higher that 1NTU in 2015 (Boxley Greensand – SEW). This works, near Maidstone, takes water from greensand beds which have high levels of naturally occurring dissolved metals (iron and manganese) which can give rise to turbidity when flows change and were not associated with an increased *Cryptosporidium* risk. The company's Regulation 28 risk assessment categorises the risk from *Cryptosporidium* as being controlled by treatment and addressed by pressure filters. There have been no further detections since April.

**Table 10: *Cryptosporidium* risk assessment and monitoring of groundwater abstraction points in the London and South East region in 2015**

| Company | Number of raw water monitoring points where data submitted | Number of abstraction points where raw water is monitored for *Cryptosporidium* | Number of abstraction points where risk of *Cryptosporidium* was verified* by the detection of oocysts |
|---|---|---|---|
| Affinity Water | 191 | 3 | 0 |
| Portsmouth Water | 17 | 16 | 2 |
| South East Water | 71 | 73 | 2 |
| Southern Water | 94 | 86 | 1 |
| Sutton and East Surrey Water | 43 | 1 | 1 |
| Thames Water | 103 | 14 | 4 |
| **Regional total** | **519** | **193** | **10** |
| **Industry total** | **1,601** | **420** | **31** |

*verified means either positive detection of *Cryptosporidium* oocysts or data quality insufficient. Unclear data is assumed to be positive.

Affinity Water had five turbidity failures at groundwater works during 2015. These occurred at Friars Wash (near Harpenden), School Lane (near Welwyn Garden City), Blackford, and Northmoor (both near Harefield), and Piccotts End (near Hemel Hempstead). In the cases of Friars Wash and School Lane, the company were unable to establish a root cause for the failures. All other cases were reported to the Inspectorate as water quality events (see *Annex 3*) and were determined to be caused by flow changes re-suspending settled deposits.

Southern Water had two failures of the turbidity standard at groundwater treatment works during 2015. A failure from Wingham works, (near Canterbury) was reported to the Inspectorate as a water quality event (see *Annex 3*) and attributed to the sample having been taken post-shutdown of the site. The company has since cleaned the contact tank to remove settled deposits. Another water quality event was notified to the Inspectorate when a sample taken from Mile Oak (near Hove) failed the turbidity standard (see *Annex 3*). The failure was determined to be caused by a failure of the analytical method and considered as part of a wider investigation into turbidity analytical issues by the company's analytical provider.

In 2015 Thames Water had three failures at three groundwater works, Darenth near Dartford and Sandridge near Sevenoaks which were reported as events (see *Annex 3*), and Ashton Keynes near Cirencester all of which were associated with sediments of deposits in the main or tanks. Companies are reminded to ensure risk assessments identify where ongoing maintenance work is required at sites to minimise erroneous readings.

Portsmouth Water detected *Cryptosporidium* at both Eastergate and Westergate treatment works in November. The company removed the works from supply during the investigation, as a precaution. As reported in *Drinking water 2014* the company has committed to install ultraviolet (UV) treatment for *Cryptosporidium*, which is on target to be completed by August 2016.

In December, Southern Water were contacted by a health protection practitioner, to notify of an increase of cryptosporidiosis in the local population. The company carried out investigative sampling, reviewed raw water *Cryptosporidium* levels and investigated the upstream works. The review concluded that no link between the water supply and the cryptosporidiosis could be identified. (This was reported as an event to the Inspectorate, (see *Annex 3*).

Thames Water detected *Cryptosporidium* at Speen treatment works in Newbury (see *Annex 3*), a repeat of a similar failure in 2013. The company identified a deterioration in one borehole and while there is a membrane which is an effective barrier to *Cryptosporidium,* the Inspectorate undertook a technical site audit (see *Chapter 6: Technical audits activity*). A Notice was served to ensure locally identified improvements were completed, as well as a review of the *Cryptosporidium* monitoring regime at the site. The company has completed work as part of the Notice to improve the integrity of the two on-site boreholes and this has mitigated risks to a shallow well on site and removed the potential pathway for contamination to enter the water supply. The company completed all works on site as detailed by the Notice by early May 2016.

In June, South East Water completed the demonstration of benefits phase for a scheme to install UV treatment for *Cryptosporidium* at Greywell treatment works. The scheme will improve the safety of water supplied to 98,000 customers in Greywell, Itchel, Swainshill and Whitedown.

**Surface water works**

Turbidity in surface water is related to sediment and biological matter. Following rainfall the flow and hence the turbidity in rivers and streams can rise very quickly and values in excess of 100NTU are not uncommon. Surface water may be abstracted into reservoirs where storage of the

water allows particles to settle out; however, some of these reservoirs do not have a sufficiently long retention time for settlement of pathogens such as *Cryptosporidium*. All surface waters are likely to contain some faecal matter originating from animals, birds and sewage works discharges. For this reason, surface water must be prepared for disinfection (clarification and filtration). The Bouchier report recommended continuous turbidity monitoring after filtration at surface water works against a performance target for each individual filter of <1NTU. Since turbidity can interfere with the efficiency of disinfection, it is a critical control measure that should be validated by continuous on-line monitoring of filtered water with alarms set to make sure that action is taken to guarantee that turbidity in water entering the final disinfection stage is <1NTU at all times. Where a risk from *Cryptosporidium* has been identified in the catchment upstream of the abstraction point, then companies should be carrying out monitoring of the raw water and this should be taken into account when determining the nature of the risk and the sufficiency of the control measures.

Table 11 illustrates the potential surface water *Cryptosporidium* risk in the region and compares it to the actual *Cryptosporidium* risk in 2015. Out of a total of 62 surface water raw water abstraction points where data were submitted, 47 were subjected to risk-based monitoring for *Cryptosporidium* and the risk was verified by positive oocysts detections at 37 abstraction points serving the following treatment works: Walton Mains (AFW); Itchen (PRT); Bough Beech (SES); Bewl Bridge, Bray, Hazards Green, Barcombe Mills, Crowhurst Bridge (SEW); Burham, Hardham, Hardham High, Otterbourne, Brede, Sandown, Testwood, Broadfield Cowes, Weirwood Forest Row (SRN); Ashford Common, Chingford South, Coppermills, Farmoor, Hampton, Hornsey, Kempton Park, Fobney, Shalford, Swinford, Walton (TMS).

One of these surface water works exhibited a turbidity value higher than 1NTU in 2015 (Walton – TMS).

**Table 11: *Cryptosporidium* risk assessment and monitoring of surface water abstraction points in the London and South East region in 2015**

| Company | Number of raw water monitoring points where data submitted | Number of abstraction points where raw water is monitored for *Cryptosporidium* | Number of abstraction points where risk of *Cryptosporidium* was verified* by the detection of oocysts |
|---|---|---|---|
| Affinity Water | 4 | 2 | 1 |
| Portsmouth Water | 4 | 2 | 1 |
| South East Water | 10 | 10 | 5 |
| Southern Water | 18 | 15 | 12 |
| Sutton and East Surrey Water | 1 | 1 | 1 |
| Thames Water | 25 | 17 | 17 |
| **Regional total** | **62** | **47** | **37** |
| **Industry total** | **428** | **274** | **208** |

*verified means either positive detection of *Cryptosporidium* oocysts or data quality insufficient. Unclear data is assumed to be positive.

Following the detection of elevated turbidity at Walton treatment works in March, Thames Water removed the works from supply while investigations were carried out. The company determined that sediment in the high-lift pump manifolds had been disturbed by a change in flows. The company carried out flushing of the manifold and also installed additional turbidity monitors to enable closer monitoring of this area of the works.

Thames Water notified another event to the Inspectorate in April, after a *Cryptosporidium* detection at Kempton Park treatment works, which followed *Clostridia* detections at the same works (see *Chapter 4.1: Microbiologoical quality*). The event notification was accompanied by related event notifications from Affinity Water, Independent Water Networks and SSE Water who all take bulk supplies from this treatment works.

In March, South East Water completed the installation of a scheme to install UV treatment for *Cryptosporidium* at Hazards Green treatment works. The scheme will improve the safety of water supplied to 59,000 customers in Standard Hill and Powdermill.

## Coliform bacteria at service reservoirs

Testing for coliform bacteria gives reassurance that the quality of water held at these strategic points in the distribution system is adequately maintained. The national standard requires that at least 95% of no less than 50 samples collected from each service reservoir throughout one year are free from all coliform bacteria. In 2015, all service reservoirs (including water towers) in the region met the standard.

Affinity Water found coliform bacteria at Sibleys Tower near Elsenham in February and in High Street Green Tower in Hemel Hempstead in September. The company considered that stagnation of the stored water was occurring due to insufficient turnover. However the turnover was good and the company were unable to find a cause for the coliform detection. The company has implemented new pumping regimes to improve the turnover of water at both towers.

A coliform failure attributed by the company as caused by sampling during the rain and being under an overhanging tree, occurred in September at Affinity's Saltwood reservoir, near Hythe. This site was reported in *Drinking water 2014* as having failed twice previously and an inspection in 2013 led to repairs to points of potential ingress.

Ingress was found to be the cause of coliform detections at South East Water's Selsfield reservoir (near West Hoathley) in September and Cottage Hill reservoir (near Rotherfield) in October. Both assets were removed from supply for the duration of the inspection and remedial work.

South East Water detected coliform bacteria at Friston reservoir (in East Dean) in January and again in August. In response to the first failure, the company brought forward the planned inspection and cleaning of the reservoir. No source for the contamination could be found for either failure, although the sampling facilities were not to the internal standard now specified by the company. The sampling facilities were upgraded in September. The company were unable to identify root causes for coliform detections at The Mount, Exedown 1, Kemsing and Wraik Hill 2 reservoirs. This information will be taken into account during the Inspectorate's risk-based programme of technical audit.

The Inspectorate noted that South East Water had a high incidence of coliform detections during the year. The company were issued with an advice letter and asked to provide details on actions being taken to reduce detections.

Sampling facilities were also identified as the most likely cause when coliform bacteria were detected at Southern Water's Tenants Hill reservoir (near Worthing) in September and again in October. The initial investigation into the first detection failed to identify a definitive cause.

Following the second detection both cells were removed from supply to allow inspection and inundation testing. The sampling facilities were concluded to be the most likely cause and were upgraded. The company also implicated the sampling facilities in the coliform failures at Sarum Road reservoir (in Winchester).

Companies are reminded that sampling facilities must be suitable for use at all times including during inclement weather and require appropriate design and, if necessary, replacement as part of ongoing maintenance.

Thames Water have attributed coliform detections either entirely or in part to the sampling facilities at Blackdown B, Shalbourne B, Watlington A, High Beech Tank, Chapman Lane B, Honor Oak 4, Sewardstone Green A, Chessington B, Barnes, Fortis Green B, Over Norton B and Barrow Hill A and B reservoirs during 2015. In the case of Blackdown reservoir, this was the fourth failure and the third for Over Norton since 2012. Sewardstone Green A and Chessington B have all failed once since 2013. Thames Water was criticised in 2013 and 2014 by the Inspectorate for failing to ensure that the sampling facilities at all of its sites were fit for purposes required by the Regulations.

After a coliform failure at Shotover reservoir in Oxford, Thames Water carried out repairs on the sample line. After a further failure in August the company carried out an inspection and found ingress points highlighting the need for thorough proactive inspections.

Addington A reservoir (in Croydon), operated by Thames Water failed the coliform standard twice in August. Investigative samples identified the same type of coliforms at the inlet of the reservoir and at an upstream reservoir at West Wickham where ingress was also found. In response, chlorine dosing was increased at the supplying works.

The Inspectorate expects the companies to develop evidence-based investigations to ensure root causes are identified and risks with mitigations appropriately assigned.

The Inspectorate has noted that coliform bacteria were found in 35 samples from service reservoirs in the London and South East region during the year and this information will be taken into account during the Inspectorate's risk-based programme of technical audit.

## *E.coli* and Enterococci at consumers' taps

A total of 48,671 consumers' taps were tested in 2015 for *E.coli* and seven were positive (3 SEW, 1 SRN, 3 TMS). There was no indication, from

information gathered by the three water companies, of a faecal contamination event affecting other properties in these zones.

Like *E.coli*, the presence of Enterococci is indicative of faecal contamination and neither bacterium should be found in any sample. In 2015, the companies carried out 3,985 tests for Enterococci at consumers' taps. Only two samples, each in a different zone (2 TMS) were positive. There was no indication, from information gathered by the water company, of a faecal contamination event affecting other properties in these zones.

South East Water detected *E.coli* in samples collected from customer properties in January, February and April. In all cases, investigation determined there were no issues with upstream assets or in the wider distribution network and the problem was related to the domestic plumbing and advice was provided to the consumers.

In September, Southern Water detected *E.coli* at a customer property which was reported to the Inspectorate as an event (see *Annex 3*). A Water Fittings inspection carried out at the property identified the likely source to be a redundant dishwasher feed pipe. A plumber attended the property and rectified the faults. All subsequent sampling was satisfactory.

Water fittings defects were found by Thames Water during investigations of *E.coli* failures in three consumer tap samples in Newbury and Kintbury, Culham and Wandsworth zones in May, November and December respectively. The faults were rectified and appropriate advice was given to the householders about maintaining good tap hygiene.

Samples taken by Thames Water in February and December contained Enterococci. The detection in the February sample was reported to the Inspectorate as an event (see *Annex 3*), with both Enterococci and coliforms present and was followed by a restriction of use notice. The company investigation implicated the tap as the source of contamination.

## Chemical quality

The drinking water regulations set out the minimum testing requirements for all chemical and physical parameters. A full summary of the results of testing by each company, including the results for indicator parameters, is provided on the DWI website.

The following text and Table 12 set out the results for those parameters where there has been a failure to meet a European or national standard (mandatory quality standards) and any other parameter of interest. In addition, at the request of local authorities, the results of testing for fluoride, iron, lead, manganese, nitrate, nitrite, pesticides and radioactivity

are given. The Inspectorate has also included instances where residual chlorine results were reported at a level that may be considered undesirable on grounds of consumer acceptability (2mg/l).

**Table 12: Chemical and physical parameters**
**The number of tests performed and the number of tests not meeting the standard or specification**

| Parameter | Current standard or specified concentration[1] | Total number of tests | Number of tests not meeting the standard | Additional information |
|---|---|---|---|---|
| Aesthetic parameters | | | | |
| – colour | 20mg/l Pt/Co scale | 13,595 | 1 | TMS (1) |
| – odour | | 10,224 | 10 | PRT (1), SEW (2), SRN (3), TMS (4) |
| – taste | No abnormal change | 10,327 | 7 | AFW (1), PRT (1), SEW (1), SRN (3), TMS (1) |
| Aluminium | 200µg/l | 12,820 | 5 | AFW (3), TMS (2) |
| Arsenic | 10µg/l | 3,992 | 1 | SEW (1) |
| Chlorine – residual (free)[2] | 2mg/l | 13,799 | 2 | SEW (1), SRN (1) |
| Chlorine – residual (total)[2] | 2mg/l | 48,716 | 12 | SEW (11), SRN (1) |
| Fluoride | 1.5mg/l | 3,869 | 0 | |
| Iron | 200µg/l | 14,259 | 27 | SEW (13), SRN (3), TMS (11) |
| Lead | 10µg/l | 3,987 | 23 | AFW (2), PRT (2), SES (2), SEW (1), SRN (2), TMS (14) |
| Manganese | 50µg/l | 13,307 | 1 | SEW (1) |
| Nickel | 20µg/l | 3,989 | 10 | SES (1), SEW (1), TMS (8) |
| Nitrate | 50mg/l | 9,758 | 0 | |
| Nitrite | 0.5mg/l | 9,741 | 0 | |
| Pesticides – total | 0.5µg/l | 2,750 | 0 | |
| Pesticide – individual[3] | 0.1µg/l | 85,241 | 19 | Metaldehyde AFW (4), SEW (5), SRN (5), SSE (1), TMS (4) |

| Parameter | Current standard or specified concentration[1] | Total number of tests | Number of tests not meeting the standard | Additional information |
|---|---|---|---|---|
| Radioactivity | | | | |
| Gross alpha[4] | 0.1Bq/l | 971 | 1 | SRN (1) |
| Gross beta[4] | 1.0Bq/l | 970 | 0 | |
| Total indicative dose | 0.1mSv/year | 0 | 0 | |
| Tritium | 100Bq/l | 782 | 0 | |
| Turbidity (at consumers' taps) | 4NTU | 15,171 | 6 | AFW (1), SEW (1), TMS (4) |

Notes:
[1]For comparison, 1mg/l is one part in a million, 1µg/l is one part in a thousand million.
[2]The value of 2mg/l at the consumer's tap is a screening value set by the Inspectorate.
[3]A further 4,553 tests were done for aldrin, dieldrin, heptachlor, heptachlor epoxide, all of which met the relevant standard of 0.03µg/l.
[4]These are screening values to trigger action. The standard is 'Total indicative dose'.

## Aesthetic parameters

### Aesthetic parameters: Taste and odour

Consumers expect their drinking water to be clear and bright in appearance and free from discernible taste or odour. In recognition of this the Regulations stipulate national standards for colour, odour and taste. Companies are required to investigate the cause of any adverse result.

In 2015, a total of 15 samples from consumers' taps in the region exhibited a positive taste or odour.

The positive detections of taste and odour are summarised below in relation to their nature and cause as determined by the investigations carried out by the companies. From this information it can be seen that many were confined to a single property and did not reflect a wider problem in the water supply zone.

Pencil: 1 (TMS): this descriptor is specific to a substance associated with unapproved plastic pipe; the remedy is to advise the householder to replace the pipe with approved medium density polyethylene pipe. When Thames Water investigated a pencil taste/odour in a consumer's tap sample collected in June from a property in the Streatley and Basildon zone, they found a long length of black plastic pipe commonly associated with a pencil odour and advised the householder appropriately.

Tastes described as Strong/Sweet/Soapy: 2 (1 AFW, 1 SRN): these descriptors relate to samples where the tap water was artificially softened; the remedy is to advise the householder to draw water for drinking and

cooking from the tap connected directly to the mains (or to fit a mains fed tap if one does not exist). Both Southern Water in Otterbourne, (August) and Affinity Water in Edgware, (October) identified a sweet taste where a softener served the whole property. It is inadvisable for taps used in food and drink preparation to be fed by a softener. In both cases, advice was provided to the consumers.

Bitter/Metallic/Astringent: 1 (SRN) this descriptor relates to situations where plumbing metals, such as copper, iron or galvanised pipes are present; the remedy is to advise the householder on necessary changes to the design and maintenance of the plumbing system. When Southern Water detected a bitter taste to the water at a consumer's property in Brede zone in March, a water fitting inspection identified that neither the washing machine or the dishwasher were fitted with non-return valves and the hot water combined with the drinking water at point of use via a blending valve. Advice was provided to the customer.

Chemical/Medicinal: 1 (TMS) this descriptor often described as a TCP taste can be caused by the reaction between chlorine in the supply and plastic or rubber components found in household appliances. More unusually these can be associated with industrial chemicals. When Thames Water investigated a very strong solvent/salt/chemical/seaweed odour, (dilution 10), from a public house in Stepney zone in July, they found cleaning chemicals near the sink, high levels of zinc in the sample and coliforms on the tap. The company required the landlady to remedy problems with the plumbing and notified the local authority.

Oil/Solvent: 1 (TMS) these descriptors relate to situations where there has been a spillage of central heating oil, petrol or diesel on the property and this has permeated through the plastic water supply pipe, as occurred in this case; the remedy is to advise the householder on the need to replace the affected pipe and to safeguard against future spills. This detection in the Childrey and Wantage West zone in June and the subsequent restriction of use notice were reported to the Inspectorate as an event (see *Annex 3*).

Earthy/Musty: 3 (1 SEW, 2 SRN) these descriptors relate to situations where harmless, but objectionable, substances are produced by the growth of algae in raw water storage reservoirs or the growth of fungi in poorly designed plumbing systems; the remedy is improved treatment/reservoir management by the company or to advise the householder on necessary changes to the design and maintenance of the plumbing system. One sample, taken by Southern Water in Fairlight zone in October exhibited an earthy/musty taste and odour after a rise in algae in Darwell reservoir. This zone was reported in *Drinking water 2012* after which a Notice was

put in place to dose powdered activated carbon. This is the first detection since then and is discussed in more detail under the Geosmin section.

Other tastes or odours: Portsmouth Water did not find a cause for a mild stale/chalky taste and odour in Portsmouth South zone in September, however, significant plumbing work was taking place at the time which required the water to be turned off. Companies should ensure that samplers collect representative samples.

When South East Water detected a sulphide odour in a sample taken from a customer property in the Canterbury zone in September, the investigation failed to identify a root cause. Sulphide odour can be associated with the use of sodium thiosulphate as a dechlorinating agent in the taste and odour test method. Companies are expected to follow the prescribed analytical method and where a sulphide taste or odour is detected, the use of an alternative dechlorinating agent such as ascorbic acid should be considered in order to discount a laboratory artefact as the cause.

South East Water detected two odours and one taste failure, (Sulphide, Musty and Bitter) in 2015. In Surrey Hills zone in June, the company failed to re-enter the property or report this as required after the initial investigation of the bitter taste. An investigation is not considered complete when a company fails to collect another sample from the property. This was treated as an event, (See *Annex 3*).

Southern Water were also unable to find a cause for an odour described as peardrop in the Whitchurch supply zone in February, but considered that there was poor turnover as the property was located at the end of the main. The company carried out flushing of the main as a precaution, and the consumer was provided with advice to flush the tap prior to use.

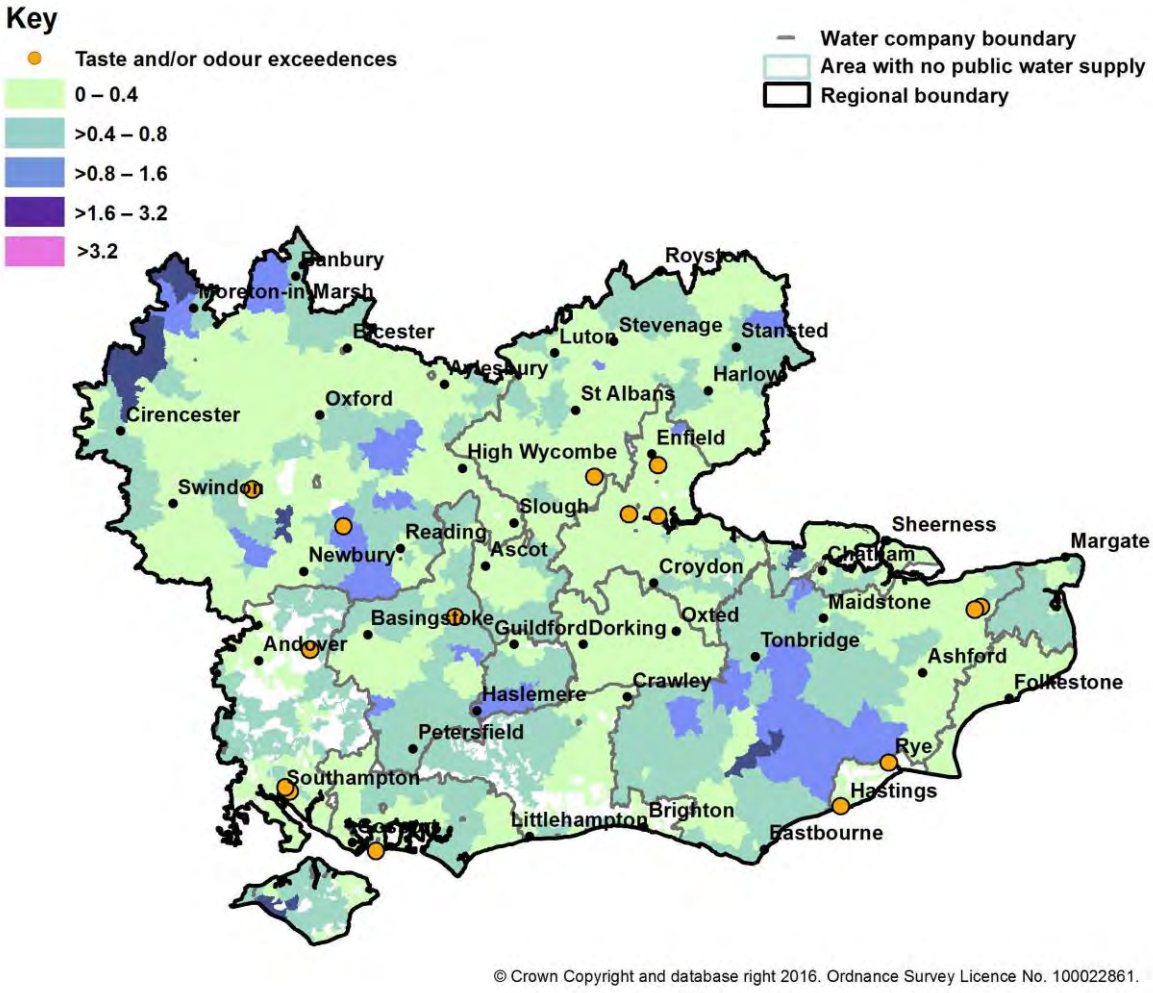
## Consumer contacts to water companies for taste and odour

When consumers experience a persistent taste or odour, they may contact their water company to report the problem. Records of these contacts in each zone are recorded by water companies and passed to the Inspectorate annually. Figure 13 shows the zone by zone contact rate per 1,000 population across the London and South East region.

The industry rate for taste and odour contacts is 0.38 per 1,000 population. In Figure 13 seven zones in the London and South East region exceeded 1.6 contacts per 1,000 (1 SEW, 2 SRN, 1 SSE, 3 TMS). Thames Water has seen an improvement in contact rates from Frampton Mansell and Sapperton zone and from Brimpsfield zone, which both had contact rates >4.00 per 1,000 population in 2014. In 2015, the highest taste and odour contact rate (2.5 per 1,000 population) was from Brightwalton

(TMS), which is associated with a high rate of chlorine contacts. The SSE zones (New South Quarter) all had a single contact but due to low population in the zone the resulting contact rate per thousand was above the industry figure.

**Figure 13: Rate of taste and odour contacts per 1,000 people**




Southern Water has two legally-binding AMP6 programmes of work agreed with the Inspectorate, with Notices put in place in 2014, to install granular activated carbon (GAC) treatment at Beauport Hastings treatment works and Brede treatment works, both in East Sussex. The GAC treatment is required to remove pesticides, and also to remove naturally occurring compounds present in the raw waters, such as geosmin and methylisoborneol, which can impart earthy or musty tastes and odours to the drinking water. The planning, design and procurement stages of these schemes have been completed and construction work is due to start in the spring of 2016.

### Aesthetic parameters: Colour

Colour occurs naturally in upland water sources. It is removed by conventional water treatment, but can arise also as a result of problems within building water systems. The national standard is 20mg/l on the Platinum/Cobalt (Pt/Co) scale.

In the region in 2015, out of 13,595 tests, one failed the standard for colour (1 TMS).

In July a sample failed the colour standard in Dartford South zone, Greater London operated by Thames Water. The company investigation identified the original sample had been taken from a tap supplied by a water softener installed at the property. Satisfactory resamples were taken from the tap supplied by non-softened water and the consumer advised to only drink water from this tap. Companies are reminded that for a representative sample to be taken it must come from a non-softened tap.

## Aluminium

Aluminium can occur naturally in some water sources. Also, aluminium-based water treatment chemicals may be used at surface water works to aid the process of filtration.

In 2015, a total of 12,820 samples were tested for aluminium in the London and South East region. Portsmouth Water, South East Water, Southern Water, Sutton and East Surrey Water, SSE Water and Independent Water Networks achieved 100% compliance with the aluminium standard. Just five tests exceeded the standard (3 AFW, 2 TMS) and none of these were found to be related to process control at the works.

The three failures attributed to Affinity Water were in Hillingdon/Hayes and Uxbridge zones in March and June respectively all of which are supplied by Iver works. The failures in Hillingdon/Hayes were also associated with iron and turbidity, characteristic of disturbance of mains deposits. The Inspectorate considers that the presence of aluminium in the network should be taken into account in companies own risk assessments to put in place and secure the adequacy of water treatment and mains cleaning.

In September a consumer's tap sample collected from a property in the Bicester zone by Thames Water contained 1,841µg/l of aluminium, 794µg/l of iron and exhibited a turbidity of 11.1NTU. The sample was collected at a time when a nearby main had burst causing a rapid change of flow that disturbed historic mains deposits in the local network. In November, Aluminium was also detected at a level of 219µg/l at a property in the Charlton zone, however, there were no wider network issues at the time and all resamples proved clear.

## Arsenic

Arsenic only occurs in drinking water where natural minerals containing arsenic are present in the local bedrock. In England this is not a frequent occurrence. Where companies have identified a potential risk, either water treatment or blending arrangements to reduce arsenic have been installed.

In 2015, a total of 3,992 tests were carried out for arsenic across the region and all but one met the standard (10µg/l), which is the same as the new tighter World Health Organisation (WHO) provisional guideline set because of health concerns arising from much higher exposures (greater than 50µg/l) in other parts of the world.

A level of 13.1µg/l arsenic was reported in a sample from a consumer's tap in the Tilford water supply zone. Arising from a naturally occurring mineral source at Tilford Meads works, South East Water blend and treat water from three boreholes to maintain levels. The company investigation found that the detection was most likely an arsenic spike, caused by the startup of a particular borehole. The company are investing in their Tilford Meads treatment works, in order to improve arsenic removal by 2020 benefiting 103,000 consumers. The current treatment uses aeration and pressure filters, and blending is in place to minimise arsenic concentration in supply. The company has assessed the risk and has shown that current treatment and monitoring of processes adequately mitigates the risk of a recurrence.

## Chlorine

Chlorine is widely used as bleach and has a long history of use in circumstances where the maintenance of good hygiene is essential, for example, food preparation, swimming pools and water supplies. In the UK levels of residual chlorine in tap water are very low, typically 0.1 – 0.5mg/l and rarely exceeds 1.0mg/l in water drawn from taps in premises. This compares very favourably to the WHO health-related guide value of 5mg/l.

Water companies are required to measure residual chlorine whenever samples are collected for microbiological analysis. Any abnormal change in the level of residual chlorine in a particular supply must be investigated. The Inspectorate checks the action taken by companies in relation to any chlorine result above 2mg/l at treatment works, at service reservoirs or in zones. Across the region in 2015, there were 12 (SEW 11, SRN 1) of these abnormal results. The causes and actions taken by the companies are described below.

In January and September, South East Water recorded maximum levels of total chlorine of 2.18 and 2.08mg/l respectively at Bray works, near Maidenhead. Subject to a similar occurrence in 2014 at this works, the

company reduced marginally the relatively high set point for chlorine to 1.8mg/l from 2.0mg/l in order to maintain residual chlorine throughout the long distribution system supplied by the works. Water from Bray works is not directly supplied to customers and is blended with water from Bray Gravels and Egham works at Surrey Hills reservoir. In September, the company further reduced the set point to 1.45mg/l to take into account the variability of about 0.5mg/l in this system in an attempt to reduce the likelihood of exceeding 2.0mg/l. Consumers are often sensitive to small changes in their water supply and while in this instance there were no customer contacts following the two occurrences, the Inspectorate will continue to monitor consumer contact data which will be taken into account during the assessment of company risk.

As occurred in 2014, in 2015 chlorine was measured at greater than 2.0mg/l in the water leaving South East Water's Ford treatment works on five occasions, (July, August, October, November and December), ranging from 2.03mg/l to 2.45mg/l. Some types of water demand a higher level of chlorine before it becomes effective as a disinfectant. In this case water from the works is supplied directly to Ford service reservoir, with no customers fed directly in between and chlorine levels leaving the reservoir did not exceeded 2mg/l during 2015.

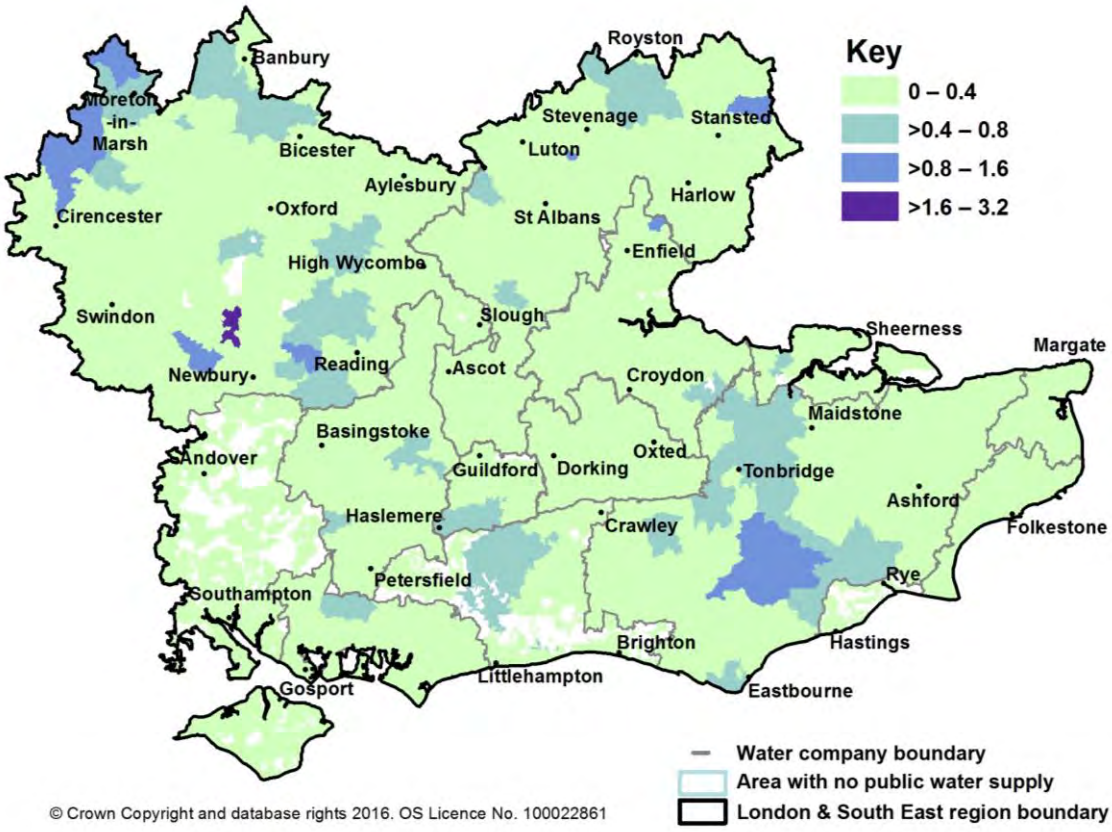
In February, South East Water recorded a maximum level of total chlorine of 2.02mg/l at Bewl Bridge works. There is a discrepancy between the sample result and the on-site monitors. There were no reported chlorine contacts from consumers during this period of time. Companies are reminded that monitoring equipment designed to control critical treatment processes must at all times be verified to ensure accurate readings are available to be taken into account during operational practices and risk assessments.

Southern Water detected a maximum total chlorine result of 2.61mg/l, with a free chlorine concentration of 2.48mg/l at Rownhams works, near Southampton in December. These detections occurred during an event where a large works nearby (Testwood) suffered a power outage (see *Annex 3*). Residual chlorine was increased and sodium bisulphite dosing, which is used to reduce chlorine, was turned off to aid disinfection in the system in response to an increase in turbidity on restarting the works. Companies are reminded that increasing chlorine is not a mitigation in response to turbidity. Appropriate measures should be in place for this as a separate risk.

In addition to investigating any abnormal change in the level of residual chlorine, water companies must also investigate and address any situation where the level of residual chlorine is not acceptable to consumers. Companies therefore have in place protocols for receiving, assessing and

recording contacts from consumers reporting chlorine-related tastes or odours in tap water. Figure 14 maps the chlorine taste and odour consumer contact rate per 1,000 population for all zones in the London and South East region during 2015.

**Figure 14: Map illustrating rates of chlorine-related consumer contacts to water companies per 1,000 population**




From Figure 14 it can be seen that consumers in Thames Water's Brightwalton zone near Newbury exhibit a relatively high rate of reporting chlorine-related tastes and odours (>1.6 per 1,000 population) and this is well in excess of the industry average of 0.2 per 1,000 population. This information will be taken into account during the Inspectorate's forward programme of technical audit in the region.

## Fluoride

Traces of fluoride occur naturally in many water sources, particularly in groundwaters. Consumers can obtain specific information on the level of fluoride in the drinking water supply to their home or workplace from their water company. Fluoride is not removed by conventional water treatment. In 2015, all 3,869 tests for fluoride taken across the region met the regulatory standard (1.5mg/l).

On 1 April 2013, the Secretary of State for Health became responsible for existing fluoridation schemes via Public Health England, and local authorities became responsible for proposing and carrying out consultation on new schemes and extensions to existing schemes.

There are no fluoridation schemes in the London and South East region.

## Geosmin

Geosmin is a natural substance produced by the seasonal growth of algae, in slow moving surface water. It gives rise to a characteristic 'earthy' or 'musty' taste and odour discernible to consumers.

In 2015, Southern Water investigated a detection of a taste and odour in a sample taken in Fairlight zone (Hastings). The area is supplied from Beauport works, which has powdered activated carbon (PAC) installed. There was a rise in geosmin levels in Darwell reservoir where algae were identified as the source. This works has a Regulation 28(4) Notice in place, which will result in the installation of a granular activated carbon (GAC) treatment stage and additionally a UV disinfection stage. The company informed the Inspectorate of potential delays to the programme due to delays in outlining the planning, design and procurement stage for the GAC filters. However, the company has since confirmed that the overall delivery will be unaffected with all measures delivered by 2018, benefiting 110,000 customers.

## Lead

Lead in tap water typically arises in premises where the pipes and brass fittings have not been refurbished since the 1970s when the use of lead in contact with drinking water was banned. The other reason why lead may be found in tap water is the illegal use of lead-based solder for making joints on copper pipes.

In addition to the ban, the standard has been progressively tightened from 50µg/l in 1990 to 25µg/l in 2004 and since the end of 2013 has stood at 10µg/l. During this time water companies have assessed the risk of lead being present in tap water at the point of use and, where necessary, installed additional water treatment (generally phosphate dosing or pH correction) to minimise the propensity of lead to leach out of pipes and fittings within consumers' premises.

Since the only permanent long-term solution to the issue of lead in tap water is the removal of lead pipes and fittings, water companies have been engaged in a range of other activities to identify where specific action

plans for lead removal are required, for example, in social housing or schools. If a lead failure occurs in a public building then water companies and local authorities are able to use their powers to require the owner to remedy the problem; however, in relation to private property, water companies and local authorities can only give advice, they cannot compel homeowners to replace lead pipes or fittings.

Figure 15 shows the position of the London and South East region in relation to the industry as a whole. For the last three years, the


In 2015, companies in the London and South East region reported 23 (2 AFW, 2 PRT, 2 SES, 1 SEW, 2 SRN, 14 TMS) failures of the standard of 10µg/l out of a total of 3,987 tests.

All but four of these failures occurred in zones where the water is treated with phosphate to reduce the risk from lead and the circumstances of the other four failures (1 AFW, 1 PRT, 1 SEW, 1 TMS) are described below.

Affinity Water carried out a Water Fittings inspection in response to a lead detection of 267µg/l at a consumer's tap in Stevenage, in October. The presence of lead solder was identified.

In November, Portsmouth Water detected 11.1µg/l lead in a sample taken from a consumer's tap in Bognor. A fittings inspection did not reveal any lead pipework, although lead solder was suspected.

In both cases the customers were provided with advice to flush the tap before drinking. These examples illustrate the continuing problem with

lead solder used in domestic plumbing, which means companies must remain vigilant when investigating failures in systems which otherwise appear lead free.

Thames Water detected lead at a consumer's property in Twyford, Wargrave and Sonning zone, in May. The communication pipe has been scheduled for replacement, with advice provided to flush the water in the meantime.

Lead above 10µg/l was found in two samples collected from public buildings (1 SEW, 1 TMS). When South East Water detected lead at a concentration of 20µg/l in the Grovelands zone, which is not phosphate dosed, in March, the building owners were required to carry out pipe replacement work within the building. A sample taken after the work was completed still failed the standard (10.1µg/l). Further work was then undertaken by the building owners and satisfactory sample results followed this.

Thames Water detected lead at 17.2µg/l in a sample taken in June, from a public building in the Battersea South zone which is phosphate dosed. The company issued advice to the building owners to replace lead pipework within the building and to flush the tap before using for drinking in the meantime. The investigation failed to determine a definitive cause for the failure, as resamples, including stagnation samples from the building detected lead below the standard. Companies are reminded that they are under a duty to provide clear advice enabling consumers to take action to safeguard themselves and, in the case of public buildings, companies must require and verify remediation.

## Nickel

Nickel may be present in coatings on modern tap fittings. In 2015, a total of 3,989 tests were carried out for nickel and all but 10 (1 SES, 1 SEW, 8 TMS) met the standard (20µg/l).

In all 10 instances, the company investigations determined the most likely cause to be the consumer's tap. Customers were provided with advice either to replace the tap fittings, or to flush the water before use for drinking.

Thames Water detected elevated nickel together with copper and lead in a public building (an adult education centre) in their Stepney zone. The company carried out a water fittings inspection as part of the investigation and required the owner to remedy the issues with the plumbing and install backflow prevention. An arrangement was made with the company for the communication pipe to be replaced, due to the lead detection.

## Nitrate and nitrite

Nitrate occurs naturally in all source waters due to the decay of vegetable material in soil. Nitrogenous fertilisers used on arable farmland are a significant source of nitrate in groundwater. Rainfall washes nitrate from the soil into lakes, rivers and streams. Nitrate levels can be reduced by water treatment or by blending with another, low nitrate, water source.

In 2015, all 9,758 tests for nitrate met the standard (50mg/l).

In March 2014, Affinity Water completed a scheme to install nitrate removal treatment at Kings Walden works serving 6,500 consumers in the Luton area. The company continue to report problems with the controlling software. The company intend to resolve the problems and put the plant into full operation during 2016. However, they have highlighted that there is likely to be an extended period before they can fully demonstrate the effectiveness of the programme. There were no failures linked to this works during 2015.

Nitrite may be formed when chloramine is used as the residual disinfectant to maintain the microbiological quality in the distribution network. The formation of nitrite is controlled by careful optimisation of the chloramination process. Nitrite can also form in samples of water, after collection and before analysis, especially if the sample is not kept cool.

In 2015, all 9,741 tests carried out across the region for nitrite met the standard.

## Pesticides and related products

This group of substances, generically called pesticides, includes many organic chemicals ranging from weed killers, to insecticides and fungicides. Water sources may contain traces of pesticide residues as a result of agricultural use (pest control on crops) and non-agricultural use (herbicides for weed control on highways, railways etc.). Water companies are required to assess the risk to drinking water supplies of pesticide use in source water catchments and then test for those that might be present. Companies have taken raw water monitoring into account when documenting potential and actual pesticide hazards through their Regulation 27 risk assessments. When pesticides are first detected, water companies will enhance the monitoring of raw water and notify the Environment Agency to facilitate appropriate action in the catchment to safeguard drinking water quality.

Table 16 illustrates the potential pesticide risk in the region and compares it to the actual pesticide risk in 2015. Out of a total of 713 raw water monitoring points, 536 were subjected to risk-based monitoring for

pesticides and the risk was verified by positive detection of pesticides at only 70 abstraction points.

**Table 16: Raw water monitoring points at risk from pesticides in 2015**

| Company | Number of raw water monitoring points | Raw water monitoring points monitored for pesticide risk | Number of raw water monitoring points where pesticide risk verified by monitoring |
|---|---|---|---|
| Affinity Water | 212 | 187 | 12 |
| Portsmouth Water | 23 | 19 | 1 |
| South East Water | 106 | 81 | 8 |
| Southern Water | 137 | 109 | 25 |
| Sutton and East Surrey Water | 91 | 18 | 5 |
| Thames Water | 144 | 122 | 19 |
| **Regional total** | **713** | **536** | **70** |
| **Industry total** | **2,553** | **1,506** | **229** |

Data are for raw water monitoring points in the region in 2015. Verification of risk is based on at least one sample containing pesticide above the limit of detection. Albion Water, Independent Water Networks and SSE Water do not operate abstraction points in the region.

The outcome of pesticide risk management by companies in the region was that there were only 19 failures of the pesticide standards in 2015. All failures of the standard during 2015 were due to metaldehyde. The circumstances and substances involved are summarised in the metaldehyde section below.

### *Metaldehyde*

Metaldehyde is the active ingredient in some slug pellets. The standard is 0.1µg/l. In 2015, companies in the London and South East region collectively reported 19 failures of the pesticide standard (4 AFW, 5 SEW, 5 SRN, 1 SSE, 4 TMS) due to metaldehyde detections. All of the breaches except one (SEW bulk supply from SRN) occurred in zones or at treatment works where legal instruments are in place to improve catchment, monitoring and abstraction for metaldehyde. In the case of this bulk supply, the supplying works are covered by a legal instrument for metaldehyde with the works operating company.

This is a significant improvement on 2014 where there were 33 failures reported and is a result of extensive work with the local farming community to minimise the amount of metaldehyde getting into farm drains and

subsequently to streams and the sources itself. Strategies used by companies include; awareness raising, keeping farmers informed of the latest water quality data, product substitution where an alternative product is used instead of metaldehyde and abstraction management at high risk periods and at high risk sites.

One new legal instrument was put in place for Independent Water Networks in the form of an undertaking for metaldehyde in bulk supplies, which replaces previous legal instruments. Those receiving bulk supplies where there is a risk of metaldehyde in the supply also have undertakings in place to ensure that support is given to the work being done by the bulk supplier and that appropriate monitoring is carried out. In the London and South East region five companies (AFW, IWN, SSE, SEW, TMS) import water from neighbouring companies that is at risk of metaldehyde. Companies are reminded that bulk supplies must be fully risk assessed and details shared to ensure water is wholesome when imported/exported as both parties are equally responsible even when using another company's network.

All companies with a risk of metaldehyde in the catchment have such undertakings in place. The undertakings state that where catchment management fails, treatment should be considered.

## Radioactivity

### Gross alpha/gross beta/total indicative dose

Radioactivity in raw water can occur naturally in the environment or from a specific point source emission. Water companies are required to screen for radionuclides that emit either alpha or beta particles. If such screening exceeds guide values (Gross alpha 0.1Bq/l, Gross beta 1.0Bq/l) then fuller analysis for specific radionuclides is carried out to determine the origin. Under these circumstances the total indicative dose (TID) must be calculated. TID is a measure of the effective dose of radiation through consumption of the water and no further action is required if the guide value of 0.1mSv/year is not exceeded.

Where screening and other information has shown there to be no risk relating to radioactivity in a specific water supply, companies can apply for and have been granted, an exemption from further radioactivity monitoring (known as a waiver) by the Inspectorate. In 2015, a waiver for TID has been renewed for 65 works operated by Thames Water and new waivers were granted for TID and tritium for Portsmouth Water and covering 13 zones.

In 2015, there were eight companies (ALB, IWN, PRT, SEW, SES, SRN, SSE and TMS) in the region that carried out radioactivity monitoring. Out

of a total of 1,941 tests, there was one result that exceeded the gross alpha or gross beta screening values (Southern Water) with a result of 0.11Bq/l for gross alpha. The elevated screening value occurred at Sparrow Castle works. The company carried out resampling and reviewed the previous five years of data and found no further breaches. The company requested speciation analysis on the failing sample, but insufficient nuclei were present to complete the analysis. Southern Water demonstrated that the TID was below the guide value of 0.1mSv/year in at Sparrow Castle works and no further action was required.

## Tritium

Monitoring for tritium is necessary only where a source of tritium is present within the catchment and it cannot be shown on the basis of other surveillance programmes or investigations that the level of tritium is well below its parametric indicator value of 100Bq/l.

In the London and South East region, the following companies monitor for tritium; Albion Water, Portsmouth Water, South East Water, Southern Water and SSE Water. Together these companies analysed 782 samples for tritium in 2015 and none of them breached the parametric indicator value.

Monitoring waivers time expire after five years and the Inspectorate has been in discussion with companies to ensure they are now carrying out monitoring in those situations where a waiver had not been renewed.

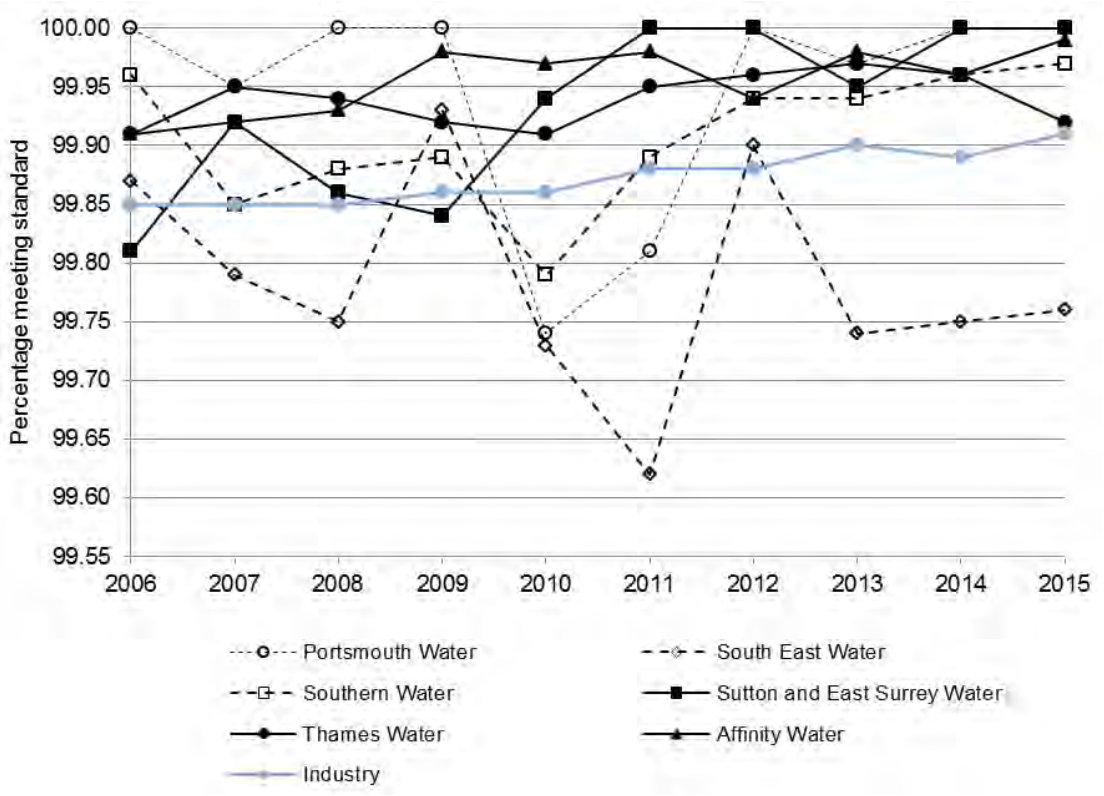
The EU Council Directive made under the Euratom Treaty came into effect in October 2013. The Directive sets out the requirements for the protection of the health of the general public with regard to radioactive substances in drinking water. In England the Inspectorate has been working closely with Defra to ensure that the necessary changes are made to the 2016 drinking water quality regulations. The principal change introduces new requirements for radioactive parameters, in particular the indicator parameter radon, with its own monitoring requirements. The other requirements already being in place.

The Inspectorate commissioned a project to understand the implications of the EC's proposals relating to radon in drinking water in the UK and the report may be found on the Inspectorate's website. In May 2015, the Inspectorate published the requirement for companies to carry out risk assessments for radon in all of their catchments and to begin regulatory monitoring for radon from 1 January 2016 where the risk is considered to be moderate or high, or until risk assessment shows there to be no or low risk and monitoring can cease.

## Maintaining water quality in distribution

Elevated levels of iron or manganese are objectionable to consumers because the water may appear turbid or discoloured due to unsightly deposits and may also stain laundry and water fittings. Since 2004 the Inspectorate has been monitoring the progress of companies' distribution maintenance work, using an index made up of three parameters (turbidity, iron and manganese). Figure 17 shows the long-term improvements in the London and South East region. In 2015, there was a decline from 99.94% in 2014 to 99.92% in 2015.

**Figure 17: Percentage of tests meeting the standards for turbidity, iron and manganese**



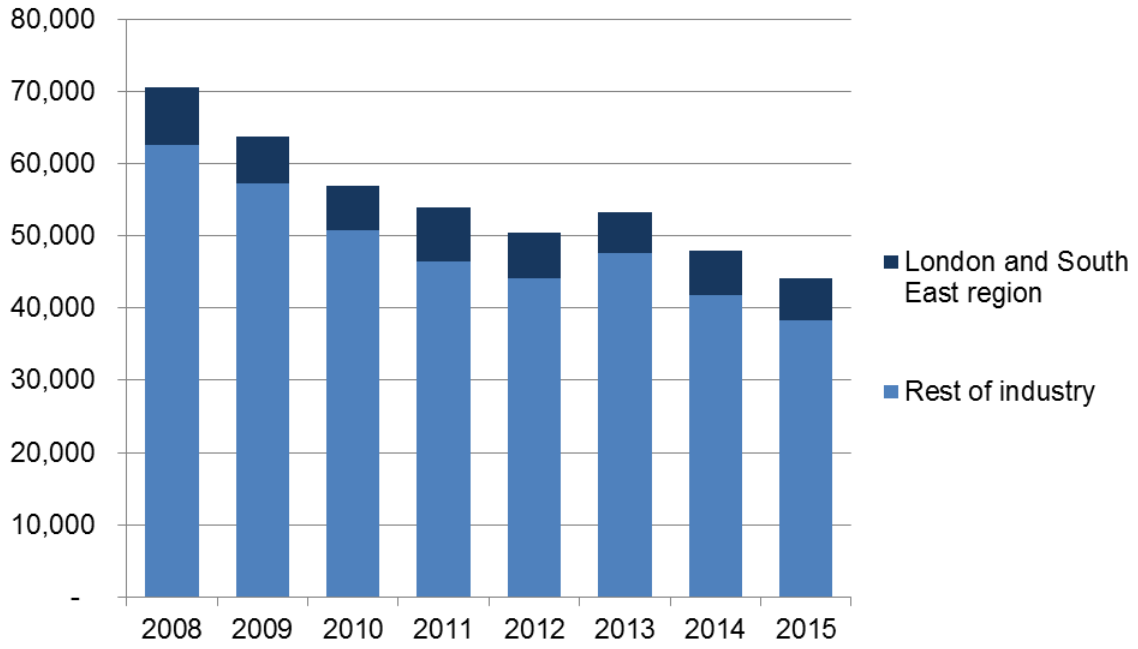

Note: IWNL began supplying water in the region in 2010. All of their tests met the standards for turbidity, iron and manganese.

Note: SSE Water began supplying water in the region in 2008. All of their tests met the standards for turbidity, iron and manganese.

Discolouration of tap water often prompts consumers to contact their water company. The number of people contacting water companies about discoloured water is reported annually to the Inspectorate in accordance with Information Letter 1/2006. Looking at the trend since 2008, it can be seen from Figure 18 that across the industry, the numbers of consumers contacting their water company to complain about discoloured water has fallen from 70,648 to 44,141 in 2015. Between 2014 and 2015 in the

London and South East region, the situation is similar to last year with the figure now standing at 5,918, down from 6,131 in 2014. Overall the region accounts for 13% of all consumer contacts for discolouration across England and Wales.

**Figure 18: Total contacts for discolouration 2008–2015**



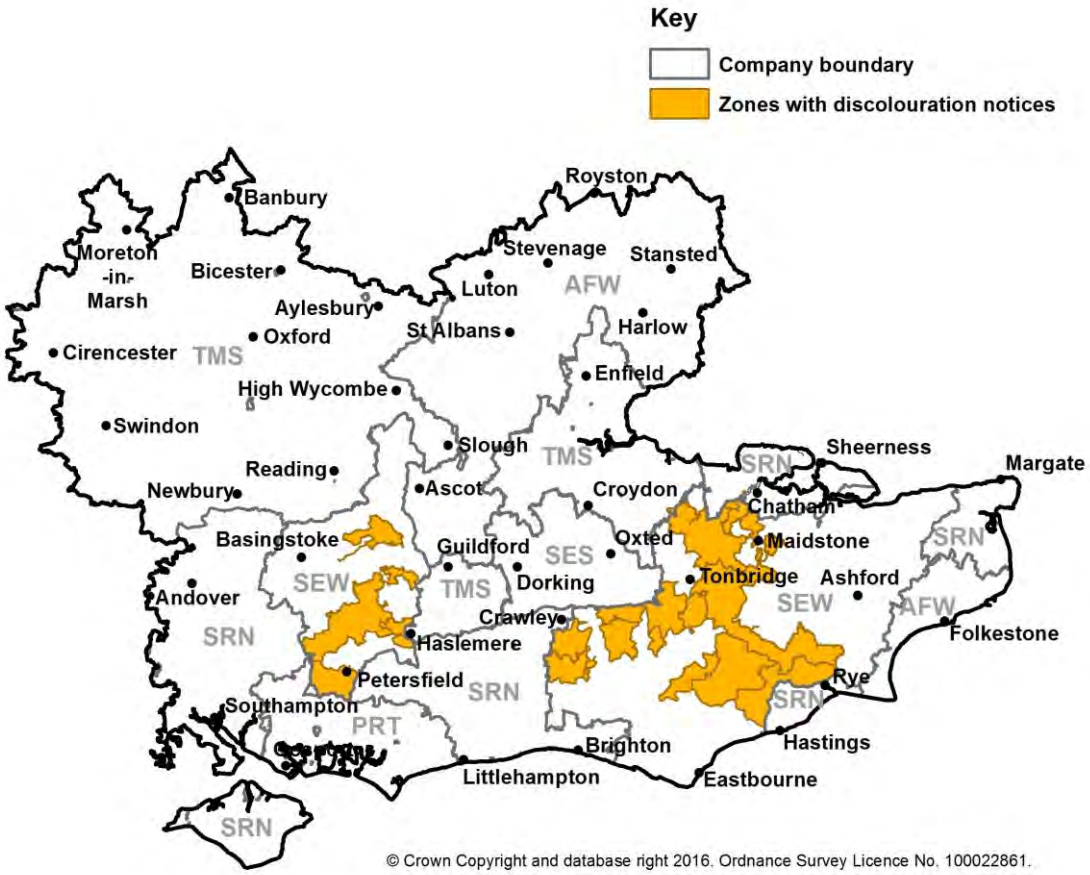

In *Drinking water 2014*, the Inspectorate asked companies to review consumer contact data on a continuous basis to identify zones with persistent problems that require remediation, irrespective of whether the zone has been the subject of improvement works in the past. In 2015, the Inspectorate carried out the exercise to identify these zones starting with where the level of consumer contacts had been above the industry level for the three preceding years. Discolouration of tap water often prompts consumers to contact their water company indicating a persisting problem for consumers. Further work then identified six companies in England where such zones existed, but where no legal instruments were in place. Legal instruments describe the planned drinking water quality improvements of companies where progress to rectify the problem can be monitored against set objectives. The Inspectorate met with the companies to understand what plans existed in these areas to reduce consumer contacts for discolouration, distribution compliance failures and water quality events. Such plans would be expected to include, treatment works upgrades, reservoir cleaning and carrying out operational measures (such as flushing) within zones to help improve distribution water quality.

After reviewing the company plans, customer contact data, compliance failures and distribution water quality event information the Inspectorate

assessed these plans to see if they aligned with the areas of concern and were appropriately targeted to their own performance targets. Where necessary, the Inspectorate issued new legal instruments to formalise these operational plans ensuring delivery of the required improvements for the benefit of consumers.

From the review, one company was identified as being in the London and South East region, (SEW). South East Water as part of their company programme, paln to dose with SeaQuest at Crowhurst Bridge, Pembury, Arlington, Forstal, Barcombe, Bewl and Keleher works which supply 17 zones, all identified as having high discoloration contact in this exercise. SeaQuest is blend of polyphosphates and orthophosphates added to the water which reduces discolouration and corrosion by keeping metals in solution. In addition to this strategy, the company has adopted a flushing programme to tackle the discolouration contact rates and associated metals failures. In order to ensure the full delivery of these programmes, the Inspectorate has initiated enforcement action in the form of zonal Regulation 28 Notices in the 20 zones shown in Figure 19.

**Figure 19: Zones where notices have been served to address discolouration**



In 2015, across the whole of the London and South East region, out of a total of 46,780 tests for the four parameters (iron, manganese, turbidity and benzo(a)pyrene) there were 34 failures (iron 27; manganese 1; turbidity 6). The Inspectorate expects that the location and circumstances of the 34 failures reported by the companies will have been taken into account during the relevant risk assessments and Distribution, Operation and Maintenance Strategies (DOMS). The details of where these failures occurred are described below:

- Affinity Water – one failure for turbidity. This failure was in the Hillingdon/Hayes zone in May which was associated with an aluminium failure at the same time (see *Chapter 4.2 Chemical quality*).

- South East Water – 13 failures for iron, one failure for manganese, one failure for turbidity. The failures did not have any geographical focus, but companies are expected to have taken the data into account during their risk assessments and DOMS. Of these failures, nine were in zones identified as having elevated consumer contacts as described above and where Notices have been served.

- Southern Water – three failures for iron. The failures did not have any geographical focus, but companies are expected to have taken the data into account during their risk assessments and DOMS. In December an exceedance of iron in a sample collected from Chandler's Ford, in Rownhams zone followed a power failure at Testwood works causing supplies in the zone to run low and disturbing sediment in the network. This was treated as an event, (see *Annex 3*). The Inspectorate made several recommendations in response to this event, including the completion of remedial work, seeking public health advice for disinfection failures and improving investigations.

- Thames Water – 11 failures for iron, four failures for turbidity. The failures did not have any geographical focus, but companies are expected to have taken the data into account during their risk assessments and DOMS. In the majority of cases, the company either failed to find a definitive cause for the results, or considered the cause as resuspension of settled mains deposits. The company are taking the data into account during their AMP6 mains replacement scheme, as well as targeted flushing activity and increased treatment options at supplying treatment works.

In all cases the Inspectorate will take this information, the consumer contact rates and the effectiveness of company strategies into account during its risk assessment of companies and, where appropriate, take enforcement action.

*Annex 4* details the legally-binding programmes of distribution maintenance work scheduled for completion between now and 2020 to address ongoing distribution quality problems in the region.

# Chapter 5: Drinking water quality events

Chapter 5

- Explains how events are classified.
- Provides summary figures of the number and type of events.
- Illustrates industry-wide learning points from case studies.

Water quality events are classified into five broad categories based on the initial company report. The categories are:

**Not significant:** no further information required by an inspector to assess the event.

**Minor:** it is unlikely that further information would be required by an inspector to assess the event.

**Significant:** a full company report is usually required to enable an inspector to assess the event.

**Serious:** in addition to a full company report, the assessment may involve more than one inspector and site visits in the investigation.

**Major:** in addition to a full company report, will require an investigation led by senior inspectors involving extensive information gathering and usually site visits.

In 2015, companies in the London and South East region notified the Inspectorate of 161 events. Table 20 shows how these events were classified.

**Table 20: Water quality events in the region in 2015**

| Nature of event | Risk assessment category (DWI) | | | | | |
|---|---|---|---|---|---|---|
| | Minor* | | Significant | | Serious** | |
| | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 |
| Air in water | 3 | 3 | 1 | 2 | - | - |
| Chemical | 6 | 11 | 6 | 1 | 1 | - |
| Discoloured water | 3 | 7 | 7 | 6 | - | - |
| Inadequate treatment | 1 | 6 | 8 | 9 | - | - |
| Loss of supplies/poor pressure | 22 | 6 | 6 | 15 | - | - |
| Microbiological | 12 | 26 | 10 | 5 | 1 | - |
| Taste/Odour | 3 | 6 | 2 | 4 | 1 | - |
| Health concern | 3 | 5 | 3 | 6 | 1 | - |
| Public concern | 35 | 19 | 6 | 3 | - | - |
| Other | 2 | 8 | 4 | 11 | 2 | 2 |
| **Region overall** | **90** | **97** | **53** | **62** | **6** | **2** |
| **England and Wales** | **281** | **322** | **218** | **223** | **12** | **10** |

*Minor category numbers include all not significant and minor events
**Serious category numbers include all serious and major events

A summary of the nature, cause and duration of each event categorised as significant, serious or major along with details of the Inspectorate's findings are set out in *Annex 3*. Most events were of relatively short duration and the company took appropriate action to inform and safeguard consumers and other stakeholders. A comparison of 2014 events with those of 2015 shows an overall slight increase in the numbers of minor and significant events, and a decrease in serious events.

The region experienced two serious events in 2015 resulting in; the bypassing of works safeguards; and the potential for the loss of supplies to 280,000 customers. These events are described in more detail below.

### Auto shut-down arrangements

As a precautionary measure to ensure water is appropriately treated and disinfected before leaving works, a safeguarding system was installed to prevent a works from being started when turbidity increases above the standard of 1NTU. This was in response to an event at Matts Hill works in 2008 where the company was prosecuted in 2010 for permitting turbid water to enter supply by repeatedly overriding fail safe controls. In July 2014 the Inspectorate received information concerning the ability to evade this new system by bypassing on-line monitors at works. Doing so would permit a works to start improperly where otherwise an alarm would sound in response to the presence of turbidity or chlorine problems safeguarding untreated water entering supplies.

A series of 12 investigatory site audits were carried out to investigate this information and following detailed testing it was confirmed that it was possible to bypass on-line monitors without alarms being raised and avoid

sites being automatically shut down. Investigations noted the instrument design permitted nominated operators to start certain sites without causing a shutdown, however, the knowledge of the method had become commonly known and subsequently used inappropriately through the wider area of the company. By allowing this practice to continue, local management and therefore the company had failed to put adequate measures in place to prevent routine abuse of the very system designed to prevent inappropriate practice and consequently the potential increased risk to its customers.

The monitor alarm system has since been updated and the company initiated the need for managers' intervention when sites sound an alarm indicating water quality is outside the set parameters. Any attempted bypassing of on-line monitors is now clearly visible on the company's SCADA system. Following the discovery by the Inspectorate, the company has worked closely with the on-line monitors' manufacturer, to determine if the monitors could be bypassed in other ways and to ensure future untoward tampering is prevented.

This serves to remind companies that when expensive on-line monitoring systems are ordered and installed, appropriate verification should be carried out as part of the commissioning stage where all relevant persons within the company are involved, including process and water quality scientists. It is disappointing to state that while such occurrences are very rare, the opportunity for an operator to defeat monitors in order to start-up works must be considered a risk and mitigated appropriately. Simple risk mitigation methodology will also remove the impossible position some operators are put in where no facility exists to deal with a quality problem due to an inappropriate design of the works. Such mitigation may be as simple as a run to waste facility at treatment works, where quality issues are often seen during initiation of a works or setting water quality triggers appropriately for each site.

### Improving resilience – identifying and remediating single points of failure

In June 2015 a burst occurred on a 1,000mm glass reinforced plastic (GRP) main within the treatment stages at Egham works. Critically it was the only route for water between two treatment stages and could not be easily or effectively bypassed. This resulted in the works being out of service for 57 hours at a time when the weather was warm and demand for water was high.

The works typically produces 90Ml/d supplying a population of 280,000 and also provides a continuous bulk supply to another water company that averages 33Ml/d. Due to the strategic supply of this works, the company

running Egham works had a pre-determined plan to manage the supplies which included increasing supplies of other works, lowering pressures in the network, agreement with neighbouring water companies to import and conversely reduce the export of water, initiating repairs and the provision of alternative supplies. The early implementation of these actions allowed the company to maintain the majority of supplies to customers with only a small number of consumers having intermittent issues and these were provided with bottled water. This illustrates the merits of predetermined plans to mitigate such a circumstance. Under normal circumstances this would have been sufficient, however, when the main was exposed and repairs initiated, the company discovered that the shape of the main had become oval and the initial attempted repair was ineffective. This resulted in a further delay of a day for the repairs until a specialised coupling was made available.

This unexpected turn of events demonstrates the failure to identify a critical stage where no mitigation existed and no supply redundancy was built in. The location of the burst was on a single point of failure and while the works had been fully risk assessed, the risk surrounding this main had not been previously identified. The Inspectorate reminds companies that they should consider all scenarios when conducting risk assessments to ensure an appropriate level of resilience can be maintained.

Following the event the company running Egham works conducted a thorough review of its emergency procedures and asset resilience to large scale events. This has been added to the learning from the flooding event in 2014, to create a full company resilience report which the company are using to improve its procedures and site mitigation. The outcome for this site was to install a duplicate connecting main.

The following examples are included in this report because of the industry-wide learning points.

**Failure of disinfection control – weakness of asset design and function**

During the year there were two events at Sweetloves works concerning improperly disinfected water as a result of the loss of pH control in the disinfection treatment stage. Sweetloves works is situated north of Bolton and supplies just short of 80,000 properties. The treatment consists of coagulation, clarification and primary and secondary filtration with pH adjustment at several points before disinfection. The control of pH is critical to the process so when in both cases, control was lost due to the failure of a sample pump to the pH meter, the resultant high pH (>pH10) interfered with the formation of hypochlorous acid for effective disinfection.

For the first event the company decided against isolation of the contact tank due to the length of time to operate the isolation valves and risk of interrupting supply to customers. The company also decided against the issue of boil water advice due to the timescale involved in distributing notices and additionally that the raw water quality was within normal ranges and not indicating any significant challenge to the works.

For the second event the company were slow to recognise the same scenario, but once realised, actively worked to restrict any further improperly disinfected water entering supply. The company again decided that boil water advice was not required. However, due to the length of time it took to regain control of the treatment process, alternative supplies were insufficient. The company latterly decided to release the improperly disinfected water, in association with a boil water advice, provided the pH did not exceed 9.5.

Public Health England, as part of their role, will provide advice and information to the public, professionals and government on health protection issues, based on scientific and health protection expertise. The company consulted with PHE on both occasions and they supported the decisions for which the company remains responsible.

This event provides a further example of companies failing to prevent inadequately treated and disinfected water entering supply from works and failing to control operational risks in the light of previous events and when the company is clear that the control is dependent upon critical equipment. It is questionable when the company strategy considers it acceptable not to put in robust maintenance for something as basic as sampling pumps compared to the senior decision and business risk necessary to recover from events of this size when considering a boil notice. Furthermore, why has the company not considered the design of the contact tank which in its current state could only be isolated and not discharge any improperly treated water to waste? Even when the situation results in the inevitable and a boil notice is called for, why is there not effective management and effective public health protection?

Senior managers must be aware and be responsible for water quality and this must include all aspects of company operations. There must be clear understanding at the most senior level that risks are identified, works and assets work within predesigned limits, the technology is suitable and robust, and redundancy is built in to critical steps; control measures are in place and robust, and those who work in or with the company are competent to carry out the functions and duties of the company. Senior managers should expect that the Inspectorate will continue to identify those companies who present the greatest risk to be a focus of attention.

While there was a catalogue of errors in both events, the greatest weakness was the design. In addition, there was the inconsistent approach to issuing boil water advice, which was symptomatic of policy. The Inspectorate expects companies to have appropriate design of treatment assets and robust public health policies.

**Issue of a do not drink notice to 17 properties**

In May to June, 17 properties in the village of Stoke Goldington, Northamptonshire were issued with a do not drink notice when the company detected polycyclic aromatic hydrocarbons (PAH) in the water after planned cleaning. PAHs are present in coal tar, a technique widely used before 1970 to line the inside of iron pipes. When the lining degrades or is disturbed by cleaning, PAHs can be released into the water resulting in an unpleasant taste often described as similar to white spirit. The Inspectorate noted that this outcome was the result of a consumer complaint dating back three years when she complained her water was the colour of teabags, left a rusty looking residue in the sink and she could not use the water supply for drinking, cooking, laundry or washing. The consumer finally resorted to contacting the Inspectorate in August 2014 who took up her case on her behalf.

During the period June 2014 – June 2015, the company tried: mains flushing, air scouring, partial mains replacement, ice pigging and eventually conducted a complete mains replacement of old cast iron main, which finally solved the problems in the local network. Prior to complete mains replacement of a further 1.4km section in addition to the initial replacement of 900 meters, the company were still detecting high levels of iron to which the company decided to use ice pigging. This is a relatively new technique which is becoming more widely used since it simply uses crushed ice pushed through the pipe as an abrasive material for cleaning. It was this exercise which led to the release of PAHs from a previously unknown coal tar lining. The cleaning was unsuccessful due to a blockage in the main which had restricted the effectiveness and the full mains replacement finally resolved the matter in June.

There are any number of criticisms that could be levelled at the company in this event, not least was the fact that it was unnecessarily protracted; the remedial techniques were poorly chosen, planned and inappropriate given the uncertainties of mains materials and potential linings present in an old cast iron main in the area. It remains, however, that this event may well have been avoidable had a risk analysis appropriate for ice pigging been effective. This technique has resulted in a number of events in recent years and close scrutiny of these events often uncovers uncertainties of the company over their own networks and of the application of the method.

Companies are reminded to ensure they are familiar with the technique and to ensure it is appropriate for the task in hand before use. In this instance had the company elected to replace the whole main rather than half of it, the event would never have happened and while it is impossible to understand the exact reasons for the decision at the time, a long-term risk assessment would have identified the removal of all the degraded iron main as this would have eliminated this event from ever happening again in the future.

Fundamentally, however, this was the failure of the company to their consumers: The consumer who had been complaining for three years; those consumers who complained of unusual tastes; and the significant inconvenience and distress to some of the consumers served, whose businesses and social plans were severely disrupted when the event occurred.

**Loss of primary disinfection**

In the late hours of 1 October the main chlorine dosing system at Frankley works failed. Chlorine is the most commonly used disinfectant for water and is used to remove any remaining microbes after treatment. An important process such as this is expected to have a secondary system in place which starts automatically in the event of the main chlorine dosing system being lost. Such a system exists in Frankley works, but in this case the backup system failed to operate as expected. As a result the plant did not dose chlorine for a period of about six hours. Frankley works supplies around 1.5 million people in Birmingham and parts of the West Midlands. A critical treatment works supplying water to the UK's second largest city, the consequence of a loss of disinfection and possibly the supply, at the very least would cause significant disruption to the consumers and the city.

The company carried out an investigation and determined the computer controller of the main chlorine dosing system had failed. The system was such that this same controller operated the back-up system and provided information to the control centre. The event resulted from the single operational control dependency of both the primary and back-up disinfection. Consequentially when the control system failed, the works failed and the company were unaware of the status of dosing. The Inspectorate attended the site in October and issued a Provisional Enforcement Order in relation to a failure to adhere to the conditions of an existing Notice at the works. This is a very unusual step for the Inspectorate to take and reflects the serious concerns to the fundamental principle of having separate systems on critical processes. The order required the company to reassess the design and control of the works to

ensure that chlorination systems did not fail in this way. It also stipulated that sufficient trained staff were available to run the plant, particularly outside normal working hours. The company has redesigned the system appropriately complying with the Provisional Enforcement Order.

The Inspectorate reminds senior managers in the industry that they are responsible for ensuring systems are in place and are robust to prevent inadequately treated and disinfected water entering supply from works, a point made repeatedly this year and over the 25 years it has been a requirement. This principle, arguably of resilience for companies, is not solely about interconnectivity, but also retaining focus on the first principles of operating treatment works which are too critical to fail.

### Secondary events caused by initial event investigations

Lartington works near to Darlington is a large surface water treatment typically supplying 110 Ml/d of treated water to a population of approximately 580,000 in the Teesdale and Teesside area. The site, originally from the 1960s, treats raw water collected in five impounding reservoirs and consists of two different clarification streams, pH correction for manganese removal before rapid gravity filtration and finally disinfection.

In August 2015, a single *E.coli* was detected and as part of the investigation a remote operated vehicle survey of the contact tanks was undertaken. This technique allows companies to inspect tanks and reservoirs for signs of internal damage while still in supply. In September, in preparation for this survey, flow rates on the site were reduced to allow the inspection to be undertaken. While this in itself is not unusual, due regard for the operability limits of a works must always be considered and this should consider not only the upper limits, but the lower limits to determine the hazards and likely consequence of an action which may present a risk. In this works the lower limit is, in part, governed by the minimum dosing of lime which can be achieved by the pumps. When the flows were reduced, the works was operating at the minimum possible limit for the lime dosing pumps. When the lime batch changed to a higher concentration the pump could not dose any less to compensate for this change causing the pH to rise outside the critical limit. The effectiveness of chlorine used for disinfection is partly based around the pH of the water it is dosed into. The consequential effect of this was for disinfection to drop to less than 30% of the World Health Organisation recommended minimum of 15mg.min/l. The company, as a reactive measure, have set the alarm to 22mg.min/l to ensure there is an earlier warning of problems, however, the objective of risk analysis is to identify proactively conditions which may occur based upon historic analysis.

This site was subject to an earlier event in June where the company sought to allow the plant to perform more effectively at low flows, the sudden change in flow resulted in a problem with the clarifiers. While this was not exactly the same situation, this was an example of the works being asked to perform outside its operability limits and should have served to identify the risk of changes. The question arises therefore as to why the company had not carried out an appropriate risk assessment of a site known to have had recent operability problems prior to initiating an investigation which reduced the output to the minimum possible limit eliciting an event more serious than the one it was investigating. Senior managers should ensure that risk analysis is transferred to risk assessment and this information is taken into account and used to direct future work which may be carried out by staff or contractors who do not have an overview of the consequential effects on treatment processes.

**Turbidity event due to lime dosing failure – single point of failure**

In October, it was reported that water with elevated turbidity had been leaving Legacy works, which supplies approximately 44,000 consumers in Legacy and Rhos zones. This surface water works uses lime dosing for pH correction to optimise the coagulation process after which it passes through rapid gravity filters and then onto chlorination where lime is added once again to ensure a suitable pH for disinfection. The effectiveness of chlorine used for disinfection is partly based around the pH of the water it is dosed into and at Legacy work is measured by a single probe which also controls the lime dosing adjustment.

In the week leading up to the event, the company experienced problems with the pre-contact pH probe, in the form of drift, when compared to manual pH readings. The probe was cleaned, recalibrated and returned to service. However, the probe began to drift again. The drift caused false pre-contact pH readings and the lime dosing system increased dosing as it tried to compensate. As the same probe controlled the dosing and monitoring, no alarms were triggered and the site did not auto shutdown. While the resulting increase in pH was recorded by the final water pH monitor, at the time this was not linked to alarms or the automatic shutdown system. The event eventually manifested as high final water turbidity from the excess lime. At that time, the site auto shutdown alarms were set to respond to filtered turbidity, pre-contact chlorine and pre-contact pH. As none of these alarms were triggered, water with turbidity >1NTU was presented for disinfection and entered supply for a period of approximately 15 hours with the pH rising to 9.3.

The company installed a second pre-contact pH probe, so that monitoring and lime dosing control are handled separately. This will prevent a repeat

of this event, as a single probe defect cannot cause complete failure of the pH control and monitoring. Additionally, monitors not previously linked to alarms, including the final water pH probe are now alarmed, allowing greater control of the works.

This event illustrates both the failure to prevent inadequately treated and disinfected water entering supply from works and the failure to adequately identify the risk of not having separate systems which control interlinked critical processes consequently leaving the works without a robust critical measure, and subsequently and unknowingly losing control of the works. It is questionable how such a basic element of risk control was missed and why companies must ensure a site set up is fully known and is appropriate for its operation at all times. The not so obvious risk in all of this is the effect of a raised pH, some two points over normal. How aggressive the now highly alkaline water has become may not be truly known, but the risk of metals from the network should be considered as company directors are reminded that they are responsible for supplying water which must not be aggressive.

The offence of supplying water unfit for human consumption is under consideration by the Inspectorate in connection with one event that occurred in the region in 2015.

# Chapter 6: Technical audit activity

Chapter 6:

- Describes the audit strategy of the Inspectorate.
- Summarises the outcome of audit activity in 2015.
- Highlights learning points for the industry.
- Summarises the strategic AMP6 drinking water improvement programme.

The Inspectorate has operated a risk-based approach to technical audit since 2005 and no technical audit takes place without a reason.

Technical audit is the means by which the Inspectorate verifies whether companies are operating and maintaining water supplies in a sustainable manner that is likely to secure a safe, clean supply of drinking water into the future. Audit activities take a number of different forms:

- Assessment of information provided by water companies.
- On-site inspection of company records, procedures and plans.
- Meetings to challenge the veracity of specific plans, procedures or programmes of work.

For the purposes of the report the audit activities in 2015 are divided into two tables. Table 21 summarises the outcomes of inspections, including consumer complaint investigations. Table 22 covers the outcomes of audits relating to the enforcing of water quality improvements.

**Table 21: Outcomes from inspections and consumer complaint investigations in 2015**

| Company | Location and reason | Main findings from audit |
|---|---|---|
| **Audit focus: Abstraction and treatment** | | |
| Southern Water | Weirwood works – pH and chlorate breaches | Generally satisfactory.<br>Although the site audit was generally satisfactory a Reg28(4) Notice has been issued due to inappropriate operation of works in allowing pH and chlorate breaches to occur (see *Annex 3*). |

| Company | Location and reason | Main findings from audit |
|---|---|---|
| Thames Water | Fobney works – black headed gull bones in contact tank | Generally satisfactory.<br>Mitigation measures introduced by company at Fobney works and other sites with similar risks of animals and birds contaminating water treatment processes. Company are installing slow sand filter weir chamber covers and also mesh on doors.<br>Notices to be put on doors to process streams advising operators to keep them closed.<br>Concern about possible cross contamination with unused boreholes on site that need decommissioning. |
| Thames Water | Hambleden works – *Cryptosporidium* detections | Unsatisfactory.<br>Boreholes have risk of connectivity to surface water.<br>*Cryptosporidium* detections from site with no appropriate treatment for oocysts. This was an unacceptable risk.<br>Company to update risk assessment and install effective *Cryptosporidium* barrier at site including UV. This was implemented immediately.<br>Notice issued to prevent further *Cryptosporidium* occurrences. |
| Thames Water | Speen works – *Cryptosporidium* detections | Satisfactory.<br>Although the audit was satisfactory a Notice was issued in response to the associated *Cryptosporidium* event (see *Annex 3*).<br>Some concerns raised at the audit regarding the audit trail of filter housings and possible cross contamination. |
| **Audit focus: Service reservoirs integrity and management** | | |
| Southern Water | Fourwents tank<br>Dunkirk tank – break tanks audits | Unsatisfactory.<br>No regular sampling at this asset and it fits the criteria for definition of service reservoir.<br>Company to update asset definition to include as service reservoirs.<br>Discussed outcome of break tank audits by brief to Water UK and Information Note. |
| Sutton and East Surrey Water | Margery Hill tank – break tanks audits | Satisfactory.<br>Correctly classified as break tank.<br>Covered by brief to WaterUk and Information Note. |

| Company | Location and reason | Main findings from audit |
|---|---|---|
| **Audit focus: Sampling arrangements** | | |
| South East Water | Sampler audits x2 | Generally satisfactory.<br>Minor observations about calibration of equipment on one of the samplers.<br>Sampling procedures followed appropriately. |
| South East Water | Six vertical audits of failed micro samples | Generally satisfactory.<br>Generally laboratory paperwork was good.<br>Some criticism about company investigation of bias triggers during analytical quality control. |
| **Audit focus: Consumer complaint handling** | | |
| South East Water | Discolouration (1)<br>Illness (1)<br>Taste and odour (1) | 3 Satisfactory |
| Southern Water | Particulates (2)<br>Taste and odour (1) | 3 Satisfactory |
| Thames Water | Discolouration (1)<br>Other (3)<br>Taste and odour (1) | 5 Satisfactory |

During 2015, the Inspectorate focused on two special areas within its audit programme. Focusing on special areas is additional to the risk-based programme described above and is usually where sites or assets are outside the requirement for companies to submit data under regulatory monitoring, but have the potential to affect water quality. These areas were for structures called break tanks and for bulk transfer of water.

Break tanks exist in networks for operational reasons often to allow a change of pressure from one area to the next or as a safeguard against backflow and are usually relatively small. These are not considered to be regulatory assets unlike a service reservoir which are considered to be a stored reserve of water to meet a variable demand and can be a range of sizes sometimes containing millions of litres of water.

These tanks represent a similar risk in companies' distribution systems as service reservoirs and can provide an access route for external contamination to enter the water supply if not maintained. Unlike service reservoirs, monitoring is not specified in the Regulations and is left for the company to determine along with the risk assessment. The Inspectorate has been notified of at least two events that included a microbiological failure associated with a break tank and considered it appropriate to establish their number and significance for drinking water quality. Companies, when asked as part of the audit, declared 55 break tanks from which the Inspectorate then carried out 13 site audits. The audits looked at

a number of aspects to develop an understanding of the tanks in use and this included; age, construction, capacity and the time water was retained as well as quality considerations such as sampling, maintenance, inspections and if they were within the company's risk assessment.

Even though the Regulations do not specify the monitoring requirements of break tanks, we would expect companies to treat them similar to service reservoirs as they present a similar risk to the water supply. The Inspectorate concluded that this was not the case. In tanks, which ranged from 6 to 130 years, some were in very poor condition. While most companies undertook weekly visits to tanks for maintenance checks, the internal inspection frequency was between 1 – 15 years and some were never inspected. The question arises therefore; what were the companies doing to assure themselves there were no developing quality problems? In 39 (71%) cases, there was no sampling at all and in 13 (24%) cases the companies had not even included the tank in their risk assessment. Senior managers of water companies are reminded that they are responsible for completing risk assessments for the whole supply system and not to do so will result in enforcement action.

Turning to the tanks themselves: The capacities of the tanks audited varied between 359l up to 19.35Ml, the largest being about eight times the size of an Olympic swimming pool and the longest retention time, of those which were known, was found to be over three days. Several sites were found to have been previously designated as service reservoirs and were reclassified as break tanks. Senior managers must ask themselves, why in some cases these are not a stored reserve of water to meet a variable demand and why some were reclassified as tanks, effectively increasing the risk. Two companies have proactively stated they will reclassify their break tanks as service reservoirs and commence regulatory sampling and reporting. This has been taken into account in the forward plan for the Inspectorate and sites which were identified as a risk, or incorrectly classified, will be the subject of further audits.

The second special area of interest in 2015 was water companies' arrangements for bulk transfers. The water industry has many interconnections within and between water companies that allow the interchange of water to ensure a sufficient volume is available. These supplies are referred to as bulk transfers or bulk supplies. When a company supplies water to another company both are responsible in this arrangement. That means water must be wholesome when exported and must not cause a deterioration to the system at a later point by the effects of the change in the source. Equally, the importer must ensure they have taken measures to secure suitable water for their system. This is achieved through information sharing and a combined risk assessment ahead of any transfer.

In North London during 2012 an export of water from one company to another resulted in a taste and odour event, this was reported in *Drinking water 2012*. In response, companies undertook to share quality information and up-to-date knowledge of the status of all bulk transfers (including both inter-company and intra-company transfers). However, during 2013, two events were notified to the Inspectorate where a bulk transfer connection was in place, but the companies involved did not know if it was in operation or which consumers were served by it.

In 2015, the Inspectorate identified further evidence that weaknesses existed in the protocols and arrangements for bulk supplies. The Inspectorate instigated an audit to establish the current status of arrangements for bulk transfers and their fitness for purpose, the strategies for operating bulk transfers, communication with receiving companies, and sharing of water quality data. In total, 24 companies were audited and one was selected for a site audit to assist with a more detailed inspection of communications between supplying and recipient water companies.

As a forward strategy for companies to develop their resource and resilience plan involving bulk transfers, it would be expected that senior managers would, by 2015, have clear framework agreements and risk assessments to ensure water quality is the highest priority. The Inspectorate was therefore disappointed to identify 25% of the companies' bulk transfer protocols did not include a regular transfer of data or interaction between provider and recipient company, nor had the majority of arrangements audited been reviewed or updated since being introduced in 2012. Companies failed to share risk assessments, water quality data or any other water quality risk mitigation approach for supplies between companies or within companies. Companies should ensure that they are fully aware of the risks when exporting or importing water and they have taken all steps to assess the risk to both companies.

The Inspectorate, as part of its better regulation strategy, shared with the industry the findings from these audits in November 2015 at WaterUK. As best practice, the advice to companies has been incorporated into the revised guidance of the Regulations, currently in consultation and scheduled for release in early summer 2016.

Table 22 summarises the Inspectorate's activity in relation to improvements to water quality. These activities cover the putting in place of Notices or undertakings and the checks made to ensure the work specified by the company is technically appropriate, has been carried out in the required timescales and the benefits to water quality have been realised.

**Table 22: Outcome of audit activities relating to enforcing water quality improvements**

| Activity | Number of improvement programmes (and outcomes) |
|---|---|
| Issuing of statutory instruments | Notices:<br>AFW (1), SEW (1), TMS (4) |
| Reviewing schemes | Schemes reviewed:<br>AFW (6), SES (2), SEW (48), SRN (31), TMS (25) |
| Changes of solution | Schemes examined:<br>AFW (2), SRN (1), TMS (1) |
| Closure of schemes | Schemes reviewed for closure:<br><br>Satisfactory – PRT (1), SEW (27), SRN (13), TMS (5) |
| Inspection of schemes | None during period |
| Receipt of risk assessments* | AFW (12,969), TMS (63,553), SES (5,536), SEW (38,315), SRN (17,798), PRT (7,191) |
| *These figures represent lines of data reported to the Inspectorate. The outcome of the review of the data can be found in the Inspectorate's new quarterly report[2]. | |

*For further information on the Water Supply (Water Quality) Regulations 2000, or the microbiological and chemical parameters covered by the regulations please refer to the DWI website (www.dwi.defra.gov.uk).*

*If you have a need for more specific information than that on our website, please contact us on the DWI enquiry line: 0300 068 6400.*

[2] http://dwi.defra.gov.uk/about/annual-report/2016/index.html

# Annex 1
## Further sources of information

The reports and other content are published on the DWI website only (www.dwi.defra.gov.uk).

The publication *Drinking water 2015* comprises the regional reports for England and a report covering Wales. There are four regional reports for England (Central and Eastern, London and South East, Northern, and Western) and one for Wales (in two languages). Each report presents information from 2015 under the following headings:

- Summary.
- Water supply arrangements.
- Drinking water quality testing.
- Drinking water quality results.
- Drinking water quality events.
- Technical audit activity.

There are also separate reports covering private water supplies, one covering England and one covering Wales (in two languages).

### Water company look-up tables

These summarise all the results of water company monitoring in 2015. They provide information on:

- what was tested;
- how many tests were performed;
- the range of the results of testing; and
- how many tests failed to meet the standards.

### Significant drinking water quality events in England and Wales 2015

To promote shared learning, the Inspectorate has compiled a list of all significant, serious and major events that occurred in 2015, which illustrates the nature and cause of each event, the main actions by the company and findings from the inspectors' assessments. Relevant content from this overall list is contained in an annex to each regional report.

# Annex 2
## Information relating to public water supplies published by the Inspectorate in 2015

## Information Letters

| Ref | Title |
|---|---|
| 01/2015 | Regulation 28 reporting requirements |
| 02/2015 | Legal Instruments – Processes for reporting on, agreeing changes to and closure/revocation |
| 03/2015 | Regulation 31 approval of products and substances intended for disinfestation, disinfection or cleaning agents of waterworks apparatus and distribution systems |
| 04/2015 | Publication of a research report on the significance of chromium in drinking water |
| 05/2015 | Publication of research: Understanding the implications of the European requirements relating to radon in drinking water |

The letters, and their associated annexes, can be found on the Inspectorate's website at http://www.dwi.defra.gov.uk/stakeholders/information-letters/index.htm

## Technical guidance

- World Health Organisation technical brief – Boil water

Copies of the above guidance can be found on the Inspectorate's website at http://www.dwi.defra.gov.uk/stakeholders/guidance-and-codes-of-practice/

## Research

| Ref | Title |
|---|---|
| DWI 70/2/223 | Free-Living protozoa and opportunistic pathogens in distributed water |
| DWI 70/2/256 | Risk assessment of VTEC infections in English and Welsh drinking water |
| DWI 70/2/261 | Effective microbial control strategies for main breaks and depressurization |
| DWI 70/2/275 | Understanding the significance of chromium in drinking water |
| DWI 70/2/281 | National assessment of the risks to water supplies posed by low taste and odour threshold compounds |
| DWI 70/2/292 | Volatile organic compounds – Understanding the risks to drinking water |
| DWI 70/2/300 | Effect of UV on the chemical composition of water including disinfection byproduct formation |
| DWI 70/2/301 | Understanding the implication of the EC's proposals relating to radon in drinking water for the UK |

Copies of research reports and executive summaries can be found on the Inspectorate's website at http://www.dwi.defra.gov.uk/research/completed

# Annex 3

## Not significant and minor drinking water quality events

| Nature | Number of not significant and minor events | Area affected (estimate of population affected) |
|---|---|---|
| Air in water (white) | IWN (1) | Greenwich, London (175) |
| | SEW (1) | Maidenhead (155,000) |
| | SSE (1) | Bromley Common, Kent (1,500) |
| Chemical | AFW (3) | Denham, Ickenham, Uxbridge and North Hillingdon, Buckinghamshire/Middlesex (40,415)<br>Hayes, Middlesex (3)<br>Hertsmere, Hertfordshire (3) |
| | SES (1) | Epsom Downs, Surrey (3) |
| | SRN (2) | Chatham, Kent (3)<br>Timsbury, Hampshire (3) |
| | TMS (5) | Aldsworth, Gloucestershire (3)<br>Newbury, Berkshire (150)<br>Southgate, North London (3)<br>Wallingford, Oxfordshire (3)<br>Willesden, North West London (5) |
| Discolouration | SEW (4) | Sevenoaks, Kent (8,750)<br>Burgess Hill, Sussex (3,390)<br>Petersfield, Hampshire (4,500)<br>Farnham Town, Surrey (7,500) |
| | SRN (2) | Horsham, Surrey (8,185)<br>Isle of Wight (23) |
| | TMS (1) | Swindon, Wiltshire (28,424) |
| Health concern | AFW (1) | Hampstead, North London (491) |
| | IWN (1) | Kings Cross, Central London (1,377) |
| | SRN (2) | Isle of Wight (3)<br>Large area of East Sussex (368,867) |
| | SSE (1) | Inset appointments in London (2,000) |

| Nature | Number of not significant and minor events | Area affected (estimate of population affected) |
|---|---|---|
| Inadequate treatment | IWN (3) | Dartford, Kent (1,238)<br>Kings Cross and Greenwich, London (1,128)<br>Inset appointments in London (1,377) |
| | SRN (1) | Isle of Wight (37,198) |
| | SSE (2)* | Inset appointments in London (2,800)<br>Inset appointments in London (2,000) |
| Loss of supplies/ poor pressure | AFW (1) | Stansted Mountfitchet, Essex (12,998) |
| | PRT (1) | Bishops Waltham, Hampshire (8,260) |
| | SRN (1) | Crawley, West Sussex (2,669) |
| | TMS (3) | Shepherd's Bush, West London (43,233)<br>Enfield, Greater London (25,000)<br>Westminster, Central London (52,840) |

*For SSE events, these were inadequate treatment of the bulk supply to the company.

| Nature | Number of not significant and minor events | Area affected (estimate of population affected) |
|---|---|---|
| Microbiological | AFW (3) | Hampstead, North London (491)<br>Paddlesworth, Kent (13,000)<br>Sheppeton, Surrey (1) |
| | ALB (1) | Upper Rissington, Gloucestershire (1,200) |
| | IWN (1) | Kings Cross, Central London (1,046) |
| | SES (1) | Cheam, Surrey (3) |
| | SEW (4) | Burgess Hill, West Sussex (3)<br>Farnborough, Hampshire (3)<br>Hale, Hampshire (17,394)<br>Eastbourne, East Sussex (3) |
| | SSE (3) | Croydon, Surrey (500)<br>Didcot, Oxfordshire (1,750)<br>Inset appointments in London (2,000) |
| | TMS (13) | Abingdon, Oxfordshire (3)<br>Bedwyn, Wiltshire (3)<br>Brent Cross, North West London (3)<br>Bromley, Kent (3)<br>Chiddingfold, Surrey (7,015)<br>Cirencester, Gloucestershire (38,866)<br>Croydon, Surrey (130,000)<br>Kentish Town, North London (3)<br>Oxford (3)<br>Stoke Newington, North London (3)<br>Twyford, Berkshire (3)<br>Wandsworth, South West London (3)<br>Watlington, Oxfordshire (14,429) |
| Other | AFW (1) | Sampler issue, Dover, Kent (N/A) |
| | SEW (1) | Wych Cross, East Sussex (48,988) |
| | SRN (4) | Rye, East Sussex (3,161)<br>Hove, East Sussex (3)<br>Thanet, Kent (3)<br>Laboratory issue (N/A) |
| | TMS (2) | Bromley, Kent (95)<br>Laboratory issue (N/A) |

| Nature | Number of not significant and minor events | Area affected (estimate of population affected) |
|---|---|---|
| Public concern | IWN (1) | Aylesbury, Buckinghamshire (3) |
| | SES (1) | Reigate, Surrey (3) |
| | SRN (5) | Andover, Hampshire (1)<br>Horsham, West Sussex (3)<br>Meopham, Kent (3)<br>Northfleet, Kent (96)<br>Brighton (15) |
| | TMS (12) | Battersea, South West London (50)<br>Bermondsey, South East London (3)<br>Deddington, Oxfordshire (3)<br>Farringdon, Oxfordshire (3)<br>Hackney, East London (75)<br>Hungerford, Berkshire (3)<br>Kilburn, North West London (3)<br>Newbury, Berkshire (3)<br>Shoreham, Kent (1)<br>Sparsholt, Oxfordshire (3)<br>Streatham, South London (3)<br>Whitley Wood, Berkshire (3) |
| Taste or odour | AFW (3) | Amersham, Buckinghamshire (8)<br>Uxbridge, Middlesex (2)<br>Uxbridge, Middlesex (3) |
| | IWN (2) | Kings Cross, Central London (3)<br>Kings Cross, Central London (1,046) |
| | TMS (1) | Ickford Village, Buckinghamshire (3) |
| **Total** | **97 – AFW (12), ALB (1), IWN (9), PRT (1), SES (3), SEW (10), SRN (17), SSE (7), TMS (37)** | **1,102,846** |

## Significant, serious and major drinking water quality events

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 07 Jan 2015<br>For 2 days<br>(SEW) | Crowthorne, Bracknell | 140,000 | Air in water (white) due to failure of a compressor at Bray Gravels works. | **South East Water Plc action:**<br>• Repaired faulty equipment.<br>• Flushed distribution system.<br><br>**DWI comments and findings:**<br>• The risk of compressor failure was not considered in the company's risk assessment for Bray Gravels works and was required to be updated.<br><br>Risk classification: Significant |
| 12 Jan 2015<br>For 1 hour<br>(AFW) | Piccotts End works, Hemel Hempstead and Kings Langley | 29,102 | High turbidity on final water. | **Affinity Water Ltd action:**<br>• Shut down works.<br>• Sampled affected area.<br><br>**DWI comments and findings:**<br>• The company carried out valve operations which resulted in chalk deposits being scoured from pipework.<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 18 Jan 2015 For 3 days (SRN) | Martin Mill service reservoir, Eastry, Kent | 5,760 | Loss of supplies/poor pressure due to unplanned emptying of a service reservoir caused by loss of telecommunications for reservoir level. | **Southern Water Services Ltd action:**<br>• The company telecommunication links to the reservoir level probe were lost and in response the company initiated manual control. The control was insufficient and loss of supplies resulted. Alternative supplies were then switched from Martin Gorse works.<br>• Bottled water was provided on request.<br><br>**DWI comments and findings:**<br>• The company failed to conduct adequate risk assessments and had poor contingency planning. The event was wholly avoidable as the company did not consider the extent to which they could rezone. The company has been required to update its risk assessments and to improve event reporting processes.<br><br>Risk classification: Significant |
| 22 Jan 2015 For 3 days (SRN) | Crawley, East Sussex | 32,500 | Potential loss of supplies/poor pressure from Turners Hill reservoir. | **Southern Water Services Ltd action:**<br>• The company initiated contingency plans, which included the use of vehicle tankers to support depleted service reservoir levels in response to the loss of power at Hardham works and a treatment issue at Weirwood works, both supplying Turners Hill service reservoir.<br>• Restarted supplying works.<br>• Sampled affected area.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 23 Jan 2015<br>For 10 days<br>(TMS) | Farringdon Station | 385 | Media interest following a burst main flooding Farringdon station. | **Thames Water Utilities Ltd action:**<br>• Repaired main.<br>• Flushed mains.<br>• Sampled affected area.<br>• Retrained staff.<br>• Review of procedures.<br><br>**DWI comments and findings:**<br>• A number of recommendations were made in respect of the failure to notify the Inspectorate, not following the company's own procedures, returning the supply pre-emptively and prior to appropriate quality clearance and failure to carry out an adequate risk assessment.<br><br>Risk classification: Significant |
| 06 Feb 2015<br>For 4 days<br>(SES) | Coulsdon, Surrey | 500 | Taste or odour due to mains lining material. | **Sutton And East Surrey Water Plc action:**<br>• The company carried out planned mains rehabilitation to remove chalk deposits, using a technique known as ice pigging, The company investigated and identified elevated levels of organic chemicals associated with coal tar pipe lining material following consumer complaints of an unusual taste to their supply. A do not drink notice was issued, while the company flushed the mains.<br><br>**DWI comments and findings:**<br>• Recommended that the company reviews its procedures for investigating water quality events to ensure that events are thoroughly investigated and that the company regulatory risk assessments are reviewed company-wide in light of this event.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 17 Feb 2015<br>For 3 days<br>(AFW) | South Hatfield | 13 | Taste or odour due to uncontrolled valving operations during planned work on the distribution system. | **Affinity Water Ltd action:**<br>• Company valving operations while assessing the position of valves within the distribution network caused stagnant water to enter a live main resulting in consumer contacts of an unusual taste to the supply.<br>• Flushed the affected mains resolved the issue.<br><br>**DWI comments and findings:**<br>• The Inspectorate was highly critical of the company in respect of:<br>– its handling of this event;<br>– failure to fully risk assess planned operations;<br>– failure to take sufficient and appropriate samples in response.<br>• Recommend that for similar events, the company collect samples after flushing to confirm whether or not it has been successful.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 19 Feb 2015<br>For 104 weeks<br>(SEW) | Company-wide, Bournemouth and some local authorities | N/A | Laboratory error due to incorrect calculation. | **South East Water Plc action:**<br>• The company introduced an error into the nitrate/nitrite calculation and reported this error for two years. It also affected data from Bournemouth Water.<br>• The company compounded the problem when it introduced new software with the error embedded which was not properly validated.<br>• The company has implemented procedural updates and ongoing checks.<br><br>**DWI comments and findings:**<br>• The Inspectorate was highly critical of the company because this error was undetected for two years and new laboratory computer software was introduced without full validation.<br>• Recommendations were made in respect of the failure to notify the Inspectorate and the failure to inform their customers including a local authority.<br><br>Risk classification: Significant |
| 20 Feb 2015<br>For 4 days<br>(SRN) | Sittingbourne, Kent | 53 | Issue of boil water notice due to microbiological contamination following a burst main. | **Southern Water Services Ltd action:**<br>• Repaired main.<br>• Sampled affected area.<br>• Issued a boil water notice.<br>• Flushed mains.<br>• Provided bottled water on request.<br>• Boil water notice lifted following a clear set of samples.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 24 Feb 2015 For 24 hours (AFW) | Doddinghurst, Essex | 3,781 | Brown discolouration due to burst main, caused by planned work to isolate a water tower. | **Affinity Water Ltd action:**<br>• The company closed a valve in an attempt to isolate a burst main. This caused depressurisation of the wider network leading to calls of no water. The valve was then closed and the changes in flow and pressure mobilised mains deposits resulting in discolouration of supplies.<br>• Rezoned area (brought in water from different source).<br>• Sampled affected area.<br>• Repaired main.<br>• Resamples satisfactory.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br>• The company carried out an appropriate risk assessment for the planned stage of the work, but failed to have adequate contingency measures to address the burst main.<br><br>Risk classification: Significant |
| 26 Feb 2015 For 2 days (TMS) | Kempton works, Hanworth, Middlesex | 480,000 | Evidence of microbiological contamination due to flow change within treatment works. | **Thames Water Utilities Ltd action:**<br>• The company detected two separate instances of *Clostridium perfringens* in the final water. The first was after a reduction of flow following a burst on a delivery main from the works. The second was the following day after a power fluctuation at the works. An enhanced sampling regime was employed within the affected area.<br>• The company has implemented continuous monitoring for *Cryptosporidium*, because of the possibility that these failures are associated with operation of the slow sand filters.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 05 Mar 2015 For 4 days (TMS) | Walthamstow, North East London | 58 | Loss of supplies and media interest due to burst main flooding the North Circular Road. | **Thames Water Utilities Ltd action:**<br>• Repaired main.<br>• Provided an alternative supply by tanker/bowser.<br>• Flushed mains.<br>• Sampled affected area.<br>• All samples satisfactory.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |
| 09 Mar 2015 For 7 hours (AFW) | Iver works, North London | 750,000 | Treatment failure – inadvertent return to supply of an out of service filter. | **Affinity Water Ltd action:**<br>• A works shutdown closed all the valves on 12 carbon filters. Upon restart of the works all valves opened automatically, however, one filter had been out of service and contained no carbon filter media. The works was shut down again and sampling conducted throughout the affected supply area.<br><br>**DWI comments and findings:**<br>• The company failed to ensure adequate protection for such a situation in its risk assessment. The company also failed to take sufficient and appropriate samples in their investigation of the problem.<br><br>Risk classification: Significant |
| 12 Mar 2015 For 1 day (AFW) | Northmoor works, South Buckinghamshire | 73,934 | Treatment failure – high turbidity due to suspension of chalk deposits. | **Affinity Water Ltd action:**<br>• The company were changing borehole use and valve operations caused a flow surge which suspended chalk deposits. The elevated turbidity shut the works down. The affected area was sampled.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 15 Mar 2015<br>For 3 days<br>(TMS) | Moreton- in-Marsh, Gloucestershire | 6,250 | Loss of supplies/poor pressure due to burst main. | **Thames Water Utilities Ltd action:**<br>• Rezoned area (brought in water from different source).<br>• Provided bottled water on request.<br>• Provided an alternative supply by tanker/bowser.<br>• Repaired main.<br>• Sampled affected area.<br>The company restored supplies with minimal impact on water quality.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |
| 18 Mar 2015<br>For 1 day<br>(TMS) | Walton works, South West London | 2,500,000 | Treatment failure – elevated turbidity in the final water following plant start up. | **Thames Water Utilities Ltd action:**<br>• The company identified that a statutory sample collected from the final water contained high turbidity. The company concluded that sediments in the sample tap pipework was the most likely cause. The pipework was flushed and a new operational regime established, together with new online monitoring.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 18 Mar 2015<br>For 3 days<br>(TMS) | Abingdon, Oxfordshire | 22,000 | Taste or odour following rezoning after a burst main. | **Thames Water Utilities Ltd action:**<br>• The company rezoned the network following a burst main and the valve operations resulted in resuspension of mains deposits including coal-tar mains lining material.<br>• In response the company:<br>– flushed the mains;<br>– provided bottled water on request; and<br>– reviewed their procedures.<br><br>**DWI comments and findings:**<br>• The company was criticised for compounding the situation with inaccurate valve position records and lack of knowledge about the location of coal-tar lined mains.<br>• Recommendations were made in respect of inadequate risk assessment and were required to identify the location of coal-tar lined mains.<br><br>Risk classification: Significant |
| 27 Mar 2015<br>For 52 weeks<br>(SRN) | Company-wide | N/A | Errors and shortfalls in data reporting. | **Southern Water Services Ltd action:**<br>• Inadequate regulatory data submission.<br><br>**DWI comments and findings:**<br>• The company was criticised for its poor quality assurance procedures in the submission of data to the Inspectorate which contained significant errors and shortfalls.<br>• The company was required to review its systems and improve self-governance.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 05 Apr 2015<br>For 3 days<br>(TMS) | Kempton Park works, North and West London | 360,000 | *Cryptosporidium*. | **Thames Water Utilities Ltd action:**<br>• The company increased the frequency of *Cryptosporidium* monitoring at Kempton Park works following a number of *Clostridium perfringens* detections (see the event at Kempton works on 26 February 2015). Investigations identified suboptimal operation of a slow sand filter, which was removed from operation.<br><br>**DWI comments and findings:**<br>• It was identified that at this time the associated turbidity data failed to be archived because new online turbidity analysers were being installed and the company were required to make improvements to the manner in which instrumentation archived data.<br><br>Risk classification: Significant |
| 16 Apr 2015<br>For 1 hour<br>(SRN) | Wingham works, near Canterbury | 153,431 | Treatment failure due to elevated turbidity on final water. | **Southern Water Services Ltd action:**<br>• A routine compliance sample failed for turbidity. It was later established that the sample had been taken after the works had shutdown automatically because of elevated turbidity.<br>• Company identified deposits within the contact tank were disturbed due to operating the tank at a low level.<br>• Reviewed procedures for the alarm and shutdown levels of water in the contact tank.<br>• Staff were retrained.<br><br>**DWI comments and findings:**<br>• The company did not notify Inspectorate of the event and were recommended to review its event notification procedure and to clean the contact tank to prevent a recurrence.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 28 Apr 2015<br>For 3 days<br>(TMS) | Swindon area, North Wiltshire | 40,000 | Loss of supplies/poor pressure due to burst main on the inlet to Flaxlands service reservoir. | **Thames Water Utilities Ltd action:**<br>• Provided an alternative supply by tanker/bowser.<br>• Repaired main.<br>• Flushed mains.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |
| 08 May 2015<br>For 1 week<br>(SRN) | Cooks Castle service reservoir, near Sandown, Isle of Wight | 1,890 | Evidence of microbiological contamination. | **Southern Water Services Ltd action:**<br>• The sample was collected from an overland main which was being used as a temporary means of bypassing Cooks Castle service reservoir. The main and sampling equipment were replaced. Subsequent samples were satisfactory.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 10 May 2015 For 3 days (SEW) | Hailsham, Polegate and Pevensey, West Sussex | 7,500 | Loss of supplies/poor pressure due to burst main. | **South East Water Plc action:**<br>• The company rezoned the area (brought in water from a different source) and increased output from other works to supply Folkington service reservoir. Network valve operations to isolate the burst were hampered by inaccurate records, inoperable valves and lack of confined space trained staff. The company provided an alternative supply by tanker/bowser, as well as invoking their emergency bottled water supply contract.<br><br>**DWI comments and findings:**<br>• The company was criticised for inadequate procedures; and inadequate training/competence of staff and were required to improve. A recommendation was made to update the Emergency Plan to ensure adequate alternative supplies are requested from the outset.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 15 May 2015<br>For 52 weeks<br>(SRN) | Company-wide | N/A | Bypassing turbidity meters at works. | **Southern Water Services Ltd action:**<br>• Review of procedures.<br>• Retrained staff.<br>• The company made improvements to the Control and Shutdown software and raised access control for turbidity monitors.<br><br>**DWI comments and findings:**<br>• The company were criticised and warned for the routine practice and the ability for operators to bypass turbidity meters disabling a critical control point intended to protect consumers from inadequately disinfected water. Furthermore, the company was criticised for:<br>– not notifying the Inspectorate.<br>– Inadequate procedures.<br>– Inadequate investigations into root cause.<br>– Inadequate risk assessment.<br>– Inadequate treatment process – disinfection.<br>• Investigation ongoing.<br><br>Risk classification: Serious |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 15 May 2015<br>For 7 days<br>(TMS) | Hackney, London. | 385 | Taste or odour due to contamination of private water storage tank. | **Thames Water Utilities Ltd action:**<br>• In response to consumer complaints in a block of flats, the company:<br>– Sampled affected area.<br>– Issued a do not drink notice.<br>– Carried out plumbing inspections.<br>• The company investigation indicated the likely cause of the taste and odour was as a result of the room housing the communal water tank for a block of flats had been painted with epoxy paint. WRc toxicological information suggests this is the likely source of the compounds detected.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |
| 22 May 2015<br>For 25 hours<br>(SEW) | Pluckley, Kent | 1,298 | Brown discolouration following repair of a leaking main. | **South East Water Plc action:**<br>• The company in response to a straightforward repair to a leaking main supplied discoloured water after the failure of a pressure reducing valve. The company then:<br>– Repaired main.<br>– Flushed mains<br>– Sampled affected area<br>– Reviewed procedures.<br><br>**DWI comments and findings:**<br>• The company failed to carry out an adequate risk assessment for the work carried out. Recommendations requiring the company to update procedures to risk assess and review the status of PRV valves before commencing work on mains.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 02 Jun 2015<br>For 2 days<br>(SRN) | Weirwood works, Sussex | 32,000 | Treatment failure due to excessive pH. | **Southern Water Services Ltd action:**<br>• The final water pH monitor developed a fault, which resulted in excessive sodium hydroxide being dosed and the works shut down.<br>• The affected area was sampled but results were satisfactory.<br><br>**DWI comments and findings:**<br>• A technical audit of the site was carried out in response to this event.<br>• Recommendations were made in response to findings of very poor control by the company resulting in an escalation of a series of problems leading to the event. These include instances where samples were not analysed for appropriate parameters and where:<br>– Sampling was not timely enough.<br>– Lack of maintenance of equipment.<br>– Inadequate number of samples taken.<br>– Inadequate investigations into root cause.<br><br>Risk classification: Significant |
| 06 Jun 2015<br>For 12 weeks<br>(SEW) | Frimley | N/A | Failure to report a regulatory standard exceedance. | **South East Water Plc action:**<br>• The company failed to report a regulatory taste result.<br>• Company investigations identified that this was caused by a laboratory analyst failing to follow internal procedures and also a computer error and retrained the staff involved.<br><br>**DWI comments and findings:**<br>• No further action was taken.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 11 Jun 2015<br>For 3 days<br>(TMS) | South East London | 38,112 | Air in water (white) due to compressor fault. | **Thames Water Utilities Ltd action:**<br>• A solenoid valve on a surge vessel compressor system failed resulting in air entrainment in the distributed water.<br>• The company replaced faulty equipment and sampled the affected area.<br>• Routine maintenance schedules were amended to incorporate full function tests.<br>• Sampling inadequacies unlikely to recur (resource difficulties).<br><br>**DWI comments and findings:**<br>• The company was criticised for not following maintenance procedures; taking insufficient investigational samples; and inadequate procedures to demonstrate the geographical locations of customer contacts.<br><br>Risk classification: Significant |
| 12 Jun 2015<br>For 1 hour<br>(TMS) | Hampton works, West London | 417,000 | Treatment failure due to elevated turbidity at the point of disinfection. | **Thames Water Utilities Ltd action:**<br>• A slow sand filter was inadvertently returned to service without preconditioning. Water with excessive turbidity entered the contact tank.<br>• Review of procedures.<br><br>**DWI comments and findings:**<br>• The company was criticised for changing valve configurations without communicating with staff and for inadequate labelling of valves. Recommendations were made for the company to review its procedures when making changes on works and removing redundant equipment as well as for inadequate sampling in response.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 12 Jun 2015<br>For 1 day<br>(TMS) | Speen works, Newbury, Berkshire | 59,000 | *Cryptosporidium*. | **Thames Water Utilities Ltd action:**<br>• The works is continuously sampled for *Cryptosporidium*. One oocyst was detected in 1,100 litres of sample.<br>• Blended supply with another source.<br>• Review of procedures.<br>• Sampled affected area.<br><br>**DWI comments and findings:**<br>• A technical audit of the site was undertaken because this was a repeat of an event in 2013.<br>• The company was unable to provide a definitive root cause for this event and so enforcement action has been initiated with a Regulation 28 Notice requiring that the company takes action to mitigate the risk of *Cryptosporidium* at this works.<br><br>Risk classification: Significant |
| 13 Jun 2015<br>For 1 day<br>(TMS) | Sundridge works, Westerham, Kent | 38,000 | Treatment failure due to elevated turbidity. | **Thames Water Utilities Ltd action:**<br>• The company took a routine compliance sample which failed for turbidity. Company investigations indicated that the sample was taken after the works had automatically shut down after a high turbidity alarm.<br>• The company attributed the turbidity to a disturbance of deposits in the outlet main following a works shut down.<br><br>**DWI comments and findings:**<br>• The company were required to carry out regular flushing of the outlet main and to investigate the occurrence of turbidity spikes on the inlet to the contact main.<br>• The investigation identified aeration issues in the turbidity monitor on works start up, which were resolved with the installation of appropriate equipment.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 15 Jun 2015<br>For 1 day<br>(AFW) | Great Dunmow | 30,849 | Loss of supplies/poor pressure due to a burst main. | **Affinity Water Ltd action:**<br>• Repaired main.<br>• Sampled affected area.<br>• Flushed mains.<br>• Provided bottled water on request.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |
| 18 Jun 2015<br>For 12 hours<br>(TMS) | New Malden, Merton, Tooting and Kingston upon Thames | 209,039 | Loss of supplies/poor pressure and media interest due to burst main. | **Thames Water Utilities Ltd action:**<br>• The burst main caused flooding of New Malden underground station, leading to significant local media coverage.<br>• Rezoned area (brought in water from different source).<br>• Repaired main.<br>• Sampled affected area.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 23 Jun 2015<br>For 52 weeks<br>(SEW) | Company-wide | N/A | Sampling shortfall in 2014 data returns. | **South East Water Plc action:**<br>• Following a significant shortfall in 2014 (see *Drinking water 2014 – London and South East region*) compliance data submissions, the company belatedly notified the Inspectorate, following an instruction to do so.<br><br>**DWI comments and findings:**<br>• The company were criticised for very poor data handling and poor internal communications which caused this issue. Improvements have been made to the company's data systems and management of its sampling programmes. The Inspectorate will continue to monitor the company submissions for errors and data quantity.<br>• A recommendation was made in respect of the absence of appropriate notification.<br><br>Risk classification: Significant |
| 29 Jun 2015<br>For 1 day<br>(TMS) | Lambeth, London | 185,000 | Loss of supplies/poor pressure due to burst main. | **Thames Water Utilities Ltd action:**<br>• Burst main isolated and repaired, with significant media interest due to local flooding. Bottled water was provided to vulnerable customers.<br>• Flushed mains.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 01 Jul 2015<br>For 3 days<br>(AFW) | Egham works, Egham and Staines | 300,000 | Loss of supplies due to a burst main within the treatment process. | **Affinity Water Ltd action:**<br>• The single delivery main prior to the filtration stage ruptured and the works shut down. The company put in place contingency plans which maintained supplies to the majority of consumers supplied by the works.<br>• Provided an alternative supply by tanker/bowser.<br>• Provided bottled water on request.<br>• Rezoned area (brought in water from different source).<br>• Sampled affected area.<br><br>**DWI comments and findings:**<br>• A duplicate main has been installed to remove the single point of failure and the company were required to review all their risk assessments and include actions to mitigate against single points of failure.<br>• The company was also required to conduct a desk top exercise of the worst case scenario to ensure actions are identified for future events and to satisfy themselves their alternative water plan is fit for a prolonged event.<br><br>Risk classification: Serious |
| 01 Jul 2015<br>For 2 days<br>(SEW) | Crowthorne | 75,000 | Loss of bulk import from Affinity Water. | **South East Water Plc action:**<br>• Loss of bulk import from Egham works operated by Affinity Water (see event at Egham works on 1 July 2015).<br>• Rezoned area (brought in water from different source).<br><br>**DWI comments and findings:**<br>• The company is undertaking work during AMP6 to remove the reliance on the bulk supply. A suggestion was made to ensure the company has the necessary plans in place to deal with a long-term loss of the bulk supply while these works are undertaken.<br>• Regulation 28 risk assessment for Crowthorne zone required to be updated.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 10 Jul 2015<br>For 12 hours<br>(TMS) | Swindon and Cricklade | 263,451 | Loss of supplies/poor pressure due to burst main on inlet to Blunsden service reservoir. | **Thames Water Utilities Ltd action:**<br>• Vehicle tankers were deployed to supplement supplies into the distribution system.<br>• Provided bottled water on request.<br>• Repaired main.<br>• Sampled affected area.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |
| 15 Jul 2015<br>For 30 weeks<br>(TMS) | London | N/A | Samples taken from the incorrect address. | **Thames Water Utilities Ltd action:**<br>• A company employee was avoiding taking regulatory compliance samples from consumers' taps by fraudulently taking all such samples from the same fixed sampling point in the distribution network and deliberately mislabelling them with the addresses of planned consumer's tap samples.<br>• Company carried out additional sampling to make up the shortfall in samples.<br>• Reviewed procedures.<br>• Implemented GPS tracking of samplers' vehicles.<br><br>**DWI comments and findings:**<br>• Samples where the sampling location is unknown have been removed from the record.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 23 Jul 2015 For 78 weeks (AFW) | Home Counties and North London | 3,375 | Potential contamination of supplies due to contractors failing to install water meters hygienically. | **Affinity Water Ltd action:**<br>• The company became concerned that meter replacements carried out by a contractor operating in its central region were not being conducted in a hygienic manner. The company investigation confirmed that hand washing facilities and disinfectant solution were not being employed.<br>The contractor carrying out meter exchange work was suspended from carrying out these duties pending review and improvement to procedures.<br>• The company reviewed contracts and ensured that appropriate water quality criteria were specified within them.<br>• The company also communicated with staff and carried out audits on contractor's work.<br><br>**DWI comments and findings:**<br>• The company did not initially notify the Inspectorate of the situation.<br>• The company report did not provide sufficient evidence to demonstrate actions taken.<br>• Recommendations were made with respect to contractor management; contractor procedures and water supply hygiene.<br>• The company was required to revise its risk assessments and reports to the Inspectorate.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 06 Aug 2015<br>For 1 day<br>(TMS) | Long Hanborough, Witney, Oxon | 2,990 | Brown discolouration due to planned work. | **Thames Water Utilities Ltd action:**<br>• The company returned a booster station to supply without assessing the impact. Sampled affected area.<br>• Flushed mains.<br><br>**DWI comments and findings:**<br>• The company confirmed that procedures were adequate but were not followed. The company issued a technical briefing note to remind staff that risk assessment is part of the required operational standard.<br><br>Risk classification: Significant |
| 12 Aug 2015<br>For 2 weeks<br>(SRN) | Hastings | 12,007 | Cryptosporidiosis notification from PHE. | **Southern Water Services Ltd action:**<br>• The company carried out extensive sampling at supplying works which did not identify a link with the drinking water supply.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |
| 13 Aug 2015<br>For 48 hours<br>(SEW) | Folkington, East Sussex | 80,904 | Brown discolouration due to burst mains. | **South East Water Plc action:**<br>• Rezoned area (brought in water from different source).<br>• Repaired main.<br>• Flushed mains.<br>• Sampled affected area.<br><br>**DWI comments and findings:**<br>• The Inspectorate was critical that the sampling was carried out after flushing was completed and the water was no longer discoloured. The Inspectorate recommended that investigative samples are taken in a timely manner.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 24 Aug 2015<br>For 1 week<br>(SEW) | Meads service reservoir, Eastbourne | 55,000 | Microbiological contamination due to ingress. | **South East Water Plc action:**<br>• *E.coli* was detected in both reservoir compartments.<br>• The company took a staged approach to cleaning the reservoir compartments.<br>• The affected area was sampled.<br><br>**DWI comments and findings:**<br>• The Inspectorate is critical of the company for failure to adequately mitigate the risk of not being able to isolate both compartments. Subsequently the company has prioritised sufficiency of supply over quality and the inherent potential risk to the consumer.<br><br>Risk classification: Significant |
| 27 Aug 2015<br>For 34 hours<br>(SEW) | Maresfield, Sussex | 4,258 | Brown discolouration due to planned work. | **South East Water Plc action:**<br>• Discolouration of network following planned mains connection.<br>• The company flushed the mains and sampled the affected area.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |
| 28 Aug 2015<br>For 2 days<br>(SEW) | Birling Farm works and Mill Gap service reservoir, Eastbourne, Sussex | 17,000 | *Cryptosporidium*. | **South East Water Plc action:**<br>• While investigating the detection of *E.coli* in Meads service reservoir (see event at Meads service reservoir on 24 August 2015) *Cryptosporidium* was detected in Birling Farm treated water and Mill Gap service reservoir.<br>• Sampled affected area.<br><br>**DWI comments and findings:**<br>• Investigation ongoing.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 30 Aug 2015 For 24 hours (SRN) | St Leonards-on-Sea, East Sussex | 15,738 | Loss of supplies/poor pressure and discolouration due to burst main. | **Southern Water Services Ltd action:**<br>• The company repaired the main but allowed an associated service reservoir to run low with consequent entrapment of air in the distribution system, which compounded the loss of supplies.<br>• Provided an alternative supply by tanker/bowser.<br>• Sampled affected area.<br><br>**DWI comments and findings:**<br>• The investigation was satisfactorily completed, with no further action required. However, the company was reminded of the requirement to provide information to the Inspectorate in a timely manner.<br><br>Risk classification: Significant |
| 05 Sep 2015 For 1 day (SRN) | Chatham | 1,560 | Brown discolouration due to Fire Brigade use of a hydrant disturbing mains sediment. | **Southern Water Services Ltd action:**<br>• Sampled affected area.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |
| 23 Sep 2015 For 24 hours (TMS) | Darenth works, Dartford | 275,000 | Elevated turbidity on final water. | **Thames Water Utilities Ltd action:**<br>• A statutory sample collected from the final water demonstrated elevated turbidity. The on-line monitoring of the water did not confirm the level, but the works was removed from supply for an inspection. Sand and corrosion deposits were found.<br>• Sampled affected area.<br><br>**DWI comments and findings:**<br>• The Inspectorate recommended the company carry out further investigations to confirm the source of the deposits in the contact tank and take the necessary steps to prevent a recurrence.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 23 Sep 2015<br>For 8 weeks<br>(SRN) | Tenants Hill service reservoir, Worthing | 12,701 | Evidence of microbiological contamination. | **Southern Water Services Ltd action:**<br>• Company removed reservoir from supply for cleaning and inspection as well as replacing the sampling kiosk.<br>• Sampled affected area.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |
| 01 Oct 2015<br>For 3 days<br>(AFW) | St Albans, Hertfordshire | 133 | Media interest in burst main, and subsequent precautionary boil water notice. | **Affinity Water Ltd action:**<br>• A sink hole appeared in a road, causing damage to a water main.<br>A temporary overland supply was provided until access to repair the main was obtained. The company issued boil water notice following the damage.<br>• Sampled affected area.<br>• Provided a alternative supply by temporary main.<br>• Provided bottled water.<br>• After restoring supplies, affected consumers were issued a precautionary boil water notice, which was lifted following satisfactory sample results.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 18 Oct 2015<br>For 6 hours<br>(SES) | Puddledock service reservoir, Edenbridge, Kent | 7,500 | Loss of supplies/poor pressure due to unplanned emptying of service reservoir. | **Sutton And East Surrey Water Plc action:**<br>• Communications from the reservoir level monitor were lost. Attempts to restore supplies by manual operation of the delivery pumps failed because the company did not ensure that there was sufficient water available in the reservoir.<br>• Provided bottled water.<br>• Rezoned area (brought in water from different source).<br>• Repaired faulty equipment.<br>• Sampled affected area.<br>• Reviewed internal procedures.<br><br>**DWI comments and findings:**<br>• Suggested the company carry out Fittings Inspections of high risk properties when mains are depressurised.<br><br>Risk classification: Significant |
| 29 Oct 2015<br>For 12 hours<br>(SRN) | Redbridge Lane, Southampton | 300 | Loss of supplies and brown discolouration due to burst mains. | **Southern Water Services Ltd action:**<br>• Sampled affected area.<br>• Repaired main.<br>• Rezoned area (brought in water from different source).<br><br>**DWI comments and findings:**<br>• Investigation ongoing.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 08 Nov 2015<br>For 2 days<br>(TMS) | Sheafhouse works, Chipping Campden | 8,075 | Treatment failure due to failure of automatic shutdown. | **Thames Water Utilities Ltd action:**<br>• The works experienced a power outage, but the auto-shutdown failed to operate allowing water to enter the downstream service reservoir which may not have been fully treated.<br>• The system was flushed and sampled.<br>• The company is at risk of enforcement action at this site.<br><br>**DWI comments and findings:**<br>• Inadequate risk assessment.<br>• Lack of maintenance of equipment.<br>• Inadequate treatment process – disinfection.<br>• Inadequate communication caused delay in response.<br>• Recommended the company revises its mains records to comply with Regulations 17 and 18.<br>• Recommended the company reappraises the control philosophy for the works to deal with a power failure.<br>• Recommended the company revises its Regulation 27 risk assessment for Sheafhouse works.<br>• Recommended the company reviews its disinfection policy for Sheafhouse works, to ensure future compliance with Regulation 26.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 10 Nov 2015<br>For 1 day<br>(SRN) | Burham works, Kent | 242,400 | Treatment failure due to excess sodium hydroxide dose. | **Southern Water Services Ltd action:**<br>• Following a works shut down it was identified that the sodium hydroxide dosing pump, post contact tank, had continued operating as it had been left in manual mode. The high pH water was removed to waste from the high lift pump sump.<br>• Sampled affected area.<br>• Review of procedures.<br><br>**DWI comments and findings:**<br>• The event was caused by staff not operating the plant as per procedure and recommendations were made in respect of inadequate training/competence of staff.<br><br>Risk classification: Significant |
| 13 Nov 2015<br>For 4 days<br>(SRN) | Hove, East Sussex | 3 | Taste or odour due to mains problem. | **Southern Water Services Ltd action:**<br>• The company connected a property to a stagnant main. The owner was advised not to use the water, while the connection was transferred to a different main.<br><br>**DWI comments and findings:**<br>• The company was criticised for not following its procedure for mains connections and for not having a policy for physically isolating decommissioned mains. A recommendation was made in respect of inadequate procedures.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 21 Nov 2015 For 3 days (PRT) | Eastergate and Westergate works | 83,065 | *Cryptosporidium*. | **Portsmouth Water Plc action:**<br>• Detection of *Cryptosporidium* following a period of heavy rainfall. Both works were shut down.<br>• Sampled affected area.<br><br>**DWI comments and findings:**<br>• Notices are in place covering both works requiring installation of UV treatment for inactivation of *Cryptosporidium*, due for completion in 2016.<br>• The company was criticised for a short-lived failure to comply with the requirement to continuously monitor for *Cryptosporidium*, which was a condition of the Notice when Eastergate works was returned to supply.<br><br>Risk classification: Significant |
| 25 Nov 2015 For 1 hour (TMS) | Coppermills works, West Ham, Stratford, Stepney | 1,000 | Loss of supplies/poor pressure due to power loss. | **Thames Water Utilities Ltd action:**<br>• A momentary power loss at the works caused a high lift pump to trip. The pump trip system had been incorrectly set.<br><br>**DWI comments and findings:**<br>• The company was criticised for not identifying the error in commissioning tests and are to inform the Inspectorate on completion of a review of all large treatment, and confirm that similar faults do not exist or have been rectified at other critical works.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 02 Dec 2015<br>For 1 day<br>(TMS) | Shalbourne service reservoir, Bedwyn | 3,544 | Evidence of microbiological contamination. | **Thames Water Utilities Ltd action:**<br>• Statutory samples collected from two compartments at the reservoir detected *E.coli* in one compartment. The company sampled widely and then isolated the compartment from supply.<br>• The cause of contamination was attributed to the condition of the sampling facilities.<br><br>**DWI comments and findings:**<br>• No points of ingress were identified, but the sampling facility was not fit for purpose. Enforcement action was considered, but the company has developed a prioritised action plan for resolution of company-wide sampling facilities which the Inspectorate will keep under review.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 11 Dec 2015 For 1 day (SRN) | Greatwood service reservoir, Shanklin, Isle of Wight | 10,991 | Risk of contamination due to ingress into service reservoir. | **Southern Water Services Ltd action:**<br>• Ingress into the reservoir at a site of a previous internal repair was identified during a routine inspection.<br>• The reservoir was isolated from supply, but because the risk of losing supplies was not fully mitigated, the reservoir was later returned to supply without any measures to prevent the ingress.<br>• A boil water notice was issued.<br>• Supplies were further maintained by use of tankers until a temporary bypass main was installed to allow Greatwood reservoir to be bypassed and removed from supply.<br>• Company are reviewing the repair options.<br><br>**DWI comments and findings:**<br>• Did not keep customers informed.<br>• Boil water notice was delayed to some customers. The company were recommended to review procedures to ensure notifications on restriction of use are made as soon as is practicable.<br>• Repairs carried out in 2008 failed before the scheduled ten year inspection, however, repairs carried out this year will be inspected in two years.<br>• Quarterly visual inspections were not followed up when comments were made regarding work needed.<br>• Recommended that staff carrying out reservoir inspections are kept abreast of issues identified and timely closure of actions is made.<br>• Recommended that risks identified at inspections are addressed in a timely manner to protect public health.<br>• Recommended that the service reservoir is not returned to supply until it is structurally sound and watertight.<br>• Recommended that the company reviews the work of the reservoir repair team to determine if a wider issue exists.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 12 Dec 2015<br>For 1 day<br>(SEW) | Burwash zone, East Sussex | 10,000 | Loss of supplies/poor pressure and discolouration due to burst main supplying Flimwell service reservoir. | **South East Water Plc action:**<br>• Bypassed service reservoir.<br>• Repaired main.<br>• Sampled affected area.<br><br>**DWI comments and findings:**<br>• The company investigation, response, provision of information and assistance was satisfactory.<br><br>Risk classification: Significant |
| 16 Dec 2015<br>For 12 hours<br>(SRN) | Romsey, Chandler's Ford and Rownhams, Southampton | 162,500 | Brown discolouration following shutdown and restart of Testwood works after power outage, causing suspension of sediments and elevated turbidity. | **Southern Water Services Ltd action:**<br>• Emergency generators failed after operating for a short period.<br>• Reviewed procedures.<br>• Sampled affected area.<br>• Shut down treatment works.<br>• Restarted the works.<br><br>**DWI comments and findings:**<br>• Maintenance of equipment was lacking.<br>• The company did not liaise with health authorities and were recommended to do so in future, on all occasions where the water supplied has been improperly disinfected.<br>• Inadequate follow-up sampling. Recommended that the company reviews it sampling procedures to comply with the requirements of the Regulations.<br><br>Risk classification: Significant |

| Date and duration | Area | Estimate of population affected | Nature and cause of the event | Main actions and findings from the Inspectorate investigation |
|---|---|---|---|---|
| 23 Dec 2015 For 4 weeks (SRN) | Worthing, West Sussex | 157,250 | *Cryptosporidium* – PHE notification of five cases. | **Southern Water Services Ltd action:**<br>• Sampled affected area.<br><br>**DWI comments and findings:**<br>• Sampling was not timely enough. Recommended that the relevant parts of the business are reminded for the need to conduct robust and timely investigations when investigating water quality events and the requirements of the regulations are reinforced.<br><br>Risk classification: Significant |

Note: A complete table of events in England and Wales in 2015 can be found on the DWI website (www.dwi.defra.gov.uk). It is named **Significant drinking water events in England and Wales 2015.pdf**.

# Annex 4
## Planned drinking water quality improvements

| Company | Parameter, hazard or driver | Site | Due for completion* | Status* | Legal Instrument |
|---|---|---|---|---|---|
| AFW | Lead | Distribution System | 31-Mar-20 | Ongoing | Notice |
| AFW | Manganese | Blackford | 31-Mar-17 | Ongoing | Undertaking |
| AFW | Manganese | Roydon | 31-Mar-17 | Ongoing | Undertaking |
| AFW | Metaldehyde | Bulk Imports | 31-Mar-20 | Ongoing | Undertaking |
| AFW | Nitrate | Kings Walden | 31-Jul-16 | Delayed | Undertaking |
| AFW | Pesticides and metaldehyde | North Mymms | 31-Mar-17 | Ongoing | Undertaking |
| AFW | Pesticides and metaldehyde | River Thames treatment works | 31-Mar-20 | Ongoing | Undertaking |
| AFW | Pesticides, carbetamide, propyzamide and metazachlor | Iver | 31-Mar-18 | Ongoing | Notice |
| IWN | Pesticides and metaldehyde | Kings Cross and Greenwich Millennium Village | 31-Mar-20 | Ongoing | Undertaking |
| PRT | *Cryptosporidium* and turbidity | Eastergate | 31-Aug-16 | Ongoing | Notice |
| PRT | *Cryptosporidium* and turbidity | Westergate | 31-Aug-16 | Ongoing | Notice |
| PRT | Lead | Lead strategy | 31-Mar-20 | Ongoing | Notice |
| SES | Metaldehyde | Bough Beech | 31-Mar-20 | Ongoing | Undertaking |
| SEW | Coliform bacteria and *E.coli* | Stockbury | 31-Dec-16 | Ongoing | Notice |
| SEW | Coliform bacteria and *E.coli* | Waterworks Road | 31-Mar-16 | Ongoing | Notice |
| SEW | Company improvement | Company data | 28-Feb-17 | Ongoing | Final Enforcement Order |
| SEW | *Cryptosporidium* | Hazards Green | 31-Mar-15 | Completed 16-Mar-15 | Notice |
| SEW | Ingress | St Lawrence | 31-Mar-15 | Completed 31-Mar-15 | Notice |
| SEW | Iron | Ashford | 31-Mar-16 | Ongoing | Undertaking |
| SEW | Pesticides and metaldehyde | Bulk imports | 31-Mar-20 | Ongoing | Undertaking |
| SEW | Pesticides and metaldehyde | Catchment management | 31-Mar-20 | Ongoing | Undertaking |
| SEW | Turbidity | Kingston | 31-Aug-16 | Ongoing | Notice |
| SRN | Bacteriological | Lord of the Manor | 30-Nov-15 | Delayed | Notice |

| Company | Parameter, hazard or driver | Site | Due for completion* | Status* | Legal Instrument |
|---|---|---|---|---|---|
| SRN | Bacteriological | Ventor | 31-Mar-15 | Delayed | Notice |
| SRN | Chlorate | Weirwood | 31-Mar-16 | Ongoing | Notice |
| SRN | Company improvement | Company data | 28-Feb-17 | Ongoing | Final Enforcement Order |
| SRN | Inadequate disinfection | Calbourne | 31-Mar-15 | Completed 19-Feb-15 | Notice |
| SRN | Inadequate disinfection | Chillerton | 31-Mar-15 | Completed 13-Feb-15 | Notice |
| SRN | Inadequate disinfection | Gore | 31-Oct-16 | On Target | Notice |
| SRN | Iron | Woolmans Wood | 31-Nov-18 | Ongoing | Undertaking |
| SRN | Nitrate | Burpham | 30-Sep-16 | Ongoing | Notice |
| SRN | Nitrate | Chilbolton | 30-Sep-16 | Ongoing | Notice |
| SRN | Nitrate | Findon | 30-Sep-16 | Ongoing | Notice |
| SRN | Nitrate | Gore | 30-Sep-16 | Ongoing | Notice |
| SRN | Nitrate | Shoreham | 30-Sep-16 | Ongoing | Notice |
| SRN | Nitrate | Sompting | 30-Sep-16 | Ongoing | Notice |
| SRN | Operator competency and Regulation 26 | Weirwood | 31-Mar-2021 | Other | Notice |
| SRN | Pesticides and metaldehyde | Catchment management | 31-Mar-20 | Ongoing | Undertaking |
| SRN | Taste, odour, pesticides and trihalomethanes | Beauport | 31-Mar-18 | Ongoing | Notice |
| SRN | Taste, odour, pesticides and trihalomethanes | Brede | 30-Sep-18 | Ongoing | Notice |
| SSE | Metaldehyde | Distribution system | 31-Mar-20 | Ongoing | Undertaking |
| TMS | Coliform bacteria | Kiddipore | 31-Mar-15 | Delayed | Notice |
| TMS | Coliform bacteria and *Clostridium perfringens* | Ashford Common | 31-Mar-15 | Completed 03-Dec-15 | Notice |
| TMS | Coliform bacteria, *E.coli* and *Cryptosporidium* | Sturt Road, Haselmere | 31-Mar-16 | Completed 27-Jul-15 | Notice |
| TMS | *Cryptosporidium* | Hambleden | 31-Dec-16 | Ongoing | Notice |
| TMS | *Cryptosporidium* | Speen | 31 Dec 16 | Ongoing | Notice |
| TMS | *E.coli* | Kangley Bridge | 30-Apr-16 | Ongoing | Notice |
| TMS | Lead | All zones | 31-Mar-20 | Ongoing | Notice |
| TMS | Lead | Ashton Keynes | 30-Sep-16 | Ongoing | Notice |
| TMS | Lead | Chipping Campden | 31-Dec-16 | Ongoing | Notice |
| TMS | Lead | Dancers End | 31-Jul-17 | Ongoing | Notice |

| Company | Parameter, hazard or driver | Site | Due for completion* | Status* | Legal Instrument |
|---|---|---|---|---|---|
| TMS | Metaldehyde | Anglian Water bulk supply catchment | 31-Mar-20 | Ongoing | Undertaking |
| TMS | Pesticides and metaldehyde | 11 treatment works | 31-Mar-20 | Ongoing | Undertaking |
| TMS | Power supply | Coppermills | 31-Mar-15 | Completed 03-Mar-15 | Notice |
| TMS | Turbidity and disinfection control | Bedwyn | 30-Nov-14 | Delayed | Notice |

*Dates used are those for the completion of the agreed programme of work. There is a further period of 12 months before a programme is officially closed to ascertain the benefits of the work to consumers.

## Annex 4.1
## Delayed programmes

| Company | Parameter, hazard or driver | Site | Reason for delay |
|---|---|---|---|
| AFW | Nitrate | Kings Walden | Reliability issues with equipment. |
| SRN | Bacteriological | Lord of the Manor | Site has been out of supply for extended periods. |
| SRN | Bacteriological | Ventor | Delays to solution validation. |
| TMS | Turbidity and disinfection control | Bedwyn | Treatment options being investigated. Change application has been submitted. |
| TMS | Coliform bacteria | Kiddipore | Remedial work has been completed but the site has been out of supply for extended periods so the monitoring phase is delayed. |

# Annex 5
## Competition in the water industry

The following table indicates the extent of competition in the water industry in England and Wales.

**Inset appointments in place in 2015**

| Site | Appointee | Incumbent and region | Status |
|---|---|---|---|
| Shotton Paper, Shotton | Albion Water | Dŵr Cymru Welsh Water, Wales | Supplying water |
| Rissington, Bourton-on-the-Water | Albion Water | Thames Water, London and South East region | Supplying water |
| Buxted Chicken, Flixton | Anglian Water | Essex and Suffolk Water, Central and Eastern region | Supplying water |
| Wynyard, near Wolviston | Hartlepool Water | Northumbrian Water, Northern region | Supplying water |
| Brooklands, Milton Keynes | Independent Water Networks Ltd | Anglian Water, Central and Eastern region | Supplying water |
| Great Billing Way, Northampton | Independent Water Networks Ltd | Anglian Water, Central and Eastern region | Supplying water |
| Long Croft Road, Corby | Independent Water Networks Ltd | Anglian Water, Central and Eastern region | Supplying water |
| Priors Hall, Corby | Independent Water Networks Ltd | Anglian Water, Central and Eastern region | Supplying water |
| Oakham North, Oakham | Independent Water Networks Ltd | Severn Trent Water, Central and Eastern region | Supplying water |
| Berryfields, Aylesbury | Independent Water Networks Ltd | Thames Water, London and South East region | Supplying water |
| Greenwich Millenium Village | Independent Water Networks Ltd | Thames Water, London and South East region | Supplying water |
| Kings Cross, London | Independent Water Networks Ltd | Thames Water, London and South East region | Supplying water |
| The Bridge, Dartford | Independent Water Networks Ltd | Thames Water, London and South East region | Supplying water |
| Media City, Salford Quays | Peel Water Networks Ltd | United Utilities, Northern region | Supplying water |
| Norwich Common, Wymondham | SSE Water | Anglian Water Central and Eastern region | Supplying water |
| Emersons Green, Bristol | SSE Water | Bristol Water, Western region | Supplying water |
| Llanilid Park, South Wales | SSE Water | Dŵr Cymru Welsh Water, Wales | Supplying water |
| Riverside, Barking | SSE Water | Essex and Suffolk Water, Central and Eastern region | Supplying water |
| Graylingwell, Chichester | SSE Water | Portsmouth Water, London and South East region | Supplying water |
| Newlands, Waterlooville | SSE Water | Portsmouth Water, London and South East region | Supplying water |
| Farndon Road, Market Harborough | SSE Water | Severn Trent Water, Central and Eastern region | Supplying water |

| Site | Appointee | Incumbent and region | Status |
|---|---|---|---|
| Hills Farm Lane, Horsham, Surrey | SSE Water | Southern Water, London and South East region | Supplying water |
| Park Views, Epsom | SSE Water | Sutton and East Surrey Water, London and South East region | Supplying water |
| Bromley Common, Bromley | SSE Water | Thames Water, London and South East region | Supplying water |
| Great Western Park, Didcot | SSE Water | Thames Water, London and South East region | Supplying water |
| Hale Village, Tottenham | SSE Water | Thames Water, London and South East region | Supplying water |
| Heart of East Greenwich | SSE Water | Thames Water, London and South East region | Supplying water |
| Kennet Island, Reading | SSE Water | Thames Water, London and South East region | Supplying water |
| Kingsmere, Bicester | SSE Water | Thames Water, London and South East region | Supplying water |
| Marine Wharf, Deptford | SSE Water | Thames Water, London and South East region | Supplying water |
| New South Quarter, Croydon | SSE Water | Thames Water, London and South East region | Supplying water |
| Nine Elms, London | SSE Water | Thames Water, London and South East region | Supplying water |
| Brewery Square, Dorchester | SSE Water | Wessex Water, Western region | Supplying water |
| Old Sarum, Salisbury | SSE Water | Wessex Water, Western region | Supplying water |
| MoD Tidworth near Andover | Veolia Water Projects | Wessex Water, Western region | Supplying water |

**New inset appointments in 2015**

| Site | Appointee | Incumbent and region | Status |
|---|---|---|---|
| Northstowe, Cambridge | Anglian Water | Cambridge Water, Central and Eastern region | Appointment granted |
| Woods Meadow. Oulton, Suffolk | Anglian Water | Essex and Suffolk Water, Central and Eastern region | Appointment granted |
| Martello Lakes, Hythe | Independent Water Networks Ltd | Affinity Water and Southern Water, London and South East region | Appointment granted |
| Cadley Hill, Swadlincote | South Staffordshire Water | Severn Trent Water, Central and Eastern region | Appointment granted |
| Castle Way, Old Sarum | SSE Water | Wessex Water, Western region | Appointment granted |

# Annex 6
## Water company indices

**Key**

Affinity Water (AFW)

Albion Water (ALB)

Independent Water Networks (IWN)

Portsmouth Water (PRT)

South East Water (SEW)

Southern Water (SRN)

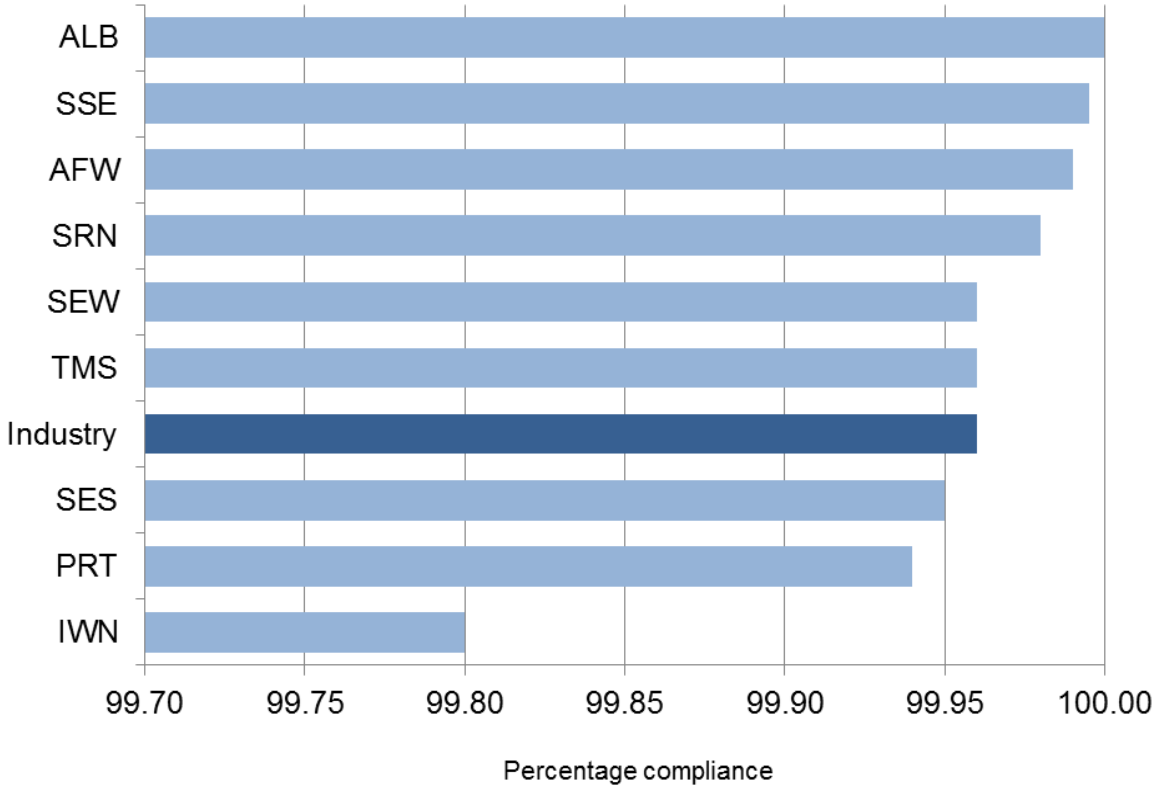
Sutton and East Surrey Water (SES)

SSE Water (SSE)

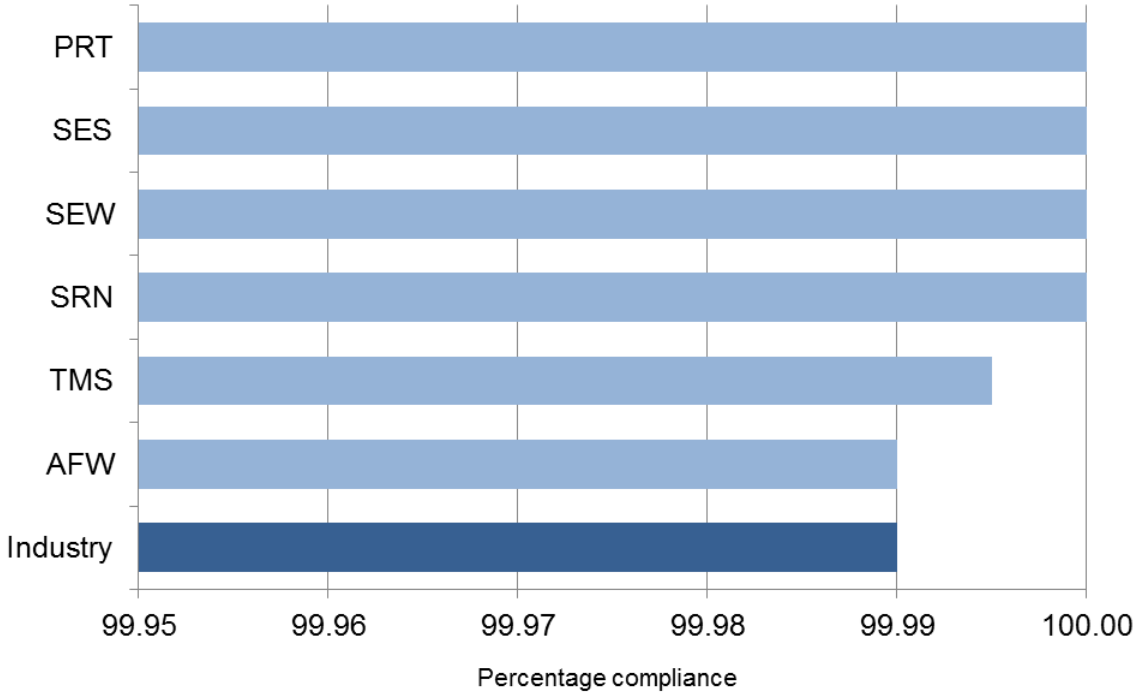
Thames Water (TMS)

Industry average (Industry)

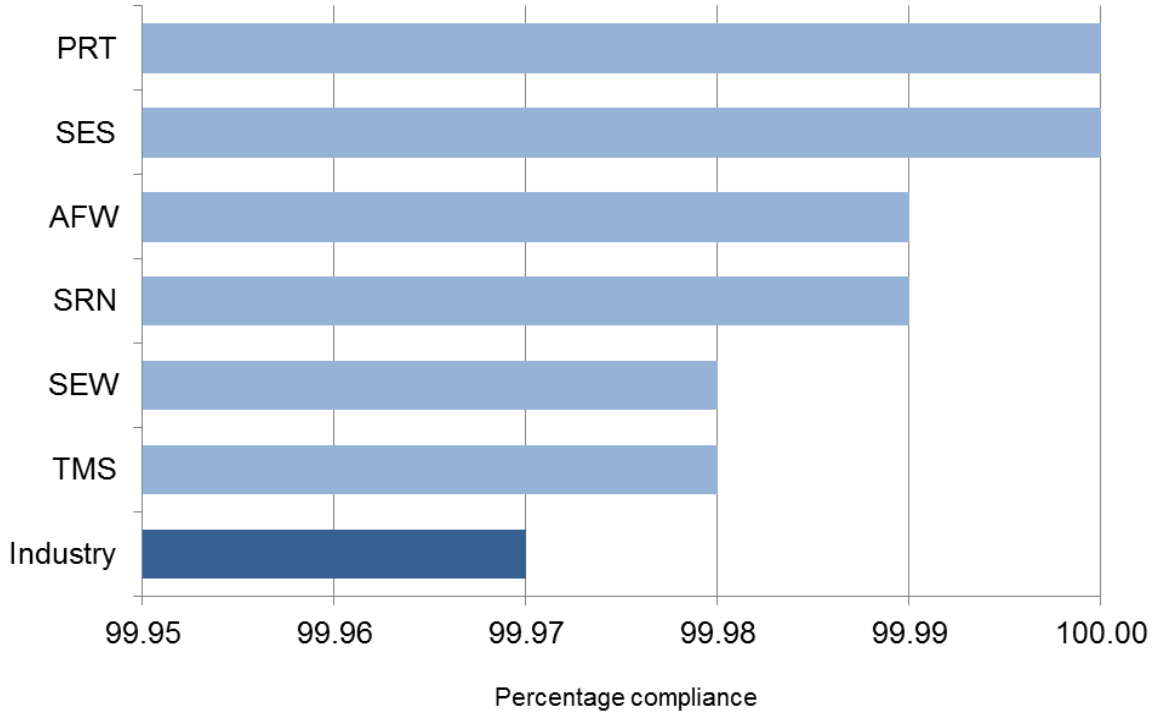
**Overall drinking water quality**



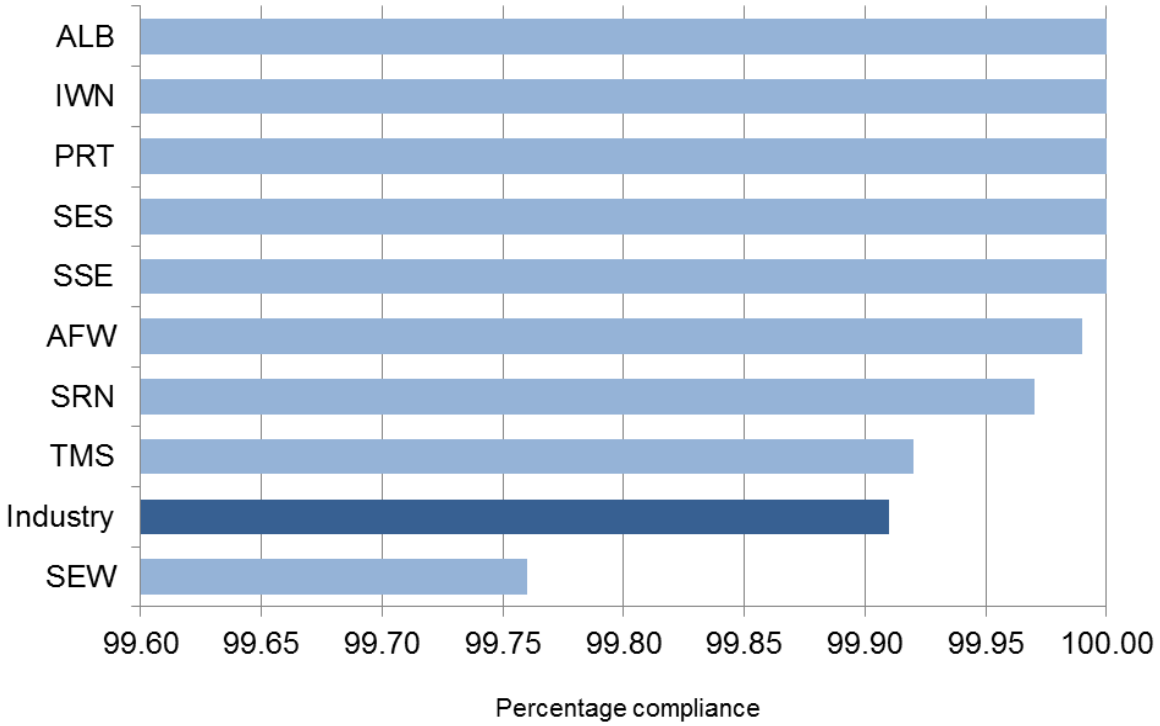
## Process control index



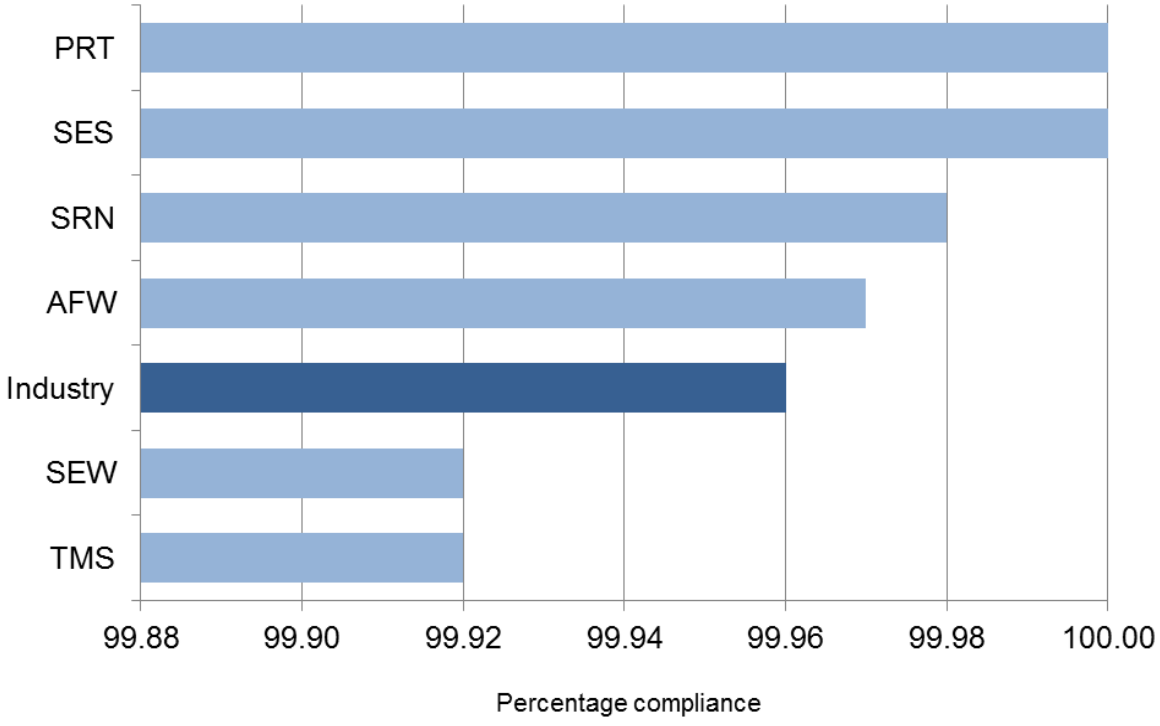

## Disinfection index



## Distribution maintenance index




## Reservoir integrity index



# Annex 7
## Glossary and description of standards

These definitions will assist the understanding of the report where technical terms have been used.

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| **µg/l** | microgram per litre (one millionth of a gram per litre). |
| **1,2-Dichloroethane** | is a solvent that may be found in groundwater in the vicinity of industrial sites. Where necessary it can be removed by special water treatment. A European health-based standard of 3µg/l applies. |
| **Acrylamide** | European health-based standard. A chemical which is not normally found in drinking water. It is produced in the manufacture of polyacrylamides that are occasionally used in water treatment. Its presence in drinking water is limited by control of the product specification. Standard is 0.1µg/l. |
| **Aesthetic** | associated with the senses of taste, smell and sight. |
| **Aggressive** | a term used to indicate that the water has a tendency to dissolve copper (and other metals) from the inner surface of a pipe or water fitting such as a tap. |
| **Alkali** | a solution containing an excess of free hydroxyl ions, with a pH greater than seven. |
| **Aluminium** | occurs naturally in some source waters. It is removed from drinking water by conventional water treatment (coagulation and filtration). Aluminium sulphate and polyaluminium chloride may be used as water treatment chemicals at some water treatment works. A national standard of 200µg/l applies. |
| **Ammonium** | salts are naturally present in trace amounts in most waters. Their presence might indicate contamination of sanitary significance and they interfere with the operation of the disinfection process. An indicator parameter with a guide value of 0.5mg/l. |

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| **Analytical quality control (AQC)** | procedures used to ensure that laboratory analysis methods are performing correctly. |
| **Antimony** | is rarely found in drinking water. Trace amounts can be derived from brass tap fittings and solders. A European health-based standard of 5µg/l applies. |
| **Aquifer** | water-containing underground strata. |
| **Arsenic** | occurs naturally in only a few sources of groundwater. Specific water treatment is required to remove it. A European health-based standard of 10µg/l applies. |
| **Benzene** | is present in petrol. It is not found in drinking water, but it can migrate through underground plastic water pipes if petrol is spilt in the vicinity. A European health-based standard of 1µg/l applies. Some bottled waters and soft drinks which include sodium benzoate as an ingredient have been reported as containing benzene. |
| **Benzo(a)pyrene** | is one of several compounds known as polycyclic aromatic hydrocarbons (PAHs). Their source in drinking water is as a result of deterioration of coal tar, which many years ago was used to line water pipes. Due to extensive water mains refurbishment and renewal it is now rare to detect this substance in drinking water. A European health-based standard of 0.01µg/l applies. |
| **Boron** | in surface water sources comes from industrial discharges or from detergents in treated sewage effluents. The very low concentrations found in some drinking waters are not a concern to public health. A European health-based standard of 1mg/l applies. |
| **Bromate** | can be formed during disinfection of drinking water through a reaction between naturally occurring bromide and strong oxidants (usually ozone). It may be generated in the manufacture of sodium hypochlorite disinfectant. Exceptionally, groundwater can be contaminated with bromate, released from an industrial site. A European health-based standard of 10µg/l applies. |
| **Bulk supply** | water supplied in bulk, usually in treated form, from one water company to another. |

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| **Cadmium** | is rarely detected in drinking water and trace amounts are usually due to dissolution of impurities from plumbing fittings. A European health-based standard of 5µg/l applies. |
| **Catchment** | when used in connection with water, the catchment is the area drained by a river or water body. |
| **Chloramination** | the process of generating a chloramine disinfectant residual in water leaving a treatment works. |
| **Chloramine** | a substance formed by a reaction between chlorine and ammonia, used as a disinfectant in distribution systems because of its long-lasting properties compared to chlorine. |
| **Chloride** | is a component of common salt. It may occur in water naturally, but it may also be present due to local use of de-icing salt or saline intrusion. An indicator parameter with a guide value of 250mg/l. |
| **Chlorine residual** | the small amount of chlorine or chloramines present in drinking water to maintain its quality as it passes through the water company's network of pipes and household plumbing. |
| **Chromium** | is not present in drinking water. A European health-based standard of 50µg/l applies. |
| ***Clostridium perfringens*** | is a spore-forming bacterium that is present in the gut of warm-blooded animals. The spores can survive disinfection. The presence of spores in drinking water indicates historic contamination that requires investigation. The standard is 0 per 100ml. |
| **Coagulation** | a process employed during drinking water treatment to assist with the removal of particulate matter. |
| **Coliform bacteria** | are widely distributed in the environment often as a result of human or animal activity, but some grow on plant matter. Their presence in a water supply indicates a need to investigate the integrity of the water supply system. The standard is 0 per 100ml. |

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| **Colony counts** | are general techniques for detecting a wide range of bacteria, the types and numbers being dependent on the conditions of the test. These counts, if done regularly, can help to inform water management, but they have no direct health significance. The standard is 'no abnormal change'. |
| **Colour** | occurs naturally in upland water sources. It is removed by conventional water treatment. A national standard of 20mg/l on the Platinum/Cobalt (Pt/Co) scale applies. |
| **Communication pipe** | the connection from the water main to the consumer's property boundary. |
| **Compliance assessment** | a comparison made by the Inspectorate of data gathered by water companies against standards and other regulatory requirements. |
| **Compound** | a compound consists of two or more elements in chemical combination. |
| **Concessionary supplies** | historical free supplies of water for a householder, established when a company wanted to lay mains across land and the landowner might agree, subject to a permission, to take a supply of water from the main. |
| **Conductivity** | is a non-specific measure of the amount of natural dissolved inorganic substances in source waters. An indicator parameter with a guide value of 2,500µS/cm. |
| **Contact tank** | a tank, normally situated on a treatment works site, which forms part of the disinfection process. A disinfectant chemical (normally chlorine) is dosed into the water as it flows into the tank. The period of time that the water takes to flow through the tank allows sufficient 'contact' time for the chemical to kill, or deactivate, any viruses or pathogenic organisms that may be present in the water. |
| **Copper** | in drinking water comes mostly from copper pipes and fittings in households. In general, water sources are not aggressive towards copper, but problems very occasionally occur on new housing estates. These 'blue water' events can be avoided by good plumbing practices. A European health-based standard of 2mg/l applies. |

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| ***Cryptosporidium*** | is a parasite that causes severe gastroenteritis and can survive disinfection. It is removed from water by conventional processes for removing particulate material, and is inactivated by ultraviolet light. In the UK, continuous monitoring is undertaken at works classified by the company as being at significant risk. |
| **Cyanide** | is not present in drinking water. A European health-based standard of 50µg/l applies. |
| **Dead leg** | refers to a piece of piping which is stopped off at one end, but is connected to the supply at the other end and can result in stagnant water in the pipework. |
| **Distribution systems** | a water company's network of mains, pipes, pumping stations and service reservoirs through which treated water is conveyed to consumers. |
| **Drinking Water Directive** | Council Directive 98/83/EC December 1998 – setting out drinking water standards to be applied in member states. |
| **Drinking water standards** | the prescribed concentrations or values listed in regulations. |
| **Enforcement action** | the means, as set out in the Water Act 1989 and consolidated into the Water Industry Act 1991, by which the Secretary of State requires a water company to comply with certain regulatory requirements. |
| **Enterococci** | see *Escherichia coli.* |
| **Environment Agency** | the Environment Agency is responsible for maintaining and improving the quality of fresh, marine, surface and underground water in England. Natural Resources Wales is the equivalent body in Wales. |
| **Epichlorohydrin** | can be found in trace amounts in polyamine water treatment chemicals. Its presence in drinking water is limited by control of the product specification. A European health-based standard of 0.1µg/l applies. |
| **Epidemiology** | a process of studying the distribution of cases of disease within a population in relation to exposure to possible sources of the infection, with a view to establishing the actual source of the infection. |

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| ***Escherichia coli* and Enterococci** | are bacteria present in the gut of warm-blooded animals. They should not be present in drinking water and, if present, immediate action is required to identify and remove any source of faecal contamination that is found. The standard is 0 per 100ml. |
| **Event** | water companies have to inform the Inspectorate about occasions when water quality or sufficiency is affected or when public confidence in drinking water quality may be impacted. The Inspectorate refer to these instances as 'Events'. |
| **Filtration** | where water is passed through a porous material (e.g. sand) to remove suspended particulate matter. |
| **Fluoride** | occurs naturally in many water sources, especially groundwater. It cannot be removed by conventional water treatment so high levels must be reduced by blending with another low fluoride water source. Some water companies are required by the local health authority to fluoridate water supplies as a protection against tooth decay. The drinking water standard ensures levels are safe in either circumstance. Fluoridation of water is a Department of Health policy. A European health-based standard of 1.5mg/l applies. |
| **Geosmin** | a substance produced by a variety of naturally occurring microbes, normally in surface waters which gives rise to a characteristic 'earthy' or 'musty' taste or odour. |
| **Granular activated carbon** | an adsorbent filtration medium used to remove trace organic compounds from water. |
| **Gross alpha/gross beta** | radioactivity in raw water can originate from natural substances or from a specific point emission. Water companies are required to screen for radionuclides that emit either alpha or beta particles. If such screening exceeds guide values (gross alpha 0.1Bq/l, gross beta 1.0Bq/l) then fuller analysis for specific radionuclides is carried out to determine the origin. |
| **Groundwater** | water from aquifers or other underground sources. |

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| **Hydrogen Ion (pH)** | gives an indication of the degree of acidity of the water. A pH of 7 is neutral; values below 7 are acidic and values above 7 are alkaline. A low pH water may result in pipe corrosion. This is corrected by adding an alkali during water treatment. A specification of between 6.5 and 9.5 applies. |
| **Improvement programmes** | water company improvement works, these are legally binding on the company and each programme will remedy an actual or potential breach of a drinking water standard within a specified time period. |
| **Indicator organism** | an organism which indicates the presence of contamination and hence the possible presence of pathogens. |
| **Indicator parameter** | something that is measured to check that control measures, such as water treatment, are working effectively. |
| **Information Letter** | formal guidance to water companies given by the Inspectorate and published on the Inspectorate's website at http://www.dwi.gov.uk |
| **Inspectorate** | The Drinking Water Inspectorate. |
| **Iron** | is present naturally in many water sources. It is removed by water treatment. Some iron compounds are used as water treatment chemicals. However, the commonest source of iron in drinking water is corrosion of iron water mains. A national standard of 200µg/l applies. |
| **Lead** | very occasionally occurs naturally in raw waters, but the usual reason for its presence in drinking water is plumbing in older properties. If the water supply has a tendency to dissolve lead then water companies treat the water to reduce consumer exposure. The permanent remedy is for householders to remove lead pipes and fittings. The European health-based standard is 10µg/l. |
| **$m^3/d$** | cubic metres per day. |
| **Manganese** | is present naturally in many sources and is usually removed during treatment. A national standard of 50µg/l applies. |

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| **Mean zonal compliance percentage** | a measure of compliance with drinking water standards introduced by the Inspectorate in 2004. |
| **Mercury** | is not found in sources of drinking water. A European health-based standard of 1µg/l applies. |
| **Methylisoborneol (MIB)** | a natural substance produced by the growth of algae, normally in surface waters which gives rise to a characteristic 'earthy' or 'musty' taste or odour. It is detected by the method for assessing taste and odour. |
| **mg/l** | milligram per litre (one thousandth of a gram per litre). |
| **Microbiological** | associated with the study of microbes. |
| **Ml/d** | megalitre per day (one Ml/d is equivalent to 1,000 $m^3$/d, 1 million litres/d or to 220,000 gallons/d). |
| **Nickel** | occurs naturally in some groundwater and where necessary special treatment can be installed to remove it. Another source of nickel in drinking water is the coatings on modern taps and other plumbing fittings. A European health-based standard of 20µg/l applies. |
| **Nitrate** | occurs naturally in all source waters although higher concentrations tend to occur where fertilisers are used on the land. Nitrate can be removed by ion exchange water treatment or through blending with other low nitrate sources. A European health-based standard of 50mg/l applies. |
| **Nitrite** | is sometimes produced as a by-product when chloramine is used as the essential residual disinfectant in a public water supply. Chloramine is the residual disinfectant of choice in large distributions systems because it is more stable and long-lasting. Careful operation of the disinfection process ensures levels of nitrite are kept below the standard. A European health-based standard of 0.5mg/l applies. |
| **Notice** | an instruction served by the Secretary of State (in the case of water supplies, the Chief Inspector of Water) requiring specific actions to be taken by the recipient within a specified timescale. |

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| **NTU** | nephelometric turbidity unit – the unit of measurement for turbidity in water |
| **Odour** | can arise as a consequence of natural processes in surface waters, particularly between late spring and early autumn. Water treatment with activated carbon or ozone will remove natural substances causing taste. The standard relates to the evaluations of a panel of people assessing samples in the laboratory. |
| **Ofwat** | the water industry's economic regulator. |
| **Oocyst** | the resistant form in which *Cryptosporidium* occurs in the environment, and which is capable of causing infection. |
| **Organoleptic** | characteristics of a substance as detected by our senses, for example taste, odour or colour. |
| **Ozone process (ozonation)** | the application of ozone gas in drinking water treatment. |
| **Parameters** | the substances, organisms and properties listed in Schedule 2 and Regulation 3 of the regulations. Parameter definitions can be found in this glossary. |
| **Pathogen** | an organism which can infect humans and cause disease. |
| **PCV** | see 'Prescribed concentration or value'. |
| **Periodic review** | the economic regulator's process of setting water prices. |
| **Pesticides** | any fungicide, herbicide, insecticide or related product (excluding medicines) used for the control of pests or diseases. |
| **Pesticides – organochlorine compounds (aldrin, dieldrin, heptachlor, heptachlor epoxide)** | are no longer used in the UK because they are persistent in the environment. They are not found in drinking water. A European chemical standard of 0.03µg/l for each compound applies. |

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| **Pesticides – other than organochlorine compounds** | is a diverse and large group of organic compounds used as weed killers, insecticides and fungicides. Many water sources contain traces of one or more pesticides as a result of both agricultural and non-agricultural uses, mainly on crops and for weed control on highways and in gardens. Where needed, water companies have installed water treatment (activated carbon and ozone) so that pesticides are not found in drinking water. Water companies must test for those pesticides used widely in their area of supply. Pesticide monitoring thus varies according to risk. A European chemical standard of 0.1µg/l for each individual substance and 0.5µg/l for the total of all pesticides applies. |
| **Phosphate dosing** | treatment of water that results in a protective film building up on the inside of pipes minimising the likelihood of lead being present in drinking water supplied through lead pipes. |
| **Plumbosolvency** | the tendency for lead to dissolve in water. |
| **Polycyclic aromatic hydrocarbons (PAHs)** | is a group name for several substances present in petroleum-based products such as coal tar. (see Benzo(a)pyrene listed above for more information). A European health-based standard of 0.1µg/l for the sum of all the substances applies. |
| **Powdered activated carbon (PAC)** | powdered activated carbon is employed in treatment processes to remove pollutants. |
| **Prescribed concentration or value (PCV)** | the numerical value assigned to drinking water standards defining the maximal or minimal legal concentration or value of a parameter. |
| **Private supply** | water supplied for human consumption or food production which is not provided by a water undertaker or licensed water supplier. |
| **Protozoan parasites** | a single cell organism that can only survive by infecting a host, for example *Cryptosporidium*. |
| **Public supply** | water supplied by a company licensed for that purpose. |
| **Raw water** | water prior to receiving treatment for the purpose of drinking. |

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| **Regulations** | The Water Supply (Water Quality) Regulations 2000 (England) and subsequent amendments, and the Water Supply (Water Quality) Regulations 2010 (Wales). |
| **Remedial action** | action taken to improve a situation. |
| **Remote operated vehicle (ROV)** | equipment for inspecting areas that are difficult to access, for example, inside tanks and pipes. |
| **Residual disinfectant** | the small amount of chlorine or chloramines present in drinking water to maintain its quality as it passes through the water company's network of pipes and household plumbing. |
| **Risk assessment** | a review undertaken to identify actual or potential hazards to human health in a water treatment works and associated supply system. Prioritisation of risk is based on consideration of likelihood and consequence of the risk occurring. |
| **Secretary of State** | Secretary of State for Environment, Food and Rural Affairs. |
| **Selenium** | is an essential element and a necessary dietary component. Amounts in drinking water are usually well below the standard. A European health-based standard of 10µg/l applies. |
| **Service connection** | connection between the water company's main to a consumer's property. |
| **Service pipe** | any pipe subject to mains water pressure or subject to mains pressure but for the closing of some valve. |
| **Service reservoir** | a water tower, tank or other reservoir used for the storage of treated water within the distribution system. |
| **Suggested no adverse response level (SNARL)** | a level of substance at which no adverse effects would be anticipated. |
| **Sodium** | is a component of common salt. It is present in seawater and brackish groundwater. Some treatment chemicals contain sodium. Concentrations in drinking water are extremely low, but some water softeners can add significant amounts to drinking water where they are installed in homes or factories. A national standard of 200mg/l applies. |

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| **Springs** | where water naturally emerges from below ground. |
| **Sulphate** | occurs naturally in all waters and is difficult to remove by treatment. An indicator parameter with a guide value of 250mg/l. |
| **Supply pipe** | see service pipe. |
| **Supply point** | a point other than a consumer's tap authorised for the taking of samples for compliance with the Regulations. |
| **Surface water** | untreated water from rivers, impounding reservoirs or other surface water source. |
| **Taste** | can arise as a consequence of natural processes in surface waters, particularly between late spring and early autumn. Water treatment with activated carbon or ozone will remove natural substances causing taste. The standard relates to the evaluations of a panel of people assessing samples in the laboratory. |
| **Technical audit** | the means of checking that water companies are complying with their statutory obligations. |
| **Tetrachloroethane and Trichloroethene** | are solvents that may occur in groundwater in the vicinity of industrial sites. Where necessary they are removed by specialist treatment. A European health-based standard of 10µg/l for the sum of both substances applies. |
| **Tetrachloromethane** | is a solvent that may occur in groundwater in the vicinity of industrial sites. Where necessary it is removed by specialist water treatment. A national standard of 3µg/l applies. |
| **Time of supply** | the moment when water passes from the water company's pipework into a consumer's pipework. |
| **Total indicative dose** | is a measure of the effective dose of radiation the body will receive from consumption of the water. It is calculated only when screening values for gross alpha or gross beta (radiation) are exceeded. An indicator parameter with a guide value of 0.10mSv/year. |
| **Total organic carbon** | represents the total amount of organic matter present in water. An indicator parameter with a guide value of 'no abnormal change'. |
| **Toxicology** | the study of the health effects of substances. |

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| **Treated water** | water treated for use for domestic purposes as defined in the Regulations. |
| **Trihalomethanes** | are formed during disinfection of water by a reaction between chlorine and naturally occurring organic substances. Their production is minimised by good operational practice. A European health-based standard of 100µg/l applies. |
| **Tritium** | is a radioactive isotope of hydrogen. Discharges to the environment are strictly controlled and there is a national programme of monitoring surface waters. An indicator parameter with a guide value of 100Bq/l. |
| **Turbidity** | is a measure of the cloudiness of water. At treatment works, measurement is an important non-specific water quality control parameter because it can be monitored continuously on-line and alarms set to alert operators to deterioration in raw water quality or the need to optimise water treatment. An indicator parameter with a guide value of 1NTU. When detected at the consumer's tap it can arise from disturbance of sediment within water mains. A national standard of 4NTU applies in this case. |
| **Ultraviolet treatment** | the use of ultraviolet light to kill pathogenic microorganisms, for example *Cryptosporidium*. |
| **Undertakings** | Legally-binding programmes of work agreed between a water company and the Chief Inspector of Drinking Water to address actual or potential water quality issues, for completion within a specified time period. |
| **Vinyl chloride** | may be present in plastic pipes as a residual of the manufacturing process of polyvinyl chloride (PVC) water pipes. Its presence in drinking water is controlled by product specification. A European health-based standard of 0.5µg/l applies. |
| **Water supply zone** | a pre-defined area of supply for establishing sampling frequencies, compliance with standards and information to be made publicly available. |
| **WHO** | World Health Organisation. |
| **Wholesome/wholesomeness** | a legal concept of water quality which is defined by reference to standards and other requirements set out in the Regulations. |


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www.dwi.gov.uk