

Drinking Water

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A report by the Chief Inspector of Drinking Water





Drinking water 2022

Public water supplies for England and Wales

Quarter 2

April – June 2022

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Compliance

Table 1: Microbiological failures at water treatment works April – June 2022

Parameter	Number of tests not meeting the standard	Company
Coliform bacteria	8	BRL (1), ISC (4), NES (2), SRN (1)
Turbidity water treatment works	4	DWR (1), SRN (1), SWB (1), WSX (1)

Case study: Introduction of sampler training and accreditation on the Isles of Scilly

There were a series of coliform detections on the Isles of Scilly. These were from Vane Hill North and Vane Hill South treatment works and Tresco Abbey service reservoir, on the same day in April, and again from Tresco Vane Hill North and Vane Hill South treatment works and Tresco Abbey and Tresco Sea Garden service reservoirs, on the same day in May. South West and Bournemouth Water reported these unusual detections to the Inspectorate as water quality events.

The company increased the chlorine dosing concentrations and reviewed the UV disinfection system to protect consumers. They also carried out a wider investigation into the cause of the coliforms, including enhanced sampling, inspection and swabbing of sampling taps, examination of sampling equipment, and a laboratory review, but in all cases no issues were found. Critically, coliform species typing showed that the species in the samples were not the same as those in the raw water, indicating the possibility of sample contamination from another source. Critical investigations must be central to keeping water quality first and this finding led the company to audit the sampling process and procedures. The findings included: - wiping equipment with a dirty cloth; failure to follow quality procedures for on-site chlorine measures; inadequate disinfection of sampling taps by either heat or chlorine; improper flushing, and incorrect order of sampling.

The minimum requirement set by the Regulations is for a representative sample. Adequate sampler training and competency are essential for maintaining and validating water quality. The Inspectorate made a recommendation for the company to review sampler training, and South West Water committed to achieving ISO 17025:2017 accreditation for the Isles of Scilly. After an assessment on 7 June, UKAS recommended that accreditation should be extended. Other improvements to the supply systems on the Isles of Scilly have been captured under a series of island wide notices.

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Northumbrian Water works coliform exceedances

In April 2022 Northumbrian Water recorded a compliance failure at Chigwell water treatment works. Samples were collected from the raw water, treatment processes and final water, downstream service reservoirs, and consumer properties, all of which were found to be satisfactory, and no root cause was found. Providing a water quality first service is underpinned by robust and verifiable information demonstrating confidence in drinking water. It was therefore concerning when the company reported that the North contact tank was out of supply, but at the same time provided chlorine SCADA trends and CT calculations, indicating the tank was in service. Investigations confirmed that the North tank was indeed out of supply. The chlorine trends provided to the Inspectorate were incorrect. This calls into question the control and verification of water quality at this site. Compliance reports are technical documents which form the basis of the Inspectorate's assessment and should be accurate.

Northumbrian Water detected a coliform compliance fail (>100 colonies/100 mL) at Broken Scar water treatment works in May 2022. A failure in the final water of this magnitude is quite rare in England where water quality is very high. Consequently, subsequent investigations must be thorough to maintain assurance of drinking water. A second final water sample taken just seven minutes after the failing sample was satisfactory, as were samples from downstream consumer properties and service reservoirs. The company took large volume samples and analysed for an extended suite of microbiological parameters, which were satisfactory. The treatment works performance at the time of the failing sample was also satisfactory. Whilst no definitive root cause could be identified, confidence in drinking water quality is assured by robust investigations supported by clear sample results, with additional benefits accrued through learning from the investigation. The company identified rainfall as a risk factor for ingress into the contact tanks and outlet wells. Significant ingress risks during wet weather where tanks are overdue inspection or unable to be inspected is a known risk and has been highlighted in previous Chief Inspector Reports. Companies should make every effort to maintain inspection frequencies and, where necessary, complete suitable enabling works to ensure tanks can be removed from supply for an adequate length of time. In June 2022 the Inspectorate audited Broken Scar site operations, maintenance, and asset health. Broken Scar treatment works is under a statutory notice to complete a tank inspection by December 2022.

Wessex Water Arn Hill turbidity from long sample line

In June elevated turbidity was detected in a sample collected from Wessex Water's Arn Hill works. Online water quality monitors demonstrated that turbidity levels at the time were satisfactory, and investigations concluded the breach was caused by the disturbance of sediment in the final sample line, which was 28 metres long. The sample line has since been replaced, and Wessex Water is reviewing its procedures for sample line maintenance

including additional maintenance/design standards are needed for longer sample lengths to ensure representative sampling.

Table 2: Microbiological failures at service reservoirs April – June 2022

Parameter	Number of tests not meeting the standard	Company
<i>E. coli</i>	0	N/A
Coliforms	23	AFW (2), ANH (3), BRL (2), DWR (1), ISC (4), SVT (2), TMS (1), UUT (2), WSX (2), YKS (4)

Welsh Water quality of inspections at Rhymney Bridge service reservoir

In May, five coliforms were detected from a sample taken from Rhymney service reservoir. This reservoir is covered by a statutory notice for microbiological risk. The relevant compartment was taken out of service and inspected whilst being inundated. Ingress was identified through the roof and walls and a section of redundant pipework within the compartment was found to need sealing internally. Although this service reservoir had been last inspected in January 2021, at that time the company did not perceive any risks to water quality. The Inspectorate was concerned that the company did not take the precaution of removing redundant pipework during the inspection in 2021, and that internal inspections at other service reservoirs had been classed as ‘low risk’ but were later found to have ingress when they were removed and inspected following coliform failures.

This case illustrates the need for thorough and robust inspections and risk assessments. All potential risks must be mitigated before a reservoir is returned to service.

Wessex Water use of colony counts as supporting information on risk

Following a coliform detection at Wessex Water’s Maiden Beech service reservoir 2 in May, the company drained both compartments of the service reservoir to clean and inspect them. A leaking cable duct was found in Compartment 2a. Compartment 2b was found to have routes of ingress through the cable ducting, upstand concrete joint, and upstand mastic joint. Wessex Water sealed the routes of ingress. In addition, a common inlet chamber, which showed multiple points of ingress, has been permanently isolated.

The Regulations set colony counts as an indicator parameter and expect no abnormal change. Samples from Maiden Beech service reservoir 2 showed elevated 22°C colony counts, whereas in contrast, the upstream service reservoir, Coker Hill, demonstrated relatively low colony counts. It is unusual to observe in the high-quality water in England and Wales such wide variations in colony counts without proactive consideration.

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In distribution systems, increasing colony counts can indicate a deterioration in cleanliness, possibly stagnation and the potential development of biofilms. The Inspectorate recommended that the company reviews its response to elevated colony counts, to ensure effective investigations, remedial actions, and appropriate recording on the company drinking water safety plan system. The company has confirmed that it is developing a new procedure for reviewing and actioning unusual colony count results, with the changes to be embedded in its drinking water safety plan methodology.

Companies should ensure that they have robust policies and procedures in place to monitor and investigate where there are indications of deterioration of the water quality within their distribution systems. By monitoring chlorine residuals and indicator parameters such as colony counts, companies can take timely action to investigate where there may be an issue which is causing a deterioration in water quality before there is a resulting sampling failure.

Bristol Water coliform detections at service reservoirs

Bristol Water detected coliform bacteria at Withywood 1a service reservoir in April. The company identified a potential point of ingress at Withywood. A seal around the sample line entering the reservoir compartment, which is in the high security kiosk, was no longer secure and presented an increased risk of access into the reservoir compartment for small invertebrates. This was compounded by the angle of the drain tray which would have resulted in the seal becoming wet from water splashing during sampling visits. The company removed the reservoir for an internal inspection and clean and rectified the identified defects before returning to supply.

Following a detection of a presumptive coliform result at Durdham Down tower in June, Bristol Water immediately removed the structure from supply. An internal inspection and inundation test did not identify any points of ingress, but a small area of biofilm growth on the opposite side of the common inlet/outlet was identified. The company collected swabs off surfaces in the compartment, including from the area of biofilm, all of which were free of coliforms, *E. coli*, Enterococci and *Clostridium perfringens*. The company cleaned the structure to remove the biofilm growth and undertook a period of enhanced water quality monitoring. Turnover in the tower was increased to maintain chlorine residuals and reduce biofilm regrowth.

Anglian Water failures

Anglian Water had three service reservoirs failures, the most serious of which was at Maidford service reservoir on 29 June. An upstream booster chloramination process was offline. Chloramination is required to mitigate against coliform risks in the supply area. Companies are reminded of the Court judgement in respect of High Park in 2021, which set out that the addition of a disinfectant in the network is a treatment process, and therefore that interruptions would be interpreted as a failure to treat water adequately. The company

received a recommendation, and further enforcement would be considered if the booster chloramination is not maintained in future.

Yorkshire Water asset compliance and sampling facilities

In May 2022 Yorkshire Water detected repeat compliance failure from Stockdale Farm service reservoir. As a site where a failure was also detected in August 2019, a robust investigation is always required to assure water quality. All resamples were satisfactory for bacteriological parameters, but an investigation into the upstream pumping station showed the potential for the inlet pipework to become depressurised. Although the determination of a direct cause and effect can be difficult, identification of risks and their mitigation will always be beneficial. Modifications to the pipework were completed to remove this potential risk. During the Inspectorate's investigation, it was noted that the sample point drainage tundish was a cut off plastic drum and that the sample tap spout was below the lip of the drum (Figure 1). This arrangement presents a risk of contamination with no drainage system and no air gap between the tap and waste should the drum not be emptied. This sampling arrangement is likely to cause a breach of regulation 16 relating to the collection and analysis of samples, and a recommendation was given to improve standards for sample point drainage sinks.



Figure 1: Yorkshire Water regulatory sample point tundish at Stockdale Farm service reservoir

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On 9 June 2022 Stockdale Farm service reservoir detected another breach for coliforms, and again, the company did not identify a root cause. Upstream checks at the water treatment works were satisfactory, however a dip sample from Stockdale Farm service reservoir failed for coliforms, and one downstream property also failed for coliforms. The company stated it had plans to modify the pipework at Stockdale Farm reservoir to remove it from supply indefinitely. The Inspectorate concluded that the risk of a breach of regulation 4 for wholesomeness remained and recommended that the company expedites the removal of Stockdale Farm service reservoir from the supply network.

Companies are reminded that where no root cause can be found, the failing asset should meet the required standards in all aspects. Where an asset is not needed (e.g., due to changes in industrial customer demands) action should be taken swiftly to remove the asset from the supply network. Regular appraisal of network systems should be undertaken to ensure efficiency across distribution grids and reduce risks from redundant assets.

Severn Trent Water service reservoir failures

Enforcement action is being taken to address overdue inspections at a number of service reservoirs operated by Severn Trent. Among these is Whiteborough service reservoir, where a coliform was detected from the combined outlet of compartments 8 and 9 on 16 May. The company was unable to remove both compartments from supply as this would cause supply issues, however compartment 9 was removed from service three days after the failing sample was taken. The inspection identified ingress around the roof and wall joints. The company installed a temporary membrane over the roof during May and June and started an enhanced sampling regime. The company subsequently had plans to remove compartment 8 from supply.



Figure 2: Temporary membrane installed over Whiteborough service reservoirs 8 and 9

Whilst these reactive measures addressed the issue, there were delays to putting these measures in place. Both compartments were overdue their 10 yearly inspection and the company had previously inspected and repaired the compartments within weeks of each other in 2012. The sites are critical to maintain supplies and both compartments cannot be removed contemporaneously. All companies are asked to consider, in such circumstances

whether it would be better to stagger the timings of internal inspections and repairs of linked compartments in order to reduce risk of delays. More importantly, companies are advised to ensure that their risk assessments appropriately consider the consequences of a failure and the steps that are required to minimise the risk to consumers, including ensuring the frequency of internal inspection and repair is such that it prevents ingress to service reservoirs.

A similar issue occurred at Ullenwood New service reservoir which had a coliform failure in June. Only Cell A of the two-cell reservoir was in supply. Cell B had been previously inspected, cleaned, and remained out of service since 2019. When a sample failure occurred, the company was unsure of the condition of Cell B. It was filled, sampled, found to fail, drained and repaired again before being returned to service, resulting in a 19-day delay in removing the failing cell A from supply, with the consequent ongoing and undue residual risk to consumers. It is understood that only one cell was required to be in supply due to low demand on the system, but this has impacted on resilience and has increased risk to consumers. The Inspectorate recommended that the company consider these water quality resilience issues at all service reservoir sites where compartments are out of supply.

Affinity Water coliform detection at Blackhills service reservoir

Affinity Water identified the likely cause of the coliform failure in June to be a torn membrane, which was discovered as part of an external inspection. However, an external inspection two weeks prior to the failing sample did not identify any such issue. The Inspectorate recommended that the company reviews the way in which operatives carry out and report their external inspections.

Table 3: Compliance in water supply zones – microbiological failures April – June 2022

Parameter	Number of tests not meeting the standard	Company
<i>E. coli</i>	10	ANH (2), BRL (1), DWR (1), SVT (4), UUT (2)
Clostridia	2	NES (1), SVT (1)
Coliforms	86	AFW (6), ANH (11), BRL (8), DWR (3), HDC (1), IWN (1), LNW (1), NES (2), PRT (1), SEW (1), SRN (1), SST (1), SVT (10), TMS (17), UUT (17), WSX (1), YKS (4)

Anglian Water *E. coli* detections

In May Anglian Water had a failing *E. coli* result from Rushmere rural supply zone, of 9 CFU/100 mL. Upstream asset performance was satisfactory and network sample results

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suggested that there was not a wider issue within distribution. The original property kitchen tap repeatedly failed on pre- and- post disinfection swabs and spot/flush samples, indicating a tap hygiene issue. A second mains-fed tap from the property passed for bacteriological parameters, and the consumer was given tap hygiene advice.

In June a single *E. coli* was detected from a consumer tap in the March supply zone. During the investigation all pre-disinfection swabs contained coliforms in samples taken at the kitchen tap, and the likely cause of exceedance was the condition of the kitchen tap. The consumer was advised to thoroughly disinfect or replace the kitchen tap to improve hygiene. Anglian Water again used a second mains-fed tap from the property to support their investigation. These samples were clear all other investigatory samples taken from neighbouring properties and the upstream assets were satisfactory.

Companies are reminded of the benefits from utilising second mains-fed taps to support zonal failure investigations.

United Utilities *E. coli* detections

In May, a consumer property in the Halewood zone failed for 27 *E. coli*/100 mL, the sample also contained 51 coliforms/100 mL. Pre- and post- disinfection resamples taken the following day (including tap swabs) were satisfactory for coliforms and *E. coli*, as were related samples taken from neighbouring properties. No issues were reported from the supplying treatment works, and there were no activities on the local network which could have caused the exceedance. There were no consumer contacts of illness in the supply zone during the previous three months. The consumer declined a water fittings inspection. They were advised in writing of the sample results and provided with tap hygiene advice. The Inspectorate's assessment was that this investigation was satisfactory with no root cause found.

In June, 1 *E. coli*/100 mL was observed in the Fleetwood supply zone. All resamples (including pre and post disinfection samples and swabs) and related samples taken from up and downstream neighbouring properties, were satisfactory for coliforms and *E. coli*. The supplying works was assessed as operating normally and there were no unusual activities on the local network. An audit identified that the sampler did not remove the external tap fitting in the original sample, but during resampling the fitting was removed. A water fittings inspection was carried out, and no contraventions were found at the property. The exceedance was probably caused by the external tap sprayer. The company reviewed its sampling procedure and re-briefed all samplers. The consumer was informed in writing of the sample results, the outcome of the fittings inspection, and was given tap hygiene advice. Companies are reminded to provide regular sampler briefing about the necessity to remove tap fittings before proceeding to sample from consumer properties, to prevent unnecessary failures.

Northumbrian Water Clostridium perfringens failure

The Billingham zone had a Clostridium perfringens failure in May 2022. Resamples were clear for microbiological parameters, including Clostridium. Samples from the upstream works and service reservoir have been clear for microbiological parameters in the 12 months preceding this sample failure. The SCADA trends of the upstream works did not highlight any issues which could have caused this exceedance. The company completed a water fittings inspection at the property. Several issues were identified, including lack of backflow protection on the white goods and toilet cistern, as well as the consumer storing a dishcloth over the tap. The company concluded that the likely cause was tap hygiene and possible contributory factors from the water fittings contraventions. The company sent a letter to the consumer and provided the consumer with backflow protection valves. The company have carried out a satisfactory investigation into the root cause of this failure with the likely cause of the issue being the domestic plumbing system.

Table 4: Chemical parameter failures April – June 2022 supply points and zones

Parameter	Current standard or specified concentration ¹	Total Combined Supply Point & Zonal Breaches	Company
Turbidity	4 NTU	3	AFW (1), TMS (1), UUT (1)
Odour	No abnormal change	20	ANH (2), DWR (1), HDC (1), NES (3), PRT (1), SEW (3), SRN (2), SVT (1), SWB (1), UUT (2), YKS (3)
Taste (Taste Quant)	No abnormal change	25	ANH (1), DWR (5), ICW (1), ISC (1), IWN (1), NES (2), SRN (3), SVT (3), UUT (3), WSX (1), YKS (4)
Hydrogen ion (pH) - Indicator (Hydrogen ion) (pH)	6.5-9.5	1	YKS (1)
Aluminium (Total)	200 µg/L	7	AFW (1), ANH (1), BRL (1), NES (1), TMS (1), UUT (2)
Iron (Total)	200 µg/L	25	AFW (1), ANH (2), BRL (1), DWR (2), NES (3), SEW (1), SRN (1), SVT (1), TMS (2), UUT (8), YKS (3)

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Manganese (Total)	50 µg/L	3	ANH (1), UUT (2)
Nickel (Total)	20 µg/L	7	BRL (1), NES (3), SST (1), SVT (1), YKS (1)
Lead (10 - will apply 25.12.2013)	10 µg/L	12	AFW (1), ANH (1), PRT (1), SVT (2), SWB (2), TMS (4), YKS (1)
Polycyclic Aromatic Hydrocarbons (Total by Calculation)	0.1 µg/L	1	AFW (1)
Benzo[a]Pyrene (Total)	0.01 µg/L	1	AFW (1)
Tetrachloromethane (Total)	3 µg/L	1	ANH (1)
Gross Alpha	0.1 Bq/L	13	ISC (7), SST (1), SVT (4), TMS (1)
Gross Beta	1.0 Bq/L	1	ISC (1)
Radon	100 Bq/L	4	ISC (4)

Welsh Water taste and odour detections

Qualitative taste and odour analysis in the industry is by taste panels made up of suitably trained laboratory personnel.

A breach for taste was reported in a sample taken in May from Holywell/Mold zone, and another for taste and odour in Rhymney/Bargoed zone. The company identified particulate matter in the sample from Holywell/Mold and described the sample from Rhymney as being discoloured with a musty/sulphurous odour. This sample also breached the standard for iron. On both occasions the laboratory declined to taste the samples due to their aesthetic appearance and/or odour. The Inspectorate recommended that where the water is considered unwholesome by virtue of laboratory rejection, that the consumer is provided with suitable advice whilst the company investigates the cause and extent of the breach. The company responded by stating that in these instances resamples are taken from the original location and upstream/downstream locations and these results are used to inform the risk to the consumer. Furthermore, that this and other information gathered as part of their investigation would be used to establish if any necessary advice is required to protect customers. Investigations nevertheless can take several days, and include sampling and analytical time, which can be a protracted period for different reasons. During this time the cause or any actual risk to health remains unknown.

Companies are therefore reminded that in any instance where a sample is rejected by the laboratory by reason of its taste, odour, or appearance, that appropriate restrictions of use are put in place, and a wholesome alternative is provided, to protect consumers.

Severn Trent Water taste rejections

There were three occasions in the second quarter where Severn Trent Water's laboratory rejected samples for taste analysis, but did not take appropriate action to protect consumers, whilst it carried out investigations into the cause. Each of these failures to protect consumers resulted in recommendations to the company. Summary details of these breaches are given below.

In May, a sample taken from the Tenbury Wells zone was rejected for taste analysis due to a 'milky' appearance, which was consistent with elevated iron concentrations the company detected in the sample. Resamples were satisfactory, but the company never established a root cause for the failure.

Also in May, a sample from the Churchdown zone was rejected due to the presence of 'bits' in the sample, which were subsequently identified as scale and biofilm, but again whilst the laboratory chose not to taste this sample, no protective advice was given to consumers.

The third rejection in this quarter related to a sample from Binley Woods zone in June, where the laboratory rejected the sample for taste analysis due to the detection of a 'solvent' odour. The company analysed the sample for trace organic compounds but could find no cause for the odour detected. A water fittings inspection took place 11 days after the date of the original sample and whilst the company considered providing advice not to drink to the consumer, it decided not to issue advice as a risk to health was considered unlikely. It is inappropriate for companies to protect their own staff but neglect their consumers. All companies are expected to do the right thing and carry out taste analysis where it is safe to do so and protect their staff and consumers when it is not.

South East Water odour detection

South East Water detected a 'burnt match' odour in April in Victoria water supply zone. This is the second odour detection from this supply zone within in a year, with a 'burnt matchsticks/sulphurous' odour detected in August 2021. The company's water fittings investigation identified the probable cause was the internal plumbing arrangements and potential backflow from an immersion heater. The Inspectorate noted the close proximity of the two properties and requested details of the supplying mains materials to help rule out a common cause. In response to these detections, South East Water is undertaking an enhanced monitoring programme within the supply zone to determine whether there is a wider issue. The company incorrectly recorded the enhanced monitoring as a Category A (Target risk mitigation received, verified and maintained) in the regulation 28 risk assessment submissions, when in accordance with the company drinking water safety plan

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methodology this should be Category E (Mitigation under investigation). The Inspectorate raised a recommendation. and the company has reminded the drinking water safety plan team to refer correct guidance document when reviewing the categorisation of risks. Companies are reminded to ensure that all compliance breaches are appropriately reviewed to ensure that any change in risk, or additional measures the company's may be taking to understand whether there is a change in risk, are appropriately recorded on the company systems and returned accurately to the Inspectorate.

Yorkshire Water taste and odour detections

Yorkshire Water had five taste and odour detections, all of which received recommendations.

The company identified low turnover in the supplying distribution main as the root cause of a taste and odour in Colne Valley zone. Resamples from upstream properties and the upstream service reservoir were found to be satisfactory. However, failures from the original property persisted. A flushing programme failed to completely remove the taste and odour. The Inspectorate recommended a review of the flushing frequency and further sampling, to support a robust risk assessment.

A taste sample from the Beverley zone in May was not analysed due to foaming in a bottle. The company reported there was no evidence of any similar foaming in other sample bottles collected, as part of the same sampling batch. The odour result reported by the laboratory on the same sample was 0. All resamples were satisfactory for taste and odour. The company was unable to find the root cause of the foaming in the sample. As the sample was not tasted, the laboratory rejected the water as potentially unfit for human consumption, but the company did not issue precautionary advice to the consumer, and no justification was given. Following the requirements set out in Information Letter 02/2022, a recommendation was given that the company reviews its procedures for when the laboratory rejects taste samples and that appropriate restriction of use advice to the consumer is considered.

A further taste and odour detection occurred in June in the Skipton/Craven zone for an 'earthy, musty' flavour. The company's investigation found the root cause to be the presence of Geosmin in the raw water at Embsay water treatment works. At the time that the original failing sample was collected, Embsay water treatment works didn't have the mobile Powdered Activated Carbon (PAC) dosing operational. The company's trigger for deploying the PAC unit was greater than 0.004 µg/L as Geosmin. The Geosmin operational SNARL threshold range is 0.001 µg/l to 0.004 µg/L, as defined within the UKWIR datasheets. The company's current procedure for the management of taste and odour forming compounds is reactive rather than precautionary, with action only being taken once the raw water reaches a concentration of 0.004 µg/L as Geosmin. This approach increases the likelihood of breaching wholesomeness requirements and the Inspectorate therefore

recommended that the company reviews its trigger level. All companies are reminded that operational trigger levels should take a proactive stance in preventing failure. In this instance the breach could have been avoided had the PAC dosing been activated earlier.

United Utilities taste and odour breach

In May United Utilities had a ‘fragrant, fruits, citrus, lemon’ odour and taste failure in the Litherland zone. The sampler did not detect an odour or taste at the time of collecting the sample and no issues were reported at the supplying treatment works or upstream service reservoirs. A review concluded that the network was operating normally. Resamples from the original property and two neighbouring properties were satisfactory for all parameters, however the taste and odour sample bottle from one of the neighbouring properties was reported missing. The company were slow to respond to the missing bottle report and to complete the investigation. A recommendation was given to review the quality management of the sample bottle chain of custody. Companies are reminded that where bottles are missing or not delivered to laboratories in time, action is taken quickly to ensure that investigations are not delayed. Management of the chain of custody should be periodically reviewed to confirm that quality systems are operational for the collection and transportation of samples to laboratories.

Events

The following events have been highlighted for significant learning to the wider industry.

Burham works – use of non-approved products

Southern Water has a programme of work to improve the performance and condition of Burham treatment works in Kent, which is captured under a legal instrument. Burham works has a granular activated carbon stage designed in conjunction with the ozone system to remove any pesticide risks which are carried over from the raw water catchment. Six filters are housed in a concrete structure with a flat base, fitted with plastic nozzles which enable water to flow through but retain the carbon within the absorber. Due to issues with media carry over into the contact tank, the work completed by Southern Water included the cleaning of the filter floors and replacement of the filter nozzles and grommets which were double nutted to secure them in place.

The work to prevent the filter media carry over was not successful and issues with media carry over continued. This was confirmed during a technical audit of the works by the Inspectorate in November 2021. Southern Water investigations identified the widening of the aperture of the hole which the nozzle sits in the concrete floor as the cause of the issue. Each hole was originally built to be 53mm diameter, however, over time the holes had widened due to the vibrating actions of the backwash and air scour process so that they were approximately 60mm in diameter. Each filter has around 1600 nozzles. Figure 3 shows

the worn holes which were not sealing correctly, leading to issues with carbon loss and bypassing of treatment.

The company is fitting the nozzles with 75mm oversized neoprene gasket washers to ensure a secure fit (Figure 4).



Figure 3 eroding holes and Figure 4 oversized gaskets installed

Work to replace the washers was completed on filter numbers 1 and 6, which were returned to service in January and April 2022 respectively.

Whilst undertaking work on filter number 2 company staff identified that the washer material had a strong odour. Prior to starting the washer replacement programme, the company confirmed that the nozzle components were regulation 31 approved (or exempt under regulation 31(4)(b)). Filter nozzles (including those mounted on filter floors), gaskets and rubber sealing rings come under the Small Surface Area [Advice Sheet 8](#). The washers however did not have WRAS approval and following the identification of a strong odour during the washer installation in filter number 2 it was concluded that regulation 31(4)(b) was not being met.

Regulation 31(4)(b) states that ‘the Secretary of State is satisfied that the application or introduction of the substance or product either alone or in combination with any other substance or product in the water is unlikely to adversely affect the quality of the water supplied’. Advice Sheet 8 on regulation 31(4)(b) sets out the requirement ‘that the material of which the product is made, despite the small surface area contact with the water, does not give rise to unintended odour/flavour to the water and does not support the growth of microbial organisms.’

In response to this discovery, Southern Water did not return filter number 2 to supply and is undertaking replacement of the washers installed in filters 1 and 6 with a WRAS approved product. The company monitored the water quality leaving the filters and did not identify any taste and odours in the water, and GCMS scans did not identify any compounds which may cause an issue with wholesomeness. A review of consumer contacts before and after the washer installations took place did not identify an increase in contacts. The company reported that the contractor involved had undertaken the company's regulation 31 training but had not understood the requirement to check that the material does not impart an adverse taste and/or odour. The Inspectorate recommended that the company reviews all procedures and forms relating to regulation 31(4)b to ensure that all the conditions within advice sheet 8 are appropriately included.

The learning from this event is that the full requirements of regulation 31(4)(b) for small surface area products are sufficiently understood within water companies. This should include throughout the procurement, design and delivery teams as well as persons employed on behalf the company. Water companies are reminded that the responsibilities of complying with regulation 31 rest with themselves, so should be satisfied that there are sufficient procedures, controls and checks in place to ensure that where small surface products are used that they fully met the requirement of the Regulations.

Northumbrian Water Discolouration Events caused by resuspension of sediment by planned maintenance operations

In quarter 2 Northumbrian Water reported three significant discolouration events.

Consett

Planned maintenance at Castleside pumping station in June 2022 involved the isolation and removal of a faulty pump for refurbishment, and separate work on telemetry maintenance. During the telemetry maintenance, the pressure set point for a controlling valve was changed, resulting in a decrease in pressure on the transfer main between the pumping station and the Consett area. As a result, there was an increase in flow from the three outlet mains from Honey Hill works which caused the scouring of the mains and consequent discolouration. This was transient but resulted in 34 complaints of discoloured water. The company formed an incident team, issued text warnings, coordinated sampling and flushing. All samples returned bacteriologically satisfactory results, but a number of properties received water containing aluminium and iron.

The cause of the event was human error in the change of the pressure setpoint. The technician working at the pumping station was unaware that the pressure setpoint had been altered. A second technician was required to attend the site and correct the setpoint, which returned pressure and flows to their expected values. The company has now installed a cover to the control panel, to avoid accidental adjustment of the setpoint in future but had this risk been identified as part of the work on the pump, then consumer confidence

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would not have been impacted through discoloration. This demonstrates that a water quality first approach must be always taken by company staff.

The Inspectorate recommended that as part of the sign off process for work at critical sites setpoints are checked both before work commences and after the work is completed, to avoid future breaches of regulation 4, wholesomeness, and consumer impact. This should be extended to other sites, which could have a similar setup, to prevent a repeat event.

Billingham

On 21 June 2022, planned maintenance was carried out, to replace a district meter in Northumbrian Water's Billingham area. This involved the isolation of a six-inch Cast Iron Cement Lined (CICL) main and subsequent rezone of the area supplied by it. However, the companies attempt to isolate the six-inch CICL main, through rezoning and the operation of valves, was unsuccessful causing discolouration.

In response the company sought to return the network back to its original configuration but a further issue with a Pressure Reducing Valve (PRV) meant that a bypass valve was required to complete the rezone. This resulted in further mobilisation of sediment worsening the situation with discolouration contacts and bursts downstream. A total of 57 contacts were received by the company over two days, with 54 of them reporting discoloured water.

This event provides another example of where company planned work has directly resulted in discolouration, which is disturbing to consumers and completely avoidable.

The company held an event review meeting and noted that escalation of issues on site did not take place quick enough. Rather belatedly, the company have briefed team members on the importance of escalating issues quickly. It was also noted that prior to commencement of the planned work, all valves were checked, but PRVs were not. This specific learning was included in the CIR in 2021 to highlight water quality first in all operations and once again, all companies are reminded to check the operation of valves and PRVs prior to commencing network maintenance or other planned activities.

United Utilities discolouration events

Lostock

A reversal of flow, at an increased velocity, within a 15-inch diameter unlined cast iron main contributed to 162 consumer contacts for appearance and 140 contacts for loss of supply/ low pressure between 6 and 9 May 2022. This occurred downstream of United Utilities Lostock water treatment works and a complicated pumping set arrangement. Maintenance work had been occurring on the pumping set in the days prior to the event, and upon restart, an airlock occurred causing the pumps to overheat and the normal flow to cease. This led to downstream service reservoirs reaching a very low level known as the low-low alarm. To mitigate against the low-low alarming service reservoirs and increasing loss of

supply risks the incident management team took the decision to alter the flows of water between a number of different pump sets on the strategic mains. Due to misunderstandings regarding valve positions, six district metred areas (DMAs) were left without water and flow reversals occurred with more than double the flow rate.

There are three key lessons of learning in this situation which could have prevented the completely unnecessary outcome of discolouration affecting consumers' supply: Understanding the risk and updating this through a dynamic assessment when altering flows; that staff working on complicated maintenance tasks at strategically critical assets are familiar with the site including valves, pressure vessels, access to telemetry and are competent to do so; and, that procedures relating to handover and commissioning of new installations during maintenance work are adhered to. All these learnings were highlighted in the company's own post incident review resulting in the incorporation of several procedural changes to prevent reoccurrence, including revisions to the incident management process which now includes a situational awareness handover slide showing system configuration at the time of handover. In addition, the commissioning and handover process for assets has been amended, incorporating a new section on recommissioning and work authorisation. It was however necessary to recommend that the company reviews their process for conducting dynamic risk assessments when altering flows within large diameter trunk mains so that in future breaches which affect the wholesomeness of drinking water would be prevented; a water quality first approach perhaps should have driven this thinking before the incident.

Belle Vale, Liverpool

In a second example of discoloration due to inadequate planning, a total of 68 contacts reported that their water was discoloured when a 12-inch cast iron main was damaged during contractor excavations in May 2022. Further contacts of loss of supply and low pressure were also received from the Halewood area of Liverpool. Contractors had been provided with incorrect construction drawings indicating that the 12-inch main was completely slip lined. This error was central to the incident because the excavation activities were not appropriately conducted for the unknown non-slip lined section of the cast iron main which fractured under the force of a mechanical excavator used in the excavation and separation of the main. This was further exacerbated because the banksman supporting the excavator activities was not fully trained to complete the role anyway. Once the fracture had occurred, inevitably the flow increases in the upstream 24-inch and 36-inch cast iron mains mobilised deposits in the main, a well-known risk for this company's mains network.

Again, there are three very similar learnings from this incident: Understanding the risk as the risk assessment associated with the emergency shut off following the damage was incomplete and that there was no consideration for the risk of flow increases and discolouration; that staff working on the job are competent to do so because not only was the banksman unqualified, the network staff did not understand the terminology of the risk

assessment; and, that procedures relating to instructions for work handover are accurate because in this case, the plans were not accurate.

Since the event the company have improved their audit regime on contractor work involving large diameter schemes. A check list has been implemented to improve communication between company and contractors and a review of the event and further training has been held with the Developer Services team and contractors working on the networks. Arguably, if this had been put into place before the work with a water quality first strategy, this incident could have been avoided.

Asset health audits – results and shared learning

The Inspectorate undertakes a risk-based audit programme with the water industry. In Quarter 2, the Inspectorate's audit programme focussed on asset health, and how water companies are operating and investing in their assets to ensure that they are fit for purpose to treat raw water challenges and meet their regulatory requirements.

The audit programme focussed on variety of water treatment assets, from larger surface water works to smaller groundwater sites, selected using a risk-based approach. Where a breach of the Regulations, or a significant risk was identified, the Inspectorate made recommendations and will consider further enforcement if deemed necessary. An audit at South East Waters' Bewl works was generally satisfactory, but audits at Bristol Water Banwell works, Wessex Water Castleton and New Lake works, Yorkshire Water Loftsome Bridge works, and Northumbrian Water Broken Scar, were all unsatisfactory.

The main themes from the audits are set out below: -

Surface water treatment works

- Historic construction standards may present a risk to water quality:
The legacy of the construction of treatment assets was evident, for example, the positioning of rapid gravity filters directly above a contact tank. Similarly, at another site, a company could not satisfactorily complete filter checks because the way the filters had been constructed did not allow safe access to complete this check. In such cases water companies should implement additional measures or checks to ensure assets are functioning appropriately and any deterioration in asset performance can be identified and remediated. However, for future construction, sites must be designed and engineered with water quality first in mind and not simply about the site footprint.
- Inability to inspect assets:
Another theme which was identified during the audit programme was the inability for treated water structures to be removed from supply for inspection, or for a longer period to facilitate repairs. Companies will be aware that information is collected on all treated water tanks including last

inspection date, and where the inability to remove a tank for inspection poses an unacceptable risk to water quality, enforcement may be necessary.

- Poor condition of internal structures:
At one site, a recent inspection report identified issues with the poor condition of the internal baffle wall which had become softened. This deterioration could cause an increase in turbidity compromising the disinfection stage and is therefore an unacceptable risk. In addition, approximately 165m of joint sealant was also deteriorating and ineffective presenting a further risk. The absence of a solution for site removal meant that the tank had to be quickly returned to supply after the inspection. This fundamental absence of resilience prevented any long-term repairs being completed leaving an unacceptable residual risk to consumers.

Groundwater boreholes

- At the groundwater sites visited, whilst the general security of the boreholes was satisfactory, a theme emerged with the general condition of the borehole headworks. Un-glanded cable holes and other points of ingress were seen, and at one site the general internal condition of the borehole kiosk was not being maintained. The risks should not need to be spelt concerning inadequate maintenance. Investment in protecting water quality should be a priority.



Figures 5 and 6

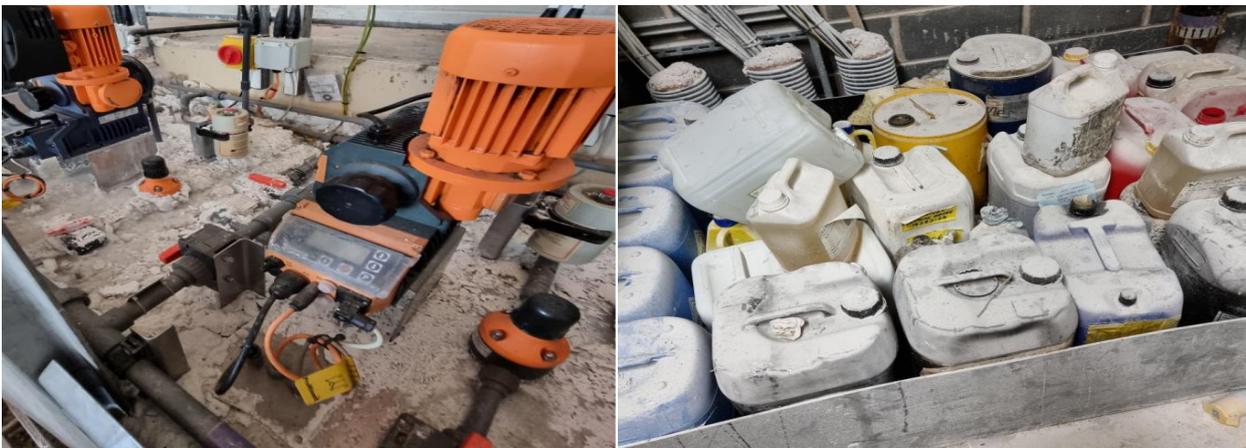
- At one site, the headworks were below ground level, and there were sump pumps and flood alarms, in case the chamber flooded. A clear identification of a risk with no action. Above ground construction of kiosks is the preferred method of terminating the borehole casing, to reduce risks of surface water ingress if for instance there were to be an un-glanded cable hole. If a borehole is at risk of flooding, consideration should be given to raising the borehole casing to above ground level, with the addition of sanitary sealing to remove the likelihood of it becoming contaminated by surface water (Fig. 5 and 6).

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- One company did not have a routine borehole inspection programme in place at all. Companies are reminded of the importance of the multi-barrier approach to ensuring water quality, and that groundwater assets should be inspected frequently to ensure their condition is such that they offer appropriate sanitary protection. A water quality first inspection program is a proactive measure to mitigate risk.

General Housekeeping

1. Issues with general housekeeping were also observed, with poor condition of dosing pumps and unsatisfactory storage of chemicals (Fig. 7 and 8). Whilst this does not have an immediate risk to water quality, this questions the care taken in a food production premises where the product is drinking water.



Figures 7 and 8

Sampling facilities

2. The condition of sample taps was also noted to be of a poor standard at several of the sites visited. One sample tap was leaking. Water companies should ensure that sample taps are maintained and replaced as necessary to remove the risk of an unrepresentative sample being taken and equally sets an example of reducing waste. Suitable sampling facilities reduce the risk of failure, with associated investigations and penalties (Fig. 9).



Figure 9

Ground maintenance

- Issues with grounds maintenance were identified, including the growth of shrubs and weeds near built structures, and in one case, on the roof of a treated water tank (Fig. 10 and 11). Companies should ensure that structures are kept clear of weeds and other vegetation to prevent root growth compromising the integrity of the structures.



Figures 10 and 11



Figure 12

- At one site, a vermin control fence protecting a wash water recovery tank was damaged and had not been repaired (Fig. 12).
- One company was unable to locate an overflow pipe from a treated water tank. Companies were reminded of the importance of understanding where all outflow pipework is located. Outflow pipework should be included on regular inspections to ensure that physical measures such as flap valves and meshes are in place to prevent animal or insect entry.

Hazard review process

Several of the sites audited have been subject to a Hazard Review process, in which every stage of the process is reviewed to identify where there are risks to drinking water quality, including: -

- single points of failure,
- power resilience,
- chemical dosing arrangements,
- water quality instrumentation and monitoring, and
- the general structural conditions of the works.

The Inspectorate welcomes the Hazard Review approach as a systematic way to understand the general condition and operating risks at company assets. The process can help identify where investment is needed and inform planning to ensure assets are sufficiently maintained.

Process for asset upgrades and investment

Water companies should record these risks in their drinking water safety plans. This applies to all identified risks to water quality, including where assets such as tanks cannot be taken out of supply for repair. The water safety plan should feed into the company investment plans, so that investment is appropriately targeted. By not doing so, water companies are not investing for the future and are storing up potential water quality issues. Any resultant water quality failure resulting in a restriction on use would be deemed unacceptable for risks which have long been known about.

Enforcement

The Inspectorate publishes Legal Instruments on the website under [company improvement programmes](#). A summary of the Legal Instruments issued in this quarter is below.

Table 6. Legal instruments issued in Q2 2022

Type of legal instrument	Number	Companies
Regulation 27(4) notice for improvements to water safety plans	3	Affinity Water Anglian Water United Utilities Water
Regulation 28(4) notice relating to risks identified in water safety plans	8	Affinity Water Dwr Cymru Hafren Dyrfrdy South West and Bournemouth Water (2) United Utilities Water Wessex Water Yorkshire Water

Service reservoir integrity notices

Regular inspection of service reservoirs and treated water tanks forms a key part of the management and maintenance of these structures to ensure there is no risk to the wholesomeness of the water contained within them. The longer the time between internal inspections, the greater the uncertainty around the integrity of the structure and the potential risk of ingress.

Following the reservoir and tank data submission from Dŵr Cymru (relating to Information Letter 01/2021), the Inspectorate identified several service reservoirs and water storage tanks exceeding the 10-year internal inspection frequency. For several of these tanks, the company is unable to remove these from supply without significant risk of impact to consumers. In addition, during 2021 there was an increase in microbiological compliance failures at service reservoirs and treatment works, often due to ingress and structural issues.

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In some cases, the failing tanks had been physically internally inspected or significant remedial work completed within the previous 24 months. Consequently, a regulation 28(4) notice was served on Dŵr Cymru for service reservoir and treated water tank inspections, and to review existing procedures for completing and testing any remedial work required. The notice requires regular updates with any additional tanks which fall outside of the recommended 10-year inspection frequency to be added to the notice. Therefore, it is implicit for the company to ensure that no further tanks exceed the recommended 10-year internal inspection frequency. The notice shall reduce the risk of potential ingress and subsequent risk to wholesomeness for at least 2,103,730 consumers.

A regulation 28(4) notice was served on Affinity Water for tank inspections, which will reduce the risk to wholesomeness for a population of 331,176. The notice covers the inspection of Egham water treatment works treated water tank south cell that is over the 10-year frequency for physical internal inspection. Farthing Common reservoir 1 is also included in the notice but the company is in the process of building two new cells at Farthing Common to replace Farthing Common reservoir 1. The notice formalises the delivery of the construction and commissioning of the new cells, which will reduce the risk of potential ingress from Farthing Common reservoir 1 that is over the recommended 10-year internal inspection frequency.

Yorkshire Water have some treated water storage tanks that have not been physically internally inspected and cleaned within the last 10 years. An audit by the Inspectorate in October 2021 noted consistent shortcomings associated with protection on overflow pipework, records of external inspections, and action tracking. The company's process tanks were not included on a risk-based frequency of inspection. Therefore, a regulation 28(4) notice was served on the company for tank inspections, which will reduce the risk to wholesomeness for a population of 2,873,981. The notice requires the company to bring all service reservoirs and treated water storage tanks within the maximum 10-year physical internal inspection frequency and complete a programme of inspections and any required remedial work of washout, overflow and pipework arrangements at all water treatment works and service reservoirs.

Risks associated with concessionary supplies

A regulation 28(4) notice was served on Hafren Dyfrdwy in May 2022 due to the risk posed by several concessionary supplies at Lake Vyrnwy. A population of 19 people are supplied by individual spring sources with each property having point of use treatment. A permanent precautionary boil notice in place and routine monitoring is ongoing. The company assessed this supply as category D (Additional control measures are required to materially reduce risk) for several risks, including microbiological, such as *Cryptosporidium*, coliforms and *E. coli*, and chemical, including iron, manganese, turbidity, pH, taste and odour. The company has proposed to put in place permanent control measures to manage the water quality risk

associated by the spring sources and provide a supply of wholesome water and the regulation 28(4) notice seeks to formalise this arrangement.

Risks at Knapp Mill and Alderney water treatment works

Following a long period of co-operative discussion with South West & Bournemouth Water, four notices were crafted to capture ongoing risks (initially identified through site audits) at the company's Knapp Mill and Alderney Treatment Works. Both these treatment works are receiving significant upgrades using PR19 funding, which has been accelerated for the Knapp Mill works, under the Government's Green Economic Recovery scheme. There are two notices for each site; one for maintaining the existing treatment process, and one for the replacing treatment process. The replacing treatment process notices were served this quarter for each site, with the existing treatment process notices being issued early in the next quarter. Due to the time required to finalise these extremely complex notices, time had elapsed between the audit and the serving of these notices. The Inspectorate expects all companies to proactively mitigate any identified risk during these periods and begin planning towards the long-term solutions for risk mitigation. This is exactly what South West and Bournemouth have done in this instance, with the company already progressing well with the actions within the notices. The serving of these notices also enabled the revocation of the two previous notices covering these sites.

Water Quality First at United Utilities

The Inspectorate's assessments of the United Utilities compliance and events reports in 2020 and 2021 identified improvements required in the company's investigations, risk assessment process, policies, and procedures, as well as staff training. In late 2021, the company recognised this and revigorated its transformation program under the banner of "Water Quality First". The company has worked collaboratively with the Inspectorate in drafting a regulation 28(4) notice to facilitate the improvement of training, procedures, and investigations. The notice aligns with the objectives of the 'Water Quality First' initiative to resolve the issues that have been identified with the previous compliance failures and events.

Disinfection system upgrade to treat deteriorating raw water quality

In January 2022, a storage tank downstream of Forston water treatment works failed for *Enterococci*, resulting in the company notifying the Inspectorate of an event. The subsequent investigation found that raw water quality has deteriorated in one of the boreholes, with elevated levels of *E. coli* and *Enterococci* being detected following periods of heavy rainfall. In addition, the company had previously carried out a raw water category review at the treatment works and downgraded the company's category for the raw water quality at the site. This meant the disinfection applied at this site was no longer in accordance with the company policy. The company highlighted this as a high risk on its

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drinking water safety plan and planned remedial works to mitigate the risks. A regulation 28(4) notice was served on the company in June 2022, to formalise plans for the company to install UV treatment at Forston water treatment works, thereby upgrading the disinfection system to comply with the company's policy and safeguarding the drinking water supply to 537,436 consumers.

PFAS

the Inspectorate served four regulation 27(4) notices within Q2, to ensure the risks associated with the detected compounds at their assets were prioritised for risk assessment and the identification of mitigation measures. The Inspectorate's regulatory actions for PFAS are included later in this report.

Notice closures

In April 2022, the Inspectorate received a closure report from Bristol Water for the completion of the physical internal inspection and clean of Montpelier service reservoir No. 2. Montpelier service reservoir No. 2 was the company's only service reservoir outside of the recommended 10-year internal physical inspection frequency. The reservoir had not had a full structural internal inspection since November 2010 due to potential impact on the downstream network and concerns regarding the resilience of the system. Consequently, a regulation 28(4) notice was served on the company in January 2022 (see quarter 1 CIR), which expedited the internal inspection of the reservoir. The company carried out a test isolation and bypass of the reservoir in February 2022, which was successful given no significant impact on the downstream network was identified, allowing the internal inspection to be completed.

In preparation for the test isolation of Montpelier service reservoir No. 2, the company implemented several checks and control measures prior to the test isolation to ensure minimal impact on the downstream network, including a review of properties with vulnerable consumers within the affected network and a review of the AWS plan in case of loss of supplies. During the isolation, the company implemented 24-hour monitoring of the flow, reservoir levels, turbidity, pressure and pump performance in the network to verify the control measures in place and detect any impact on the supply system. The company provided a satisfactory completion report, and the notice was revoked on 20 April 2022 and Bristol Water have no service reservoirs outside of the 10-year internal inspection frequency.

New Sources (regulation 14 and 15)

An application to use a new source under regulation 15 was received from Thames Water. The initial application was straightforward, an existing borehole used for compensation flow was going to be changed into a supplying borehole for an existing water treatment works.

The borehole was the same construction and source water as the existing raw water sources. The Inspectorate wanted to confirm that the existing materials in contact with water met regulation 31. It is possible for the existing sources to meet the regulation, but a change of use of an existing borehole of similar construction might not.

During the course of this assessment, the assessing Inspector asked for confirmation, from the water company, that all components coming into contact with the new water source conformed to the requirements of regulation 31. In response, the company provided the Inspectorate with a certificate of conformance (to regulation 31). The components for which this certificate was provided were a pump and associated ancillary equipment.

Whilst the certificate looked as though it was issued by the Inspectorate – it carried our logo, both as a header and as a watermark, and carried our address and contact details, it was in fact not one issued by the Inspectorate. Furthermore, the product manufacturer had never made an application for approval of their products under regulation 31(4)(a).

The Inspectorate wrote to the product manufacturer requesting they desist from producing such certificates and that all current copies were destroyed. The manufacturer complied with this request in short order. The Inspectorate also issued reg31 information letter [R31-01/2022](#) to all companies in England and Wales to raise awareness of the issue.

However, in completing root cause analysis into how this certificate came to exist, we uncovered a wider problem. Regulation 31(4)(b) applies when the surface area of a product in contact with water is small. Guidance on this is available in [DWI advice sheet 8](#) and states:

The Secretary of State is satisfied that substances or products either alone or in combination with any other substance or product in the water is unlikely to affect adversely the quality of the water supplied when:

- 1. that product offers only a small surface area contact ratio with the water; and;*
- 2. that the material of which the product is made, despite the small surface area contact with the water, does not give rise to unintended odour/flavour to the water and does not support the growth of microbial organisms.*

When products meet these criteria, they are permitted to be used under regulation 31(4)(b) of the Regulations.

It is the responsibility of the water undertaker (water supplier) to satisfy themselves whether products come into this category either by reference to the exemplar list in Section 2 of this advice sheet, or by determining, through calculation as shown in 3, whether the contact risk score C of product surface area exposed to water falls into the category for regulation 31(4)(b) usage. In either case the company will have to assess compliance with criterion (ii) above.

The situation with the false certificate arose because product manufacturers are under increasing pressure from water companies to prove their products meet the requirements of regulation 31. Where a product falls into the remit of regulation 31(4)(a), this is a perfectly acceptable practice. However, when it comes to regulation 31(4)(b), the guidance is clear in that it must be the water company who risk assess the risks posed by introducing a product. There is no approval system in operation for these products and companies cannot derogate their risk assessments to product manufacturers.

PFAS risk assessment and regulation

Introduction

Per and poly fluoroalkyl substances (PFAS) are a large group of synthetic chemicals. PFAS are made with a carbon fluoride bond, which is one of the strongest chemical bonds and provides the molecules with some very useful properties. The group includes PFOA, PFOS, and many other substances. PFAS are widely used in industrial and household products in England and Wales. Some PFAS compounds persist in the environment, including in water, and some bioaccumulate or have other harmful properties, and therefore can pose a risk to drinking water.

DWI guidance to industry

The Inspectorate provided updated [Guidance on the Water Supply \(Water Quality\) Regulations 2016¹ specific to PFOS \(perfluorooctane sulphonate\) and PFOA \(perfluorooctanoic acid\) concentrations in drinking water](#), in January 2021. This sets a guideline value of 0.1µg/l for PFOS and PFOA, based on available toxicology data and discussions with UKHSA. Companies are required to identify sites at risk from PFOS, PFOA, and a wider range of PFAS, and adopt a tiered response of escalating actions depending on the concentrations detected in the raw water. Companies are required to put in place measures to reduce concentrations to below 0.1µg/l as soon as practicable.

The Inspectorate wrote to the industry in October 2021 setting out further requirements for risk assessment, sampling and analysis for PFAS ([Information letter 05/2021](#)). Companies were instructed to monitor for 47 priority PFAS compounds. These were selected based on substances of concern, international standards, usage, and environmental surveillance data from the Environment Agency.

Further guidance was provided in 2022 ([Information letter 03/2022](#)) regarding appropriate sample frequencies. This set out further guidance on good practice for PFAS risk assessments, and actions required based on concentrations found in raw water. Information letter 03/2022 extended the guideline value to all PFAS and provided more specific details about risk assessment requirements. This included ensuring that water companies included a minimum number of potential PFAS sources in their catchment risk assessments.

The new requirements specified that the guideline value should be achieved at the final (treated) water point, reduced the number of tiers to three, and provided more detailed descriptions of the DWI categories used as part of regulation 28 submissions. Companies were also required to submit historic sample results in a format that could be uploaded into the Inspectorate’s sample results database for scrutiny.

Companies are reminded to exercise care when cleansing and error checking their data prior to submission. Final water results in tier 3 should be reported to the Inspectorate as an event, but to date there have been no reports made of this nature.

Review of sampling results

The results of the water company sampling identified that PFOS, PFOA, and five other PFAS substances were detected at 17 raw water sites, at or above the guideline value of 0.1 µg/l. The sites belong to four water companies as shown in Table 7, and the specific PFAS substances are shown in table 8. These results are indicative as the analytical methods are not yet fully accredited by UKAS.

On the basis of these results, the Risk Assessment team met with the four water companies. Regulation 27(4) notices were served on each company to ensure that an adequate risk assessment was carried out for the raw and final water, and to ensure the identified control measures were working as expected, to manage risk in drinking water provided to consumers. Those companies were required to review their PFAS risk assessments, and these were completed satisfactorily. The Inspectorate highlighted the importance of setting alarm triggers in both sampling and control measures as a preventative measure to protect consumers.

Table 7. Companies reporting sites in Tier 3, with PFAS greater than 0.1 µg/l in the untreated water.

Company	Number of sites	Enforcement Action
Cambridge Water	1	Duxford airfield. A statutory notice under regulation 28(4) Water Supply (Water Quality) Regulations was served on the company preventing the use of Duxford borehole for drinking water supply. Regulators are monitoring company progress with the installation of a treatment process to remove PFAS. The site will not go back into supply until such time that the company can demonstrate that risks of PFAS are fully controlled.

		The Inspectorate is assessing the supply of water from Duxford borehole as an event. The assessment is ongoing.
United Utilities	1	<p>One raw water site had a sample with a concentration above the guideline value of 0.1 µg/l for perfluorooctanoic acid. This was at a point which is subsequently blended and receives treatment. A statutory notice under regulation 27(4) Water Supply (Water Quality) Regulations 2016 was served to ensure the company carries out a risk assessment. This was completed in May 2022 and continues to be reviewed and updated periodically as per the regulatory requirements.</p> <p>Investigations are ongoing to determine the raw water source or sources. There have been no final water detection exceeding the PFAS threshold.</p>
Affinity Water	14	<p>A statutory notice under regulation 27(4) Water Supply (Water Quality) Regulations 2016 was served to ensure company carries out risk assessments for perfluorooctanoic acid, perfluorooctane sulphonate, perfluoroheptanoic acid and perfluorohexanesulphonic acid, at each relevant site. This was completed in May 2022.</p> <p>Some of these sites are blended raw water points. The Inspectorate investigated the blending arrangements at two treatment works supplied by these sources and confirmed that appropriate blending arrangements were in place to prevent an exceedance of the Inspectorate’s guideline value.</p>
Anglian Water	1	<p>PFAS was detected at a raw water point, but all downstream samples after blending showed PFAS values within the guideline value of 0.1 µg/l, (tier 3).</p> <p>A statutory notice under regulation 27(4) Water Supply (Water Quality) Regulations 2016 was served to ensure the company carries out a risk assessment,</p>

	<p>at the treatment works, catchment and abstraction for risks associated with;</p> <p>F033A - Perfluorooctane sulphonic acid F338 - Perfluorohexanesulfonic acid F333 - Perfluorohexanoic acid F329 - Perfluoropentanoic acid F300 - 6:2 Fluorotelomer Sulphonate F033 - Perfluorooctanoic acid F341 - Perfluoroheptanoic acid F330 - perfluoropentane-1-sulphonic acid F243 - Perfluorobutanesulfonic acid</p> <p>This was completed by May 2022 and continues to be reviewed and updated periodically as per the regulatory requirements.</p>
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Table 8: PFAS compounds detected > 0.1 µg/l in raw water abstraction (untreated) across all companies, (December 2021 return).

PFAS substance detected	Maximum concentration (µg/l)
6:2FTS	0.166
PFBS	0.107
PFHpA	0.576
PFHxA	0.276
PFHxS	0.9
PFOA	0.241
PFOS	0.422

Review of risk assessment methodologies and sampling programmes

The Inspectorate reviewed all company risk assessment methodologies using a standard set of criteria and establishing a minimum suite of expected content, and quality of approach. The outputs of this review fed into enhanced guidance, with the aim of helping all companies achieve that minimum standard. Many companies had only conducted limited

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raw water sampling, and risks could not be verified. A company protocol for sampling should relate to the risk assessment methodology and be reactive to risk assessment outcomes and test results.

Analytical capabilities

The Inspectorate initiated research into fully quantitative analytical methods for 20 PFAS for use in testing drinking water in 2020, the final report was received in 2022. The method development was challenging. The lowest spike selected (0.5ng/L) is 0.5% of the European Standard for individual PFAS compounds. Whilst the method meets required standards for the Standing Committee of Analysts for short chain PFAS, the method is sub-optimal for long chain PFAS. The Inspectorate continues to work with the industry on development of an accredited analytical method for the 47 PFAS of interest.

The Inspectorate is reviewing the water companies' submissions against the most recent information letter, and it is encouraging to see that many more laboratories can now analyse for the 47 PFAS, including the widely used external contractor ALS Ltd. Laboratory Testing Accreditation for these methods is underway.

ALS Ltd. have also developed a Total Oxidisable Precursor (TOP) assay, which converts PFAS precursors into compounds which can now be detected by accredited methods. This allows for a better estimation of PFAS loading in raw water, as many of these precursors are converted to PFAS in the natural environment as part of the breakdown process.

Conclusions

- Proactive risk assessment is critical for adequate control measures to protect consumers. Sampling is only ever a snapshot at a given moment in time, and risk assessments should never be decided on sample results alone, but wider catchment considerations. Risk assessments need to be continually improved to provide a better and more predictive tool for PFAS risk. The Inspectorate will continue to monitor PFAS risk assessments through regular contact with water companies as well as the audit process.
- Where blending is used as a PFAS control measure, this must be accurately calculated and controlled. Boreholes drilled within the same aquifer can have different PFAS risks and blending protocols should be supported with alarms and shutdowns to ensure the minimum blend is always maintained.
- Following a dry summer, groundwater levels are expected to rise in the winter, and this may affect mobilisation of PFAS in superficial soils and landfills. In addition, heavier rainfall may result in partially treated or untreated sewage entering watercourses for abstraction for water treatment. For these reasons it is important to correctly identify raw water risk and implement treatment processes where necessary, alongside a robust sampling programme.

- Academic and industrial knowledge around PFAS continues to advance. This includes advances in diagnostic capability allowing for the detection of a greater number of PFAS at even lower detection limits.

Next steps

The Inspectorate will complete its assessment of the Cambridge Water PFAS event at Duxford and take enforcement action if appropriate. This borehole remains out of supply by a statutory notice, which will remain in place until a suitable remedial treatment process is installed and shown to be effective.

The Inspectorate will review the historic data which has been resubmitted by companies. This will be in a format compatible with our information systems allowing greater scrutiny.

The Inspectorate will continue to monitor progress with company regulation 28 risk assessments, and ensure mitigations are in place to protect consumers where necessary.

The Inspectorate is collaborating with UKWIR on a research project 'Bench-Scale and Pilot Scale Water Treatment Efficacy Study of poly and perfluorinated alkyl substances (PFAS)', commencing autumn 2022. All our completed research publications are available on the [DWI website](#).

