

# Drinking water 2021

Quarter 1

January - March 2021

A report by the Chief Inspector of Drinking Water



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Drinking water 2021  
Public water supplies for  
England and Wales

Quarter 1  
January – March 2021

Published by  
Drinking Water Inspectorate  
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# Contents

|   |    |
|---|----|
| Water quality compliance monitoring .....   | 2  |
| Water quality at treatment works .....  | 2  |
| Water quality at service reservoirs and in distribution .....                                   | 5  |
| Water quality at consumers' taps .....  | 5  |
| Events Case Studies .....   | 12 |
| Animalcules Within Assets .....   | 12 |
| Affinity - Taste and Odour, Hitchin .....   | 14 |
| Wessex Water – <i>Cryptosporidium</i> , Empool WTW .....  | 16 |
| Anglian Water – Odour, Market Harborough .....  | 17 |
| Northumbrian Water - <i>Cryptosporidium</i> , Rochester .....                                   | 18 |
| Notable Discolouration Events .....   | 18 |
| Audits .....  | 20 |
| Risk Assessment .....   | 20 |
| <i>Cryptosporidium</i> .....  | 24 |
| Legal Instruments .....   | 26 |
| New Legal Instruments Issued .....  | 26 |
| Annual Progress Reports .....   | 28 |
| Radioactivity Notices .....   | 28 |
| Regulation 15 Applications .....  | 29 |
| Recommendations .....   | 29 |
| Research on drinking water quality .....  | 34 |
| Risk maps for evaluation of water-quality monitoring requirements in<br>England and Wales ..... | 34 |
| Long-term strategies to reduce lead exposure from drinking water .....                          | 35 |

## Water quality compliance monitoring

There were 148 regulatory breaches reported in the first quarter of 2021 for assessment. This represents a decrease from 165 in the same period of 2020. A further 51 samples were reported where the fluoride concentration did not meet the specification required by Public Health England in fluoridated water supply zones. 16 recommendations were made but there were no common themes arising.

## Water quality at treatment works

### Microbiological failures at treatment works

There were three failures of the *E. coli* standard in this quarter (NES, SVT and UUT), with 18 total coliforms failures reported (ANH 4, ISC 2, NES 2, SVT 2, UUT 2, YKS 2, BRL, DWR, SWB and TMS).

Table 1: Q1 2021 – Microbiological tests

| Parameter                           | Total Number of tests | Number of tests not meeting the standard |
|-------------------------------------|-----------------------|--|
| Water leaving water treatment works |                       |  |
| <i>E. coli</i>                      | 44,844                | 3  |
| Coliform bacteria                   | 44,840                | 18                                       |

### *E. coli* and coliforms at treatment works

*E. coli* was detected in combination with a number of different coliforms at Severn Trent Water's Ford borehole pumping station in January. Whilst the company were unable to conclusively determine a cause, the investigation was thorough and included a survey of the boreholes. The works had failed safe on high turbidity earlier in the day and had been subject to maintenance work for some weeks before being subsequently returned to service four days prior to the detection. This site has not had any *E. coli* detections on record dating back to 1990 and so the failure was unusual. Whilst there is no direct evidence that the work was linked to the failure, any intervention in the water supply can cause disturbance leading to water quality challenges. In response the site was removed from supply.

An improvement notice is already in place to address microbiological issues at Severn Trent Water's Strensham works. Remedial work was completed in May 2020 to the contact tanks which included a water proofing membrane and structural work in response to five previous *E. coli* failures since November 2017. A subsequent coliform failure occurred in January which demonstrated a particularly good example of the use of in line flow-cytometry in providing data on the number of bacteria passing through the works. This evidenced an increase of cell loading coincident with high river flows and high works output. The critical link between source challenge and works output is crucial when maintaining water quality by setting and then operating within the limits of the works. In this instance, the company was able to demonstrate that the bacterial loading was not linked to the integrity of the contact tank.

A single *E. coli* was detected at Northumbrian, Essex and Suffolk's Layer works in February. Ingress was identified in contact tank 2 and repairs were completed by the end of March. The occurrence was assessed as unlikely to recur as the defective components of the contact tank were repaired.

United Utilities detected a single *E. coli* in February at their Ridgeway works. Although the company completed a satisfactory investigation, no root cause was found. The works was operating within expected performance limits and Contact time (Ct) was being met at the time of the failure. Resamples collected from the works, downstream storage and distribution, including large volume samples, all returned satisfactory results. The company reported building works close to the works final water sample kiosk, however upon inspection the sample point was satisfactory.

Following a single coliform detection in March at Thames Waters Enborne Grange works, the company identified an ant infestation around a poorly sealed cable duct. The inability to remove the works from supply to inspect the contact tank in a timely manner led to a recommendation for the company to review its resilience. The provision of wholesome water, at all times, is a minimum expectation. Sites should be configured for removal at any point in the year without sufficiency being the primary consideration. Risk assessments should be applied across all sites. Difficult risks should not be an exception but the reason why an assessment should be undertaken. Variable disinfection residuals led the Inspectorate to recommend that the company reviews its start-up procedures as the company was unable to validate the disinfection process.

Following the detection of coliform bacteria at the Isle of Scilly, Vane Hill works it was identified that the sampling point was not representative of the final water as it was located before the final UV treatment. In response South West and Bournemouth Water installed a new, correctly located, final water sampling points. A recommendation was made that the previously collected data from this site be resubmitted to the Inspectorate to indicate that it was not representative of the final water.

There were three coliform failures in February: two at Yorkshire Water, and one in Dŵr Cymru Welsh Water. In March, there were four at Anglian Water. Of these seven failures, five of the on-site tanks were found to have points of ingress either through the roof or around hatches. The importance of rigorous and responsive investigation is clear when investigating coliform failures since it expedites early remediation of identified risks reducing the likelihood of further failures protecting water quality. Suggestions were made on the Anglian Water's Pitsford works and Yorkshire Waters Nutwell works. In both assessments, suggestions were associated with poor site schematics which hampered investigations. Shortcomings on site schematics can present a risk to decision making and companies are reminded to maintain frequent reviews of site plans and representations of tanks, pipework and valve positions.

### Turbidity failures at treatment works

Two samples exceeded the standard for turbidity at treatment works this quarter (DWR and SST). Whilst South Staff's Water had taken some action to prevent a recurrence of a turbidity breach that occurred at Prestwood pumping station in March, the Inspectorate recommended the company address the risks associated with sand deposits in the boreholes, which was the root cause of this breach. Equally, the turbidity failure at Dŵr Cymru Welsh Water's Court Farm works was because of the deposition of sand in the outlet pipe, in this case from sand blasted from a previous internal clean of the tank wall. This failure serves as a reminder that any intervention within water supply carries a water quality risk.

### Radiological failures at Supply Points

Radon and gross alpha were detected three times each at supply points on the Isles of Scilly during Q1. The gross alpha detections were determined to be trivial following total indicative dose calculations showing that the level was within the regulatory standard. Two of the Radon detections were also deemed to be trivial as the measurements in the zone were below thresholds where further action would be needed. The third radon detection was above the level where action should be taken, and the Inspectorate initiated enforcement action by way of a regulation 20(4) notice requiring the company to mitigate the risk.

South West and Bournemouth Water have programmes of work for the five populated isles on the Isles of Scilly to ensure water supplied to consumers meets the requirements of the Regulations. The Inspectorate will issue island wide notices to cover these proposed works to bring the water supply up to a standard to supply wholesome water.

## Water quality at service reservoirs and in distribution

There were no *E. coli* failures at service reservoirs in the first quarter, but nine samples contained coliform organisms (ANH 2, HDC 2, SWB 2, AFW, ISC and NES).

Table 2: Q1 2021 – Microbiological tests

| Parameter                        | Total Number of tests | Number of tests not meeting the standard |
|----------------------------------|-----------------------|--|
| Water leaving service reservoirs |                       |  |
| <i>E. coli</i>                   | 50,094                | 0  |
| Coliform bacteria                | 50,098                | 9  |

In all but one case the service reservoirs were removed from supply and internally inspected shortly after the failure. The remaining site was scheduled for inspection more than four months from the failure (ISC). From the eight sites inspected, five or over 60%, were found to have ingress. This demonstrates clear evidence that companies must always act on coliform failures to reduce future risks.

Where there is swift removal of compartments followed by a thorough investigation and, as necessary, timely completion of remedial works, a conclusion of unlikely to recur is appropriate.

## Water quality at consumers' taps

### *E. coli* at service reservoirs

There were no reported *E. coli* failures at consumers' taps in the first quarter of 2021.

### Enterococci

Enterococci were detected in a sample taken by South East Water in January, from the upstream Kilnwood service reservoir due to restrictions with obtaining consumer samples during the pandemic. The company removed from supply and inspected the service reservoir which identified water ingress through the roof and wall joint intersection and through the mastic seals to the access covers. This was considered to be the root cause

of the detection and the company undertook repairs to address the points of ingress.

A *Clostridium Perfringens* was detected by Northumbrian, Essex and Suffolk Water in February. This sample was taken from an outside tap whilst some CoViD-19 restrictions remained in place. The regulations permit this parameter to be monitored from samples of water leaving treatment works or other supply point as it is deemed that no significant change occurs during distribution, the purpose being to monitor the efficacy of the treatment works. Subsequent samples from the treatment works were satisfactory and consequently it was concluded the failure was a tap specific issue.

## Aluminium

A detection of aluminium during March in the Portsmouth Water Hoads Hill East supply zone identified potential issues with coagulant control at the supplying Itchen works which may have led to a legacy issue of sediment in the network. A previous detection of aluminium above the PCV was reported by the company in September 2020 from this zone. A significant increase in the treated water aluminium concentrations from the Itchen works was identified as was a build-up of silt on the floor of Hoads Hill service reservoir 1 in an inspection completed by the company in 2018. Fixed coagulant dosing at the treatment works risks excess carry over to supply. The company were required to optimise coagulation control at the supplying works and to investigate and address the risks associated with accumulated deposits in the network. Managing coagulant dosing reduces not only the risks of unwanted aluminium in the supply and consequent sedimentation in networks but also promotes efficient operation of treatment works by using no more coagulant than necessary for the source water.

A Yorkshire Water regulatory zonal sample collected in January from Mappleton water tower service reservoir contained 224µg/l aluminium. Resamples from upstream and downstream assets were satisfactory in addition to first draw, flush and dip samples from Mappleton tower. The tower was last inspected internally in 2016 and a planned external inspection was carried out in July 2020 where remedial work was carried out on the mesh screens. An internal inspection was planned for August 2021. The assessment outcome was covered by a legal instrument.

## Iron

In February South East Water detected iron in excess of the prescribed standard in a sample which was collected from the supplying Cranbrook service reservoir. A repeat sample has led the company to conclude that the sample line is the likely contributory factor to the iron detection. The company is investigating the tapping point and sample line to ensure it is sampling water representative of that being supplied into the network.

In March a sample collected from a commercial property by Southern Water also failed the standard for iron. The company investigated, which included taking repeat samples and the investigations pointed to a mains disturbance caused by mains repair work on the upstream network to be the most likely cause.

Following a failure in March, Thames Water plan to investigate the risk of iron failures close to the end of the network in its Wandsworth Wandle zone after a recommendation was made by the Inspectorate.

Recommendations were issued to Northumbrian Water and United Utilities in response to two iron compliance failures in January 2021 that were attributed to the condition of cast iron mains supplying the properties. In both instances' investigations had shown that flushing was not successful in mitigating the risk of iron exceedances. Both recommendations were given to prevent a recurrence of unwholesome water being supplied to the affected properties and to ensure the companies completed mains rehabilitation and/or replacement.

Suggestions were made regarding a Yorkshire Water iron failure (947µg/l) in Beverley water supply zone following sampling at a company depot. The company identified that the depot was supplied by a 128-metre length of 90mm diameter MDPE supply pipe which in turn is supplied from a 25" cast iron main. The company attributed part of the cause of this exceedance to low turn-over in this supply pipe, being lower than normal due to reduced access to the depot. The Inspectorate suggested that the company put in place an appropriate flushing programme to improve the turn-over in this supply pipe and prevent recurrence.

## Lead

Bristol Water detected lead in a sample taken from a church which was being used as a fixed-point sample location during the restrictions associated with the pandemic. The church also failed for lead when it was sampled in October 2020 and the company confirmed that the section of lead supply pipe which they are responsible for has now been replaced and they have advised the persons responsible for the church to replace the section they are responsible for. The works for this supply adds phosphoric acid for plumbosolvency control with pH adjustment to reduce the risk of lead leaching into drinking water. However, this example serves as a clear reminder that plumbosolvency control is not completely effective, and removal of the lead communication and supply pipe is the only effective permanent and sustainable solution. Where the public access a building, companies can require owners to remove their part of the pipe.

Southern Water also detected lead in excess of the standard in an estate agent premises in March and initiated a lead communication pipe replacement. Like Bristol Water, the supply has plumbosolvency control but

in this supply the company had reduced the dose by nearly 25%. A cause and effect cannot be drawn from a single data point, but any assessment should balance the risk of reducing mitigation measures set against the potential outcomes. Commercial premises such as estate agents, will use relatively small quantities of water by the staff and customers and then only during the day. Where there is lead pipework, the risk of a lead failure is likely to be quite high with the combination of low usage and water standing in the lead pipes. It is therefore a priority to inform the building owners to protect their health by flushing away stagnant water, which the company did, but also where a building is used by the public to require the company to replace their part of the pipework which is lead.

South West and Bournemouth Water found lead in excess of the standard in a sample taken from their own Water Quality Office in Plymouth, also in March. A water fittings inspection identified the presence of lead solder on pipework below the tap from where the sample was taken from. The Water Quality staff were, as an interim measure, advised to flush the tap for two minutes before using it, prior to the pipework which had the lead solder identified being replaced. The presence of lead solder in companies own premises was previously reported in CIR 2020. An altered sampling strategy in the face of CoViD-19, where companies collect samples at their own staff rooms, has identified fittings below the standard expected of a water company. Companies should take proactive steps to identify fittings, such as lead piping and solder prior to a failing sample requiring action to be taken afterwards.

Recommendations were issued to United Utilities to include a risk assessment of the extent of lead service and communication pipework at properties within the Warbreck Tower supply zone, following investigatory resamples detecting 9.9µg/l of lead at a second property in the zone. A suggestion was also made to the company for a procedural review and a benchmarking exercise with current industry good practice as at the time of the failure United Utilities would only take responsive action to a failure greater than 10µg/l as lead (Pb). There is no safe concentration for lead in drinking water and many companies operate to internal trigger values <5µg/l as lead (Pb). Subsequently United Utilities have changed their internal trigger level to 5µg/l which is welcomed by the Inspectorate.

## Manganese

A regulatory sample taken in March from a commercial property by Yorkshire Water contained 117µg/l manganese. All resamples including first draw and flushed samples contained manganese in excess of the PCV. No issues were identified at upstream assets and so the root cause of the exceedance was determined as the public distribution network. The company established regular network flushing with sampling which ran from March until the end of May 2021. Post flush resamples were compliant for iron but not manganese.

Following further investigations, the company is preparing to alter the supply arrangement or replace the main. The area is covered by a notice which includes measures to improve discolouration in the zone.

## Nickel

Wessex Water detected a nickel failure, in a sample taken in January, from a company depot. The company concluded the most likely cause of the exceedance was the tap and low turnover as the sample was collected first thing on a Monday morning. The tap has been replaced. Like the failure of lead in the above section, the presence of nickel in companies own premises was previously reported in CIR 2020. Likewise, companies should take proactive steps to identify fittings, such as nickel-plated taps to set the standard for all.

Nickel above the PCV was detected four times in Quarter 1 by Portsmouth Water. Once in a sample collected from a golf course in the Hoads Hill supply zone, and twice (February and March) from a new fixed-point sample tap which was installed in an employee's garden in the Farlington supply zone. The tap was intended to assist with making zonal sampling more accessible during the restrictions associated with the pandemic. At the golf course the company suspected that work being carried out by the golf course contractors who had damaged the supply pipe may have contributed to the cause as the supply had to be switched on and off in the week leading up to sample being collected. The supply pipe was replaced in resolution. After the second detection of nickel from the newly installed fixed-point sample tap installed in the employee's garden, the company identified the new tap was the most likely cause and decided to stop using this location for the collection of regulatory samples. There is an opportunity for companies to take a cross sector strategic approach to remove or limit products which use nickel or leach nickel into drinking water to remediate the root cause. Not sampling at a particular tap is an avoidance of the problem.

South West and Bournemouth Water also detected nickel in a sample taken from an outside tap from a consumer property in the Pynes Central supply zone in March. The sample was taken from the outside tap due to the restrictions associated with the pandemic. The company conducted a sampling survey and a water regulations fittings inspection and concluded that the most likely cause was due to the material and age of the tap as it had been installed relatively recently and used infrequently. The consumer was advised not to use the outside tap for drinking. Outside taps are not a point of consumption for domestic purposes and under normal circumstances should not be used as a sampling point. As all restrictions have been removed, companies would be expected not to use such taps going forward.

After Southern Water detected nickel in a sample collected from a commercial unit in the Wigmore supply zone in February the investigations identified that the elevated nickel was confined to the premises. The

occupiers were advised to flush the tap before use or alternatively replace the tap.

A recommendation was given to United Utilities in response to one nickel failure investigation where the root cause was found to be attributed to the domestic distribution system in a public building. The recommendation required United Utilities to work with the property owner to complete a water fittings inspection and comply with its duties under Section 75 of the Water Industry Act 1991.

## Taste and Odour

A substantial number of taste and odour failures were reported from Anglian Water in Quarter 1 (11 failures). Enforcement was initiated for the Mundesley water supply zone due to taste and odour breaches in October 2020 and February 2021. The Inspectorate could not conclude that further breaches were unlikely to recur. The company have subsequently removed Mundesley works from supply and are undertaking an evaluation of long-term mitigation. A Regulation 28(4) Notice was issued to the company to ensure remedial action at the treatment works is completed.

The taste failure in the Anglian Water Skegness zone in January 2021 was the third breach of this kind since September 2020 in the zone. Enforcement action was initiated in December 2020 and therefore, this assessment was covered by a legal instrument. The company are required to identify a long-term strategy(s) to reduce the risk of any future taste detections in this area.

On a further taste and odour breach in Anglian Water's Winterton zone, the assessing Inspector issued recommendations to the company in response to failures of chlorine taste and odour. Anglian Water were requested to provide the Inspectorate with evidence of chlorine monitor validation and full loop checks for the upstream assets. Information provided showed that calibrations on chlorine monitors were due to expire in February 2021 and were not planned for calibration until July 2021, exceeding the companies own requirements by six months. A recommendation was given for the company to ensure it follows its internal frequency for calibration of chlorine monitors as set out in its procedures, to maintain compliance with regulations 26 and 27.

An odour was detected in samples collected by Southern Water in both January and March. The first sample taken in January in the Easton supply zone was found to have a chlorine odour and was collected from a domestic property's kitchen tap. A water fittings inspection detected the presence of dead-legs and a non-WRAS approved hose connecting to the cold tap. Non-approved fittings can give rise to taste and odour complaints as the components have not gone through testing to ensure they do not impart any

objectional tastes or smells. The company advised the consumer to undertake remedial works.

In March a sample collected from a dry cleaner in Southern Water's Nurstead zone had a fruity/solvent odour. The company investigation identified the presence of tetrachloroethene in the sampled tap and in a second mains fed tap. Tetrachloroethene is widely used in dry-cleaning as the cleaning liquid in which clothes are washed. Dry-cleaners are reported to have resulted in significant levels of tetrachloroethene in drinking-water in specific sites in the United States of America as reported by the WHO. The organic solvent readily permeates the standard blue pipe used for water supply particularly when near leaking storage tanks. The company inspected the premises and identified the absence of backflow protection on the connection of the water supply to the commercial washing machines. Whilst the exact cause was not readily apparent the company concluded the detection was likely to be property specific. As part of the wider investigation, the company reported that the supplying works had GAC installed in 2011 for solvent removal which is no longer used and is awaiting by-pass and decommissioning. The Inspectorate raised a recommendation that the company expedites the decommissioning to ensure that any potential risk of solvents desorbing from the defunct GAC is removed in a timely manner.

## Events Case Studies

### Animalcules Within Assets

There is nothing more unacceptable than to identify the remains of an animal within assets which are under the direct control of a water company. The following two case studies report on such events.

#### Southern Water - Animal Remains, Matts Hill WTW

Matts Hill works is a groundwater abstraction works in Kent. Four boreholes can abstract water and under normal operation, two boreholes are run as a duty pair with one of the other two boreholes assisting as needed. The site has a known risk of elevated turbidity following rain, and consequently in 2008 the company was prosecuted following the supply of inadequately treated and disinfected water when water entered supply as no engineering solution was available when the works was restarted. The boreholes now automatically run to waste when elevated turbidity is detected by the online monitoring equipment. On the 31 January water was appropriately run to waste avoiding a similar situation. However, the following day when the company attended site it was identified that a faulty solenoid valve on the chlorinators continued to dose whilst the site was running to waste. This led to an undetermined quantity of chlorine in pre-contact pipework. Without a means to clear the chlorine and the turbid water from the boreholes, which initiated the automatic shutdown on restart, the company drained the contact tank and initiated a complete inspection followed by a clean.

During the inspection a partially decomposed animal carcass, which was believed to be a rat, was found on the contact tank floor.

Photo 1. Animal remains on service reservoir floor



Following the identification and removal of the animal remains the company undertook an internal and external inspection of the contact tank. This inspection identified a single potential point of entry via the contact tank overflow pipe which was not suitably protected. The company installed a temporary mesh before a permanent flap valve could be installed to prevent a recurrence. Following this event, the company instigated a programme of inspections at contact and storage tanks which has identified 115 sites where no suitable protection has been installed on the overflow pipework.

### Dŵr Cymru Welsh Water – Animal Remains, Rogerstone Grange SR

Dŵr Cymru Welsh Water had a serious event in March 2021, at one of their service reservoirs - Rogerstone Grange, where a suspected animal carcass was observed during a remote operated vehicle (ROV) clean.

The company's response to finding the suspected animal was to remove the asset from supply the same day, thus removing the immediate risk to consumers. Rezoning and tankering of supplies into the network were required to maintain supply to the local area. Several hours were lost whilst the modelling was completed, and the new arrangements put in place to enable the tank to be isolated. The tank was drained down and inspected and a number of routes of ingress were identified.

The Inspectorate gave five recommendations to the company following this event, relating to risk assessment and contingency planning of planned work, sampling, mitigating risks identified in previous inspections and management of this process, as well as ensuring the accessibility of flap valves for inspection. Enforcement is currently being considered in two areas; contingency planning and risk assessment for planned work, and the inspection of service reservoirs which have gone beyond the 10-year maximum guidance.

Companies are reminded that risk assessments for planned work should be carried out, with risks to water quality and sufficiency of supply carefully considered and understood. Mitigation should be put in place to reduce these risks.

In addition to the risks the planned work itself may pose, companies should consider the risks, as well as the likelihood and impact, if the work does not go to plan. Contingency arrangements should be identified and, depending on likelihood and impact, plans put in place to reduce the time taken to enact these arrangements in the event they are required. This may be, for example, modelling of the network to identify rezone options or areas which may be affected, confirming tanker availability, pre-flushing mains and checking operability of valves which may need to be used for the work, or in an emergency, if work does not go to plan.

## Conclusion

The Inspectorate has, over the years, highlighted the importance for companies to ensure that all points of entry including overflows and vent pipes are identified and suitably protected from vermin ingress. These basic yet important protections ensure the integrity of water storage facilities and the safety of the water within. Regular site inspection as part of identifying and assessing risk is a vital part of ongoing operations across all sites and all companies. The entry of an animal could result in a consequence such as Pitsford (2008) where a rabbit contaminated water with *Cryptosporidium* causing illness in the community. In these cases, reported upon above, whilst there was no identifiable consequence the risks were the same, and they were preventable. This makes both these circumstances wholly unacceptable because they should not be down to a chance discovery on drain-down due to the failure of another critical piece of equipment, or a ROV cleaning of the asset.

## Affinity - Taste and Odour, Hitchin

In January, Affinity water reported consumer contacts regarding objectionable tastes and odours in the supply near Hitchin, Hertfordshire with contacts starting on 21 December 2020. The company was slow to investigate and initially ascribed the “metallic”, “sulphurous/fishy”, “mouldy/stagnant” and “chemical” complaints to increased chlorine at the supply works due to under-reporting chlorine monitors.

The monitors were recalibrated, but the complaints continued with samples on 31 December and 6 January being described as “mouldy” or “musty”. On 5 January a sampler detected a “stagnant” odour on a borehole at Temple End works and this was removed from supply. A catchment investigation on 5 January identified a large amount of maize silage being stored near the abstraction point for Temple End works.

Vermin had gnawed their way into the plastic silage bag, causing leachate to escape. The leachate was visibly running out from the storage, onto the ground and into the soil. Temple End works has remained out of supply and the hydraulically linked Wellhead works was also removed from supply in January, as a temporary precaution following elevated total viable counts.

Since the event the company has carried out a number of actions to investigate further, improve processes and reduce the likelihood of a repeat occurrence. These include reviewing and improving their cluster reporting tool, enhancing chlorine monitor verification checks, creating training courses for staff, and introducing perimeter checks for spotting catchment changes.

Photo 2: Pooling leachate from a silage bag near Temple End works



Whilst a verbal agreement was made to the company on 12 January 2021 that the bags would be moved, the landowner did not remove them from the field until 8 April 2021. In the intervening period a sump had been dug to collect and pump the leachate, however this was unlined and brought the leachate to within 25 metres of the Temple End borehole, increasing the risk of pollution migration.

The Inspectorate concluded that the initial response to this event was poor. The investigation was limited and did not include rudimentary checks on the catchment that could have identified this sooner.

The principle of a risk assessment is to identify risks from source to tap prior to any impact upon water quality. As a dynamic and living document central to the operation of a water company, a perimeter check should have identified such a risk, which was within meters of the borehole catchment. Instead, the company had to react to widespread consumer complaints which took an investigation over two weeks before the root cause was identified largely because the focus was on dismissing the data from monitors. A simple odour test at the source borehole by a sampler identified the problem. Arguably, once the company were in the reaction stage of the event perhaps this should have been one of the first tests undertaken. In the Wem incident of April 1994, the source of the odour tainting the supply in the Worcester area was tracked back upriver to Wem, Shropshire, by the National Rivers Authority. An independent report into this incident recommended “More frequent on-site taste/odour testing at treatment works”.

Use of taste and odour at treatment works as well as perimeter checks and spotting changes in the catchment adjacent to a works have been good practice in the industry for decades and this oversight raises concern over the level of risk the company is taking and points to deficiencies in procedures, training or competence of site staff. Equally, the risk assessment score as measured by the Inspectorate is at the low-end suggesting identification of risks is perhaps not a central focus for the company.

All companies are reminded to carry out appropriate checks on the catchments of their ground water sources, particularly within the defined source protection zones. In this case the water was rejected by consumers for drinking, the next incident of this kind could involve something far more hazardous to health.

## Wessex Water – *Cryptosporidium*, Empool WTW

In February, Wessex Water detected a single *Cryptosporidium* oocyst in a sample taken from Empool works. The works receives water from two boreholes (boreholes 1 & 3). The company increased the monitoring frequency for *Cryptosporidium* and completed a site survey, which did not identify any areas of concern. As a precaution the company reduced the output from this site. To aid investigations, the company installed *Cryptosporidium* sampling units on the individual boreholes at Empool works, as well as a sampling unit on the east-west main, which supplies the motive water to Empool works. In addition, the company carried out an inspection and flood test of the contact tank at Empool works, both of which were satisfactory.

A second single *Cryptosporidium* oocyst was detected in a filtered sample collected on the 17 February from the final water at Empool. On this day borehole 1 was automatically shut down due to elevated levels of turbidity in the raw water. The disinfection system was not compromised with a maximum turbidity of 0.36NTU recorded at the combined raw water point of disinfection.

The company's investigation into the event has focussed on three key areas; raw water quality, contact tank structure and the motive water system. The company believes the most likely source of the *Cryptosporidium* oocysts to be the raw water. Therefore, the company has accelerated an engineering scheme, to install Ultra-Violet (UV) treatment at Empool works.

During the investigation of this event the Inspectorate noted that there appeared to be a correlation between rainfall events and the two detections of both oocysts. The company identified that the headplate in borehole 3 was not sufficiently sealed and was housed in a kiosk with a leaking roof. The contamination risk of borehole 3 has been known to the company since at least 2016 with additional control measures to raise and seal the headplate

listed in the company regulatory risk assessment. The Inspectorate concluded that the company had not addressed these risks in a timely manner, which may have potentially led to the event occurring. The Inspectorate issued a recommendation that the company reviews its catchment risk assessment approach, with a view to implementing the required control measures in suitable timeframes.

Companies are reminded that where known risks exist to raw water quality, they should instigate appropriate remedial action or other mitigation (following the multi-barrier approach) to ensure the integrity of the water treatment process. Failure to remediate known risks in a timely manner would be viewed as a serious derogation of duties should any cases of illness in the community be identified where the root cause is attributed to these risks.

## Anglian Water – Odour, Market Harborough

Approximately 200 consumers in Dingley, near Market Harborough were affected by an abnormal odour, associated with Anglian Water's Dingley Water Tower. The tower was isolated from supply and network flushing was undertaken. Bromophenol compounds (2,4,6-tribromophenol; 2,4-dibromophenol; 2,6-dibromophenol and 2-bromophenol) were detected within samples collected from Dingley Tower. The detections were above the taste and odour thresholds and operational acceptable levels but below health-based levels where any adverse outcome might be expected over 24-hours. Following internal and external inspection minor ingress from the roof was identified. Additional soak testing on the external roof membrane detected two bromophenol compounds. The roof products are: Irathane CR 94 (DWI 56/4/293), Aqualine 400 coating (WRAS 0912514) and Irabond BC50 primer (WRAS 0912513) all of which had been applied to the roof in 2013. All three products are used across Anglian Water's assets and had Regulation 31 approval at the time of application. The products are no longer manufactured, and company mergers have made product formula information hard for Anglian Water to gather. The company do not believe they can conclusively identify the cause of the bromophenols due to the age of the tower and historical remedial work not being recorded. The company has taken the decision to permanently decommission the tower, therefore removing the source of the bromophenols detected.

This event has some similarity with the Anglian Water 2014 Oundle taste and odour event, which was caused by chemical products used on the roof of Southwick water tower leaking into the water body. Companies are reminded to carefully evaluate the suitability of tank roof materials and control the use of products by contractors to prevent those which are unsuitable. Furthermore, companies should maintain accurate records of products including all work and materials as well as those subsequently used to repair

roofs. Whilst products used on a roof might not be directly in contact with water, it is important to remember that unsuitable materials may impact water quality. In this case example, the detection of an odour means the water supplied is technically unwholesome, and if not acceptable to consumers, could be considered as unfit for which the company is legally responsible, not the contractor.

## Northumbrian Water - *Cryptosporidium*, Rochester

In Quarter 1 of 2021 the event assessments for the serious Northumbrian Water Rochester Treatment Works events of October 2020 and January 2021 were concluded. A single oocyst detection in October and January were reported as separate events. In both cases, root cause analysis considered heavy rain in the catchment to be the main contributory factor to an increased *Cryptosporidium* loading in the raw water. A company audit of the treatment works revealed many shortcomings in both asset condition and maintenance which the Inspectorate believes were both avoidable and a contributory factor to the presence of oocysts in the final water. The Inspectorate concluded that the events were caused by the works being unable to provide adequate treatment for the removal of *Cryptosporidium* during periods of increased rainfall. The deterioration in raw water during the first event in October 2020 was additionally not acted upon promptly due to an unreliable raw water turbidity monitor and issues with coagulation instruments requiring operators to manually calculate dosing requirements. The Inspectorate was critical of the company's approach to planned maintenance and remedial work. Recommendations were given in relation to online monitoring, compliance with regulation 26 and regulation 18. The company are replacing the works with a membrane plant in 2021, progress of which is being tracked by the Inspectorate.

## Notable Discolouration Events

United Utilities had three notable discolouration events in Quarter 1 2021; the Levenshulme discolouration event was caused by a catastrophic main failure, causing significant flooding, loss of supply and discolouration. A total of 172 water quality consumer calls were received in relation to this event with 240 calls from consumers reporting poor pressure or loss of supply. Aluminium and manganese exceedances were recorded in investigational samples. A recommendation was issued relating to updates to the company's Regulation 28(1) report for the zone. In addition to this, the event investigation identified deficiencies in re-sampling following failures within the zone. A recommendation was given for the company to review its procedures for sampling in response to failures to ensure samples are collected from upstream and downstream locations in a timely manner.

In addition, United Utilities reported a discolouration event at Failsworth which was caused by a large industrial user drawing a large volume of water from the mains supply resulting in flow changes above the conditioned velocities. A recommendation was issued for the company to consider their risk assessment and control measures for all distribution zones relating to industrial users drawing large quantities of water.

In response to a United Utilities discolouration event in Preston, the Inspectorate suggested that the company ensured briefings regarding the appropriate use of fittings was received by relevant network individuals. The event was caused by a failure of a burst repair fitting which had been installed earlier in the day.

## Audits

The Inspectorate carried out two programmes of desktop audits in the first quarter of 2021. The first was an examination of the risk assessment approach taken by companies where the overall assessment by the company classed themselves as a low risk. These audits assessed company procedures to ensure that the assessments were being carried out appropriately and in line with good practice across the industry.

The second audit programme focussed upon *Cryptosporidium* and the risk it poses at some treatment works. Sites were selected on a risk-based process.

## Risk Assessment

The Inspectorates first quarter audit programme focussed on company Drinking Water Safety Plans to further understand how companies are reporting risks, by exploring how companies' methodologies identify risks and control measures and categorise these risks for regulatory reporting. Companies were selected based on relative low risk assessment scores when compared with the wider industry. An examination of whether a company's self-assessment process was appropriate was considered as part of the audit.

Following introduction of the Risk Assessment Risk Index in 2020, the Inspectorate has been working to gain insight from the company scores. It is recognised that the scores do not necessarily represent the risk *per se* of each company with regards to water quality, because the scores also reflect the risk appetite of each company and inconsistencies in interpretation of risk categories. There is substantial inconsistency between companies with regards to reporting of DWI risk categories, which is an essential multiplier for RARI, indicating where hazards require some form of further action to reduce water quality risk. Ongoing collaboration with the water industry is welcomed to drive consistency between company reporting.

Excluding New Appointments and Variations (NAVs), Severn Trent Water reported the highest percentage of risk lines (8.25%) requiring some form of additional action (Category B to E). Sutton and East Surrey Water reported the lowest proportion of risk lines requiring additional action (0.008%); this amounted to two lines of data out of 23,536 as of February 2021 where the company was taking action to mitigate metaldehyde, a molluscicide of well-known national importance. SES have since increased this reporting to 21 records out of 23,834 by addition of 19 risks under investigation for the persistent chemical perfluoro-octane sulphonate (PFOS), which is used as a flame retardant and in non-stick materials.

Some companies reporting the lowest number of DWI risk category B to E were highlighted through DWI audits, events and compliance breaches, suggesting that there may have been a disagreement between what companies are reporting and the actual risks. In order to investigate this and identify good or bad practice that can be shared with the industry, the DWI audited the companies with the lowest RARI scores in January 2021.

The three companies with the lowest RARI scores were Sutton and East Surrey, Affinity Water and South West and Bournemouth Water. Both Sutton and East Surrey and South West and Bournemouth Water had several known issues identified during audits, events and compliance breaches.

The audit of SES Water identified a fundamental flaw in the company's approach to Drinking Water Safety Planning, whereby risk was solely informed by sample results. This is a misinterpretation of the World Health Organisation's guidance on water safety plans and all companies are reminded that the widest possible range of risks and relevant information should be considered in water safety plans.

The assessment team raised several recommendations to address findings around insufficient resources applied to water safety planning and a lack of consideration of catchment and abstraction risks; a failure to consider risks from parameters not specifically defined in the regulations such as disinfection by-products and perfluorinated compounds. SES Water had no programme for inspecting the condition of boreholes.

The treatment standards used by the company for pH, taste and odour and *Cryptosporidium* were all called into question by the Inspectorate as they would not prevent regulatory breaches.

At SES Water's Kenley works, the quantity and quality of the wash water supernatant return was known to exceed recommended guidance specified in the Badenoch and Bouchier reports. *Cryptosporidium* control was further compromised due to the supernatant being returned to the rapid gravity filter inlet yet monitoring for *Cryptosporidium* was upstream at the inlet to the works.

There is little connection between the DWSP team and site operators at Kenley works and therefore an understanding of the drinking water safety planning process is not well embedded within the operational team, and the DWSP team do not gain an insight into the operational risks that the operators are aware of.

The audit highlighted a need for companies to ensure that site staff, operators, mechanical and electrical engineers, catchment operatives and all relevant personnel are involved in the Drinking Water Safety Plan (DWSP) process. This is essential to understand the likelihood and consequence scores that make the foundation of a sound risk assessment. These operational staff should be central to the process. The onus should not be on these staff to autonomously identify when a DWSP needs to be updated.

There should be processes and procedures in place to ensure these teams are an integral part of DWSPs. The benefits of involvement in the DWSP process are that a comprehensive operational overview of a system is produced, which should greatly assist business decisions on funding and resourcing of issues that cause concern with regards to drinking water quality.

There was clear evidence at Sutton and East Surrey that the asset management system was not properly reflected in either regulation 27 risk assessments or regulation 28 reports. At Godstone works the company's asset management record identified that the accelerators (a design of a sedimentation clarifier process) required refurbishment, with an internal company water quality score of 4 out of 5 (5 being highest need). The audit assessment confirmed that the accelerators were in need of refurbishment and that they introduced a significant risk to water quality. This outcome was not translated into any additional risk in the company's regulation 27 risk assessment or reported as requiring any further action in the regulation 28 reports. All risks reported at Godstone works were category A, suggesting all risks were mitigated, verified and maintained with no further control measures required.

Regulation 28 reports must identify where companies need to take action to reduce water quality risks. Where refurbishment of treatment processes is needed with a strong water quality driver, the company cannot record that adequate control measures are 'verified and maintained'. The asset management system and related processes for identifying investment need are part of the verification process. All companies should ensure that asset management systems are integrated with regulation 27 risk assessments and that all risks that require significant schemes with water quality drivers are reported as appropriate DWI risk categories in regulation 28 reports.

At Affinity Water, communication between those carrying out operational activities that may affect water quality risk categories could be improved, better engagement between operational/engineering and water quality teams could help here. There was no clear methodology to define how the Inspectorate's risk categories are applied by the company and a recommendation was made to address this. More fundamentally, the company carry out no audits of their drinking water safety plan processes. This is a key requirement of the World Health Organisation's methodology to ensure that water safety plans are properly implemented and effective. All companies are advised to ensure that they have appropriate audit strategies in place to demonstrate that their safety planning activities are effective.

An audit of South West Water's Stanbridge works, and Sway service reservoir noted issues with the company's drinking water safety plan methodology and discrepancies in how risks are identified and reported to the Inspectorate through the regulation 28(1) reporting. Recommendations were made around catchment risk assessments to ensure both the

Bournemouth and South West regions are aligned. A recommendation was made that the company links asset maintenance to their DWSP methodology and regulation 28(1) reporting. Recommendations were also made regarding the company linking their risk register to the DWSP process and regulation 28(1) reporting, and also around governance for the DWSP methodology. Generally, it was concluded that the company could be more proactive in the risk identification process to capture potential risks before they materialise.

Nationally recognised hazards (e.g. metaldehyde) or company legal instruments are usually well reported and accounted for in regulation 28 reports. Whilst this is correct and welcomed, it should be noted that the purpose of regulation 28 reporting is not solely to identify issues that are already known to DWI through notices and national initiatives. Reporting should encompass all issues where significant additional work is required to improve water quality. A significant aim of DWSPs and regulation 28 reports is to reduce the need for reactive legal instruments by self-identifying and mitigating water quality risks before they result in breach of the regulations.

Some of the issues with under-reporting are to do with interpretation of how DWI risk categories should be applied. After the introduction of Information Letter 02/2019, some companies introduced a hybrid compliance hazard and hazardous event system that treats hazardous events separately in terms of DWI risk category compared to associated compliance hazards. The most obvious example of this was to do with service reservoir cleaning during an audit at Affinity Water. The company reported a single hazardous event under the hazard *E. coli* for any service reservoir that was overdue cleaning and inspection. However, all other hazards that may be associated with lack of inspection and cleaning (e.g. coliforms, enterococci, *Cryptosporidium*, iron, manganese, aluminium, turbidity etc) were not aligned with the same DWI risk category. Compared to the approach followed by other companies that would report all relevant hazards as a DWI category E or D for the same issue, Affinity Water's RARI score would be lower for comparable issues. Additional guidance will be produced in due course after consideration of the best way to capture the common risk associated with tanks that are overdue cleaning and inspection, in addition to other inconsistencies which may arise as a result of the interpretation of Information Letter 02/2019.

Reporting of risks requiring further action does not reflect badly on a water company. Identifying the need for additional mitigations is the precursor to preventing water quality risks developing into events, compliance breaches or unsatisfactory operational audits. Self-identification of risks that require additional control measures indicate that a company is responsible and reliable in the absence of regulatory intervention. This is demonstrated by the fact that companies which enter transformation programmes are often required to complete hazard reviews (Hazrevs) as a starting point in identifying and mitigating water quality risks and consequently regaining trust. A risk requiring additional action only becomes a negative indicator for a company if it remains unaddressed for an unreasonable duration, which

will be assessed on a case-by-case basis by DWI. This will automatically be captured by the RARI score with the 'days in risk category' metric, which measures how long a risk has remained in the risk category.

None of the three companies audited in January 2021 had clear procedures to understand how the companies themselves interpret the use of the DWI risk categories. Without such procedures, there is no assurance that companies have a reasoned process for assigning risk categories. A clear message from these audits is that companies should have such procedures in place. DWI will be providing additional guidance on interpretation of risk categories in due course and these procedures should therefore be a 'work in progress'. DWI will continue to collaborate with the Industry Drinking Water Safety Plan forum to develop an approach based on good practice across the Industry, which promotes consistency whilst still allowing individual company innovation where possible.

## *Cryptosporidium*

Companies are required to risk assess the sources used for drinking water to meet the requirements of regulations 15 and 27. Inadequate risk assessment and sub optimal treatment streams can present a risk to public health. The aim of the desk top audit programme was to show *Cryptosporidium* breakthrough and associated faecal risks remain adequately controlled.

An audit at Warkworth works (Northumbrian Water) focused on four primary topics regarding *Cryptosporidium* risk to water quality: the risk assessment process; company policy; site and final water performance; and stakeholder reporting. Extended absences of continuous raw water monitoring were identified during the audit which potentially undermines the process control, maintenance, and water quality monitoring control measures. A recommendation was given for the company to review the priority given to raw water instrument repairs. It is important that company's stock appropriate spares and if needed replacement instruments for critical process control points at treatment works.

Two recommendations issued during this audit assessment were related to instrument calibration; one was associated with the lack of calibration of a coagulant flow meter and the second was in response to the lack of an adequate calibration or validation scheme for head loss monitoring on the rapid gravity filters.

A serious concern raised during the audit was the return of supernatant water from the works process to the head of the treatment works. Data from the supernatant turbidity monitor scale regularly reached 9.9NTU which was the maximum scale output recording. The Inspectorate concluded that it is probable the supernatant water is returning to the head of the works at a rate greater than 10% of the input flow and, on occasions exceeding 10NTU.

This is outside recommended good practice of 5NTU and 5-10% of raw maximum return, and the company's own operating standards. Badenoch and Bouchier recommended recycling supernatant water from clarifier sludge and filter backwash water treatment facilities to the treatment works inlet should not be practised unless no more than 5% return of oocysts to the works inlet can be assured. Therefore, a recommendation was made for the company to review their supernatant control philosophy and assess the scaling on the data axis. Companies should be mindful of control points and alarm settings that are associated with returning supernatant to the head of the works and ensure that operators and managers are setting the alarm set points to address water quality risks rather than obscure them. Companies are reminded that evidence from the *Cryptosporidium* outbreak in Oxford and Swindon 1988/89 suggested that re-cycling backwash water to the head of the works was a practice that can amplify the treatment challenge with up to  $10^6/l$  of oocysts at the time detected in the settled backwash.

Due to concerns around the supernatant monitoring and control philosophy and a lack of suitable validation of critical control point instrumentation this audit was deemed unsatisfactory.

A *Cryptosporidium* risk audit was also conducted at United Utilities Lamaload water treatment works. This audit was generally satisfactory. Lamaload works is categorised as a low risk for *Cryptosporidium* by the company and only requires further sampling when oocysts are detected at a concentration of  $>2/l$ . The Inspectorate identified 28 detections of *Cryptosporidium* in the raw water inlet between February 2011 and February 2021. During this time the raw water inlet sampling frequency was reduced from weekly to monthly and no samples were taken from the raw water between March and December 2020. A recommendation was given to the company to ensure the frequency of raw water sampling was sufficient to verify the *Cryptosporidium* risk and that response triggers for final water monitoring and investigations were reviewed. It is important that appropriate sampling frequencies are maintained at categorised low risk surface water sites to verify the level of risk.

Severn Trent Water's Tittesworth works was selected for audit following positive *Cryptosporidium* detections in January and March 2020, enhanced sampling of raw and final water was delayed leading to potential breaches of regulations 4 and 18. Of greater concern was that the company reported a thorough investigation had found no possible causes of the detections. However, the Inspectorate investigation identified elevated levels of iron leaving the dissolved air flotation (DAF) plant, which is likely to have been coincident with the detections.

It was apparent that critical monitor calibrations had not met the company's frequency standards with a completion rate of around 34% for the year to February 2021. Severn Trent Water are at serious risk of breaching regulations 4 and 26 and this level of performance could question the company's diligence in carrying out its duties.

## Legal Instruments

### New Legal Instruments Issued

In the first quarter of 2021, the Inspectorate served 22 new legal instruments.

Table 3. Legal instruments issued in Q1 2020

| Type of legal instrument | Number | Companies   |
|--------------------------|--------|---|
| Regulation 28(4) Notice  | 2      | NES, UUT  |
| Regulation 21(3) Notice  | 1      | UUT   |
| Regulation 7 Notice      | 19     | AFW, ANH, BRL, DWR, HDC, ICW, IWN, LNW, NES, PRT, SES, SEW, SRN, SVT, SWB, TMS, UUT, WSX, YKS |

In March 2020, in response to the changing situation with the pandemic, the Inspectorate served regulation 7 notices to all companies in England and Wales. A regulation 7 notice suspends the requirement for samples to be collected at random from within zones (customer properties). With the changing situation over the year, the Inspectorate kept these notices under review. One major change made when the second set of notices were served was to make them zone specific, rather than companywide. This enabled companies to specify exactly which of their water quality zones were unable to be sampled at random. As all the regulation 7 notices had been issued with a 6-month expiry, those served during March 2021 were the third set (which were revoked in July/August).

Table 4. Zones covered by regulation 7 notices

| Company                    | No. zones covered by regulation 7 notices |            |
|----------------------------|---|------------|
|                            | March 2020                                | March 2021 |
| Affinity Water Ltd         | 90  | 33         |
| Albion Eco Ltd             | 1   | 0          |
| Albion Water Ltd           | 2   | 0          |
| Anglian Water Services Ltd | 164                                       | 48         |

|                                       |     |     |
|---------------------------------------|-----|-----|
| Bristol Water Plc                     | 27  | 16  |
| Cambridge Water Company Plc           | 9   | 0   |
| Dŵr Cymru Welsh Water                 | 82  | 82  |
| Hafren Dyfrdwy                        | 18  | 16  |
| Icosa Water Ltd                       | 9   | 11  |
| Independent Water Networks (Eastern)  | 21  | 27  |
| Isles of Scilly                       | 5   | 0   |
| Leep Networks Water                   | 27  | 26  |
| Northumbrian, Essex and Suffolk Water | 116 | 123 |
| Portsmouth Water Plc                  | 13  | 7   |
| SES Water                             | 20  | 13  |
| Severn Trent Water Ltd                | 201 | 126 |
| South East Water Plc                  | 72  | 72  |
| South Staffordshire Water Plc         | 28  | 0   |
| South West and Bournemouth Water      | 44  | 2   |
| Southern Water Services Ltd           | 74  | 64  |
| Thames Water Utilities Ltd            | 254 | 219 |
| United Utilities Water Plc            | 229 | 7   |
| Veolia Water Projects                 | 1   | 0   |
| Wessex Water Services Ltd             | 78  | 77  |
| Yorkshire Water Services Ltd          | 89  | 76  |

Some companies made better progress than others in achieving random collection of samples from within their zones. Of particular note, South Staffordshire Water and Cambridge Water achieved random sampling in all zones and have maintained that since the middle of 2020. United Utilities have also achieved random sampling in the vast majority of their 229 zones. This was no easy task, and those companies are applauded for their efforts, along with the other companies (ALB, ALE, AFW, ANH, SVT, SWB, VWP) who have achieved significant reductions in the zones requiring a regulation 7 notice.

The regulation 28(4) notice served on Northumbrian, Essex and Suffolk Water formed part of the company's transformation programme and covers all service reservoirs and contact tanks operated by the company, delivering improvements for all 4.5 million of the company's consumers. Service reservoirs and contact tanks can present a significant risk to the wholesomeness of the water they contain if they are not managed and maintained appropriately. Regular inspection forms a key part of that management. This notice shall see the company develop a detailed risk assessment methodology for their assets. It will also ensure that the inspection frequency is risk-based and that no tanks exceed the maximum time between inspections, and that all tanks operated by the company are able to be removed from supply in order to conduct inspections. The work is scheduled for completion by 31 March 2025.

A regulation 28(4) notice was served on United Utilities during January 2021 for discolouration improvements. See the annual CIR 2020 report for the full details of this notice. It shall reduce the risk of receiving discoloured water to over 1.7 million consumers, in a staged approach across the current AMP and AMP8.

A regulation 21(3) notice was served on United Utilities, requiring the company to use its powers under section 75 of the Water Industry Act 1991 (as amended). The notice was served following a Lead compliance failure at a golf club, for which the internal plumbing was suspected as the root cause of the failure. Although the building owner replaced the tap from which the failing sample was collected, no assessment was made of the risk presented by the rest of the plumbing within the building.

## Annual Progress Reports

January 2021 saw the Inspectorate receive the second set of the summary annual return reports, along with full annual progress reports for those schemes selected for audit by Inspectors. Of the 303 legal instruments in place at the end of 2020, 60 were selected for audit with full progress reports. On the whole, progress with legal instruments was found to be satisfactory and although some significant delays have occurred due to the pandemic, the number of legal instruments affected is small (less than 10%).

## Radioactivity Notices

The Inspectorate received a single application for a cessation of compliance monitoring for radioactivity parameters under regulation 6(12) from Independent Water Network. The company added a single new zone to the existing notice. The application was successful, but it did highlight the complications that can arise on occasions, with bulk supply arrangements. In

this case, the bulk supplier was unwilling to supply the recipient with operational monitoring data to assist in the application, resulting in additional sampling being necessary. Companies must ensure that their bulk supply agreements take into account all aspects of drinking water quality, including the supply of necessary water quality data and effective communication over events or changes to the supply system.

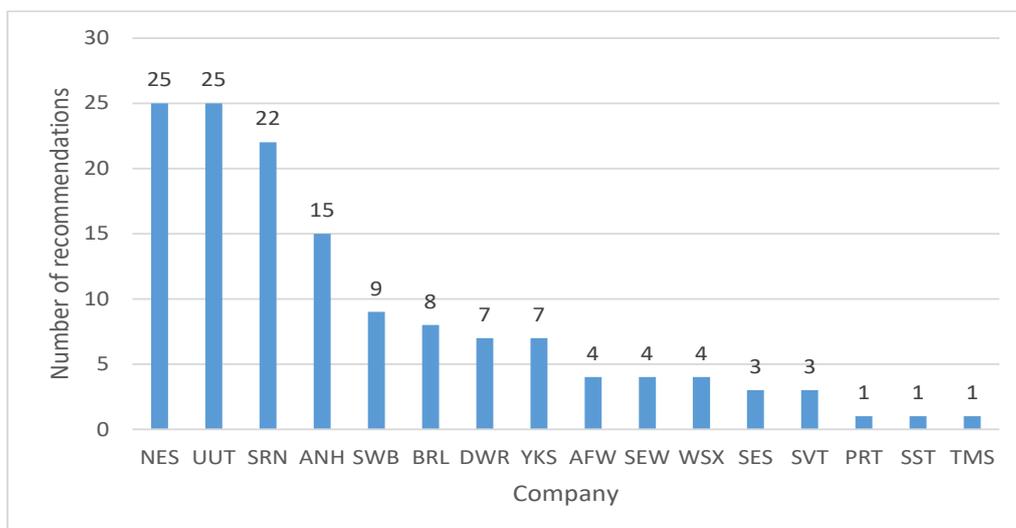
## Regulation 15 Applications

A single application under regulation 15 was received in the quarter, from South East Water, for two new sources at Butler Water Treatment Works. The initial application prompted a number of queries on source condition, previous land use, repurposing of existing infrastructure, consumer acceptability considerations, and further details of treatment processes for mitigating any raw water challenges. Following receipt of a satisfactory response and evidence from the company, an acceptance letter was issued, stipulating that the company consider the requirements of regulation 31 when repurposing existing infrastructure. A suggestion was also made for the company to keep raw water monitoring frequency under review for parameters of concern to ensure the raw water risk is accurately characterised.

## Recommendations

Inspectors made 139 recommendations during the first quarter of 2021 as identified in figure 1. Companies receiving zero recommendations in the quarter are not shown.

Figure 1. Number of recommendations by company, Q1 2021



The sources of recommendations were attributable to: audits (47); compliance failures (48); and drinking water quality events (43). No

recommendations were made in relation to water quality complaints during the quarter and a single recommendation was made in relation to legal instruments, as shown in figure 2.

Figure 2. Recommendations from each work area of DWI, Q1 2021



### Northumbrian, Essex and Suffolk Water

Six recommendations were made to the company following an event in 2020 where *Cryptosporidium* oocysts were detected at Rochester treatment works. The recommendations focused on the online monitoring, disinfection policy and investigation.

A further nine recommendations came from an audit of Redgrave works, focused on borehole contamination risks, operational procedures, monitoring and treatment.

### United Utilities

11 of the recommendations made to United Utilities came from a single audit at Cliburn works.

### Southern Water

Six recommendations were made in relation to a loss of coagulant dosing event at Hardham High works. Investigation, maintenance, procedures and risk assessment were the themes for these.

A further four recommendations came from compliance and were all related to issues with sampling, specifically in this case the condition and naming of a sample tap. Such recommendations are not expected at this company as

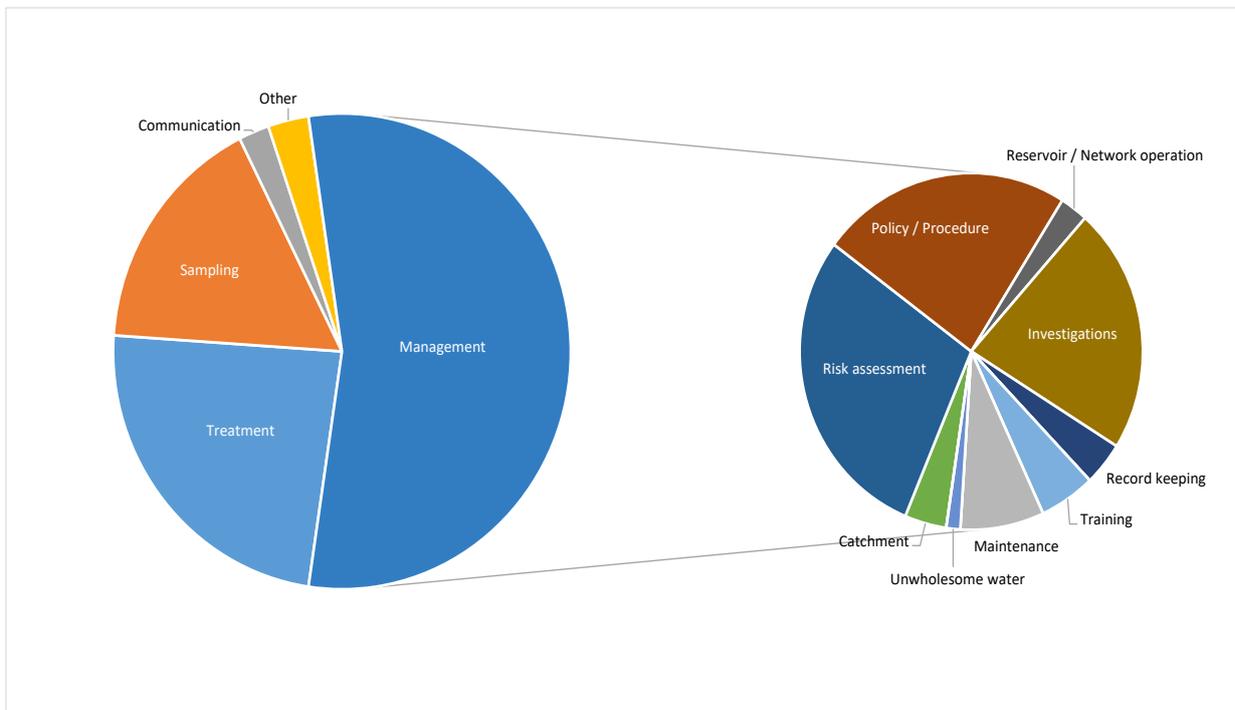
work was completed to assess the condition and naming conventions of all asset sampling taps as part of their transformation programme. This is being discussed further with the company.

### Anglian Water

Almost half (seven) of the 15 recommendations made to Anglian Water were from a single audit carried out at West Pinchbeck works.

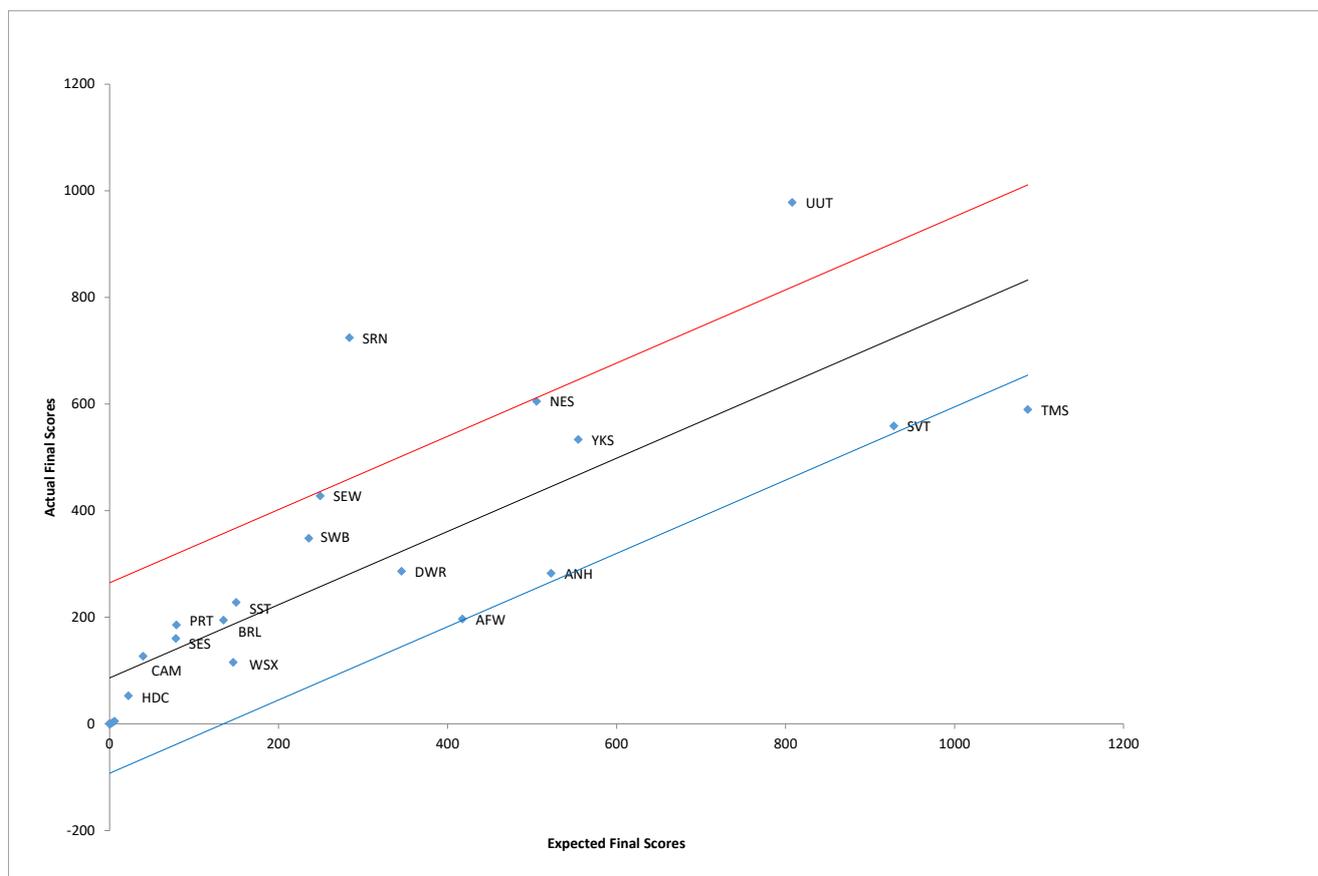
Figure 3 shows the distribution of all recommendations made to the industry in the first quarter of 2021, by category. Those areas within the ‘management’ group continue to make the biggest contribution to the total, with treatment and sampling contributing smaller but still significant numbers of recommendations.

Figure 3. High level categories of recommendations made in Q1, 2021



The recommendations risk index examines all recommendations made to the industry. The expected allocations of recommendations scores are predicted based on company size (population served). The actual score is then plotted against this. 95% confidence interval lines are added to the graph, to show which companies are statistically outside of the expected recommendations score (figure 4).

Figure 4. Recommendations analysis to 31 March 2021



Two companies (SRN and UUT) remain statistically above the predicted recommendation scores, a position both companies have now been in for over two years. United Utilities have been working with the Inspectorate to understand and address both the sources of their recommendations and the quality of their responses to them. It is hoped that the slight narrowing of the gap between their position and the red line, marking the upper limit of the expected range, is an early sign of the positive effect of this.

The two companies which moved above the predicted values during 2020 (NES and SWB) have moved back into the expected range during the first quarter of 2021. This has become a normal occurrence when transformation programmes begin, as the legal instruments are being formed actions tend to be picked up by this process and less recommendations are made. The challenge for these companies is to keep recommendation numbers low once the programmes are fully embedded and underway.

South East Water remain in a position just inside the expected zone and should look at the sources of and responses to their recommendations to ensure they don't slip into a worsening trend that takes them outside of the expected range.

The downward trend in this metric, which Severn Trent Water have been on since the end of 2019 has continued, and the company are now at the lower end of the expected range for recommendations scores.

## Research on drinking water quality

Two research projects were completed and published in Quarter 1, 2021. Both research reports are published on the DWI website and can be found under the 'Completed Research' webpage: [Research - Drinking Water Inspectorate \(dwi.gov.uk\)](https://www.dwi.gov.uk/research-drinking-water-inspectorate)

### Risk maps for evaluation of water-quality monitoring requirements in England and Wales

This project was completed by the British Geological Survey (BGS). The research involved the production of risk maps showing the distributions of inorganic chemicals and a number of physical parameters listed in the 98/83/EC Directive for both surface and ground water. The work was conducted between 2018 and 2020 with the final report published in January 2021.

The report details the steps taken in the process of producing risk (hazard) maps for chemical parameters listed in the national Water Supply (Water Quality) Regulations that implement the requirements of the Directive 98/83/EC for drinking water in England and Wales. On the basis of the Water Safety Plan approach of the World Health Organisation, DWI contracted the British Geological survey (BGS) to produce maps showing the spatial distributions of the listed chemical parameters and their concentration ranges as evidence of risk for drinking water. Data for an agreed list of 27 chemical parameters were collated, screened, evaluated and mapped, with surface water and groundwater being treated separately.

Risk maps produced for individual parameters include expected values and 95th percentiles of measured values relative to the prescribed concentration or value (PCV) at any given location. The methodology employed required prediction of the entire statistical distribution of each parameter at each prediction location so that both expected value and percentile values for each parameter could be determined. The produced risk maps are produced for water-quality data analysed over three years, in line with the requirements of the 2015/1787 Directive. The maps are presented in ArcGIS and are available upon request.

The maps provide an estimate of the current best-available spatial distributions for parameters for surface water and groundwater to aid DWI in assessing drinking-water risks and determining monitoring requirements, in line with Directive 2015/1787. A validation exercise demonstrated that for 40 of the 54 parameter/water combinations the proportion of measurements greater than the predicted 95th percentile were within a tolerable range. It is

anticipated that the maps will be used alongside available site-specific water-quality monitoring data and site risk assessments for decision making.

## Long-term strategies to reduce lead exposure from drinking water

This project was completed by the Water Research Centre (WRC) between 2018 and 2020. The research culminated in a presentation to the industry in January 2021 and report publication in February 2021, disseminating the research outputs.

Whilst compliance with the current 10µg/L standard for lead is very high, the World Health Organisation's (WHO) Joint Expert Committee on Food Additives (JECFA) and the European Food Safety Authority (EFSA) agree that there is no lower threshold for adverse effects of lead on human health. Evidence has driven the proposed reduction in the lead water quality standard from 10µg/L to 5µg/L in the current recast of the EU Drinking Water Directive. This research project re-evaluated and compared the remediation costs and health benefits of lead exposure reduction using the latest evidence available.

The study modelled a number of policy scenarios to understand the costs and benefits of reducing the risk of lead exposure from drinking water in England and Wales over the next 60 years, relative to a reference scenario which broadly describes the current approach to risk mitigation in England and Wales. A risk-based approach to evaluating the costs and benefits associated with policy implementation at a Water Supply Zone level was taken to ensure compatibility with DWI guidance. For modelling purposes, Water Supply Zones (WSZs) were grouped into High-, Medium-, and Low-risk groups using information on historical lead water quality compliance, property type and age, and the level of plumbosolvency control currently applied. Key information was provided by a number of water companies, scaled up to a national, England and Wales level. The WRC modelled both a 10-year and 15-year programme of additional remediation over the baseline, focussing on high-risk zones, to achieve compliance with a maximum drinking water concentration of 5µg/L (e.g. by 2035 or 2040). Further remediation was modelled to achieve no detectable lead by between 2055 and 2070. The first of these policy options was designed to align with the present recast of the EU Drinking Water Directive which proposes the adoption of a new lead water quality standard of 5µg/L within 10 years; the second addresses the overarching objective to minimise lead exposure from drinking water. A key requirement of this study was to quantify the impact of the selected implementation approach on water lead concentrations and hence consumer lead exposure from drinking water.

There is sufficient scientific evidence to quantify the adverse human health effects of chronic low-level exposure to lead on neurodevelopment (measured by IQ detriment), cardiovascular disease (CVD: measured by hypertension), and chronic kidney disease (CKD: measured by renal filtration function). These health endpoints were selected as their impact can be valued in terms of lifetime earnings, deaths (mortality) and/or quality of life (morbidity), as appropriate. The inclusion of the valuation of CKD and CVD endpoints significantly advances the utility of the economic analysis from similar earlier studies which focussed primarily on the impact of IQ detriment on lifetime earnings.

Key findings from the research included:

- I. Based on available scientific and practitioner evidence, it is concluded that water companies in England and Wales will be required to replace lead service pipes to guarantee compliance with a lower regulatory standard for lead at the consumer tap of 5µg/L or lower.
- II. Compliance with regulation which mandated the minimisation of lead in drinking water would be extremely difficult, if not impossible, without remediation up to the compliance point (normally the kitchen tap).
- III. Whilst point-of-entry and point-of-use filter systems and associated consumer education activities are important measures for reducing consumers' exposure to lead, their benefits cannot be guaranteed for the long term.
- IV. For both England and Wales, the most significant components to total benefit components from reduced lead exposure from drinking water, in monetary terms, are (a) avoided reduction in lifetime earnings from IQ detriment, and (b) avoided CKD morbidity and mortality. Other benefits include avoided health impacts from CVD caused by lead exposure, as well as leakage savings and avoided plumbosolvency measures following lead service pipe replacement.



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