

Drinking water 2019

Quarter 4

October - December 2019

A report by the Chief Inspector of Drinking Water



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Drinking water 2019
Public water supplies for
England and Wales

Quarter 4
October – December
2019

Published by
Drinking Water Inspectorate
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Introduction

During the year, the quarterly Chief Inspectors Reports have included a detailed report on the audits which have occurred in each quarter. The fourth quarter saw the publication of the Chief Inspectors annual report, which only included a summary of the main findings of the Significant Risk audit programme. For the benefit of the Industry, full details of the audit findings are published in this special report.

Significant Risk Audit Programme

Risks to water treatment processes can be identified in a number of different ways. Some are immediately apparent when bearing in mind the age and condition of the assets, others are identified following more considered assessment of the processes and control measures in place to identify potential shortcomings. Some risks are discovered when an exceptional event occurs to highlight water quality deficiencies

In the final quarter of 2019, the Inspectorate carried out a series of audits where significant risks had been identified by at least one of these means. Whilst many of the sites are discussed across the themes identified, the shortcomings at Northumbrian Water's Lumley works bear closer scrutiny and all companies with direct river abstractions works, in particular, are encouraged to take note of the issues found and ensure that they are appropriately mitigated at all relevant sites.

Northumbrian Water - Lumley works

The Inspectorate audited the works following two *Cryptosporidium* related events in August and September 2019. The cause was found to be due to inadequate maintenance and investment in a treatment works where *Cryptosporidium* is a high risk. Despite the best efforts of site personnel to operate the works properly, they are hampered by a lack of investment in asset renewal and maintenance, exacerbated by Northumbrian Water's desire to minimise operational costs.

The Inspectorate identified several deficiencies including a failure to appropriately implement all relevant recommendations made in the reports of the Groups of Experts on *Cryptosporidium* in water supplies, published in 1990, 1995 and 1998 and recommended a comprehensive review of the treatment processes and operating philosophy of this site. This was duly undertaken, and further failings were identified by the company.

Northumbrian Water subsequently began working with the Inspectorate to agree the steps to mitigate the risk within an appropriate timescale. The actions arising shall be incorporated into a regulation 28 notice. Brief details of the issues found by the Inspectorate and the company are given below. It is expected that water companies should consider whether the risks identified here could apply at any other treatment works across England and Wales and take appropriate steps to address any such risks.

Cryptosporidium monitoring is undertaken on the raw water, but when turbidity is high, sampling is not carried out, as the organic loading in the water interferes with the analysis. In so doing, the company may miss occurrences of increased risk. A recommendation was made to amend practices so that it is possible to quantify the oocyst load, and hence the

challenge to the works, at times of reduced raw water quality. This should include a review of any monitoring upstream of the intake.

Lumley is a direct river works with no bankside storage and poor raw water quality increases clarifier blanket thickness and makes them more susceptible to flow changes on site. Introducing robust procedures for managing clarifiers, including cleaning, maintenance and assessing the suitability for individual clarifiers to return to service was recommended. A control philosophy and instrumentation review of this stage was also recommended to ensure that the water was adequately prepared for disinfection.

The operating philosophy has fallen behind the increased treatment challenge posed by the raw water quality which has deteriorated since construction. Northumbrian Water needed to review the whole treatment works with a view to asset life and serviceability, process suitability, control philosophy and currently available technologies. This included operability of all valves and fittings, as the company investigation highlighted filter valves allowing water to bypass parts of the process.

A water quality monitoring station situated three miles upstream of the works intake on the River Wear was brought back online after being out of service for approximately 18 months. The Inspectorate were extremely critical that this early warning system on a direct river works had been out of service for so long. The company had also failed to learn lessons raised at the audit of its Langford works in January 2018, where the raw water quality monitors had been allowed to fail without replacement. Such a situation is considered to be negligent.

There was no means of automatic shutdown on site, and single manning is in place. This poses an unacceptable risk at this site, as any lengthy absence from the control room risks supplying water that is inadequately treated or disinfected. Appropriate automatic shutdowns were recommended.

A chart was displayed for site operatives, showing the coagulant dose measured against Lumley works chemical dosing budget with the aim of keeping the coagulant dose within budget. The Inspectorate was critical that site operatives are being encouraged to prioritise treatment decisions based on cost rather than water quality. This may drive the wrong behaviours and lead to increased quality risks and a recommendation was made for the company to desist or otherwise change this practice to protect public health.

The filter operating valves at Lumley are actuated through a hydraulic piston control system, using a food grade oil. A failure of hydraulic pumps or pressure accumulator could lead to a loss of flow control. Manual intervention is cumbersome and requires the fitting of a hand pump to drive the operation of the piston should an effective repair not be possible. This could be considered a Single Point of Failure risk and requires consideration in the company's risk assessment for the works.

Disinfection is verified by a single validation chlorine residual monitor on flash mixer 4 and flash mixer 5; on the contact tank; and the final water sample points. A backup disinfection system is in operation onsite. Dual or triple validation monitoring was recommended on this key part of the process.

Lumley's site specific disinfection policy requires the site to achieve a 3 log removal for *Cryptosporidium*. Optimal performance of the coagulation, clarification and filtration processes combine to give a theoretical log removal of 2.5. Therefore, even when the processes are performing optimally, there is a foreseeable risk to wholesomeness risking breaches of regulations 4, 26 and 33. A recommendation was made that the company takes steps to implement sufficient control measures to achieve the required log removal for effective disinfection as a matter of urgency.

Examples of Good Practice

Across this series of audits Inspectors noted the following examples of good practice to share with the industry.

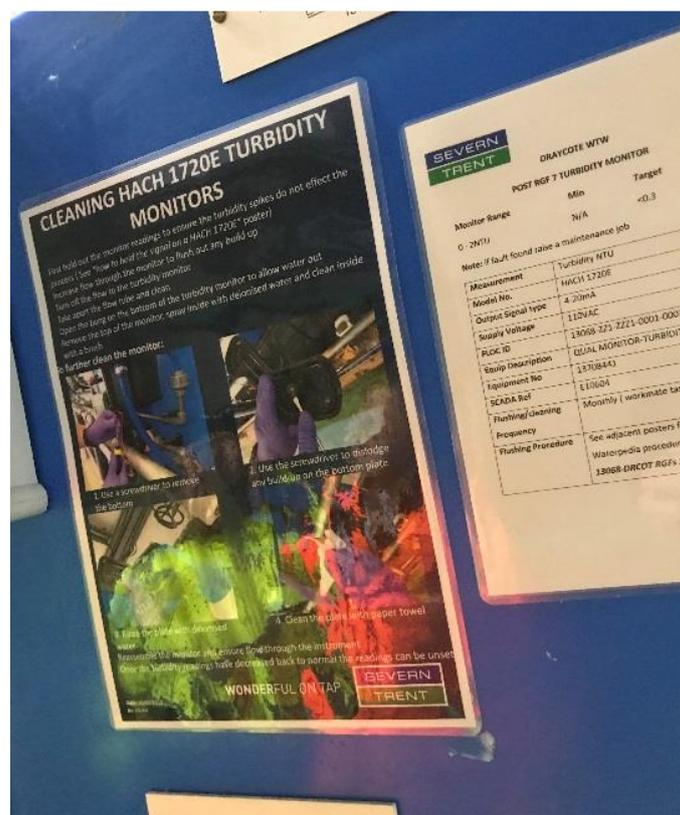
To improve the reliability of turbidity monitors on the rapid gravity filters at Draycote works, Severn Trent Water has a very clear cleaning and calibration guidance sheet mounted on the wall next to each one (Figure 1). We welcome this approach.

The Inspectorate also welcomed Dŵr Cymru Welsh Water's approach to updating its risk assessment records; providing the Inspectorate with up-to-date and relevant comments in a timely and responsive manner.

At Southern Water's Beauport works, there were good systems in place to show that chemicals received met the relevant British and European Standard and the company received test certificates for batches to show that they were compliant. Testing on site was carried out where possible to demonstrate that the correct chemical had been delivered. The company also has the specifications for its treatment chemicals, on display on the Control Room noticeboard such that they are readily available for operators to refer to as necessary.

There were a number of other findings across this series of audits, which are worthy of further comment and are broken down into different themes below.

Figure 1: Turbidity monitor cleaning guide at Draycote works



Risk Assessment

Following three compliance failures for *Clostridium perfringens* in 15 months at Eccup works, Yorkshire Water was unable to establish a definitive root cause. This was a major driver for our visit to the site. The root cause analysis found several potential deficiencies with the site's operation. Remedial actions were identified for the following processes: pre-Actiflo lime dosing; reliability and location of ozone dosing systems; GAC filter backwash; and the operation and control of final water pumping.

The Inspectorate welcomed the revised Drinking Water Safety Plan and comprehensive list of the actions. Yorkshire Water invested the capital and maintenance expenditure necessary to remediate the problems identified during 2019.

United Utilities have assessed the *Cryptosporidium* catchment risk as medium and the risk at Haslingden Grane works as low. Very little *Cryptosporidium* monitoring is carried out on the raw water (two samples per annum) as the company relies on other risk measures including potential sources of pollution and land usage. Treatment performance is continuously monitored for turbidity supplemented with clostridium and other microbiological analysis through the works. Whilst this strategy remains the company's choice, there may be risks that due diligence cannot be shown should in all circumstances.

There is a cess pit and toilet close to a Borehole at Thames Water's Dorney Taplow works. This is noted as a risk in its regulation 28 report. An alarm notifies the site controllers when the cess pit level is high. Thames Water plan to replace the cesspit and a sign has been placed on the toilet door to prevent use in the short term. The company has yet to demonstrate to the Inspectorate when this risk will be addressed.

Figure 2: Do not use sign on Thames Waters' Taplow toilet block



Dŵr Cymru Welsh Water had identified 14 risks at Preseli works where further mitigation was needed. The Inspectorate welcomed that not only had the risks been identified but the mitigation had been identified and the company were able to demonstrate appropriate timescales to implement these solutions, including dedicated run to waste schemes and a new pumping station

Catchment & Raw Water

Algae is a raw water quality risk identified at United Utilities' Haslingden Grane works. The catchment team demonstrates the 'algae management plan' that includes raw water sampling 2 to 3 times a week with triggers set for initiating mitigating treatment. The major risk is taste and odour from algal breakdown. In the short-term powdered carbon is dosed seasonally. United Utilities long term proposals include replacement of sand with

granular activated carbon in the rapid gravity filters. The Inspectorate was concerned that the change of filter media may improve taste and odour compliance at the expense of poorer filtrate quality and **recommended** the company critically review the *Cryptosporidium* risks at this works

An abandoned borehole was still physically connected to the treatment process at Thames Water's Dorney Taplow works and whilst there was no evidence of ongoing contamination, the Inspectorate recommended that the connection to the works be cut and capped and that the headworks were sealed to prevent ingress. The company however, have chosen not to disconnect the borehole as they are considering test pumping to see if the borehole can be recommissioned, but have not committed to timescales to complete this work. This lack of action and clarity is reflected in the Inspectorate's assessment of the company's ability to address risks.

Clarification and Filtration

The rapid gravity filters at Southern Water's Beauport works were leaking during backwash risking media loss. The company has put in place plans for suitable repairs to the capping stones and is increasing depth checks in the interim to ensure there is no significant media loss.

Figure 3: Leaks beneath the capping stones at Beauport works



Disinfection

The caustic dosing point was adjacent to the hypochlorite dosing point at Southern Water's Beauport works. The elevated pH at this point may compromise the effectiveness of disinfection. The company subsequently started designing an alternative caustic dosing location above the contact tank outlet weir. Southern Water also looked at improving the motive water draw off to reduce the observed fluctuations in pH. The company plan to install the new dosing point by 30 June 2020, which means that risks of compromised disinfection would remain ongoing.

A discrepancy between pH alarms and shutdown set points was found with the contact tank inlet values showing an alarm at 8.2 pH and a high shutdown value 9.3 pH. This exceeds the acceptable pH in the disinfection policy. Following a recommendation to review all set points and shutdowns. The company amended the high shutdown to 8.2, revised the site-specific disinfection policies at all works and trained Senior Scientists, Operational Managers and site operators on the new process

Figure 4: High pH on Beauport works contact tank could compromise disinfection



A new UV disinfection process was being installed at Beauport works and Southern Water could not demonstrate clearly delineated roles and responsibilities between operational staff and the company's contractors during the commissioning phase. Site staff had received basic operational training but were expected to respond to UV shutdowns and restart the plant,

but no fault finding training had been given and there was no evidence that the company had assured that operators were competent. This gives rise to water quality risk due to incompetent operation of the plant. In response to recommendations to address these points Southern Water trained its operators on the UV equipment; revised its commissioning procedure to ensure operators have the appropriate training before new assets enter supply and that the O and M manual is provided to staff. The company is also devising a containment procedure for UV lamp breakages

Beauport works has no turbidity monitoring or flow measurement on washwater returns to the head of the works in breach of guidance outlined within the Badenoch and Bouchier reports on *Cryptosporidium*. Southern Water subsequently planned to install a turbidity monitor. Meanwhile at Yorkshire Water's Eccup works Inspectors identified that the high high alarm on the supernatant return exceeded 10 NTU as per the Badenoch and Bouchier report guidance and that there was no failsafe shutdown in place at these high turbidity levels. In response, Yorkshire Water amended the alarm levels and introduced a new series of mitigating controls to address *Cryptosporidium* risks in the washwater return at Eccup works

United Utilities identified a potential single valve isolation risk of the chlorine contact tank at Haslingden Grane works. Following the audit, the company excavated the bypass pipe and found a concrete block where the bypass should be. Poor records of underground assets were an issue at their Franklaw works and learning from the *Cryptosporidium* event has not prevented another issue of poor records. All companies are reminded of the need to keep accurate records of its assets.

Other Treatment

A number of issues with treatment chemicals was identified across this audit programme. Whilst in general terms Southern Water had good procedures in place for managing treatment chemicals, the exception was use of polyelectrolyte. Records were poor with delivery checklists not completed and no means of determining from the packaging manufacture or expiry date; the company were unable to demonstrate compliance with Regulation 31 for this chemical at Beauport works. The company updated its procedures for polyelectrolyte in response.

There was concern that a single orthophosphoric acid dosing pump at Beauport works may lead to an increased lead risk to consumers should the pump fail. Following a recommendation from the Inspectorate, the company have purchased a boxed spare to reduce the risks of a protracted dosing failure. The Inspectorate would anticipate that all companies follow maintenance regimes, which incorporates good practice of holding an appropriate stock of spare equipment.

Following chemical supply resilience issues, United Utilities have reviewed its critical chemicals procurement procedure and introduced a process to ensure alternative sources of chemical supply are available. The company is also introducing supply chain resilience into its chemical supplier audits.

Dŵr Cymru Welsh Water were unable to demonstrate traceability of Carbon Dioxide and Sulphur Dioxide deliveries to Preseli works. No details of the conformance to the British Standard could be checked but the deliveries were accepted in any case. After recommendations from the Inspectorate, the company improved the chemical acceptance process and provided further training and support to front line staff.

Similarly, Thames Water were unable to provide sufficient traceability to demonstrate that the chemicals delivered to Dorney Taplow works are compliant with regulation 31, which may be considered an offence. There was a poor response to the Inspectorate's recommendation to ensure BS:EN references and other items to improve traceability are added to delivery notes. Thames Water were also unable to commit to a timescale for addressing a leak from the backwash retention pond at Dorney Taplow works. Thames Water were also unable to confirm dates for repairing a chemical tank bund on site, which has failed. The GAC stage can be bypassed, which is isolated through a single closed butterfly valve. Whilst the company are considering removal of the bypass arrangement, the company have not committed to a timescale to address this issue. Further Inspectorate action is being considered.

Figure 5: Single bypass valve for the GAC stage at Dorney Taplow works



Staff and Procedures

The audit team met a Site Operator at Thames Water's Dorney Taplow works with over 20 years of experience. Demonstration of his experience, competence and training to reflect his proficiency however is lacking. The means of training and demonstrating competence by operators has largely evolved at a local level. The Inspectorate welcome that these deficiencies across the company have been recognised and improvements, including the implementation of standard methodology, are currently in progress as part of a notice. The progress of these is being monitored monthly as part of a Transformation Programme

Yorkshire Water's Eccup No 2 works was designed with OSEC for hypochlorite generation, but the OSEC plant was condemned as unsafe in August 2015. Since this time a temporary arrangement of diluting bulk strength sodium hypochlorite (15%), to 0.8-1% for storage in the original hypochlorite tanks is used. The audit team welcome that since the audit the company has revised its document management system to include this procedure.

Nitrite Sampling Irregularities

A review of the Compliance Data reported for Dŵr Cymru Welsh Water's Preseli works identified a significant shortfall in nitrite analysis. The shortfalls had been apparent for a number of years and prompted a wider investigation showing that only 26 of 65 treatment works had supplied any nitrite results for 2019, at the time of the investigation.

The company belatedly spread nitrite samples across the remainder of the year to meet regulatory requirements. This inevitably led to issues of regularity and a recommendation to correct this going forward.

A recommendation was also made for the company to review the steps it has in place to ensure that every parameter is sampled at the appropriate frequency for each sampling location. The company reported among other activities that it has a project plan and project team in place to ensure the correct frequencies and that this is signed off by relevant managers. It is the company's view that this error was the result of a long-standing misinterpretation of the requirements of the Regulations. It was only the Inspectorate's flagging of the issue that prompted resolution.

All companies are reminded of their responsibility to ensure that the regulatory sampling programmes are accurate in compliant with the requirements of the regulations. Companies should not be reliant on the Inspectorate's shortfall reporting to provide a checking and verification service for the sampling programme.



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