Drinking water 2017

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A report by the Chief Inspector of Drinking Water

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Public water supplies for England and Wales

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Contents

Foreword

Drinking Water 2017 is the annual publication of the Chief Inspector of Drinking Water for England and Wales. It is published as a series of quarterly reports which cover public water supplies in England and Wales.

The report sets out to develop a source to tap approach in the supply of water, developing learning points from recent data, events and company strategies. It builds upon the strategic objective of DWI for wholesome and safe, clean drinking water to all consumers at all times.

This report focusses on Regulation 15 risk management of new sources or re-introduced sources. The historical challenges of catchment may, in the past, have resulted in a decision not to use the resource but future challenges and environmental pressures drive the need to review these decisions. In changing times, innovation and need may enable a resource previously not considered viable for technical or economic reasons to be reconsidered. However, whilst it is acceptable and indeed appropriate for companies to review these decisions, it is equally necessary for an appropriate risk assessment to be made, informed by evidence and mitigated for risk. This approach ensures water quality remains a priority for companies and underpins the duty to supply wholesome water without deterioration. In addition, these sources must be acceptable to consumers, have no deleterious effect on the network and be compliant with standards when transported across other networks. Companies are challenged to plan ahead for future resources and the need to risk assess when planning for compliance.

The second part of this report focusses on the risks of chemical deliveries. Highlighted in *Drinking Water 2016*, there is clear historical and current evidence that risk remains. Companies should identify the historical lessons, audit outcomes and the examples in this edition to ensure events which should never happen are mitigated.

Finally, this report considers the actions of companies in respect of coliform failures at works and service reservoirs. The absence of coliforms remains an effective determination of efficacy and integrity at treatment works and storage assets in the distribution chain. Companies should build upon resilient strategies to obviate the risk of microbial contamination by utilising the information that failures provide.

Drinking water sources and catchment management

Returning sources to supply

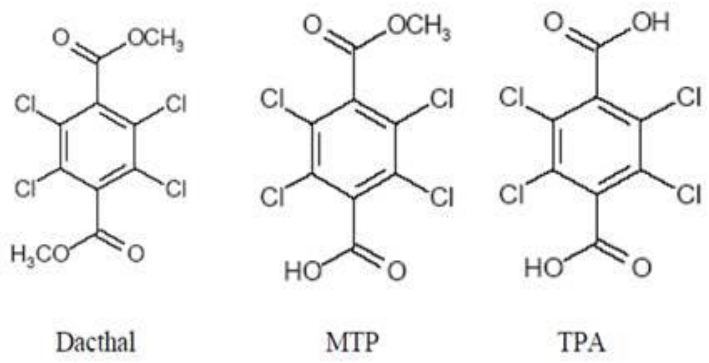
Regulation 15 of The Water Supply (Water Quality) Regulations 2016 make provision for companies to return water sources to service after six or more months out of supply, or commence using new, previously unused sources. The duty is for companies to sample new sources before they enter supply, and for sources previously used, soon after return to supply, to provide assurance the water in supply is wholesome and there is no deterioration of the source or combination of sources.

A water company must apply a source-to-tap risk assessment including catchment activities, treatment and distribution which would include any effects the source or sources may have when blended into a supply. To demonstrate compliance, companies must supply evidence of sample results from the given source showing details of all parameters required by the regulations for all new sources; and any other element, organism or substance which may cause the source to not be wholesome. For sources coming back into supply after six months or more, the requirement is reduced in not requiring consideration of indicator parameters but nevertheless requires inclusion of any other parameters which may have changed since the last time the source was analysed. The Inspectorate expects companies to take a robust and diligent approach to investigating that treatment remains appropriate and satisfy themselves that it is suitable for long-term supply and that any introduction of a source considers the acceptability to consumers as well any resulting unintentional outcomes. These would include taste and odour and undesirable dissolution of metals in distribution. There are provisions to allow water companies to apply for emergency use of sources to enable continuity of piped supply to consumers but these provisions still require a risk assessment to be carried out irrespective to ensure water meets the duties specified in the Act.

Water resources and scarcity are key for water companies when considering supply availability and demand, particularly in respect of future water planning. The pressure to use or re-open historical sources may introduce hazards previously considered unacceptable where treatment technology was not available or the company could not use the source efficiently both for quality and/or economic reasons. Equally, hazards may emerge from current sources if flows reduce resulting in an increasing concentration of parameters of anthropogenic or geogenic origin. In both cases, companies must consider the introduction or

changing risk profile of existing and new sources to ensure water quality is always maintained and, if necessary, consider the use of innovative methodology to reduce any supply deficit without compromising water quality.

In just such an instance, an application was made to the Inspectorate under Regulation 15 in 2016 as continuing water scarcity meant increasing demand was unlikely to be met if rainfall remained low throughout the summer and/or the prevailing weather remained or became hot. This application was made for a source where the company had previously carried out a full catchment survey and were aware of a legacy issues with pesticides in the water sources. There was no indication of a current source of continuing pollution since the pesticide identified in the survey was taken off the market in 2009. However, the source contained an environmentally persistent breakdown product TPA (Tetrachloro Terephthalic acid)[1,2] from the pesticide DCPA (Chlorthal Dimethyl).TPA is more water soluble then DCPA and infiltrates nearby water sources readily and should be considered an anthropogenic pollutant of interest when assessing water sources.



DCPA (Dacthal, Chlorthal, Chlorthal-dimethy, dimethyl tetrachloroterephthalate - C10H6Cl4O4)

MTP (Chlorthal-methyl, Monomethyl Tetrachloro Terephthalic acid - C9H4Cl4O4)

TPA (Chlorthal, Tetrachloroterephthalic acid - C8H2Cl4O4)

Figure 1: Dacthal and breakdown products [1,2]

The company had previously undertaken a pilot study of treatment and removal of TPA. Granular activated carbon, (GAC), was found to be able to treat the breakdown product to levels needed to meet the pesticide standards but was shown to become quickly exhausted and required regeneration to stay effective after a few months. The expense of regular regeneration of GAC would not have been efficient for economic reasons. However, the company only required the source as a short term resilience measure and permission was given as there was shown to be adequate mitigation in place and good characterisation of the source in question.

Since this time, there has been wider consideration of sources as part of water resource planning and the company has since submitted several new regulation 15 risk assessments where TPA (the breakdown product of

chlorthal dimethyl) is present. The company has been able to show that alternative sources with less problematic characteristics cannot provide enough resilience for sufficiency. The company have been working to show the effectiveness of ion exchange as a sustainable and innovative treatment option to overcome the hazard previously presented by the source which had been considered usable.

The Inspectorate has reviewed the industry reporting of this pesticide and has identified that clarification is necessary over the naming convention for the parent compound and the breakdown products and associated analysis. Where only DCPA is being tested for and not TPA, (which would include MTA in the methodology), there may be an underestimation of the total pesticide concentration and risk within catchment.

The Inspectorate will be altering its database systems to allow companies to report all variants should they be identified and companies are encouraged to work with their analytical providers to establish what compound is being reported and to verify that this is accurate and appropriate for the risk, if identified via the regulation 27 and 28 reporting process.

Water companies are encouraged to engage with the Inspectorate as many have not submitted regulation 15 reports on a regular basis but sought additional guidance or enquired about the expected content of submissions. The Inspectorate has developed a revised annex template which includes further examples of material to be included and give advice on the type of information companies should ensure they have available.

1.US Environmental Protection Agency, 2008, *Health Effects Support Document for Dacthal Degradates: Tetrachloroterephthalic Acid (TPA) and Monomethyl Tetrachloroterephthalic Acid (MTP),* EPA Document Number EPA-822-R-08-005

2. US Environmental Protection Agency, April 2008, Drinking Water Health Advisory for Dacthal and Dacthal Degradates: Tetrachloroterephthalic acid (TPA) and Monomethyl Tetrachloroterephthalic acid (MTP), Document Number: 822-R-08-011

Water quality at treatment works

During the first quarter of 2017, the Inspectorate has continued assessing the compliance data supplied by companies.

Review of compliance – microbiological failures at treatment works

Table 2: Q1: 2017 – Microbiological tests

The number of tests performed and the number of tests not meeting the standard

Parameter	Total Number of tests	Number of tests not meeting the standard
Water leaving water treatment works		
E.coli	39,278	0
Coliform bacteria	39,277	8

During Q1 2017, there were no *E.coli* detections and eight detections of coliforms at treatment works in England and Wales (ANH 2, DWR 1, SEW 1, SRN 1 , SWT 1, TMS 2). The absence of coliforms remains an effective determination of efficacy and integrity at treatment works and any storage asset in the distribution chain. Where there is a detection, a thorough investigation to determine the cause is warranted. In all cases the companies responded appropriately with investigations and in four out of the eight failures identified ingress or integrity risks at points which may allow entry of coliforms. Whilst sometimes it is difficult to determine if these points are the specific root cause, identifying risks and acting upon them drives down the overall risk of future failures. Companies should continue to focus effort on this strategy.

Over the years there have been a number of significant events where unwholesome water has been supplied or health and safety risks have materialised because of contaminated treatment chemicals and chemicals being transferred to the wrong receptacle. The most notable incident occurred in 1988 at Lowermoor water treatment works where aluminium sulphate was inadvertently added to the water supply. More recently in 2006, diesel entered supply at Marypole service reservoir in a sodium hypochlorite drum and in 2010, at Ainderby water treatment works, bulk sodium hypochlorite tanks were found to have residual contamination of a petroleum based product from the filling cycle at the chemical production

site. In 2007, an example of a health and safety risk to workers followed the delivery of sodium hypochlorite. This was delivered to Bovey Cross works into the aluminium sulphate tank resulting in the emission of a dangerous gas cloud to the surrounding environment.

In response, the Inspectorate has issued guidance to water suppliers through Information Letters 12/2003 and 05/2011. These Information Letters were issued to remind companies about the importance of ensuring that the correct chemicals of the correct specification are received. Water companies should have in place dedicated delivery facilities for specific chemicals to ensure that chemicals are not transferred into the wrong receptacle. They should also have arrangements in place with suppliers to ensure that chemicals conform to the appropriate BS:EN standard or are otherwise approved for use in contact with drinking water, and that these arrangements include periodic audits of suppliers to confirm that appropriate procedures are in place.

In *Drinking Water 2016 Q4* the outcome of the chemical audits carried out by the Inspectorate in 2016 were reported. These audits followed concerns at two sites in England and Wales where problems relating to treatment chemicals were identified. In July 2016, the first was the overdosing of fluoride to water supplies from Anglian Water's Barrow works and the second incident related to an increase in the concentration of manganese in supplies from Dŵr Cymru Welsh Water's Alwen works. The audits identified areas for improvement in pre-delivery checks, delivery procedures, checks of delivery points and supervision.

In the first quarter of 2017, there were two further notable events reported to the Inspectorate involving chemicals used for drinking water treatment.

In February 2017, SES Water accepted a delivery of ferric sulphate at Elmer water treatment works near Leatherhead in Surrey, from its contracted supplier. The delivery comprised two 1,000 litre batches of the chemical contained in bulk containers, the contents of each to be delivered into the ferric sulphate storage tank at Elmer works. The delivery vehicle was a curtain-sided lorry carrying multiple containers of different treatment chemicals, including two bulk containers of ferric sulphate and one bulk container of sodium hypochlorite solution. The delivery was accepted by the duty operator on site who checked and signed the paperwork, unlocked the delivery point and left the delivery driver to complete the transfer of chemical. On completion of the transfer of chemical from two containers on board the lorry, the driver realised that he had incorrectly discharged 1,000 litres of sodium hypochlorite along with 1,000 litres of ferric sulphate into the receiving ferric sulphate storage tank. As a consequence of sodium hypochlorite mixing with ferric sulphate in the storage tank, chlorine gas was released and the works had to be evacuated. The works

was promptly shut down and the Fire Service was called. Fortunately there were no injuries to any personnel on site and the Fire Service was able to quench the chlorine gas without the need to evacuate local residents.

The delivery lorry was carrying multiple containers of different treatment chemicals, including identical adjacent containers, of which two contained ferric sulphate and one contained sodium hypochlorite. To illustrate this, SES Water provided the following photographs:

Figure 3: Sodium hypochlorite bulk tank (left) and ferric sulphate bulk tank (right) with labelling before the event

The photographs show that the bulk tanks for the different chemicals are of identical colour and design. Furthermore, the labels showing the contents are positioned at the top of the tanks, well above eye level when mounted on the lorry.

The company has since strengthened its procedures, including ensuring that deliveries with mixed loads of chemicals are not accepted. The chemical supplier has made changes to the labelling of bulk tanks to ensure that labels are clearly visible at eye level when mounted on a lorry. SES Water is also investigating the potential use of unique hose couplings for specific chemical deliveries, and the company has shared lessons learned from this event with the rest of the industry.

In March 2017, Anglian Water notified the Inspectorate of a near-miss event involving the delivery of regenerated granular activated carbon (GAC) from its contract supplier, at Beck Row works in February. During the transfer half a pigeon was found in the delivery tanker. The GAC contactor was isolated and the company instigated an investigation into possible contamination of GAC at other treatment works. Feathers, animal gut and ash seeds were detected in a GAC contactor at Ardleigh works,

which, fortunately, had not been returned to service following GAC regeneration, and was isolated from supply.

The company investigated possible root causes of the contamination in conjunction with the supplier. The supplier's report concluded that storage of reusable bags prior to filling with GAC and tanker loading were the most likely points for contamination. The supplier took steps to reduce the risk of contamination by installing mesh over loading ports in GAC tankers, but this would not prevent reusable bags from being contaminated. Anglian Water therefore agreed with the supplier that reusable bags should not be used. Anglian Water carried out a site audit of the carbon regeneration facility, which the Inspectorate also attended. Further issues were identified, including lack of proper labelling of containers of virgin carbon to confirm compliance with the BS:EN standard (which is a requirement of Regulation 31), and a number of actions were proposed, which Anglian Water is progressing with the supplier.

Companies must focus on the risk of contaminated chemicals and delivery errors as the past incidents should never have happened. The Inspectorate is pleased to see that in these last two incidents there were no impacts on the wholesomeness of the water supply. SES Water acted quickly to deal with the matter and brought it under control, however, the incident clearly posed a significant health and safety risk. In the incident at Anglian Water the company were vigilant when they discovered the bird and expeditiously dealt with the supply and put additional measures in to prevent a recurrence. Whilst this outcome has ensured consumers were not affected, the potential for a significant event remains and companies would do well to note the risks shown by the events discussed in this report and the outcome of audits and take further action to mitigate those risks to reduce the likelihood of any recurrence in the future.

Water quality at service reservoirs and in distribution

Assessment of compliance

In Q1 2017, there was one detection of *E.coli* at a service reservoir (YKS) and 11 coliform detections (ANH 1, ESK 1, NNE 1, SEW 3, SRN 1, SVT 3, YKS 1). On detecting *E.coli* in a routine sample from Skelmanthorpe service reservoir, Yorkshire Water removed the reservoir from supply for inspection and cleaning though no obvious cause of the failure was detected and the reservoir was subsequently returned to supply. A change to access hatches was made to facilitate access to the reservoir.

Table 4 : Q1 – Microbiological tests

Parameter	Total Number of tests	Number of tests not meeting the standard
Water leaving service reservoirs		
E.coli	51,643	1
Coliform bacteria	51,891	11

In all cases where there have been failures of the coliform and *E. coli* standards, the reservoirs were removed from service and inspected internally. In the case of the *E. coli* and coliform failure at Skelmanthorpe service reservoir, both chambers of this reservoir were internally inspected in 2015, a new roof membrane was fitted and the reservoir cleaned of sediment. It remains appropriate for companies to have a flexible network to enable the short notice removal of reservoirs from supply on detecting a failure, and the ability to internally inspect, both of which protect public health, confidence in the supply and facilitate the maintenance of the system whilst mitigating future risk. It is worth noting therefore, the expeditious actions of Yorkshire Water in removing the reservoir from supply on the day the failure was identified and this action should be commended. Such quick action was not necessarily forthcoming by the other companies when detecting coliforms as inspections in some cases were months after the failure. As previously mentioned, the absence of coliforms remains an effective determination of the integrity at any storage asset in the distribution chain. When a coliform is detected, whilst it is considered a lower risk then *E. coli,* it remains an unknown residual risk until an assessment of the asset can be made. Companies are under a duty to supply wholesome water at all times and risk mitigation should be expedited through the deployment of resource where remediation is required, it is counterintuitive to wait for this action as the realisation of

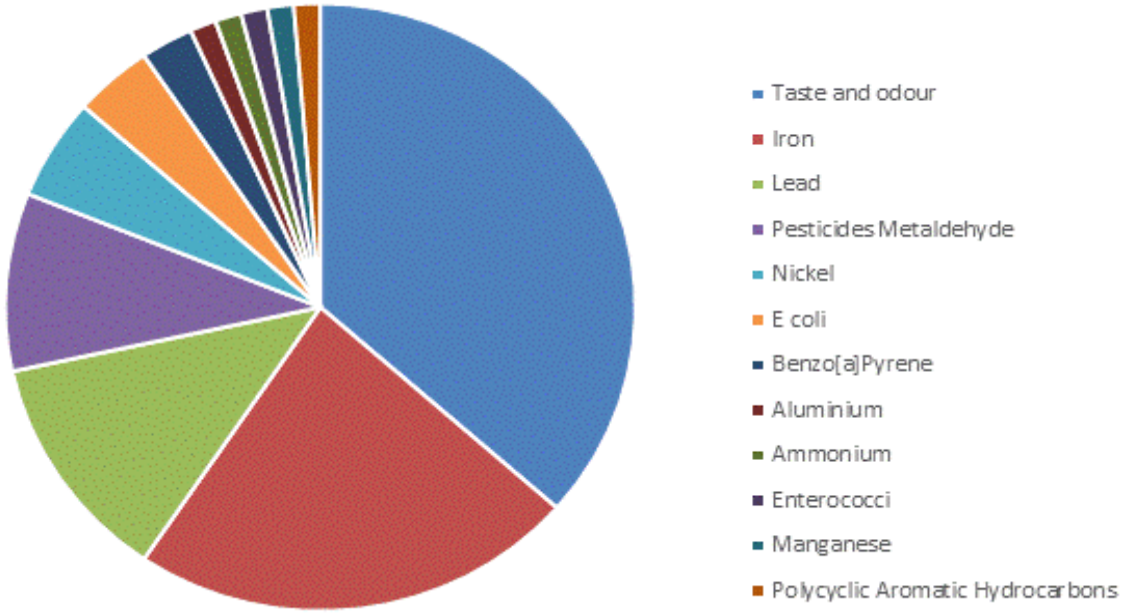
integrity failure could be costly. Proactive asset planning such as ensuring the ability to remove a reservoir from service on detection of a failure removes the risk immediately allowing assessment and remediation to take place. This ensures any integrity failure does not result in a costly public health incident. The historical evolution of networks or simply the remoteness of a reservoir can reduce a resilient network by preventing the easy removal of an asset. Companies should plan strategically for the future to improve the flexibility of their networks and drive down this risk.

Water quality at consumers' taps

Most samples taken to assess regulatory compliance are taken from consumers' taps, and testing takes place for 51 parameters that have numerical standards. Sampling frequencies are determined by the size of the population in the water supply zone. The vast majority of samples taken complied fully with regulatory requirements. From the samples taken to demonstrate compliance with a Directive or national standards, there were a total of 74 failures for 13 parameters in Q1 2017. For microbiological parameters, three samples contained *E.coli* and one contained Enterococci. With regard to chemical parameters, the most prevalent detections were for taste and odour (27) , iron, lead and metaldehyde, which together accounted for 60 failures (81% of the total).

Looking at the 74 failures in more detail, Figure 5 shows the proportion of failures for the 13 parameters.

Figure 5: Directive and national parameters failing in Q1 2017 – percentage of the 74 failures recorded at taps



A review of the circumstances of the failures for taste and odour, iron, lead and metaldehyde showed the following :

- Taste and odour – Of the 27 failures, there were nine where the predominant descriptor was fruity/fragrant and where an investigation by the company failed to identify a cause. Five failures with a woody/pencil descriptor were identified as being caused by black alkathene pipework. Other causes of ten further failures were

the attachment of hoses to taps (4), tanks or pipework within the property (3) and water softeners (3). A taste and odour described as 'cod liver oil' arose in a sample where the sampler had taken the sample from a bathroom tap and although no cause was found for the failure, the sampler has since been retrained to take samples from the kitchen tap. In all cases the failures were most likely due to the domestic distribution system and account for over a third of all failures in this quarter. The use of inappropriate or unapproved materials, inappropriate connections, such as hoses to taps, and "add-on" devices such as softeners often lead to water quality failures. The Water Supply (Water Fittings) Regulations 1999 make provision to prevent contamination of drinking water supplies requiring every water fitting to be of the appropriate quality and standard and be suitable for the circumstances in which it is used. These standards include testing if they affect the taste and odour of drinking water. Water companies, as the water fittings regulators, have a duty to ensure consumer protection law is upheld through collective strategy ensuring products which are not of an appropriate standard are not available to the market or fitted. The Inspectorate encourages companies to work with key stakeholders in this area such as the Water Regulations Advisory Scheme (WRAS) to help co-ordinate these activities.

- Iron. Of the 17 failures, eight occurred in zones covered by legal instruments where the company is carrying out work to rectify the problem or investigate in order to specify an appropriate solution. Of the remaining failures, five were attributed to short-term localised disturbance in zones where there are currently no improvements planned, two were in areas where the company has recognised the need for work to be initiated and the company are seeking funding or have already identified a main for replacement and one was linked to high iron levels at the supplying works. In addition, one public building with a long cast iron service pipe was identified and the Inspectorate made a recommendation that the company ensures that remedial action is completed using its powers under the Water Industry Act to prevent contamination before use.
- Lead. Of the nine lead failures, four were in zones covered by the companies' lead strategies. Two further failures at properties resulted in the company replacing the communications pipe. The first occurred in March where a failure of 13µg/l in Wylam High Service Zone resulted in Northumbrian Water replacing the lead communications pipe. The supply pipe was also replaced by the housing association responsible for the property management. Resamples show that the lead concentrations post pipe replacement

are now low, <1µg/l, demonstrating the result of pipe replacement by both parties working together. This commendable action effectively removed the lead risk at this property, from which, the residents have benefited. In the second example of a company replacing the communications pipe, this occurred in January in Portsmouth South Supply Zone. The initial sample failed with 11.5µg/l of lead detected and after the replacement of the communications pipe, which is the pipe on the company side of the boundary only and not the service pipe from the property curtilage, a resample result of the first draw of water from the consumers tap was measured as 4.3µg/l. Whilst this has reduced lead, clearly lead remains in the drinking water to the consumers and this represents a health risk. Actions by companies in isolation of the whole risk does not remove the residual and real risk to the consumer.

Two samples failed at properties that were described as being vacant at the time of sampling and one residential home (public building). The failure in the residential home occurred in January in Leytonstone Zone, (TMS). The communication pipe owned by the company was found not to be lead and therefore the contamination arose solely from the pipes within the home. The company were working to progress replacement of internal lead pipework but in the interim the company provided advice to flush with notices displayed by the taps. The advice to flush cannot be viewed as an unlimited solution to protect public health. The Water Fittings Regulations 1999 make provision for preventing contamination of water supplied by a water undertaker. Whilst they do not apply to water fittings lawfully installed before 1 July 1999, the duty to protect consumers where there is a danger to human health in water which is supplied to the public requires the water company to exercise its powers by a Notice to the owners of the building. The Inspectorate will be seeking clarification as to whether the company has progressed and resolved the issue.

- Metaldehyde. Seven failures occurred, five in zones supplied by Anglian Water and one each in zones supplied by Affinity Water and Severn Trent Water. All the zones supply water from surface abstraction and are covered by legal instruments requiring companies to carry out a range of catchment management activities to reduce metaldehyde input at source.

From the 60 failures of the four most common parameters failing the standards in this section, only 16 were due to company assets. 43 failures could be classified as national legacy issues covering fittings, lead and pesticides which require collective and/or long term strategies to drive the risk down. In the last two years companies have, through Water UK, WRAS

and individually, worked to raise metaldehyde on the agenda, discussed lead at a national workshop and started to collect data on fittings regulation activity. I strongly encourage companies to build upon these initiatives to deliver tangible outcomes benefiting the companies and consumers alike.

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