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The Authorising Engineer (water) Questions which shape our future needs

# Microbiological testing of water

# Water Recycling and Reuse in the Food and Beverage Manufacturing Sector

Closed systems water treatment: BG50 & VDI 2035

 An Overview of Some Water Treatment Processes, Phosphonates, and Polymers for the Oil & Gas Industry, in an Era of Water Recovery and Recycling

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waterline Editor: Geoff Walker

Guest Editor: David Harper











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# PipeLine Jan E Kershaw, Chairman WMSoc

The office has been a hive of activity over the past few months delivering a number of events to you the membership, full details of which you will find between the covers of this magazine.

In brief, April saw the renaming of our training centre in honour of Sue Pipe, and her husband and family enjoyed the ceremony along with some of our council members and friends of Sue. A webinar from Richard Bentham was also delivered this month and a recording of that can be found online.

May saw some of our members hitting the greens at the Belfry Golf Course, enjoying the country air and an evening meal. We recognise that we have a diverse membership and we would be interested to hear what other networking events you would like to see us organise in the future. Answers on a postcard please!

And by now we will have delivered our first face to face event of the year "Which direction now?" at Drayton Manor on the 21<sup>st</sup> June. Full details of that event will be published in our autumn edition.

I am sure like us you are all looking forward to a bit of sunshine and downtime over the summer months and hopefully that will give you a moment to enjoy the articles put together in this edition. Don't forget also to apply to join our council as membership applications are now open.

:

Enjoy the summer! Kershaw

# **SUE PIPE TRAINING CENTRE OPENING**

In front of both family and WMSoc friends, Sue's husband Max regaled the assembled crowd including John Lindeman, David Harper and John Alvey with stories of Sue. Talking of their life together raising a family and her many achievements both voluntary and professional, Max brought tears and laughter to the group.

Elise Maynard, Chair of the Water Management Society's Training Committee, echoed the feelings of all at WMSoc remembering what a force Sue was and how her memory lives on within the society today as we often ask ourselves in Council and sub-committee meetings 'what would Sue do?'. A legacy of a society founded as the Cooling Water Association by a group of enthusiasts including her father Philip Millington and driven by Sue for a number of years for the benefit of the industry, the continued membership and training raising the industry bar for generations to come.

Max, Elise and Mike Hunter then moved to cut the ribbon opening the new 'Sue Pipe Training Centre'. Our thanks in memory of Sue to all her family for making the event a memorable one.

![](_page_4_Picture_15.jpeg)

Dr Michael Weinbren

![](_page_5_Picture_1.jpeg)

# Microbiological Testing of water

Taking water samples for microbiological analysis forms part of the process for assuring water safety and requires direction by the water safety group. The role of the water safety group is critical, and their input is required throughout the life cycle of the building, from inception, through design construction and commissioning till eventual decommissioning. Reactive testing is also important in investigating potential incidents/outbreaks.

Whilst testing methodology has been developed for Legionella, Pseudomonas aeruginosa, and nontuberculous mycobacteria it is lacking for other organisms (see Table 1 at the end of the article) that are increasingly recognised as being transmitted by water systems (despite Stenotrophomonas maltophilia being recognised as a waterborne organism for a long time no methodology was developed). The advent of MALDIToF has improved the identification of such organisms within the clinical laboratory, which due to deficiencies in previous identification testing methodology may have been reported as 'a non-fermenting environmental organism of dubious clinical significance'. Thus, being able to obtain a definitive identification is likely to have been an influencing factor in recognition of waterborne transmission events. Access to MALDIToF in water testing laboratories is less advanced compared to clinical laboratories. This will have implications when testing for organisms which challenge some organism identification systems - for example Inkster has shown that Cupriavidus can be misidentified.1

As with any laboratory test it is part of a pathway which may be divided into 3 phases, pre-analytical, analytical and post-analytical. All three elements must be performed correctly to ensure the safety of the water system. A common and dangerous misconception is to focus solely on the analytical phase of the specimen pathway, a situation which is not restricted to water testing but equally applies to patient specimens. Unfortunately, UKAS, the accreditation service, allow laboratories to be accredited for the analytical phase alone as opposed to the pathway, which is different in other countries. For example, in Germany, the sampling process, its documentation as well as sample transport to the laboratory are all part of the laboratory's accreditation. Failure in one of these parts can jeopardise the accreditation

![](_page_5_Picture_7.jpeg)

and result in non-compliant sampling, which health authorities might not accept and repeat tests may be requested. Failure to ensure that the focus is on the entirety of the pathway permits major errors to permeate the process ultimately placing occupants of the building at risk from waterborne infections.

This is not a comprehensive review of water testing but tries to highlight some of the common pitfalls and challenges. Auditing the pathway is an important but often forgotten important step, and should be on the agenda/remit of the water safety group.

Biofilm - incoming mains water is not sterile, containing several Genera in small numbers including organisms which are natural inhabitants of water in nature. These organisms can be relatively resistant to chlorine (can pass through water treatment plants), survive in low nutrient conditions and produce biofilm. The key to water safety is ensuring conditions do not allow these organisms to attach to surfaces in the water system, form biofilm and proliferate to reach number capable of causing human

disease. Most of the organisms within a water system are embedded within the biofilm. However small numbers of organisms are released, planktonic forms, and areas of biofilm will be shed as part of the natural process of seeding other areas of a water system. The organisms free in the water are thought to represent approximately 1% of the bioburden in the system. The location and extent of the biofilm have a significant impact on how water samples are collected.

## Pre-flush or post-flush specimens or both?

Contamination of water systems may be broadly divided into systemic contamination or contamination of the periphery, which is arbitrarily described as the last 2 m of the pipework.

When there is systemic contamination, all outlets supplied by the water system should give positive results irrespective of whether a pre-flush or post-flush sample is collected.

With contamination at the periphery of the system, the contamination may be restricted to a single outlet. Here, the type

# TIMED WATER SAMPLES FROM A CONTAMINATED OUTLET

![](_page_5_Picture_17.jpeg)

6

![](_page_6_Figure_2.jpeg)

![](_page_6_Picture_3.jpeg)

of sample pre-or post-flush is critical. In the figure below water samples are being collected from an outlet immediately as opens and then at 1 and 2 minutes. The rate of flow of water from the outlet was restricted to minimise splashing whilst collecting the samples. As can be seen there is a rapid drop-off in the counts of Pseudomonas aeruginosa with time. If the outlet had been opened fully as in hand washing it is likely that not only the twominute sample would have been negative but also the one minute sample. The implications for water testing are extremely important. If an outlet has been used prior to collection of the specimen then a false negative results may be obtained. This is not just theoretical – we have witnessed this on several occasions. When testing one unit staff were asked to collect water samples at 5:30 AM in the morning and had asked not to use the outlets in the vicinity. As an audit we repeated the sampling within a week and found 20% of the previously tested negative outlets to be positive. The likely explanation is that the outlets had been used prior to sampling.

The recommendations are both for *Pseudomonas* and *Legionella* to collect a pre-flush sample. However, in order to do this requires planning and discussion with the unit where the samples are to be collected. It is not possible to walk onto an augmented care area and expect to collect pre-flush samples without any prior discussion with ward staff. Equally it is unrealistic to expect to test all outlets on the same day as staff will require access to some hand wash stations. To facilitate collection of true pre-flush samples placement of a plastic bag over Placement of bag over outlet the night before water sampling to ensure a true pre-flush sample is collected

Enquire as you go round:

'Are you contacted before the sampling is performed'

'Are all outlets sampled on same day'

the hand wash station to prevent use can be useful.

# Training in collection of water samples

It is not uncommon for certain tasks to be incorrectly seen as menial not requiring any training. Unfortunately, this attitude often exists with water sampling, so much so that when one sees a water sample result enquiry needs to be made as to how the sample was collected to establish its credibility. Failure to collect the sample correctly can invalidate the rest of the process, but as this often goes unrecognised, those in receipt of the laboratory report may end up reacting to an invalid result.

Ideally the pre-analytical phase should be UKAS accredited. Irrespective of UKAS accreditation the sampling process should be subject to local audit. A simple enquiry

![](_page_6_Picture_14.jpeg)

such as did you contact the ward prior to sampling readily establishes whether true pre-flush samples are likely to have been obtained.

Sample containers should be sterile and contain the necessary chemicals to neutralise any biocides present in the system.

Recording the date and time of collection, the asset number of outlet, type of sample (pre-or post-flush) set on request form and sample as a minimum are essential.

## Transportation

Much of the sampling in the past was geared to *Legionella* testing where the requirements for rapid transportation and storage are less demanding. With *Pseudomonas aeruginosa*, HTM 04-01 states that 'the collected water should be processed within two hours. If that is not possible, then it should be refrigerated within two hours, kept at 2–8°C and processed within 24 hours'.

When collecting a large number of samples on-site the 2 hour period may be exceeded requiring samples to be placed in a cool box at time of collection.

# **Analytical phase**

For organisms where there is no validated methodology there should be a discussion between the medical microbiologist and the water testing laboratory. The advent of MALDITOF has not only improved the identification of organisms but permits testing large numbers of colonies speedily and at little or no extra cost. In the *Cupriavidus* outbreak, water samples were plated as total viable count specimens and suspect colonies picked for analysis by MALDITOF. When looking for an unusual organism, where conventional methods of organism identification may

![](_page_6_Picture_23.jpeg)

Image on the left shows a confluent growth of *Pseudomonas aeruginosa*. The water system was also suspected of containing *Stenotrophomonas maltophilia* but with such a heavy growth of pseudomonas, it's detection would be obscured by the more rapidly growing pseudomonas. On the right-hand side an imipenem disc (meropenem is not suitable) has been placed on the filter after filtration of the water sample. The pseudomonas is sensitive to imipenem as shown by its growth only as an outer ring. Within the ring colonies of *Stenotrophomonas maltophilia* may be seen as it is inherently resistant to the antibiotic.

![](_page_7_Picture_0.jpeg)

not provide a result or an inaccurate result, using a laboratory with MALDIToF may be necessary. When investigating a potential outbreak with an antibiotic resistant organism, knowing the antibiotic sensitivity pattern can aid in selecting for the organism. This requires communication between the incident team (preferably the microbiologist) and the water testing laboratory.

The time to obtaining a result from setting up a culture will vary with organism. Results for *Pseudomonas aeruginosa* should be available within 48 hours. With *Legionella* plates will be cultured for up to 10 days. However suspect *Legionella* colonies may appear on the plates a lot earlier especially where there is a heavy bacterial load. It is useful to have an arrangement with the laboratory to inform the user of suspicious growth. Depending on availability equipment in the laboratory definitive confirmation can vary from hours to 48 hours.

There needs to be an arrangement with the laboratory to ensure that all significant isolates are kept should they be required at a later stage for typing (see British Standard 8580-2:2022). Transmission events may not be apparent at the time of testing which becomes very frustrating when an outbreak investigation is convened at a later stage.

#### **Communication of results**

Timely and effective communication of results is equally important in ensuring water safety. Again there should be an arrangement with the laboratory to ensure positive results are communicated without delay and to the correct individuals. Situations such as the results being emailed to a single individuals inbox should be avoided as these may be missed if the individual is away.

### **Response to results**

Ideally there should be a standard operating procedure delineating how to proceed in response to positive results with different organisms. This will include putting in place any immediate measures to protect patients/staff/visitors, for example installation of point of use filters. At the same time further information should be collected – for example if this is a routine sample and Legionella is positive, checking water temperatures or biocide levels (whatever the control method is) in the vicinity and water turnover may provide additional information to manage the issue. An incident meeting should be held, this need not be long depending on the situation, with minutes taken and kept as a record.

# Analysing/presenting results

Before accepting any result, it is good practice to check the date and time the sample was collected, the date and time the sample was received at the laboratory and the date of issue of report. Additionally check to see if this is a pre or post-flush sample and what procedures are in place to ensure specimens are collected correctly. This is equally applicable to negative as well as positive results – a false negative water result is fraught with risk of transmission of waterborne organisms.

When a positive result is obtained a series of questions need to be asked including where the biofilm is likely to be within the water system. Is it localised to the outlet (repeat sampling using pre-and post-flush samples should show a high pre-flush and substantially lower negative post-flush in association with other outlets on the same pipe run being negative). Guidance is provided in HTM 04 – 01 on how to manage positive samples, depending upon concentration of organism and patient risk.<sup>2</sup> With regards to Pseudomonas aeruginosa part B: operational management page 69 states: if between 1 and 10 CFU /100ML is isolated, a repeat sample should be taken and if negative there is no need to proceed further. From a scientific perspective this is illogical – when there are conflicting results between two tests why accept the negative test? The most likely explanation for differences between the two results relates to collection of the pre-flush sample, as taking a sample too soon after it has last been used has a major influence on isolation of the organism. Personally, I would accept any count of *Pseudomonas* aeruginosa as being significant and therefore requiring action.

Ideally sample results should be plotted on a schematic which also shows historical results for the same outlets. Where this is not possible, a spreadsheet showing the history for the outlets in the area as well as up-to-date schematics are required.

#### Typing and interpretation of results

Where an incident/outbreak is suspected isolates should be sent for typing. Ideally this will include environmental as well as patient isolates. Compared to patient to patient spread where traditionally a single clone of organism is involved environmental outbreaks can be more complex (polymicrobial and polyclonal). For these reasons establishing a link between patient acquisition from the environment is more difficult resulting in the true burden of disease being underestimated. This is discussed in more detail in a paper titled 'The hospital-built environment: biofilm, biodiversity and bias'.3

### When to undertake water testing

Water testing is important. Its value is frequently misinterpreted. Performed incorrectly it may be a waste of resources and place individuals at risk.

Water testing, when performed correctly, informs one of the quality of water at that point in time. It is not a control methodology. If the water system is not well controlled a negative water sample can soon be replaced by high counts of pathogens. Despite this there have been reports where the water safety group has focused on negative water samples to the exclusion of ensuring the controls on the system are working, only to be surprised when the next set of water samples shows high counts of pathogens.

Water quality testing is required at commissioning of a new water system, and routinely for *Legionella* and *Pseudomonas aeruginosa* in high-risk areas. It is also indicated when:

• considered necessary by the risk assessment;

• from areas where the target control parameters are not met (i.e. where disinfectant levels are low or where temperatures are below 50°C (55°C in healthcare premises) for HWS or exceed 20°C for cold water systems);

• from areas subject to low usage, stagnation, excess storage capacity, dead legs, excessive heat loss, crossflow from the water system or other anomaly.

The recommendation for testing for Pseudomonas aeruginosa in augmented care areas is that it should be undertaken 6 monthly. There is a view that this may be suboptimal in protecting patients. The rationale for 6 monthly testing is not based upon scientific evidence, it is the view of a committee. The sensitivity of surveillance i.e. the ability of infection control teams to recognise transmission of sensitive strains of Pseudomonas aeruginosa from water systems to patients, has been shown to be less than ideal. Thus transmission, especially with sensitive strains outside of the neonatal area (where there should be a zero tolerance) is likely to go unrecognised in adult augmented areas (adults may bring this organism onto the unit as part of their own normal flora - no baseline has been set for this, making it difficult to distinguish acquisition from the unit environment). Add to this that a single mistake for instance

by a cleaner, using a contaminated cloth to clean the end of an outlet may result in transmission, then 6 monthly testing could permit a large number of transmission events to go undetected. Therefore some highly acknowledged individuals in the field of water are recommending more frequent testing initially, and if the results are negative gradually prolonging the time between tests. Allowing for knowledge of the local water systems to be built up.

Testing the quality of water from point of use filters may seem counterintuitive. However incorrect installation or cleaning practices may lead to contamination of the water as it leaves the filter. From experience I have seen a number of occasions where such testing has revealed issues and would recommend that it is considered as part of an audit process when filters are deployed for organisms such as pseudomonas. In such a situation taking pre-flush samples and performing a total viable count is recommended. Such practices might be warranted when choosing to use a new brand of filter.

# References

1. Inkster T, Wilson G, Black J, Mallon J, Connor M, Weinbren M. Cupriavidus spp. and other waterborne organisms in healthcare water systems across the UK. J Hosp Infect. 2022 May;123:80-86. doi: 10.1016/j.jhin.2022.02.003. Epub 2022 Feb 16. PMID: 35181399.

2. Health Technical Memorandum 04-01: Safe water in healthcare premises 2016. https://www.england.nhs.uk/publication/ safe-water-in-healthcare-premiseshtm-04-01/

3. Weinbren M, Inkster T. The hospital-built environment: biofilm, biodiversity and bias. J Hosp Infect. 2021 May;111:50-52. doi: 10.1016/j. jhin.2021.02.013. Epub 2021 Feb 22. PMID: 33631235.

# Table 1

# **Opportunistic Pathogens of Premise Plumbing**

# Gram negative bacteria

- Pseudomonas aeruginosa
- Pseudomonas putida-P. fluorescens
- Burkholderia cepcia complex (B. cepacia, B. cenocepacia, at least 8 other genomospecies)
- Cupriavidus (Ralstonia) pauculus
- Herbaspirillium
- Methylobacterium spp
- Ralstonia pickettii, Ralstonia mannitolilytica
- Sphingomonas paucimobilis, Sphingomonas mucosissima, other Sphingomonas spp
- Stenotrophomonas maltophilia
- Acinetobacter baumannii, complex A. calcoaceticus
- Alcaligenes xylosoxidans, A. faecalis
- Aeromonas hydrophila, Aeromonas spp
- Elizabethkingia anophelis, E. meningosepticum
- Legionella pneumophila

# Non-fecal coliforms

- Enterobacter cloacae
- Klebsiella spp
- Pantoae aggloerans
- Rahnella aquatilis
- Serratia liquifaciens, Serratia marcescens

# Nontuberculous mycobacteria (NTM or Environmental Mycobacteria)

# Other bacteria/actinomyces

- Microbacterium spp
- Tsukamurella spp
- Rhodococcus equi, Rhodococcus spp
- Gordonae spp

# Fungi

- Yeasts (e.g. Candida parapsilosis, C. tropicalis)
- Aspergillus fumigatus, A. niger
- Fusarium spp
- Exophiala spp

# Protozoa

- Acanthamoeba spp
- Vermamoeba vermiformis
- Naegleria spp

![](_page_9_Picture_1.jpeg)

## SUMMER 2022

# **The Authorising Engineer (Water): Questions Which Shape Our Future Needs**

David Harper, Harper Water Management Group Ltd.

www.harperwater.com

Drinking water storage and distribution systems have been challenging our health and wellbeing for centuries and the stellar rise of opportunistic waterborne pathogens from this niche man-made environment has been noted since the 1950s (Schiavone, 1957). Despite more than 70 years of learning there remains a gap between knowing what a problem may be, and the installation, commissioning and operation of a "safe" in-premise water system (Proctor, 2022). Each water installation is unique, yet similar technical design and engineering problems, poor operational practices, bad behaviours by users and lack of multi-disciplinary skills in Water Safety Groups are commonly found.

The Institute of Healthcare Engineering and Estate Management (IHEEM) is an independent organisation providing guidance and development for engineers and estate managers in the healthcare sector. IHEEM have championed the role of Authorising Engineer (AE) in healthcare organisations (IHEEM, 2021) which aligns to the Department of Health's Health Technical Memorandum 00, Policies & Principles of Healthcare Engineering (DOH, 2014). Building robust and scrutinised engineering into the health sector by having an AE (Water) to help guide and assess the design, installation, operation and audit of water systems from an engineering and environmental perspective is a serious undertaking in improving water guality. It is critical that the AE (Water) remains independent of the operational structure of the healthcare organisation, with particular regard to the audit process. IHEEM have recognised the import role of an Authorising Engineer (Water) since 2016 and have eleven registered individuals active today. However it is not so clear cut how such independent support should be adopted in non-healthcare sectors, which is surprising when the majority of legionellosis cases are contracted from non-healthcare facilities. The European Centre for Disease Prevention & Control (eCDC, 2022) have just published their annual Legionnaires' Disease report for 2020, and despite a small decrease of cases during the COVID-19 restrictions there were 19 outbreaks with 10 of these from non-healthcare related sources. It would be prudent for accommodation sites such as hotels, cruise ships, campsites and other public facilities such as leisure centres and spas to have such AE (water) controls and guidance in place.

Improvements in water safety in both healthcare and nonhealthcare has been slow, hampered by lack of education and training, outsourcing to unspecialised and unsupervised third-parties, lack of necessary priority and budget and little evidence-based or experienced decision making. Often there is too high a priority on design, appearance, magic gadgets and cost-savings which have led in many cases to regression in water quality. Lessons have not been learnt or applied. Sadly, waterborne environmental pathogens which readily create and reside within biofilms are inherently resistant to systemic biocides and heat treatments, are a genetic swapshop for antibiotic resistance, are present in both healthcare and non-healthcare water systems and present the greatest risk to users. How can the Water Management industry best support improvements in safe water for drinking, bathing and recreation? Will there be registered Authorising Engineers (AEs) embedded in non-healthcare water management structures? Health and safety legislation tends to favour a risk-based approach, but with the critical nature of in-premise plumbing systems and an unsuspecting and trusting user population, the operation of a water system comes with heavy responsibilities. What will it take to get our water systems under control, and what skills will both the AE (Water) and Water Management/Safety Groups need for the future?

Of growing importance, is the need for the AE (Water) to be independent from both service and/or solution providers and for Water Safety Groups to engage external and independent expertise. It is not appropriate for the same individual or company to be providing services that have a conflict of interest at the same client site. For example, the individual or company completing the risk assessment should not then be developing the water safety plan, nor should the individual or company undertaking the water sampling and/or testing be providing a product such as systemic biocides or filtration or providing a monitoring software, for example. Here lies both conflict and bias. To be a registered AE (Water) in England you have to be a member of IHEEM and are approved only after review and scrutiny of the IHEEM team. Re-registration is required every 3 years. Clarity in recognising conflict of interest and ensuring no partiality or mis-practice must be recognised by those engaging the services of third parties to complete water management and hygiene services. "Independent" does not mean safe, so diligent examination of experience, ability and reputation is also needed. Having a fresh pair of objective eyes to assess independent evidence, give advice, inspect documentation, complete audits, review priorities and plans, support trouble-shooting, input their experience on all aspects of water management could prevent illness, reduce mortality and, in case of litigation, be protectively robust. How can the industry better recognise "independence" and improve both water safety and compliance in the future? How can service providers be better governed and how will this lead to better water management practice and hygiene results?

Good management and operation of an in-premise water system requires an inter-disciplinary approach (Proctor, 2022). Engineering knowledge and practical expertise is critical, but to grasp relevant microbiological hazards requires good understanding of the concerning pathogen(s), along with relevant water hygiene know-how which links to user-behaviour and transmission risks. Occasionally there will be an experienced engineer who has good working water microbiological knowledge and understanding, and occasionally there will be an infection preventionist who has

![](_page_10_Picture_2.jpeg)

good working engineering knowledge of the built environment. However these "unicorns" are rare. Lack of experience or omission in these areas will lead to a lower quality water system and sub-optimal management (Garrison, 2016). Within Water Safety Groups there is often a disconnect between recognising relevant hazards and risks and putting effective control measures in place. Not enough is done to assess problems properly, rather a knee-jerk reaction to "fix" without exploring and understanding all the issues and parameters affected. There is an over-dependence on chemical biocide solutions which rarely offer a long term sustainable solution (Arrigo, 2022; Thom, 2022; Hegarty, 2022; Jiang, 2022; Lane, 2022; Sabatini, 2022; Girolamini, 2022; Ma, 2022) unless considerable investment and time is spent completing remedial engineering measures first. A forensic finger-tip search to both identify and remove all dead legs, mitigation of any hydraulic balancing issues, ensuring non-return valves are fitted and working correctly, regular maintenance for plumbed in equipment, removal of inappropriate fittings and materials of construction (Wang, 2022, Proctor, 2018), temperature control (Cazals, 2022), sufficient flushing of under-used outlets or ideally their complete removal. Sometimes, once all these needed actions have been undertaken, there is no longer a need for systemic biocides – "engineer the problem out" is the best adage. If it is not possible to control temperatures, then it is likely that biocides will be needed, but as with any water system changes there should be a risk assessment completed before selection and installation with agreement to proceed from the Water Safety Group. Solutions are not always selected based on independent published data from real-life water system operations, and little is done to verify the efficacy of chosen solutions once installed or followed over years in steady state operation. Where is the independently published evidence? There needs to be a more rigorous, critical and disciplined approach to implementing appropriate and sustainable control measures to avoid costly mistakes. Unintended consequences may reflect inadequate multi-disciplined team consideration in the preparation and selection phase. Implementation of Water Safety Plans in all types of buildings and water systems has grown since the World Health Organisation publication in 2005 (WHO, 2005, 2010). Improvements are seen when a Water Safety Plan and cross-functional Water Safety Group approach is adopted for water system management. Good guidance here is not lacking (BSI, 2020), and should be embraced.

Steady state operational data measurement and management remains a gap. There are excellent opportunities to improve the guality and guantity of data whilst reducing costs through use of sensors and software. Temperature and flow measurements are critical and identify where the primary control measures of temperature control are outside of scope, and flags water outlets that are not being used sufficiently and therefore can be removed or captured on a flushing list. One way to rapidly demotivate skilled plumbing and technical engineering staff is to fill their day with the drudge of taking water temperatures or flushing outlets, worse if collected on paper. Due to resource restrictions, often the only action taken is to measure the out of specification data point again the following month rather than triggering skilled personnel to investigate the problem, develop a corrective action plan with identified resources and bring to the Water Safety Group meeting for focused discussion and agreement. Working

smarter, more cost-effectively and ensuring sustainable control requires better access to data. This includes microbiological monitoring, which is relatively expensive - perhaps monies may be better spent on improving water system infrastructure? Culturing water samples for waterborne microorganisms is inaccurate (Chiang, 2022; Delaney, 2022), and such variance would not be tolerated from an accurate digital thermometer or chlorine monitor. Plate culture methods are still considered the "Gold Standard" despite the complexity of getting a representative sample via aseptic technique, correct storage and transportation conditions to an accredited laboratory, and even then, a high chance that the organism of concern does not grow on the plate. Legionella is notoriously difficult to grow in the laboratory, particularly from water systems using continuous or shock systemic biocides. This is due to the reluctance of free-living cells exposed to environmental stresses, such as systemic disinfection, to show themselves on a culture plate despite optimal growth conditions. It is important to note that receiving a "Not Detected" culture count in isolation does not support the Water Safety Group to understand how a water system is performing or if control measures are effective. If conditions are conducive for growth, urgent action is needed whether the culture results are positive or negative, and microbiological culture is not a superior indicator or replacement for real-time temperature, chlorine, flow and throughput. To better determine a microbiological problem, and importantly how that may apply to the extent of human risk, there are more accurate, more specific and more sensitive molecular tests such as polymerase chain reaction (PCR) that can be employed to determine the effectiveness of engineering remedial measures. Results are returned the next day with relatable data to assist decision-making. There is plenty of molecular test kit about, but few laboratories have embraced the UKAS accreditation schedule for their molecular methodology in water testing. For an AE (Water) or a Water Safety Group to assure water safety from culture, the data returned must be considered one part of a bigger picture in order to support decision making or risk assessment. There is a responsibility to best understand the operation conditions and risk from a water system. Culture data can give a false "Green Light" and it may be appropriate to use presence/absence tests to give an interim picture of progress following implementation of remedial measures. Molecular testing should be more widely adopted into standard practice and written into guidance. Is continued use and dogged recognition of traditional cell culture plate counts driven by the desire to have negative or low count results? Is lack of understanding, confusion over interpretation of the results and implementation of the data generated restricting uptake of alternative technologies?

Legionella remains one of the most important waterborne pathogens and a major challenge for those managing a water system. Sixty three different species are now recognised, the newest being Legionella antarctica which was recognised last year (Shimada, 2021) and confirms that the cold water risks should be noted with this tolerant strain. Risk assessments mainly focus on Legionella pneumophila, or even more narrow with Legionella pneumophila serogroup 1. Whilst Legionella pneumophila is accountable for the majority of legionellosis detected, there are many non-pneumophila species that can cause infection and if there are conditions conducive for the growth of one Legionella species, then the water system is likely capable of supporting growth of others. There is increasing anecdotal evidence that L. anisa is more prevalent than L. pneumophila in samples analysed in UK laboratories, but this needs to be considered in conjunction with the vagaries of the current ISO 11731 culture method. Every signal of Legionella presence in a water system should be taken seriously, prioritised, investigated further and risk assessed for remedial measures. For other critical waterborne pathogens (Falkinham, 2015), such as Pseudomonas aeruginosa, Stenotrophomonas maltophilia and non-tuberculous mycobacteria, which are increasingly problematic in both healthcare and non-healthcare settings, many of the traditional water hygiene mantras remain true. Think: keep it clean, keep it hot, keep it cold, keep it moving, keep it documented. However, Pseudomonas is not the same beast as Legionella, and the risk assessment is quite different. Despite recent publications from the British Standards Institute (BS 8580-1: 2019; BS 8580-2: 2022; BS 7592: 2022; BS 8680: 2020; BS PD855468: 2015) the correct assessment and inclusion in on-site risk assessment reports for "Non-Legionella Waterborne Pathogens" has been left lacking. There remains a significant knowledge gap which must be addressed with urgency. Outbreaks from Pseudomonas aeruginosa colonised taps has been reported since the 1960s, and yet the same problems continue to be reported. An important learning from the Glasgow Cupriavidus pauculus outbreak is that there are unusual and unexpected outbreaks (Inkster, 2021; Inkster 2022), and it is critical to have a multiskilled team approach and understanding for risk assessment to capture the importance and mount effective preventative responses. Certainly risk assessment and remedial measures at the periphery of the water system (Apanga, 2022; Butler, 2022), including drains and traps, are inadequately covered in risk assessments and water safety plans. Risk assessment by a multi-skilled team is needed and must come before any change or addition to the water system is adopted as standard work practice.

The COVID-19 pandemic will leave its legacy imprinted on our water systems for many years to come (Aw, 2022; Bédard, 2018; Cassell, 2021, Chen, 2020 (a, b); Faust, 2021; Rhoads, 2022; Ye, 2022; Zhang, 2021 a & b; Zlatanovic, 2017) with the effects of stagnation leading to established immovable biofilms (Fleming, 2016 & 2020). A plethora of guidance was released to support water management practice both during lockdowns where there was little or no use, and for bringing buildings back on-line and into routine use (CDC; CIEH a & b; EPA a & b; ESGLI; HSE; LCA; WMSoc) What publications can we expect to see as a result? For many flushing will not be the answer (Hozalski, 2020; Nisar, 2020; Proctor, 2020; Totaro, 2018). Many supporting guidance documents were released, including the helpful and practical based ESGLI ones. Systemic shock and continuous biocide treatments are not the simple fix that many hoped for and can at worst lead to biofilms compiled of biocide-tolerant microorganisms many of which are multi-drug resistant opportunistic pathogens (Zhong, 2022). Water systems which have hydraulic / balance problems, where temperatures are not achieved in all areas and at all points of use, have dead legs and little used outlets will be an indication for where sub-lethal biocide levels will equally have less circulation, contact and impact. We should all reflect on the level of immune function in the

general public who are "out and about" and may be exposed to unexpected water pathogens in the community (Alhuofie, 2021; Orkis, 2018), at a hotel (Barksey, 2019), an outdoor water fountain (Faccini, 2020; Steen, 2021), from paddling pools (Carter, 2019), using public transport (Federigi, 2022; Ulger, 2022) the windscreen washer of vehicles (Politi, 2022), in their own homes (Filippis, 2018; Ricci, 2021; Ryu, 2017; Schumacher, 2020), showering (Hayes-Phillips, 2019), using CPAP devices (Schnirman, 2017), dishwashers (Matsuki, 2022; Zupancic, 2019), chilled water dispensed from the fridge (Villarreal, 2022) or an aromatherapy spray (Gee, 2022). The biggest threat from water systems in healthcare to users is antibiotic resistance. Biofilms in water systems are reservoirs of antibiotic resistance (Tiwari, 2022). Waterborne pathogens cause unnecessary illness and death, yet we have the means to control them. Indeed it has been proven that waterless healthcare in high risk patient areas is not only possible but reduces infections and antibiotic usage (De-Las-Casas-Camara, 2022). For many years we have seen increased requests for handwash basins in order to support handwashing campaigns. Yet the use of alcohol gel has reduced the need and we are left with under used outlets which are a risk for users. With such clear evidence the water safety groups in hospitals should be pushing to remove outlets, to place clinical handwash basins outside the room for all sensitive, high risk or clean areas within hospitals. In non-healthcare buildings to channel the throughput of water through fewer outlets will no doubt lead to improved water safety and easier management. Education needs to impact and change practice on-site. If you only have a small budget, spend it on good education as it will bring the best costsavings.

We have a long way to go before getting in-premise water quality consistently under control, and despite more than 50 years' experience in engineering various problems out of water systems and where there is little I have not seen or experienced, there are new challenges with different and more complex threats ahead of us. Problems which increasingly require the multi-skills of an interdisciplinary approach. Microorganisms have had 4 billion years to hone their skills in adapting to every environment on earth, they have the advantage on us. Antimicrobial resistance, water shortages, carbon zero and climate change are no longer on the horizon, but at our door. May we all rise to and recognise the water quality and safety challenges of the future.

References can be made available upon request

JOIN IN WITH OUR CPD ACTIVTY ON THIS ARTICLE SEE PAGE 15 FOR DETAILS.

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# Huwa-San Advanced water hygiene

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HUWA-SAN TR-50 FOR BOTH SHOCK AND CONSTANT DOSING (PT 4 & 5)

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EN13623 Cegionella:

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🖆 Industrial applications

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- Improve reporting time and increase profitability
  - Pre-built Legionella risk assessments
- Set up flexible inspection regimes

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# INDUSTRY UPDATES CSCA

Stuart Wilton stepped down as a member of the CSCA Management Committee and all CSCA Foundation, Sponsor and Service Provider members are invited to put forward an independent member to replace Stuart on the CSCA Management Committee. Stuart continues to support the CSCA and we were delighted he was able to attend the recent LCA Spring Conference in London (photo on right) manning the CSCA exhibition stand promoting membership of the CSCA.

Membership of the Closed System Control Association is open to companies who actively support and demonstrate a sound approach to the control

of water quality in closed systems. Benefits for members include technical support and discounted rates for CSCA events. For more information, please visit: www.cscassociation.org.uk

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# Legionella Control Association

The LCA Spring Conference Roadshow in May 2022 was a huge success, see page 50 for report and photos. The Autumn event for LCA members and nonmembers will take place in London on Tuesday 11th October 2022.

LCA members annual re-registration period starts on 1st July 2022 with no changes to the re-registration process from last year. LCA Service Provider

registered members offer the following services: Legionella Risk Assessment, Water Treatment, Hot & Cold Water Monitoring and Inspection, Cleaning & Disinfection, Independent Consultancy, Training, Legionella Monitoring and Plant & Equipment. To find a registered LCA member or information on how to join the LCA, please visit: <u>www.legionellacontrol.org.uk</u>

Legionella

Control Association

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UKAS is looking for Independent Technical Assessors for legionella risk assessment inspection work.

Suitable applicants would have significant experience and in-depth knowledge in the inspection and risk assessment of hot and cold domestic water systems, cooling tower systems and other high risk systems as identified in the HSE HSG274 publication series. UKAS contracts independent technical assessors on a day rate basis, either as self-employed contractors or through their current employer.

To find out more go to <u>www.ukas.com/about-us/careers/independent-</u> <u>technical-assessors/</u>. If you are interested and would like to discuss the details of this opportunity, please contact Nicholas Gibbons on 01784 429000 or email <u>nicholas.gibbons@ukas.com</u>.

# GAIN A CPD POINT BY ANSWERING THESE QUESTIONS ON 'THE AUTHORISING ENGINEER (WATER)' ARTICLE

Q1: Which Department of Health guidance refers to Authorising Engineers (AE)Q2: What is the benefit of a water safety plan approach to water quality and involving an inter-disciplinary team?Q3: What is the name of the latest identified Legionella species and what environment does it tolerate?Q4: What guidance is available to support Pseudomonas aeruginosa risk assessment?

# EMAIL YOUR ANSWERS IN TO ADMIN@WMSOC.ORG.UK TO GAIN YOUR CPD POINT

The answers will be published in the Autumn 2022 edition. A cpd point will be awarded for correct answers received before publication of the next edition of waterline. Extra CPD points will be awarded to members who provide extra research and/or evidence and to those members whose answers are accepted for publication in Waterline.

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# Which? magazine Seaside resort of the year 2022

A tiny village of just 400 people on the Northumberland coast has been ranked Britain's favourite seaside resort for the second year in a row. Bamburgh came first out of 87 destinations in a survey of more than 4,300 people carried out by Which?. It was rated five stars for its beaches, seafront, peacefulness and value for money, with a satisfaction score of 87%. The village also boasts a seafront castle and varied flora and fauna of the nearby Farne Islands.

The winning resort was closely followed by second placed Llandudno in north Wales with 86% followed by St Andrews in Scotland with 85%. Completing the top 5 positions were Dartmouth, Devon 83% and Tenby, Pembrokeshire, also 83%. The 5 worst rated resorts were Skegness in Lincolnshire, Bognor Regis in West Sussex, Southend in Essex, Great Yarmouth in Norfolk and Burnham-on-Sea in Somerset

UK coastal resorts have seen a surge in popularity during the pandemic as travel restrictions forced people to opt for staycations instead of holidays abroad. Rory Boland, editor of magazine Which? Travel, said: "The British seaside hasn't boomed like this since the 1960s. Holidaymakers had such a fantastic time in their caravans, tents and beach lodges over the past two years that a coastal break on home shores is on the cards for many, even with restrictions on overseas travel lifted."

# Dutch court denies children the right to running water

A Dutch court has ruled that if parents fail to pay their water bills then their children have no unconditional right to running water. The Netherlands is a signatory to the UN Convention on the Rights of the Child, but despite this the court stated that children's rights are not infringed if a water company cuts off the water to their home.

The Dutch Government said its non-payment legislation does not ask companies to disconnect water and that this is a decision for the 10 water companies owned by municipalities and provinces. An estimated 500 to 750 families are disconnected each year, some for several months, although at least 80% are reconnected the next day.

# Easter Snowdon walkers leave poo on the paths

Human faeces on some of Wales' most popular mountains are a danger to health, Mountain Rescue's senior executive has said. Mike Park said the problem was becoming more noticeable now hills are getting an "unprecedented amount of traffic." The senior officer for Wales and England said Snowdon, Tryfan, and Pen-y-fan in the Brecon Beacons were most affected.

A Snowdon guide reported a path "covered in human stools" over Easter. Gemma Davies said she was "totally disgusted" at the state of the Llanberis path on Saturday morning with stools in paper cups and under stones.

It prompted Snowdonia National Park Authority to urge people to use the toilets at the bottom of the park before their hike.

Helen Pye, the authority's engagement officer, said reports of faeces on some paths were "upsetting and alarming" but there was no need to add more toilets. She rejected claims toilets were closed adding there were facilities at the bottom of all the main paths up Snowdon. That claim was challenged by many hikers, including Gemma Davies, who all said the toilets were locked.

## Nuclear tsunami to wipe out UK, says Russian propagandist

A Russian nuclear missile attack could "sink" Britain "once and for all" threatened Dmitry Kiselyov, a presenter on Russian state television. He is known as Putin's mouthpiece.

Using maps and graphics he showed how a Russian Poseidon torpedo could "plunge Britain into the depths of the sea. The explosion of this thermonuclear torpedo near Britain's coastline will cause a gigantic tsunami up to 500 metres high." "Having passed over the British Isles it will turn whatever might be left of them into a radioactive desert unfit for anything for a long time." The simulation showed the destruction of Ireland along with Great Britain. Irish politicians condemned the report. Neale Richmond, a legislator with the ruling Fine Gael party, called for the expulsion of Russia's ambassador to Ireland, Yury Filatov.

Russian Foreign Secretary, Sergei Lavrov, sought to downplay the state TV vitriol, claiming that "western media misinterpret Russian threats."

# Guernsey drinking water concerns as pesticide use rises

An increase in the use of pesticides and weedkillers in Guernsey has limited what water can be collected and used for drinking water. Guernsey Water has warned it could mean water use restrictions or price rises to fund new water treatment equipment. Both commercial and domestic use are being held responsible. The government-owned firm is to stop using the Vale Pond catchment area, which provided about 250 million litres of water a year.

"With our climate warming up and more severe droughts predicted for the future, the fact we are currently unable to collect what would equate to around 19 days' worth of water during drought for the island is significant and concerning," said water quality risk manager Margaret McGuinness. She said the problem did not just affect the Vale Pond catchment area - with sampling showing an estimated 65% increase in pesticide concentrations in streams across the island from 2019 to 2021. "We are asking Islanders with some urgency to reconsider their use of pesticides and weed-killer and look to alternatives for the benefit of the island's vital water resources and environment. Otherwise, unfortunately it could be a case of spray now, pay later."

#### Joe Biden, an Octopus fossil

In an ancient shallow bay of what is now Montana, the body of an octopus-like creature the size of a fist was buried on the seafloor. Some 325 million years later, a new paper published in *Nature Communications* provides some interesting insights into this mysterious and ancient cephalopod. Syllipsimopodi bideni is small (about 12cm in length), has ten arms, suckers, fins, and a triangular pen of hard tissue inside its body for support. It's a unique find because "squishy" animals tend to degrade quickly after death and therefore rarely make good fossils.

In 1988 the fossil was donated to the Royal Ontario Museum in Canada. It was largely ignored for more than 30 years until American palaeontologists Christopher Whalen and Neil Landman decided to study it.

The researchers have named the species Syllipsimopodi bideni after Joe Biden, the 46th president of the United States. Biden had just been inaugurated when the study was submitted for publication, and the authors wanted to recognise his commitment to science.

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#### Heritage steam trains trial coal alternative fuel

A 'milestone' for steam is how the Heritage Railway Association has described the first-ever trial of bio-coal in a full size, standard gauge locomotive. The trials – a collaboration between the Heritage Railway Association, member railways, CPL Industries Ltd and the Advanced Steam Traction Trust – seek to find an alternative to traditional steam coal, which is proving increasingly hard to source.

The urgency behind trials of alternative fuels has only increased after it became clear the last source of UK-mined steam coal would no longer be supplying the heritage sector. There are now significant concerns that heritage rail could experience a coal shortage within months. Heritage Railway Association chief executive, Steve Oates, said: "Even though this is just an initial trial, it is a significant milestone in the history of steam locomotives in the UK. Heritage steam is a small and very responsible user of high-quality, low emissions coal, but it's clear that huge challenges are ahead for the fuel we depend upon. That's why trials like this to find alternatives are so important."

The alternative fuel, Homefire Ecoal is produced at Coal Products Ltd's UK plant, providing a unique formula featuring up to 20% biomass and manufactured using CPL's hot cured process to provide greater strength and durability. The larger, specially-shaped hexagonal ovoid is designed to sit on both narrow gauge and standard gauge locomotive fire bars, just like traditional coal. It is classified as smokeless, emitting up to 80 per cent less smoke than traditional coal. The requirements of heritage steam coal are very different to most other users. Factors like burn rate and the amount of ash produced are critical to success, but it is also important that fuel does not produce excessive smoke or damage to fireboxes and fire bars.

# Nationwide protests held over water firms discharging sewage

Thousands of people have taken to rivers and waterways to protest against water companies dumping sewage in them. The day of action, on the 23rd April, organised by the charity Surfers Against Sewage, involved 12 protests across the UK. Each protest targeted a separate water company. In Manningtree, Essex, wild swimmers marched and dressed up in mermaid and giant poo costumes by the River Stour.

Anglian Water, which admitted it dumped sewage in the river 389 times last year, said it was investing millions of pounds to rectify the "historic issue". Catherine Arnold, a nutritional therapist who helped organise the Manningtree protest, said: "We are so lucky to live in an area of outstanding natural beauty and we need to protect it. We don't release sewage into our gardens, why would we release it into our rivers?"

Water companies discharged raw sewage into British rivers 372,533 times last year, for a total of more than 2.6m hours, according to data from the Environment Agency. Untreated sewage is only meant to be discharged into rivers in exceptional circumstances, for example, during heavy rainfall. Nic Bury, professor of environmental toxicology at the University of Suffolk, is running a project looking at E. coli counts in rivers. A sample he took in Manningtree showed an E. coli count of 1000cfu/100ml. The threshold for good bathing water is less than 500cfu/100ml.

Editor. Some of the more printable protest banners read: Going through the Motions; No more Poo-Lution; More Species, less Faeces; Cut the Crap.

# Lobsters' deformities linked to subsea cables

Lobsters which hatch near subsea electricity cables risk developing life-limiting deformities, researchers have said. Scientists from Heriot-Watt University, Edinburgh exposed lobster larvae to electromagnetism in the laboratory to see how it affected their development. They said exposed lobsters were three times more likely to develop abnormalities around the tail and eyes. Experts said it meant cables must be buried on the sea bed. Many more cables will have to be laid in the coming years to service the huge number of offshore wind farms which will be constructed in Scotland's waters. Crown Estate Scotland has leased the rights to develop 17 new wind farms over the next decade or so.

The lab tests were carried out on species of crab and lobster, although it was the European lobster which was most affected. Dr Alastair Lyndon, a marine biologist at Heriot-Watt University, said: "We put them through a vertical swimming test to check they could get to the surface to find food. The exposed lobsters were almost three times more likely to fail the test, by not reaching the top of the chamber, than the unexposed ones. The most common deformities we found included bent and reduced tail sections, which could account for the swimming test results. In addition, some had disrupted eye development or had puffy and swollen bodies."

#### Easter 'sting' in Cornwall

Beachgoers were shocked to find a swarm of Portuguese man o' wars that had washed up on a beach near St. Austell, in Cornwall.

Although it superficially resembles a jellyfish, the Portuguese man o' war is in fact a siphonophore. Like all siphonophores, it is a colonial organism, made up of many smaller units called zooids. All

![](_page_16_Picture_19.jpeg)

zooids in a colony are genetically identical, but fulfil specialized functions such as feeding and reproduction, and together allow the colony to operate as a single individual.

The Portuguese man o' war carries a toxic venom in its tentacles that is strong enough, on occasion, to kill both animals and humans.

St Austell Coastguard issued a warning to tourists over the Easter weekend to stay away from the beached creatures, posting: "we have come across a number of Portuguese man o' wars coming ashore. Please be careful when on the beach with children or dogs, as the stings can be very nasty." The Marine Conservation Society classes these organisms as "extremely dangerous to humans."

# Boots announces nationwide ban on plastic wet wipes by the end of the year

Boots has announced that it is to stop selling all wet wipes that contain plastic fibres by the end of the year. The pharmacy chain, which sold more than 800 million wet wipes in the last year, said it would replace plastic-based wipes with plant-based biodegradable alternatives. This move follows Boots reformulating its own-brand wipe ranges to remove plastic.

A large proportion of the 11 billion wet wipes used in the UK every year still contain some form of plastic, according to the Marine Conservation Society, and evidence suggests they are the cause of more than nine in 10 blockages in UK sewers. Boots is one of the biggest sellers of wet wipes in the UK, with more than 140 different lines stocked across skincare, baby, tissue and health care categories. Steve Ager, chief customer and commercial officer at Boots UK, said: "Our customers are more aware than ever before of their impact on the environment, and they are actively looking to brands and retailers to help them lead more sustainable lives. We removed plastics from our own brand and No7 wet wipe ranges in 2021, and now we are calling on other brands and retailers across the UK to follow suit in eliminating all plastic-based wet wipes." Environment Minister Rebecca Pow said: "This is a really encouraging commitment from Boots to prevent the damaging plastics in wet wipes from entering our environment. We have already conducted a call for evidence on wet wipes, including the potential for banning those containing plastic. In the meantime, our message is clear - you should bin and not flush wet wipes."

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#### Huge volume of water under Antarctic ice

Vast quantities of water have been detected in sediments that underlie a part of the West Antarctic ice sheet. The volume is equivalent to a reservoir that is several hundred metres deep. The water was detected below the Whillans Ice Stream, but its presence is likely replicated elsewhere across the continent. If that is the case, it could be an important influence on how Antarctica reacts to a warmer world, researchers have reported in the journal *Science*.

Water at the base of glaciers and ice streams generally works to lubricate their movement. The transfer of water into or out of this reservoir has the potential therefore to either slow down or speed up ice flow. Models that simulate future climate impacts will now have to account for it. Dr Chloe Gustafson from the Scripps Institution of Oceanography in San Diego, US, said that the deep sediments were ancient ocean muds and sands that became saturated with salty seawater thousands of years ago when the West Antarctic Ice Sheet was much less extensive than it is today. "These sediments I like to think of as a giant sponge," she explained. "If you could squeeze out all that water and pool it on the surface, the water would range anywhere from about 220m in depth all the way up to 820m."

"For comparison, the Empire State Building is about 440m tall. So at the shallowest, this water would go halfway up the Empire State Building, and at the deepest it would almost submerge two Empire State Buildings."

Dr Gustafson made her measurements during a six-week expedition on the Whillans Ice Stream, an 800m-thick, 100km-wide convoy of fast moving ice that feeds into the Ross Ice Shelf.

## Messing about on a London canal

Whether you're a local or a visitor, one of the most unique and fun experiences you can have in the city of London is the HotTug. "Hot tub?" you might ask. No, it is a HotTug, a self-drive, electric, wood-fired hot tub, and it's available to enjoy in every season.

The floating hot tub is filled with freshwater that can be heated up to a little over 40°C, and is available for rent. You can float down a London canal, as passers-by watch, and you relax and wave.

The HotTug is the brainchild of local residents Stuart "Tommo" Thomson and his business partner, Jack Clegg. Thomson said, just before it opened to the public, that they "aim to be the most unique and fun experience you can do on water," noting that the maiden voyage was a big success. The unique idea originated in the Netherlands, brought to the United Kingdom after Thomson saw something similar cruising down the Rotterdam canals and immediately believed it would be a huge hit in London.

Up to seven people can fit in, and it can be taken out for 90 minutes. If you want the VIP experience, you'll get towels, robes, captains' hats for everyone and a bucket of ice for drinks.

![](_page_17_Picture_12.jpeg)

#### **Relentless rain in South Africa**

Survivors of South Africa's devastating floods have described "sheet upon sheet of relentless rain" that washed away entire houses, bridges and roads, killing around 450 people and making thousands homeless.

The storm, in April, which delivered close to an entire year's usual rainfall in 48 hours, took meteorologists by surprise and has been blamed by experts on climate change. The new disaster comes after three tropical cyclones and two tropical storms hit south-east Africa in just six weeks in the first months of this year.

The full extent of the devastation caused by the floods in South Africa this month is yet to become clear, with many victims still missing and authorities still learning of new damage around the eastern coastal city of Durban. Many tens of thousands of people remain without water, and there are rising concerns about an outbreak of infectious disease. The South African president, Cyril Ramaphosa, described a "catastrophe of enormous proportions" and attributed the disaster to the climate emergency. It is telling us that climate change is serious, it is here," he said as he visited the flooded metropolitan area of eThekwini, which includes Durban, shortly after the floods. "We no longer can postpone what we need to do, and the measures we need to take to deal with climate change." "This is just the beginning of a series of extreme weather events that are linked to climate change ... Africa pollutes least and suffers most from climate change," said Ibrahima Cheikh Diong, the director general of African Risk Capacity, an agency set up by the African Union to help governments better plan for disasters and mitigate their impact. Poor people living in makeshift settlements built on unstable, steep-sided gorges around Durban were worst affected by the floods. Most have inadequate or no drainage systems and homes are sometimes flimsy shacks that offer little protection against the elements.

# Six-year-old finds giant megalodon shark tooth

Sammy Shelton has found a shark tooth belonging to a giant prehistoric megalodon that could be up to 20 million years old. He found the 10cm-long (4in) tooth on Bawdsey beach in Suffolk during a bank holiday break.

It was confirmed as belonging to a megalodon - the largest shark that ever existed - by expert Prof Ben Garrod. "Its teeth are not often found around the UK coastline," he said. "Maybe just a handful a year, but this is a particularly good example, in really good condition, whereas they are usually quite worn when found."

The megalodon could grow up to 18m in length, scientists estimate, and weigh up to 60 tonnes. Dwarfing anything else swimming in the waters at the time, these were "specialist whale eaters - they were ambush hunters," he said.

Sammy's dad Peter Shelton said his son was sleeping with it near his bed as he was "very attached to it". The pair, from Bradwell near Gorleston-on-Sea in Norfolk, were searching for fossils when they came across the giant shark's tooth. "Sammy was very excited as we'd seen fragments of shark teeth on the beach, but nothing as big and heavy as this," Mr Shelton said. Megalodon translates as "big tooth".

![](_page_17_Picture_22.jpeg)

#### Cornish mines could heat county's homes

A £100,000 study will examine if abandoned Cornish mines can provide renewable and low-cost heating. The scheme will explore whether water in flooded mines can be used with heat pump technology to warm homes. If successful, the county's 400 abandoned mines could improve options for off-gas grid communities - which account for half the county's homes. Stephen Rushworth, cabinet member for Economy at Cornwall Council, said half of the homes in Cornwall do not have access to mains gas and many are "not suitable for air source heat pumps without expensive energy efficiency measures. This feasibility study could greatly improve options for our residents and further develop Cornwall's geothermal industry." The Department for Business, Energy and Industrial Strategy awarded £67,000 to Cornwall Council, housing association LiveWest and the National Trust to carry out a feasibility study. Each organisation has pledged an additional £11,000 to the project, which is being carried out at Geevor, Levant and Botallack mines near Pendeen.

Cornwall Council said water within the mines was warmed by natural processes due to the granite bedrock and was unaffected by seasonal variations. The initial study will take place at Geevor Tin Mine and examine whether the water could heat LiveWest's housing stock in the adjacent Boscaswell Estate, and at Geevor Tin Mine and Levant Mine.

![](_page_17_Picture_26.jpeg)

![](_page_18_Picture_2.jpeg)

#### Belugas rescued from Chinese aquarium will have whale of a time in ocean 'halfway house'

Two Beluga whales rescued from a Chinese aquarium will be rehomed in a giant aquatic "half-way house" before their release into an open water sea sanctuary off the coast of Iceland. Little Grey and Little White were transported 6,000 miles by air, sea and land from Changfeng Ocean World in Shanghai in 2020, but have faced a series of issues in acclimatising to their new home. After just four months in the open water, they were moved to an indoor care facility in order to protect them from the harsh winter, but have been forced to stay there after supply chain issues blighted construction plans in Klettsvik Bay. Now, as an intermediate step, a 50-metre wide, 17 tonne giant halo-like structure has been created which will allow the whales to have a halfway-house before being released into the much larger open water sanctuary. The specially designed floating habitat arrived at the remote Icelandic island of Heimaey following a 48-mile, 16-hour journey by tugboat from the mainland.

The intermediate home is designed to have a net which reaches the seabed, allowing Little Grey and Little White access to the seafloor to explore the fauna and flora of the natural habitat. Work on the halo is taking place at Vestmannaeyjar harbour before it will be installed in the nearby Klettsvik Bay ahead of the Beluga's move back to the sanctuary.

## My life has changed says Adrian Chiles

Broadcaster and columnist Adrian Chiles has revealed he has a urinal in his flat bathroom and defended the unusual concept to 'appalled' fans in his latest column. The former One Show presenter, 55, admitted that installing the device has 'changed his life', even though women are left 'retching' over the sight of the urinal.

Despite shocking many fans with his choice of bathroom appliances, the presenter was praised by activists for using trans-inclusive language in his argument, as he noted that urinals are convenient for 'gentlemen – or anyone with a penis'. Chiles explained during his latest column in the Guardian that a urinal is the solution to many domestic issues, including men leaving the seat up or having poor aim.

The TV presenter referenced his private urinal after noting that Ryan Reynolds had given Rob McElhenney (Hollywood stars Ryan and Rob co-own Wrexham FC) a urinal in the Wrexham FC grounds for his birthday. Adrian, who described himself as a urinal 'enthusiast', wrote: 'I was reminded of the urinal I have in my flat, sitting below a stained glass window, featuring West Brom's crest. I'm very proud of it – the urinal more than the crest. I'm a great enthusiast for urinals in the home.

#### Grey seal in rehab

A wild seal has been taken into rehab after becoming "overly-friendly" with people after being regularly fed with 'delicacies' such as doughnuts, sandwiches and ice-cream.

Named by the RSPCA as Spearmint, the seal had been spotted in multiple locations in Plymouth Sound. Rescuers hope to release the seal, which has become "habituated to humans", into a remote area of Scotland. Rame Wildlife Rescue Network, made up of multiple organisations, has raised more than £5,000 for the seal's relocation. The volunteers said they had been monitoring the North Atlantic grey seal since it was spotted in Cawsand Bay, Cornwall, about seven months ago. Jessica Collins, a marine medic at British Divers Marine Life Rescue started the rescue network. She said the seal, which is an endangered species, had become "habituated to humans" -with the seal interacting with wild swimmers and climbing on to paddleboards on crowded beaches. It is the second time the seal has been taken into rehabilitation, the first was due to human disturbance, the Network said.

The seal's rehabilitation will involve minimising human contact, rebuilding its wariness of people, and socialising with other seals.

## Tap left on in Japanese school to limit coronavirus infections creates huge water bill

A Japanese school has been hit with a 3.5 million yen (\$27,000) water bill after a teacher in charge of pool maintenance left a tap on for months hoping to stop coronavirus infections. The teacher, who has not been identified, thought a constant flow of fresh water into the pool would keep it COVID free and left the tap on from late June to early September 2021.

Normally, chlorine and filtering machines maintain the pool water's quality, "but the teacher somehow got the wrong idea that pouring new water in would also do the trick and even help prevent COVID," local education board official Akira Kojiri said.

Other staff members occasionally noticed the running tap and switched it off, but the offending colleague soon switched it back on. As a result, Kojiri said, an estimated 4,000 tons of excess water was used in just over two months -- enough to fill the pool 11 times over.

Local authorities in Yokosuka are now demanding the teacher and two supervisors pay half of the 3.5 million yen bill. "We deeply apologize to our residents for causing (financial) damage to our city," Yokosuka authorities said in a statement.

#### Mass opposition to plans to destroy Austrian glacier

Plans to blow up an Austrian glacier to merge two Alpine ski resorts were opposed by thousands of people, on 22nd April, who took to Innsbruck's streets in opposition. The merger contains plans that would include exploding and eradicating greater than 750,000 cubic metres of snow, rock and ice from the mountainside to make room for new slopes and providers. The challenge would join two ski resorts referred to as Pitztal Glacier and Ötztal Glacier in Tyrol, Austria.

Gerd Estermann, who organised a petition, signed by 168,000 people, stated: "For only five additional ski slopes, the ski resort operators want to block three untouched glaciers. In doing so, they are destroying the unique high-alpine natural landscape, which is already threatened by global warming. That's negligent and we want to prevent that."

Members of the local snowboarding trade have been attempting to win approval for the plans since 2019. Vacation numbers are declining and the trade supplies one in each 4 jobs in the state.

Local mountain-elevate firm director Eberhard Schultes, said: "The Pitztal glacier has hardly changed for the past 30 years in terms of offer — the amount of slopes and facilities. And given that this is winter guests' number one criteria, it is absolutely necessary to carry out this merger." The World Wildlife Fund, together with a number of different environmental charities, is opposing the plans to clear an area equivalent to some 90 soccer fields-worth of floor for the resort.

19

![](_page_19_Picture_0.jpeg)

#### Disturbing dolphins may break the law

Dolphins face an increasing risk of disturbance from people taking to the sea on boats, jet-skis, paddleboards and kayaks, campaigners have warned. Many people are not aware of the laws against disturbing dolphins, whales and porpoises - or that they risk fines for breaking them, said the Whale and Dolphin Conservation (WDC) and the National Wildlife Crime Unit (NWCU). Wildlife charities are calling for people spending time at the sea this spring and summer to give space to dolphins and other marine mammals they see, watching from a distance and not crowding them. Marine animals have been enjoying quieter waters around the UK since the pandemic started, with bottlenose dolphins regularly spotted along the Blackpool coastline in the first lockdown, and orcas and dolphins seen off the coast of Northumberland. As the latest lockdown eases and visitors flock to the coast, the marine charity WDC fears a rise in incidents of people disturbing animals with leisure craft or other recreational activities, or attempting to jump in and swim with dolphins. Most disturbance is accidental, because many boat users and holidaymakers do not know how to behave around dolphins and other wildlife, and are not aware of the rules protecting them or how to report incidents. Cetaceans such as whales, dolphins and porpoises are protected under UK law against reckless or deliberate disturbance, harassment, killing and injury, with fines of up to £5,000

The wildlife charity is raising awareness of the issue and encouraging people to reduce their impact on whales and dolphins. Tips include watching from the shore, keeping a safe distance in boats, being calm and quiet, checking if boat tour operators are accredited with the Wildlife Safe scheme for minimising disturbance to marine wildlife, and reporting any incidents. People are warned not to chase or repeatedly approach animals, try to scatter groups, make sudden changes to speed or direction, or swim with them or try to feed or touch them.

# Beach hut owners in Essex town given warning

Council bosses are clamping down on beach hut owners who have refurbished their sheds by tacking on verandas and patios. A growing number of the classic huts that line the beachfronts at Frinton-on-Sea, Essex - and other resorts like Clacton and Walton - have been 'customised' without permission and extended.

Ownership of the eleven foot by seven foot huts at Frinton-on-Sea, Essex - which change hands for up to £80,000 - depends on a licence from Tendring District Council.

But officials are now warning owners of the 3,000 huts in Frinton and neighbouring resorts that they will lose their licence if they break the strict rules by adding balconies, gardens or decking. In a warning letter to local estate agents, the council's 'Beach Hut Team' stated: 'As you are aware beach hut licences are issued by the council as the land owner. When a beach hut is sold, the licence is terminated and a new one only allows a beach hut which conforms to the approved specification to be placed on council land.' 'It has become apparent that a number of huts breach current specifications - patios, balconies and decking have been added and the site licence does not cover these adaptations.'

In order to enforce the rules, estate agents who sell the huts have been told to get 'photographic evidence' of all sides on the huts. The change in policy follows reports that some owners have been advertising their huts for rent - a practice not permitted by the council. Despite this, huts are regularly advertised on websites and in local estate agents windows with the average rental of around £150 a week in the summer.

It is only in recent years that owners have been permitted to use colours other than traditional brown, green or white. Those owners who live in the council's district currently pay around £300 a year for a licence but those who come from outside the area have to pay double.

![](_page_19_Picture_12.jpeg)

#### Whale shark population continues to fall

Shipping poses an increasingly 'significant threat' to the endangered whale shark, marine biologists have warned. They found that ships are killing large numbers of the sharks, which are the biggest of any fish species alive on Earth today. Their numbers have been declining across the world in recent years but experts were bemused

Their numbers have been declining across the world in recent years but experts were bemused as to why. Now scientists from the Marine Biological Association (MBA) and the University of Southampton have led ground-breaking research which indicates that lethal collisions of whale sharks with large ships are 'vastly underestimated' and could be the reason why populations are falling.

It has previously been suggested that because whale sharks spend a large amount of time in surface waters and coastal regions that a significant number of deaths could have been caused by collisions with ships. However, there had been no way of monitoring this threat until now. Scientists from 50 international research institutions and universities tracked the movements of both whale sharks and ships across the globe to identify areas of risk and possible collisions. The team mapped shark 'hotspots' which overlapped with global fleets of cargo, tanker, passenger, and fishing vessels – the types of large ships capable of striking and killing a whale shark – to reveal that over 90 per cent of whale shark movements fell under the footprint of shipping activity.

The study also showed that whale shark tag transmissions were ending more often in busy shipping lanes than expected, even when they ruled out technical failures. The team concluded that loss of transmissions was likely due to whale sharks being struck, killed and sinking to the ocean floor.

#### Our oceans are being industrialised – Greenpeace

A new Greenpeace International report, Squids in the Spotlight, lifts the lid on a rapidly growing and largely unregulated squid fishing industry.

The report uncovers the huge scale of the global squid fishery, which has grown over 10-fold since 1950 to almost 5 million tonnes annually in the last decade and is now jeopardising marine ecosystems around the world.

Operating out-of-sight in international waters, the meteoric rise of squid fishing and resulting demand for the species has no historical precedent, with some areas seeing a more than 800% increase in the number of vessels in just the last five years. In some instances, armadas of over 500 vessels have descended on the borders of national waters to plunder the ocean, with their collective lights being visible from space.

The Argentinian fishing area is identified as one of the best regions for squid and is suffering from this situation. Some boats are illegally crossing the border into Argentina's territorial waters which is reserved for domestic fleets. Many foreign boats turn off their public tracking systems to avoid detection.

Campaigners are calling for a strong Global Ocean Treaty, which could have prevented this situation and which will be crucial in stopping future fisheries expanding without restrictions.

# Why is the Belize coral restoration project so successful?

In Belize, community-based conservation is empowering local tour guides, fishermen and volunteers with the skills and resources needed to save the Belize Barrier Reef.

Co-ordinated by the Belize-based non-profit Fragments of Hope, the coastal community of Placencia Village in Stann Creek District, southern Belize, has spent over a decade planting hundreds of thousands of fragments of coral amongst hurricane-ravaged reefs. Guides, fishers, divers and snorkellers are trained to plant coral and monitor its development under a community-focused system that's seen coral coverage in protected areas off the coast of Placencia rebound from 6 per cent to 60 per cent.

Placencia has become one of the most successful and long-lasting coral regeneration sites in the world, and the community-based conservation model is now being expanded in order to protect and regenerate large swathes of Belize's vast, but endangered, barrier reef. The reef system is the second-largest in the world. Stretching for 190 miles along the coast of Belize, it is home to hundreds of species of coral, fish, turtles, molluscs and marine mammals.

#### 14 fall through ice on northern lake, including 4 month old baby

Seven adults and a four-month-old baby, all Italian tourists, fell through the ice on the surface of a northern Italian lake during an Easter Monday hike and the little boy was reported as being in a serious but not life threatening condition in an Innsbruck hospital.

The accident happened on Lake Braies, in Alto Adige, and was due to the ice partially melting after temperatures rose. One of the adults was taken to an Innsbruck hospital while the other six were sent to three facilities in Alto Adige.

They were all suffering from hypothermia. Over the Easter weekend a total of 14 people fell into the lake as the ice cracked and gave way. The baby was on holiday with his parents who are from the Milan area. The lake has been cordoned off.

![](_page_20_Picture_2.jpeg)

Bidding war expected for Southwold beach hut

A beach hut is on the market for £250,000 and, if sold, would be the most expensive ever in the town. Flick & Sons estate agent's opening price for the hut, in Southwold in Suffolk, exceeds the previous sale record, believed to be about £150,000.

The wooden hut, called Here's Hoping, is on the promenade below East Street and the town's Sailors' Reading Room. It has no electricity or running water, and people are not allowed to stay in it overnight. Elsewhere in the UK, beach huts have been sold for higher prices, with figures reaching £500,000 in Dorset. However, those ones have got power, water, and local bye-laws allow owners to sleep in them, unlike in Southwold.

East Suffolk Council reported last year that 60% of homes in Southwold were second homes or used for holiday letting and it has introduced restrictions to try to ensure the population of all-year round residents was not "wiped out". Southwold is known for having the most expensive beach huts on the East Anglian coast.

# Trained dolphins protecting Russian ships in the Black Sea

Russia has deployed trained military dolphins at its naval base in the Black Sea – possibly to protect its fleet from an underwater attack – according to new analysis of satellite images.

The US Naval Institute (USNI) reviewed satellite imagery of the naval base at Sevastopol harbour, and concluded that two dolphin pens were moved to the base in February at the start of Moscow's invasion of Ukraine. Russia has a history of training dolphins for military purposes, using the aquatic mammal to retrieve objects or deter enemy divers. The Sevastopol naval base is crucial for the Russian military, as it sits in the southern tip of Crimea which Moscow seized in 2014. According to the USNI's analysis, many of the Russian ships anchored there, while out of range from missiles, are potentially vulnerable to undersea attacks. During the cold war, both the US and the Soviet Union developed the use of dolphins whose echolocation capabilities can allow them to detect underwater objects such as mines.

The US has spent at least \$28m maintaining its own troops of dolphins and sea lions – which are also trainable – to potentially help with conflicts. Dolphins are not the only ocean creatures that Russian military may have trained. A beluga whale spotted off the coast of Norway in 2019 was believed to be trained by the Russian navy. Fishermen reported a beluga whale wearing strange harnesses, which may have held cameras, harassing their boats, pulling on straps and ropes from the side of boats.

# St Ives to stop 'free peeing' to tourists and second home owners

Tourists will now have to pay if they want to use public toilets in one of Cornwall's most popular holiday seaside towns. Over the next few weeks, visitors to St Ives will start having to splash out to spend a penny - but it will be free for locals. St Ives Town Council owns eight public toilets around the west Cornwall town including one which it lets out to a private operator. All public toilets have been free to use for years but they cost the small local authority a fortune to run with water, maintenance and cleaning bills running into the thousands of pounds every year.

The town council said it costs £135,000 a year to run all toilets in the town. This includes cleaning, utilities and maintenance but excludes the labour costs of staff in carrying out repairs. They are open from dawn until dusk and in high season they need to be cleaned five times a day.

The authority said that to ask visitors to pay for a wee will also help pay for vandalism repair which has increased over the past few years. Town clerk Louise Dwelly said: "Many councils across the country are closing their public toilets because of the huge cost but we understand the importance of public toilets to our visitor economy and this is not an option in a seaside town with beaches." To ensure it is fair to locals who already pay over the odds for water, council tax and precept to keep these services running, going for a wee will be free. Mrs Dwelly added: "Local residents already pay for all these costs through their council tax and we don't want them to pay twice."

# Chlorine leak in Olympic Pool hospitalises 29 people

29 people were taken to hospital with breathing difficulties on 23rd March after a "high quantity of chlorine gas" leaked in the London Aquatic Centre swimming pool which hosted the 2012 Summer Olympics.

The London Fire Brigade said around 200 people were evacuated after the chlorine gas was discharged due to a "chemical reaction." The brigade said it took 29 people to hospital and assessed another 48 people at the scene. Most of those affected reported minor breathing difficulties, it said.

The fire service declared a "major incident" and sent a large team of emergency workers including 13 ambulance crews and members of its hazardous area response team. Surrounding roads were cordoned off and members of the public were denied access to the park.

The noxious fumes occurred when the facilities management company took a delivery of pool chemicals, according to the centre's operators. The fumes are thought to have spread quickly as the building's air vents had been kept open to reduce the risk of Covid spreading.

## Barbecues and bottles to be banned along Whitstable coastline

New plans to crack down on anti-social behaviour on beaches will see anyone caught with glass bottles or having a barbecue face a £100 fine. The sanctions will also apply to overnight camping, carrying catapults and dangerous cycling or jet-ski riding along a 14-mile stretch of seafront. Similar tough rules are already in force at a number of parks and beauty spots across the Canterbury district, but now city council bosses want stronger enforcement along the coastline, from Herne Bay to Whitstable. The bottle ban follows reports of swimmers finding shards from smashed glass in their feet.

The new rules will prohibit anyone from being in possession of any glass bottle on any beach on the district's coast, unless the bottle is being carried in transit.

The clampdown is part of the city council's proposed new public space protection order which is set to launch this summer and cover the coastal strip between Seasalter and Reculver.

#### China sets new record for rising sea levels

China's sea levels reached their highest on record last year, swelled by rising water temperatures and the melting of glaciers and polar icecaps, according to its latest government report. Coastal sea levels were 84 mm (3.3 inches) higher in 2021 than the average over the period from 1993 to 2011, the National Marine Environmental Monitoring Centre said in an annual bulletin.

The report, on the 7th May, warned that rising sea levels brought by climate change were having a "continuous impact" on the development of coastal regions, and urged authorities to improve monitoring and bolster early warning and prevention efforts.

Coastal sea levels around China have now risen by an average of 3.4 millimetres (0.13 inch) a year since 1980, higher than the global rate over the period. Although the temperatures of China's coastal waters fell slightly in 2021 from the previous year, they were still the third highest on record and 0.84 degrees Celsius above the 1993-2011 average.

Its east coast cities have begun making contingency plans against rising sea levels, with the commercial hub of Shanghai looking into building new drainage tunnels and tidal gates.

![](_page_21_Picture_0.jpeg)

# Dolphins have novel way of treating infections

Dolphins may be treating their own wounds and infections by rubbing themselves against corals and sea sponges that have antibacterial properties. Many marine mammals, such as orcas and beluga whales, rub their bodies against underwater materials like sand, pebbles or limestone, perhaps to help shed the outer layers of their skin in the summer. But similar behaviour has been less well studied in dolphins.

Angela Ziltener at the University of Zurich, Switzerland, and her colleagues filmed Indo-Pacific bottlenose dolphins in the Red Sea off Egypt queueing up to rub against specific corals and sea sponges. They noticed that the dolphins would repeatedly rub certain body parts on the corals and sponges and that some of the corals released mucus as the dolphins swam past, so they suspected the animals might be self-medicating.

"They always come back to the same organism and they are really rubbing different body parts on them," says Ziltener. "It's not observed in sand or in seagrass, for example; it's a different behaviour, queueing up and waiting for their turn." The researchers took samples of gorgonian coral (Rumphella aggregata), leather coral (Sarcophyton sp.) and a sea sponge (Ircinia sp.), then analysed them using a high-resolution spectrometer in the laboratory to identify chemicals in the samples. They found 17 bioactive compounds

with antibacterial, antioxidant or hormone-like

properties.

Sunbathing seals do not need rescuing

Beachgoers have been asked not to call the coastguard if they see a seal on the shore because they are likely to be sunbathing rather than injured. HM Coastguard has been inundated with calls in recent weeks, particularly over Easter, from beachgoers who suspected seals of being injured or ill.

The sunny weather in April is likely to have brought the seals to sunbathe on the shore. They are semiaquatic, spending time both on land and water, and come ashore to relax as well as breed during the autumn and winter months.

Steve Cox, the HM Coastguard senior maritime operations officer, said: "We've been receiving a huge volume of calls over the past few days about seals on beaches which have turned out not to be injured."

"Please think before calling 999 and asking for the coastguard about a seal that just happens to be on a beach unless you really think it is hurt, as it could take up time that we need to deal with real emergencies. Seals on beaches aren't necessarily there because they are hurt, and if you approach them they can respond aggressively."

![](_page_21_Picture_12.jpeg)

#### Barbecue boat business agreed by Chester Planners

A floating pontoon for motorboats where people can have barbecues and drink alcohol on the River Dee in Chester has been given the go-ahead despite fierce objections.

It comes just a few days after it was reported that business owners on The Groves in Chester claimed that the plans would be in breach of a 200-year-old covenant. A number of business owners and local organisations have expressed concerns about the plans, saying that they are in breach of the historic covenant and could impact on access to the river and even future Chester regatta events.

Despite those concerns, as well as objections being raised by local residents and a number of rowing clubs, Cheshire West and Chester's planning committee voted in favour of the plans when they met on the 17th May.

A floating pontoon will be installed which will moor two circular motorised boats known as bbqdonut boats, and a third, safety boat.

Customers will bring and cook their own food on the boats. Alcoholic beverages will be provided by the business.

A report to the committee said the pontoon was 'not out of character' in the area. It added: "The concerns around inclusion of two additional boats (plus safety boat) to the river is noted, however it is not considered to tip the balance of significantly affecting other river users, especially when balanced against enhancing the existing tourism offer and having regard to the aims of the Chester Waterway Strategy."

![](_page_21_Picture_20.jpeg)

#### Isle of Man hoping to grow artificial reefs

Ramsey Marina will be protected by an artificial reef powered by renewable energy. According to Ramsey Marina Limited the first reefs, invented by CCell Renewables, are expected to be installed in 2024/25.

They will be placed at the base of the marina breakwater to protect the walls from erosion and create a new habitat to enhance marine biodiversity.

Work on the £100m project is expected to start within the next two years, which includes a hotel and restaurants, yacht repair yard and leisure facilities.

The technology uses low-voltage electrolysis to draw out natural minerals from the seawater, which then build up as solids around a steel frame. Rocks made from brucite, a form of magnesium hydroxide, and aragonite, a form of calcium carbonate, will form the basis of the reefs, which can then become habitats for corals, oysters and seagrass, an important carbon store. The process grows rock at a rate of around 2.5cm/year. Ramsey Marina is awaiting permission to proceed from the islands parliament, the Tynwald.

#### Paddlers' Code for England

An official Paddlers' Code for England is set to advise canoeists, kayakers and stand-up paddle boarders to "change in a discreet and considerate way" to avoid being seen naked in public in the English countryside. The guidance calls on those enjoying the UK's waterways to behave appropriately around local residents and asks people to be "respectful" when changing into kayaking gear outside.

Ben Seal, the head of access and environment at British Canoeing, said: "If you go paddling there's not changing rooms everywhere, so people get changed in their car, behind their car, behind a bush. It's about being respectful of local residents and anybody who passes by."

The new rules come after councillors in Totnes, Devon, revealed in May 2021 they had received messages from concerned locals about the increasing number of kayakers and swimmers undressing publicly. One local said she had "never seen so many naked people".

Addressing a town meeting, ClIr Allegra Galvin said: "They get out of their cars and get changed into their wetsuits on the pavement. If you're walking out of your front door, that's not what you want to see."

The summer could cause more paddlers to strip off according to another councillor who said: "It's getting warmer, so I imagine there will be more naked bodies."

The new guidance will also promote safety and instruct those taking to the water to wear a buoyancy aid and to notify the Environment Agency of any pollution in rivers and lakes. This is the first addition to the new Countryside Code which was launched last year.

![](_page_21_Picture_33.jpeg)

![](_page_22_Picture_0.jpeg)

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# SUMMER 2022

# event report e

# Water Management Society Water Reflections Webinar Series

Thursday 28th April 2022 - Compliance is not the goal of risk management Presented by Dr Richard Bentham and chaired by Linda Hannah

The webinar had an earlier start time of 9am and Richard of Built Water Solutions sent greetings from Australia as he opened his talk noting that it was a great pleasure to contribute to WMSoc and that he was looking forward to sharing ideas and information with other members.

The webinar discussed the work being undertaken to manage water systems and compared when this is done for risk management or purely for compliance reasons. Richard started by covering what is compliance? Noting this is normally a governmental initiative and noted that Legionella is quite unique as the only micro-organism that has regulations specific to it around the world. Legionella is covered in public health acts, state and federal acts, and Richard noted that they are created in reaction to a perceived risk, normally after something has happened.

As most Legionella regulations are created following an outbreak they are always reactive which means that the research behind them is limited. Richard noted that rule of thumb interventions become legal requirements but are often based on limited evidence and it is very hard to remove rule of thumb from regulations at a later time even without the evidence to back them up. Given this generic approach with a one size fits all focus it is impossible to capture things that haven't yet been identified which means that there are constant revisions as new outbreaks take place.

Providing minimum legal requirements makes regulations difficult to manage, and if requirements are not enforced or are set in a way that are unenforceable there is no point in having them. In addition the reactive nature of compliance is to fix a problem quickly. A rolling review is almost unheard of with a few exception. Richard noted that there is little evidence that compliance prevents disease, and felt that compliance may not be enough.

#### Next he asked 'What is risk management?'

This is a different approach to compliance by continuing the conversation with published evidence and keeping up to date with changing information. This encompasses a duty of care and duty of assessment. It will cover where compliance is impossible and how to deal with the non-compliance, ensuring that things outside the scope of compliance can be reviewed and a plan can be put in place to cover those for the duty of care.

Compliance issues where risk management would be useful. Richard talked at length about residence times of water within a building noting that the water utility companies provide 'safe' water but that once this passes the meter it becomes unsafe. The water will change once it enters the building as the temperature, flow, surface area to volume ratio etc will change. Green buildings in particular increase residence times which cause increased temperature gains, and residence times is a key point in biofilm build-up. Richard noted that the residence times may be different within a single system as the water reaches different areas with different usage patterns.

Of particular interest in residence times are dead-legs which are defined as areas of low or no flow. These prolong stagnation but are an integral part of the system and may service little used outlets. They will collect debris and sediment and are still connected to the water systems and create a reservoir of contamination for the whole system.

Richard had a particular aversion to sensor taps which have a large number of components and are difficult to flush and felt that restricting their numbers would be good. He also noted that flow restrictors in showers to reduce water use harbour many bugs, and disconnected elements within a system create blind ends. Long pipe lengths also cause flow and temperature issues and noted that compliance documents require up to date system plans but these are rarely available.

![](_page_23_Figure_15.jpeg)

Richard shared some data taken from ~800 positive samples taken between 2013 and 2015 and noted that basins provided the most frequent positive Legionella results. They were expecting it to be showers, but realised that the reason behind the figures was that basins do not get flushed for very long when used as the average handwash is only 20 seconds so the water is not pulled completely from the circulating loop to the tap. In South Australia the average shower is 3 minutes which ensures that the dead-leg is being dealt with at least once per day.

Richard talked about the issues of cold water compliance, especially in Australia where incoming water is already above the 20°C requirement for many months of the year. He noted that there was no evidence that Legionella does not multiply below 20°C and cold or chilled water in many instances was at as much risk as hot water, suggesting lagging to reduce heat exchange as a possible solution. He noted that in Australia cold and hot water systems accounted for more disease than warm water systems and reported that Legionella does survive and multiple up to 50°C and will survive for short periods at up to 60°C or 70°C. he warned against pasteurisation as this will increase the number of temperature tolerant Legionella which are more virulent. He then shared images of a number of micro-organisms which survive higher temperatures and are able to support Legionella growth. He shared details of Legionella not in biofilms surviving at 55°C for 5-7 minutes which is longer than thought or noted in compliance documents.

Richard noted that water sampling is required for compliance but that it lacks uniformity, with no guidelines on volume in Australia or USA. He felt that the volume matters as it determines what you are sampling and asked 'Are you sampling the outlet, the loop, or the whole system?' Knowing what you are sampling and what you will do with the results is imperative. He warned against sampling

![](_page_24_Figure_2.jpeg)

because everyone else is, without a sampling plan and an understanding of the results, and noted that live non-culturable counts will not show on the test results but may still inoculate someone or the system. There was also a question on what the numbers mean and Richard felt that in compliance these log numbers are important to reaching KPIs but in risk management the numbers are used to verify that the goals are being reached.

![](_page_24_Figure_4.jpeg)

From the graph above Richard noted that 70% of the Legionella sample results are on the detection limit with only 5% in the high. The blue line shows the results set as a normal distribution on a bell curve.

He noted that Legionella predominantly live in biofilms not multiplying free in the water. They grow in amoebae and follow the Poisson distributions in water. Richard noted that when sampling, if you find any Legionella in the free flowing water you definitely have an issue!

Control is not a static process, as the Legionella will adapt to whatever controls: temps, disinfection, flow rates, you put in place, so you need to continue to monitor and control the system.

The question then of 'why bother with risk management?' can be easily answered as it can meet your compliance requirements. It will deal with your legal liability, reduce the risk, prove duty of care and increased resilience will reduce costs as crises are costly. Richard notes that compliance is still a good idea and a cost effect exercise as according to a study of 45 multinational companies non-compliance is 3 times more costly than compliance. Richard quoted that G4S were fined \$1.8m for non-compliance, no cases of disease were linked to the site in question, but they were fined as they failed to protect from the risk of exposure.

Richard noted two approaches to compliance, Authoritarian where everything is mandatory and you tick boxes to prove compliance or Authoritative using water safety plans, risk based testing, reviewing, reporting and revising. The level of compliance is the same for both approaches, but exceeding compliance is more likely to happen with the authoritative approach.

In summary, compliance is a generic start

- It does NOT mean control
- May be unachievable
- May be outdated

- May not be evidence based
- Is necessary from a due diligence perspective

Risk Management fills the gaps

- Tailored to a unique system
- Identifies control issues
- Provides a workable plan
- Relies on current evidence

Richard concluded with the advice that a good risk management plan may not be fully compliant, but will address the control issues. Risk management addresses the system beyond the compliance requirements and is proactive. Compliance is static, which is hard to turn into something proactive.

The question and answers following the webinar and the recording can all be accessed via the members area of the WMS website. Our next webinar, on the subject of BG50, is available to book online. Please let us know if there is something you would like to see in a future webinar at: <u>events@wmsoc.org.uk</u>.

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# CLOSED SYSTEM WATER TREATMENT: BG 50 & VDI 2035

**BSRIA** 

Following the 2021 release of the 2nd edition of Water Treatment for Closed Heating and Cooling Systems (BG 50/2021), BSRIA Engineering Investigations Lead, Chris Thompson, addresses frequently asked questions about what BG 50 is and how it relates to the VDI 2035 standard.

# What needs to be done to ensure the water quality in closed water systems doesn't lead to deterioration and possibly failure?

This can be a complex subject and BSRIA Guide BG 50/2021 introduces the current theory and practice.

BG 50 applies to closed heating and cooling systems, providing guidance to achieve a well-maintained, functional closed water system. The guide includes a detailed outline of some of the methods and technologies used and provides an explanation of the science behind water quality and its importance in system maintenance. It is important to note that BG 50 is a guide and not a standard or regulation.

# Should I use VDI 2035 or BG 50?

VDI 2035 and BG 50 should not be treated as comparable documents – they serve different purposes. Being aware of the differences between the documents is key to understanding and using each of them correctly.

VDI 2035 is a German standard, which has been widely used in Germany for many years and has grown in popularity in the UK, partly due to its non-chemical approach. There are currently two parts to VDI 2035, Part 1 and Part 3, with Part 2 having recently been withdrawn and its content included in the updated version of Part 1, which was published in March 2021.

VDI 2035 Part 1 Prevention of damage in water heating installations, Scale formation and water side corrosion is applicable for closed water heating systems and focuses on limiting damage caused by scale and water side corrosion in closed hot water heating systems with temperatures up to 100°C. Like BG 50, it contains a background of the scientific principles behind corrosion and scale formation, with particular attention drawn to the importance of oxygen in corrosion processes. This document places an emphasis on the fill water quality and reducing oxygen entry into the system, the main driver of corrosion processes. The chemical inhibitor addition method is referred to in VDI 2035 Part 1 as being a last resort to manage a system's water quality where the electrical conductivity and pH of the fill water cannot achieve the levels recommended in the standard.

In the UK, the chemical inhibitor addition method is widely used to prevent corrosion issues, commonly alongside other methods. This has been proven to work but, as with other methods, if it is poorly managed or implemented, it can also lead to corrosion problems. The chemical inhibitor addition method does give resilience in terms of fill water and allows for unexpected entry of oxygen by passivating the metallic surfaces or binding with the free oxygen. Once adequately protected, the system should not require further chemical addition unless other factors deplete the chemical such as the presence of bacteria or the loss and replenishment of system water. As building services engineers will be aware, mistakes in management, often due to lack of knowledge or infrequent monitoring, can lead to the failure of this method.

One particular issue that is frequently reported to cause excessive air ingress leading to corrosion is incorrect pressurisation. To this end, BSRIA is working with industry to produce guidance on correct design, specification, installation, commissioning, operation, and maintenance of pressurisation in closed heating and cooling systems.

# Where does Water Treatment for Closed Heating and Cooling Systems (BG 50/2021) sit?

BG 50/2021 includes guidance on some of the technologies used to achieve compliance with VDI 2035 Part 1 but leaves details of achieving compliance to the standard itself. The role of BG 50 is to provide guidance on the science, technology, and management principles to allow the reader to make an informed decision or to help understand why a particular approach has been taken by the water treatment specialist. This may include chemical inhibitor addition, electrochemical water treatment, mechanical filtration, deaeration or a mixture of many methods, dependent on the system and its requirements. There is no one-size-fits-all approach for water treatment of closed heating and cooling systems.

To summarise, BG 50 is an overarching guidance document, outlining multiple methods of water treatment, the science and surrounding technologies involved in closed water systems. VDI 2035 Part 1 is a standard predominantly focussed on one method and the associated background science of treating and maintaining hot water heating systems.

Scientifically, the VDI 2035 approach is sound and through further adoption, education, and time, the application of this methodology across a range of materials and system configurations will be more widely and fully understood in the UK.

The current edition of BSRIA's guide on the water treatment of closed heating and cooling systems, BG 50/2021, can be purchased from the BSRIA Bookshop, with free downloads for BSRIA members.

An English translation of VDI 2035 Part 1 can be purchased from <u>www.beuth.de</u>.

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# 40th anniversary - Healthcare Infection Society (his.org.uk) 19th May 2022, BMA House, London

The Healthcare Infection Society (HIS) held its belated 40th Anniversary celebrations on 19th May 2022 at BMA House in London. The event had been rescheduled from 2020 due to the COVID-19 pandemic and 100 guests attended.

The sessions reflected on the last 42 years and looked to the future from past learning. The Society was formed in 1979 with their first scientific meeting following in early 1980 and the first issue of the Journal of Hospital Infection (JHI) being published in March of that same year. This issue included an article regarding an outbreak of Pseudomonas aeruginosa and many of the

presentations reflected on a certain amount of lack of learning. At their inaugural AGM in 1981 they had a membership of 264, they now have over 1300 members.

There was a fascinating BioArt and Infectious Disease exhibition by the award winning and internationally renowned Anna Dumitriu, whose work fuses sculpture, craft and bioscience. She creates her artworks in the laboratory as well as her studio, using microbiological techniques to create intricate artworks.

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# An Overview of Some Water Treatment Processes, Phosphonates, and Polymers for the Oil & Gas Industry, in an Era of Water Recovery and Recycling

Colin Frayne, CSci, CChem, CEnv, CWEM, FRSC, FICorr, MCIWEM, FWMSoc, LRIC, CWT. Consultant, Aquassurance, Inc. Barry B. Ekstrand, P.E., President & COO, Finoric LLC June 2022

### Abstract

As a result of global population growth and an increased demand for energy and good quality water, the demand and supply positions for vital resources (especially water) varies considerably from country to country; but globally, freshwater withdrawals have increased six-fold over the last 100 years, and we all face an uncertain future due to critical worldwide water shortages and quality problems. In view of this crisis, this paper focuses on the oil and gas industry and their relatively large usage of water (e.g. for hydraulic fracturing fluids). It provides an overview on the types of standard water treatment separation processes available to implement the 3-Rs (i.e. Reuse, Recycle, Reclaim), and aims to further reduce water consumption. Additionally, this paper provides some guidance notes on the benefits, limitations, and application of phosphonates, polymers, and other waterside chemical inhibitors and performance additives, for selection by water treatment practitioners when confronted with more complex brine water chemistry.

## Background to population growth and an increased demand for energy and good quality water

Demographics tell us the number of people in the world increased more than 4-fold during the 20th century, and so we may ask what will humanity's future looklike.1 Unfortunately, beyond trends on future population growth, it remains extremely difficult to predict with much certainty the future of the world's inhabitants. However, it is clear that the threads of mankind are closely intertwined with our impact on the natural environment, pandemics and other catastrophic events, fertility rates, and access to space, food, health services, education, and other resources.<sup>1</sup> It seems very unlikely that mankind's demand for energy and good quality water will ever diminish.

In spite of the politics of climate change and activist calls for a reduction in the world's dependence on fossil fuels - in favor of nuclear energy, solar and wind power, and other sustainable energy sources - global demand for crude oil (including biofuels) has in recent years been continuously climbing by approximately 10% per year. In 2006 daily global crude oil demand was 85.3 MMB/D. At the time of this writing in 2022, daily global crude oil demand is estimated to be 96.5 MMB/D, and the estimate for 2026 is 104.1 MMB/D. The only fall in demand in recent history was in 2020, when usage dropped to 91 MMBD due to the economic and mobility impacts of widespread shutdowns across the world, due to the Corona virus pandemic.<sup>2</sup> Specific to the US, the Energy Information Administration (EIA) estimates that about 2.70 billion barrels of crude oil were produced directly from shale (tight) oil resources in 2020. This is equivalent to about 7.37 MMB/D - and equal to about 65% of total U.S. crude oil production - which shows how important unconventional resource development of shale oil (and gas) production is to the total annual output of US hydrocarbon production.<sup>3</sup>

The demand and supply positions for vital water resources vary considerably from country to country, but globally, freshwater withdrawals for agriculture, industry, and domestic/municipal use has increased six-fold over the last 100 years or so, with a sharp rise from the 1950s onward. Since 2000, however, the annual increase in global water withdrawals appears to be plateauing, or at least decelerating, at around 4 trillion cubic meters per year (nb: 1 cubic meter = 264.172 US gallons). However, it is clear that most conventional renewable water resources are declining in both output and quality in many countries as a result of population increases. Today, water shortages are affecting more than 3 billion people, and the amount of freshwater available per person has

plunged by a fifth over the last two decades.<sup>4</sup>

In the US, water use in 2015 was estimated to be about 322 billion gallons per day (Bgal/d), which was 9 percent less than in 2010. The 2015 estimates put total withdrawals at the lowest level since before 1970, following the same overall trend of decreasing total withdrawals observed from 2005 to 2010.<sup>5</sup> This lower (i.e. improved) water withdrawal position is likely due to significant changes in agricultural and horticultural irrigation practices, including use of surface- and sub-surface drip irrigation techniques. Additionally, in order to reduce demands on freshwater use, we see water/wastewater recovery, recycling, reinjection, purple pipes, and other water reuse techniques being increasingly practiced by municipalities and industries of all types. We are also seeing an increase in the commercial application of a wide range of modern water and wastewater treatment technologies that barely existed 30 or 40 years ago -particularly those processes that incorporate polymeric membranes, such as wastewater membrane bioreactors (MBR), seawater reverse osmosis (SWRO), and electrochemical deionization (EDI).

The integral relationship between hydraulic fracturing and water Hydraulic fracturing treatments aim to stimulate (increase the productivity) of low permeability oil and gas wells by creating a propped fracture (a crack in the reservoir rock) extending deep into the reservoir from the wellbore. The fracture is created by pumping a hydraulic fluid at high pressures that cause the reservoir rock to fail, creating the fracture at the wellbore and then extending it into the reservoir. Sand or other propping agents are pumped into the fracture during the frac treatment, which holds the fracture slightly open after the frac job is completed. The resulting propped fracture is highly-

![](_page_30_Picture_2.jpeg)

conductive, which allows reservoir fluids to flow into the wellbore at much higher rates than those of non-stimulated wells.

The first frac job was pumped in 1947, and the early frac jobs were just a few hundred gallons in volume – a miniscule size by today's standards. Just about every fluid imaginable has been used as the base fluid for a frac job, with napalm (gelled gasoline) being used on the first job, and also including crude oil, gelled oils, inorganic and organic acids, acid/ water/oil emulsions, foams...but the vast majority of frac jobs have used water as the base fluid, both fresh and brine, and both gelled and ungelled. Not surprisingly, water brings a number of benefits over the other alternatives:

- Water is benign, and much safer to work with.
- Water is generally far more plentiful and available.
- Water usually has a much lower cost.
- Water is a great solvent that can carry multiple desired chemistries into the reservoir.
- There are a larger variety of available chemical additives that allow for easier adjustment of the waterbased frac fluid physical properties.

A fundamental design concern for frac treatments is compatibility between the frac fluid and the reservoir rock mineralogy and reservoir fluids. For example, in the presence of fresh (nonbrine) water, smectite and mixedlayer clays will swell, while **illite** and kaolinite clays will break apart and migrate. The result in each of these cases can be a significant reduction in reservoir permeability due to plugging of pore throats in the rock caused by these physical changes in clay structure. Creating an artificial brine by adding an appropriate amount of a compatible salt (such as *potassium chloride* or a "KCl substitute" such as *choline chloride*) to the fresh water will reduce or eliminate these effects. Other potential concerns include dissolution and re-precipitation of iron compounds, precipitation of asphaltic sludge from the oil, deposition of paraffin (wax) from the oil, creation of emulsions with the oil, and creation of water blocks in the reservoir. Suffice it to say that ensuring compatibility between the water-based frac fluid and the reservoir

is critical. Intuitively, the ideal frac fluid would be made with a base fluid that is from (or mimics the composition of) the native reservoir water. For many years each frac job was designed with the specific well, formation rock properties, and other reservoir parameters in mind. This effort, along with a continual focus on maximizing the commercial value of the frac treatments, led to treatment volumes growing significantly over time. By 1980, frac jobs using over 100,000 gallons were common, and very large treatments of ~1,000,000 gallons were sometimes occurring. Treatment volumes continued to grow throughout the 1980s, 1990s, and into the early 2,000s, with most frac designs incorporating relatively expensive high viscosity fluid systems. These fluid systems were designed to suspend the frac sand as it was being pumped so that it would not settle out, but rather would be carried far into the fracture so the fracture would be propped open deep into the reservoir.

By the mid-2000s, oil and gas shale drilling was growing rapidly. Shale frac designs deviated from the historic frac design approach in several significant ways:

- The viscosity of the base fluid would not be raised, so no viscosifiers / gelling agents were added.
- Because viscosity was low, enhanced sand suspension was lost. As a result, the frac jobs needed to be pumped in high turbulent flow (i.e., at much higher pumping flow rates). Use of polyacrylamide-based friction reducers (FR) to reduce the treating pressures of the frac jobs grew exponentially.
- The size of the frac sand being pumped became smaller due to lower terminal settling velocity and ability to carry it farther into the fracture before settling out.
- Well completions increasingly moved into a "manufacturing mode" where the same frac design was pumped on each job. Operational efficiency (amount of time to pump each frac job) became a primary focus.

• Correlations were seen between larger frac job sizes and higher well productivity, leading to another large uptick in treatment volumes. Today, shale frac job sizes have grown, along with wellbore lengths and number of frac stages per well, such that tens of millions of gallons of water may be used for the completion of the wells on a single drilling pad. As the demand for larger and larger volumes of water grew, a number of issues became problematic and critical:

- In some areas, access to the necessary volumes for the frac jobs became increasingly difficult to find.
- The cost of sourcing these large volumes of fresh became significantly large.
- The cost of disposing of these large volumes of water during flowback after the frac job always a concern in the past now became extremely high.
- As a result, recycling and reuse of the previously-used frac water and produced water became a necessity.
- Rising TDS levels resulting from recycling may cause a reduction in efficacy of certain frac fluid components, such as FR. In some cases dilution with additional fresh water to reduce the TDS below a particular threshold may solve the issue, while in other cases a change in FR chemistry may be required.
- Recycling and reusing frac water and produced water ultimately means dealing with all of the challenges of effective water treatment: the need to clean up brine water containing high TDS and high TSS, at times along with dissolved iron, residual oil, residual chemicals, and/or contamination with bacteria.

The number and size of frac jobs pumped annually is expected to continue to grow in the coming years, which means that the water volumes required to make up the frac fluid will continue to increase. Effective treatment and cleaning of recycled frac and produced water for reuse in frac treatments will not only remain a critical aspect of the frac job execution for years to come, but it will be a necessity and required enabler for economic and social viability of the drilling and completion of new oil and gas wells.

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# A golden age for shale plays and wastewater recycling

Given that the process of unconventional development, including hydraulic fracturing of shale for oil & gas production in the U.S., is equal to about 65% of total U.S. output, there is no doubt that we are in a golden age for shale plays (within the industry, hydraulic fracturing and the created fractures are known as frac'ing and fracs). The rise of North American shale oil & gas production has brought game changing predictions about supply and demand, and with it, key players with technologies and expertise to unlock previously inaccessible shale resources.6 The Independent Petroleum Association of America (IPAA) informs us that hydraulic fracturing has been safely used in the United States since 1947 and more than 1.7 million U.S. wells have been completed using the frac'ing process. Indeed, the EPA has stated that unconventional oil and natural gas plays a key role in our nation's clean energy future.7

However, oil and gas production obtained from shale plays uses a lot of water! Depending on the play, a well may require from 2 to 5 million gallons or more before completion, of which 80-90% is used for fracturing and only 10-20% will be typically required for drilling, and other purposes.<sup>8</sup> That is a lot of frac wastewater for potential disposal, and although the EPA advises us there are approximately 144,000 underground injection (disposal) wells for produced water (PW) disposal, some practices can possibly create problems. If injection volumes into disposal wells result in injection pressures that exceed the frac gradient of the injection formation, microfractures can be created that grow vertically into other formations that lie above or below the injection zone. For shallow injection wells, this could include formations that contain potable groundwater, resulting in risks of contamination to shallow groundwater aquifers. Another potential effect of over-injection is the creation of localized micro earthquakes being felt at the surface. With these potential negative impacts, it is clear that effective management of produced wastewater is critically important to ensure positive environmental, social, and governance (ESG) impacts result instead. Adequate numbers of local injection wells must exist and be available to ensure that wastewater disposal injection pressures stay well below formation frac gradients.

Additionally, note that during the sequential oil or gas recovery process, PW emerges as an associated byproduct, containing mainly formation water (FW) and a small portion of frac fluids as flowback. As an example, in the Permian Basin, the PW to oil ratio (PWOR) of shale wells is around three, and for all U.S. plays on average, over 90% of the PW is naturally occurring FW and connate/interstitial water. That is a lot of frac wastewater for potential disposal, and although the EPA advises us there are approximately 180,000 underground injection wells for produced water (PW) injection, some practices can possibly create problems. Currently, the preferred method for disposal of produced water is through permitted Class II water Injection wells, of which 20% are salt water disposal wells and 80% are wells that are enhanced oil recovery (EOR) injection wells. These EOR injection wells include waterflood injection wells (i.e., injection of water to drive oil in the reservoir to producing wells), steam injection wells (to thermally thin and drive viscous oils), and water alternating gas (WAG) injection wells or simultaneous water and gas (SWAG) injections wells (both are techniques to improve the sweep efficiency of waterfloods or gas floods. The alternative to disposal of frac fluids is wastewater capture, treatment, and reuse - for new frac jobs, irrigation, cooling water, or other purposes. This recycling practice has been growing year over year in output volumes. However, in view of the continuing global importance of oil & gas, produced by both conventional and unconventional means, and the need to move closer to a water-secure and net-zero world, it is important during new well development and production to aim to use even less fresh water and associated chemistries. Thus, in the oil & gas industry, it is also necessary to recover, treat, and reuse as much PW, FW, and flowback frac fluids and blends as possible.

"Water, Water, Everywhere, Nor Any **Drop to Drink**" Rhyme of the Ancient Mariner, by Coleridge.

# The Three R's of Water: Reuse, **Recycle, Reclaim**

This water reuse, recycle, reclaim focus is of significant business interest to both large and small service companies in the oil & gas and water treatment chemical/ equipment fields. These firms tend to operate in several specialist niche sectors and geographies within the global oil & gas support services market, and may offer separation processes, such as oil/water separation, evaporative water recovery, or wastewater clarification. Specific performance chemicals "packages" may be required, to perhaps include demulsifiers (treaters, droppers, and hybrids, etc. to destabilize/ break/ flocculate/ coalesce water-in-oil emulsions), reverse demulsifiers (to break oil-in-water emulsions), reverse emulsion breakers (REB), to break complex water-in-oil-in-water (W/O/W) emulsions; and also, gas hydrate inhibitors, surfactants, antifoams, coagulants, flocculants, precipitants, piping corrosion inhibitors, and antiscalents.

Prior to more recent history, chemistries for slickwater generation, proppant support, and some limited water treatment for scale, corrosion, microbiological, and/or general fouling inhibition, were typically primarily focused on treating a wide range of fresh waters, with perhaps less emphasis being given to treating the scaling tendencies of re-injected (and usually diluted) recycled brines. This focus is changing, and more applications expertise is often now available for managing the native reservoir brines that will be produced in the future. Service companies offer expertise in working with their arsenals of complex (and now usually more ecofriendly) chemistries and formulations, in order to modify produced brines for reuse as frac fluid bases. Some service firms may also be active with remedial stimulation of existing producing wells - which traditionally has been a smaller focus for business development opportunities, but is expected to grow in the future. Similarly, growth is also expected for novel or "green" production chemistries, and their application in optimizing repurposed brines and other industrial waters for reuse.

However, it is a mantra that consideration of the formation rock surfaces and mineralogy is very important and must always be a primary consideration when formulating new chemical treatment products. Nearly everything injected into a well is foreign to it, so there is a need to fully understand the likely impact of fluid constituents on the rock and its associated environment. This means that a comprehensive analysis of all fluid interactions with the formation rock and its environment is the first need. It is well understood that produced water quality

#### feature article

![](_page_32_Picture_2.jpeg)

varies from play to play, and no single technology exists that is best for treating all produced waters in all operating areas, such that it can be recovered for blending or direct reuse. More than this, operators understand that to produce a laboratory analysis of water quality and contaminants is not particularly difficult, but its interpretation and what this ultimately means in terms of slick water and other frac fluid chemistries can be challenging. The question of how best to implement any specific frac job using fresh or recycled water, and precisely what type of processes may eventually be required to treat the volumes of produced water that are ultimately evolved thereby implementing the three R's of water - reuse, recycle, reclaim are altogether more critical and arduous tasks to perform. Firstly, what chemicals are present in the frac fluid?

Frac fluids potentially contain a wide range of additive chemistry products that vary in composition from play to play, such that each additive is itself a formulation of performance chemistries, collectively providing a task-specific component of an overall fracturing fluid program. Beyond the addition of primary ingredients, such as, say 0.2-2.0% of KCl or substitute in the base water, 5-15% or so of fracturing acid employed (usually HCI), and the many tons of varying size, shape, and strength of crystalline silica sands, or other ceramic proppant (of typically, 0.1 to 0.2 mm diameter), the total formulated performance additive packs may comprise perhaps 0.3 -0.75% by volume (3,000-7,500 mg/L, or ppm) of the base frac fluid.

Chemistry additive components for hydraulic fracturing fluids may include some or all of the following materials:

**1. Surfactant:** Used to reduce oil/ water surface tension, such as a PEG methyl ether, or similar.

**2. Gelling agent:** Typically, guar gum or a derivatized guar-based polymer such as hydroxypropyl guar (HPG), carboxymethyl hydroxypropyl guar (CMHPG). Other polymers that may be used include hydroxyethyl cellulose (HEC) and xanthan gum. In all of these cases the purpose of the gelling agent is to increase the frac fluid viscosity and help support and carry the proppant. Non-derivatized guar gum is used in the vast majority of water-based frac jobs requiring significant viscosity. Other types of gelling agents include those for oilbased frac fluids, such as phosphate ester surfactants (e.g. dialkyl phosphoric ester) – or phosphorus free gelling agents, may be used to recover or enhance production output.

# 3. Gelling agent cross-linker:

Typically zirconium, titanium, or borate-based. These create or improve the polymer network and system viscosity. Uncrosslinked guarbased polymers (commonly called "linear gels") may become thinner with an increase in temperature, so a cross-linker can aid viscosity stabilization.

# 4. Slickwater friction-reducer

(FR): Fracturing fluids need sufficient viscosity to create and open a fracture, but must also have a low friction coefficient. Linear gels typically generate 12 – 18 centipoises (cPs) of viscosity, where crosslinked gels can generate viscosities of 500 - 4,000 cPs or more. For many unconventional shale formations, however, low viscosities of only 1-5 centipoises (cPs) may be all that is required and desired, although in some cases a High Viscosity Friction Reducer (HVFR) may be used to generate viscosities in the 8-13cPs range. In either case, FR or HVFR yield relatively low frac fluid viscosities. Because shale frac designs show a preference for low viscosities, the terminal settling velocity of the frac sand particles is relatively high, and results in the frac sand settling out quickly in the typical shale frac design. Since it is desirable to achieve a higher propped frac length (that is, to pump the frac sand grains farther into the fracture from the wellbore before settling out), the frac fluid pumping rate must be very high (typically 80-140 bpm) on shale frac jobs in order to achieve adequate propped frac length. At these levels of pumping rates, friction pressure becomes high and friction reducers are necessary to lower the frac job pumping pressure. In some cases a lightly gelled linear guar is used, but FR and HVFR are generally preferred because they are able to lower the friction pressure to a greater degree at a lower cost. FR and HVFR can lower the friction pressure by 60-80%, depending on the water salinity and other chemical presence. FR and HVFR chemistry are typically based

on polyacrylamide (PAM) or PAM/AM copolymers.

**5. Live breaker:** Ammonium persulfate [(NH4)2S2O8] and other oxidizers break the polymer network and reduces the viscosity of a fracturing fluid (ideally) following the end of each frac stage to help flow the well back. The breaker oxidation reaction speeds up significantly with increased temperature and increased breaker concentrations, so designing an optimized breaker schedule for the specifics of each frac job is desirable.

## 6. Encapsulated breaker:

To ensure the breaker does not reduce frac fluid viscosity too early, encapsulated breaker can be used. Encapsulated breaker consists of a time-release coating or encapsulation of ammonium persulfate [(NH4)2S2O8] that results in a slower release of the oxidizing breaker. This allows the designed concentration of oxidizer to reach the tip of the fracture at full strength before releasing, so the entire fracture sees a uniform viscosity degradation after completion of the frac job.

**7. Corrosion inhibitor:** Typically, long-chain ethoxylated fatty acid alkylamine film formers, used to reduce the corrosion resulting from acids being pumped down steel casing and tubing (pipes) that make up oil and gas wells.

**8. Scale inhibitor:** Typically, a copolymer and/or a standard phosphonate, or perhaps a DETA phosphonate, as deemed suitable for management of alkaline earth salts and scales such as calcium carbonate, barium sulfate, etc.

**9. Iron inhibitor:** Perhaps control here might also be served by the scale inhibitor/dispersant, or via a water soluble EDTA, gluconate, terpolymer, or alternatively, by imidazoline film adsorption .In combination with pH control (keeping the solution pH at less than 5), a viable approach can be to use iron inhibitors to prevent oxidation of ferrous iron (Fe+2) to its ferric (Fe+3) form - ferrous iron does not precipitate below a pH of 8.5, but ferric iron (Fe+3) forms precipitates at pH of 3.5 or above.

![](_page_33_Picture_1.jpeg)

**10. pH buffer:** Used to control the pH of a solution. Perhaps a simple chemistry such as hydronium ion/ conjugate base (e.g. a citric acid-phosphate mix), or perhaps the use of a methane/ethane sulfonic acid chemistry.

**11. Biocide:** Used to kill bacteria that is present or can grow in surface tank and systems, or downhole in producing wells. Typically a non-oxidizer gluteraldehyde, quat, or isothiazoline blend.

**12. Demulsifier:** Perhaps an EO block copolymer, ethoxylated alkylphenol, or di-epoxide (all of appropriate hydrophilic-lipophilic balance, HLB), in, say, a methanol or HAN solvent.

As discussed earlier, following frac jobs, produced water containing both formation water and flowback water is most seen, with the proportion of formation water increasing over time. It is common to find that the amount of frac fluid volume recovered to be very low, with a significant amount of the injected volume being "lost" to uptake/ absorption forms of inhibition and/or other mechanisms in the formation. We know that produced formation waters are highly variable within and between shale formations. We also understand that sometimes sampling problems and limitations of some analytical test methods can occur, which adds to problems to be solved.

Table 1, shown below is an example of typical analytical ranges of some commonly found parameters in raw produced water samples. Table 2 also shows a produced water analysis, but this time with a review of analytical constituents and key saturation parameters, as calculated using French Creek ion association modeling software. Results are indicative of which contaminants, dissolved minerals, and potential downstream problems may need to be reviewed when treated produced waters are reused as a fracfluid, or for other purposes such as drilling, cooling, or irrigation water.

• Note that inorganic and wet chemistry tests on produced waters can be affected by very high solids content and other shale matrix complexities.

• Few volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) are regularly detected in produced formation waters. However, when they are seen, benzene, toluene, and xylenes (BTX) are the most common VOCs found, and phenols and pyridene are the most common SVOCs.

• Concentrations of barium and strontium salts tend to rise and fall but generally correlate with total dissolved solids (TDS) results. Chloride represents the most abundant anion.

# Table 1: Example of typical analytical ranges for constituents of produced water across plays

Raw Produced Water samples, reflecting typical analytical ranges of some commonly found parameters					
Parameter	Units	Range of results			
pН	-	4.0 - 7.0			
Electrical conductivity	μS/cm	Not possible due to oil			
Calcium	mg/L Ca	500 - 35,000			
Magnesium	mg/L Mg	500 - 4,500			
Chloride	mg/L Cl	20,000 - 165,000			
Sodium Na	mg/L Na	22,000 - 70,000			
Potassium	mg/L K	1,250 - 1,750			
Strontium	mg/L Sr	60 - 2,400			
Boron	mg/L Bo	20 – 30			
Barium	mg/L Ba	1 – 7			
Iron	mg/L Fe	0.5 – 35			
Zinc	mg/L Zn	0 – 5			
Total dissolved solids	mg/L TDS	45,000 – 275,000			
Turbidity	Neph. TU	80 – 250			
Total suspended solids	mg/L TSS	1,000 - 12,000			

• Concentrations of these various analytical parameters appear to increase with time following hydraulic fracturing activities, and remain at high concentrations in the produced formation water from operating wells in each shale formation.<sup>10</sup>

# CONTINUE READING...

To continue reading this article, please find the stand-alone version, which can be found online on the Waterline website.

![](_page_33_Picture_16.jpeg)

Visit: www.waterline publication.org.uk/ articles/

![](_page_34_Figure_2.jpeg)

# ANSWERS TO THE ARTICLE IN OUR SPRING 2022 ISSUE

# USING HARVESTED RAINWATER

Q1: Why are NTM more likely to form biofilms?

Q2: What would be a suitable height for the draw-off from a rainwater collection tank?

Q3: What type of premises are not allowed to use harvested rainwater?

# • A1: Radon accumulation in underground tanks is a problem in some areas but not others because radon is

naturally occurring in only a few parts of the UK. Mostly the South West, much of Wales, and certain high ground areas throughout England and to a lesser extent Scotland. See UKHSA map as referenced in W046.

• A2: Tank draw-off should be high enough to not entrain sediment, low enough to not draw in surface floating

contaminant. As stated in W046 under 3.0 Risk Assessment. So probably in practice at least 100mm from the base,

- subject to detailed assessment of the system. (Note that in dry times the level may drop quite low or run out altogether,
   so that there will be no perfectly safe place for the draw-off. A well designed system would have to take account of this
   eventuality.)
- A3: Rainwater harvested water is not to be used in healthcare establishments, as stated in HTM04-01. Regarding
   the detail of this, I can imagine a difference of opinion should a healthcare establishment gardener install a water butt
   connected to the gutter down-pipe, for use watering the flowers. I expect some legionella risk assessors would point out
   the prohibition and the reasons for it, while others would take a pragmatic view due to the very low level of aerosol and
   the fact that the water is not used actually inside the establishment.
- We have selected to publish the answers above from Richard Hudson M.W.M.Soc. If you would like to get involved with this issue's CPD activity, see page 15.

# course in brief W258

# **Cleaning & Disinfection of Evaporative Cooling Systems**

This City & Guilds accredited training course has been split out from the hot & cold water systems cleaning & disinfection course and additional detail provided, to give more focus on cleaning of critical evaporative cooling systems.

Providing students with an understanding of the need for cleaning & disinfecting these systems along with how to complete the task correctly. Students attending this course will receive practical experience and advice in carrying out the work and will be able to manage their work safely and effectively.

This course covers the following topics:

- The legislative framework and legislation relating to cleaning and disinfection works and how to comply with it.
- When and why cleans and disinfections are undertaken.
- Competence and the importance of cleaning and disinfecting evaporative cooling systems correctly and safely.
- Information on the importance of: a method statement; COSHH assessment; and task risk assessment prior to carrying out the work.
- Guidance on steps required to complete a disinfection safely.
- Records (a worksheet, condition notes, photographic evidence) compiled during the work
- Instruction on calculation of systems volumes and how to calculate the amount of disinfection chemicals required for the process.
- Chlorine and alternative disinfectants which can be used

The online course W2O2 "Legionellosis Causes and Impacts of Infection" is provided as a free pre-requisite for this course and should be completed prior to attending the classroom training.

This course forms part of the Water Treatment and Risk Assessment qualification routes for Evaporative Cooling Systems qualifications.

# SEE ALL OF OUR TRAINING COURSES AT: www.wmsoc.org.uk/learning GET TRAINED. GET CERTIFIED. GET WMSoc. TRAINING.

![](_page_35_Picture_0.jpeg)

# **bSi.** Updates

# BS E/H 3/4 Committee Meeting 13/06/2022 via Teams:

# **National Work**

**BS 8580 Part 2** and **BS 7592** have been published and well publicised throughout a variety of organisations.

**BS 8693** Water treatment for small volume closed systems in residential dwellings (including apartments) – on hold due to possible overlap with another standard.

Pseudomonas Sampling – Proposal for a new British Standard and call for committee members.

# European work – CEN/TC 230

**BS EN 806-2:2005** Specifications for installations inside buildings conveying water for human consumption. Working revision draft being obtained for review.

# International work - ISO/TC 147/SC4

The following standards are all in progress - expertise is requested for the items marked with \*

**ISO/AWI 7014** - Water quality — Detection and quantification of SARS-CoV-2 in wastewater

**ISO/DIS 7704** - Water quality — Requirements for the performance testing of membrane filters used for direct enumeration of microorganisms by culture methods

**ISO/AWI 9308-2** - Water quality — Enumeration of Escherichia coli and coliform bacteria — Part 2: Most probable number method

**ISO/AWI TS 12869-2\*** - Water quality — Detection and quantification of Legionella spp. and/or Legionella pneumophila by concentration and genic amplification by quantitative polymerase chain reaction (qPCR) — Part 2: On-site methods

**ISO/AWI 13647\*** - Water quality — Enumeration of culturable microorganisms — Colony count by spread plate inoculation on R2A medium

**ISO/AWI TS 16099\*** - Water quality — Polymerase chain reaction (PCR) for the detection and quantification of microorganisms — Quality control and validation of molecular methods

# **ISO Systematic Review**

ISO 11731: 2017 Water quality - Enumeration of Legionella

**ISO 13843: 2017** Water quality - Requirements for establishing performance characteristics of quantitative microbiological methods

**ISO/TS 12869: 2019** Water quality - Detection and quantification of Legionella spp. and/or Legionella pneumophila by concentration and genic amplification by quantitative polymerase chain reaction (qPCR)

There is also an appeal for Laboratories who would be able to assist in some trial work to test suitable organisms to use for testing domestic drinking water filtration systems.

![](_page_36_Picture_2.jpeg)

![](_page_36_Picture_3.jpeg)

# In-line Thermal Disinfection Unit (ILTDU) HORNE

# DISINFECTING

# The KEY to Pathogen Control

Horne TSV1 shower with integral ILTDU: regular thermal disinfection enhances patient safety against retrograde\* contaminants

\* e.g. Pseudomonas Aeruginosa

![](_page_37_Picture_1.jpeg)

![](_page_37_Picture_2.jpeg)

# Sampling Water for Legionella an introduction

Sampling water for legionella is a useful way to confirm the effectiveness of the control measures in a water system or to further understand the extent of risk on systems where control measures fail to meet the required parameters. Reactive sampling for legionella based on loss of control measures is advised in HSG274 Part 2. This article discusses proactive sampling, but the same principles can be applied to reactive sampling.

# SAMPLING WATER FOR LEGIONELLA

# When & Where to Sample:

Understanding where and when to take samples is as important as the sampling and analysis process itself. The reason why the sample is required in the first instance is the first step to establishing an effective sampling plan that will determine where and when samples are taken. This sample plan is part of the written scheme of control and its design should be guided by the legionella risk assessment, and should not simply be 'random' samples.

Routine sampling from evaporative cooling systems on a quarterly basis is an essential part of the control regime, as recommended in the HSE's HSG274 Part 1.

Routine sampling from hot and cold water systems is not normally required unless the control measures are not being achieved, or where a risk assessment finds it to be necessary due to elevated risk due to the system or the susceptibility of the users. For example in healthcare premises where patients with elevated susceptibility to legionella infection are present. The frequency of sampling will again be recommended by the risk assessment.

Routine sampling from commercial spa pools is essential to verify control, the

frequency of which will be determined by the risk assessment, typically quarterly as recommended in HSG282. Routine sampling from other risk systems should be undertaken in accordance with the legionella risk assessment.

Samples should be collected from points on the system that represent the risk at its greatest, i.e. from parts of the system where the legionella is most likely to have colonised and where there is a risk from exposure to aerosols. Additionally, the samples should be collected at a time where the number of legionellae is most likely to be at its greatest, i.e. when the temperature or biocide control is considered to be less effective due to a lack of circulation, for example after a period of little use of an outlet.

Samples from hot and cold water systems should be taken from individual outlets rather than from mixer taps wherever possible, however if this is not possible, pre-flush samples should be collected with the mixer tap at a midpoint, whereas post-flush samples can be taken with the tap set to either hot or cold as required. Hot water samples cannot be taken from thermostatically controlled outlets due to the continual addition of cold water.

## How many samples to take:

The quantity of samples to be taken is dependent on the reason for sampling and on the size and complexity of the water system. Samples from evaporative cooling systems, spa pools and other risk systems are commonly from specific points on the system identified by the risk assessment and control regime. A common misconception is that taking one sample from a hot and cold water system gives a general indication of the effectiveness of the control regime. As a minimum, samples should be taken from various points in the system to allow interpretation of the results and an indication of any contamination of the system, this may include both hot and cold water outlets, typically the furthest (sentinels) and a number of other outlets that represent the distribution of water throughout the system. The schematic drawing of the water system should be used to identify the most suitable outlets to be sampled.

## Sample types:

The type of sample to be taken will depend on the sample location and the reason for sampling, as follows:

• Pre-flush samples are used for routine sampling and are collected from the first flush of an outlet without any prior disinfection. These are taken to identify the likelihood of

![](_page_37_Picture_19.jpeg)

![](_page_38_Picture_2.jpeg)

colonisation of the outlet itself by the water held within. Effective pre-flush samples require the outlet to have been out of use for several hours beforehand;

- Post-flush samples with disinfection and removal of tap inserts are used to identify the likelihood of colonisation of the pipework supplying the outlet and are typically only used where pre-flush sampling has identified legionella to be present. Removal of tap inserts and disinfection of the tap before sampling avoids local contamination affecting the result and requires flushing before the sample is taken to remove all traces of the disinfectant. Essentially, the water should reach its normal control value (e.g. temperature) evidencing water being drawn from within the system;
- Post flush samples without disinfection of the outlet are sometimes used for routine sampling but these samples have limited value and results are difficult to interpret. This method should not be used.
- Dip samples are required for the collection of water from a body of water such as a cold water storage tank or spa pool. Cold water storage tanks should only be directly samples for investigative purposes as routine sampling may introduce contamination.
- Swabs are used to collect samples of biofilm or sludges from a specific surface.

# Sampling after a disinfection:

Following disinfection of part or all of a system, the system should be thoroughly flushed and returned to normal use for at least 48 hours before samples are taken to allow the removal of any residual disinfectant and a "return to normal" for any remaining colonies of legionella within the system. Further sampling will aid the understanding of the effectiveness of the initial disinfection.

## **Sample bottles:**

Sample bottles will be supplied by the destination laboratory – samples in incorrect bottles may be rejected by the laboratory. Bottles must be new, unused and sterile with sealed caps fitted, and within their use-by date. They must contain a small amount of the appropriate biocide neutralising agent recommended by the laboratory - commonly sodium thiosulphate for neutralising chlorine or bromine disinfectants. Sample bottles are commonly 1 litre in volume to align with HSE guidance on sample results, although some laboratories use smaller bottles in line with their approved UKAS accreditation for analysis.

## Avoiding cross-contamination:

Samples of water from any system should be taken using aseptic techniques by appropriately competent personnel to ensure the water collected is not cross-contaminated in any way by the sampler or their equipment and nearby surfaces. When collecting dip-samples a new, sterile, disposable dip sampler or a suitable disinfected reusable dip sampler should ideally be used. If not available the outside of the bottle should be cleaned with an "alcohol wipe" and allowed to dry before use. The hands of the sampler should either be washed and disinfected with alcohol or clean (new) disposable gloves worn for when immersing into the water. When filling the sample bottle it is important that the neutralising agent within is not flushed by overfilling the bottle and a small air gap remains when the bottle is capped. The bottle should be tightly sealed and shaken to ensure the neutralising agent is well-mixed with the sample.

## Labelling:

Sample labels and chain of custody forms should be completed immediately

after taking the sample to avoid any later confusion. Sample bottles are commonly pre-labelled and printed with a unique identifier such as a bar-code or sequential numbering system. Labels and chain of custody forms should be completed fully in clear text (ideally using capital letters) with the required information, including date and time of sampling, sample matrix (e.g. drinking water, process water), sampler name, water temperature and/or biocide residual (measured from the water immediately after taking the sample, not from the sample in the bottle), building name, system type, location of sample point and any other required information.

## Storage & transportation:

Samples must be delivered to the laboratory as soon as possible for analysis to begin - ideally within 24 hours, but no longer than 48 hours to avoid alteration of the number of legionella present. Care of the sample bottle until it reaches the destination laboratory is also critical in avoiding any changes to the quality of the sample. Hot and cold water samples should be packaged and transported in separate transport containers, preferably insulated to avoid rapid heat loss/gain. During transportation to the laboratory samples should remain in their packaging away from sources of heat including sunlight, and under no circumstances should they be chilled or refrigerated or exposed to temperatures below 6°C which could render the bacteria non-culturable. You should obtain confirmation from the testing laboratory used as to how they require the samples to be transported and stored prior to reaching the laboratory.

## **Further Reading:**

British Standard BS7592 gives further guidance on developing a sample plan and the collection of samples for routine, reactive and investigative purposes.

![](_page_38_Picture_22.jpeg)

![](_page_39_Picture_1.jpeg)

# Hot tubs, spa baths and interactive water features and legionellosis in the wet leisure industry

Robbie Phillips, B.A., Fellow Institute Sport and Recreation Management (Diploma), Pool Plant Consultant Swimming Teachers Association

## Introduction

Any water source that has the right environmental conditions has the potential to be a source for Legionella growth. Hot tubs, spa baths and interactive water features are a perfect example of this as they all have the potential to promote contaminated aerosols containing Legionella.

The right environmental conditions include a source of nutrients, stored or re-circulating water, temperature, the ability to create an aerosol, and the possibility of people inhaling contaminated droplets.

Hot tubs, spa pools and interactive water systems are easily infected with contamination from body fats, cosmetic oils and other items which are continually added to the water volume if there is poor management of bathers using these facilities. These contaminants act as a perfect source of nutrients for pathogenic bacteria. Given the smaller relative water volume, these facilities often become quickly overloaded. Together with ideal water temperatures we have inadvertently created the perfect environment for biofilm growth.

![](_page_39_Picture_9.jpeg)

# Fig 1. Cartridge filter with body fat deposits.

Biofilms can form on surfaces such as tank walls, pipework and filter media surfaces. Aquatic micro-organisms prefer to grow as biofilms and organisms such as protozoae and amoebae can protect *Legionella* – Legionella has been known to survive quite successfully inside amoeba cysts.

Once a biofilm has established, it can take up to 1000 x greater exposure to a given biocide concentration to kill an organism in a biofilm as it would to kill the same organism in water. Therefore, control and elimination of biofilms is essential for control of legionellosis. There are many factors in wet leisure water systems which encourage biofilm formation. These include but are not limited to the following:

- Nutrients for microbial growth
- Assimilable organic carbon (AOC) in supply water
- Dirt from the atmosphere and via dirty floors
- Construction materials (natural, synthetic, steel, copper)
- Difficult to clean (poor design)
- Stagnation in areas where flows are poor e.g. balance tanks,
- low flow areas, dead legs or blind ends
- Tanks not properly sized, too large
- Poorly maintained pressure vessels
- High surface to volume ratio
- Ideal temperature 30°C 45°C

 Scale & corrosion in pipes filters etc which not only act as nutrients but create uneven and rough surfaces which bacteria can adhere to more easily

![](_page_39_Picture_26.jpeg)

## Fig 2. Contaminated balance tank for interactive play feature.

Once a biofilm forms in the system they might not always be visible to the naked eye. There are indicators to look out for which may indicate there is a biofilm or high bacterial load. These include:

- Cloudy water
- Poor microbial test results
- Poor filter conditions
- Ribbon like strands of matter in the spa tank
- Marked increase in disinfectant use
- · Musty smells in and around the spa and plan

![](_page_40_Picture_2.jpeg)

#### Design and maintenance

Focusing on design of both domestic and commercial models, common problems include:

- Use of corrugated pipework ideal for biofilm growth
- Pipework parts are often not easily removed for cleansing
   Poor surfaces draw off where the potentially dangerous contamination accumulates, and effective removal is not present
- no automatic disinfection and pH control system to be present
   particularly common in the domestic setting
- Inconsistent bacterial results that cannot be traced back to operational failures. Most of the domestic spas and hot tubs are manufactured in other countries. Prior to dispatch they are usually assessed for leaks. Often, there is residual water left in the pipework which can become colonised increasing the risk of bacterial contamination.

Chemical and physical cleansing of a balance tank is often overlooked

• Domestic spa baths and hot tubs often do not put enough emphasis on hygienic cleansing

![](_page_40_Picture_11.jpeg)

Fig 3. Contaminated corrugated pipe.

There has recently been a marked increase in the demand for domestic hot tubs, and as a result many more outlets selling and/ or hiring hot tubs and spa baths for domestic use. Whether the use is for domestic or commercial the same basic protocols should be followed which often is not the case and unfortunately many of these outlets do not offer sufficient guidance to the public for safe hygienic operation.

Water related infections common in these units:

- Contact Pseudomonas aeruginosa, Mycobacterium spp.
- Inhalation of aerosols- Legionella, Mycobacterium
- Ingestion usually faecal oral pathogens which cause gastroenteritis
- Aspiration water "going down the wrong way"

#### **Regular Testing**

It is essential that recommended testing is always applied, recorded, and actioned whenever required. These include:

- ✓ Chemical tests disinfectant and pH.
- ✓ Water balance.
- ✓ Microbiological laboratory and bioluminescence testing.
- ✓ Temperature.

#### Summary

Hot tubs, spa baths and interactive water features can be a relaxing and enjoyable past time. However, incorrect design, maintenance and management of these wet leisure systems can lead to serious illness. It is important that there is a suitable water quality management system in place to ensure that we are not only legally compliant, but we are safe.

More guidance can be found in the following document: HSG 282 The control of Legionella and Other Infectious Agents in spa-pool systems 2017.

![](_page_40_Picture_28.jpeg)

![](_page_40_Picture_29.jpeg)

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#### SUMMER 2022

# **CONTRACTS**, PRODUCTS **& PUBLICATIONS**

The information and advertising of products and services in this section and throughout this publication is not necessarily endorsed by the editors or the Water Management Society, who accept no responsibility for the accuracy of information in contributing articles.

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New Hollow Mountain energy scheme plans submitted

A planning application has been submitted to construct a new underground hydro-electric power station at Hollow Mountain in Argyll and Bute. Renewable energy developer Drax has proposed building the complex at its Ben Cruachan site, where it already has an existing underground power facility.

The company has sent its application to the Scottish government and work could start in 2024 if the plans are approved. Drax said the process of securing consent from the Scottish government could take about a year. It also said the project - which could see the first renewable power scheme of its kind in the UK in more than 40 years - would need support from the UK government before it could go ahead. Drax hopes to have the scheme operational by 2030.

The existing underground power station was opened by the Queen in 1965. At the time, it was the first large-scale reversible turbine storage energy project of its kind in the world. It is housed within a huge cavern dug out inside Ben Cruachan, which is nicknamed Hollow Mountain because of the project.

The new plans would more than double the facility's generating capacity to more than 1GW, and involve excavating about two million tonnes of rock. The new hollowed-out cavern would be large enough to fit the 96m (315ft) high Big Ben tower on its side.

Cruachan is a pumped hydro storage scheme and one of only four in the UK.The others are Foyers on the shores of Loch Ness and Dinorwig in Snowdonia and Ffestiniog in Gwynedd, both in Wales. These schemes involve two bodies of water at different heights. The water flows from one to the other through tunnels, passing through a power station inside a cavern which has been created by hollowing out part of the mountain. When there is low demand for electricity from consumers and/or when surplus power is available from wind farms, electricity is used to pump water from the lower level to refill a reservoir further up the hill.

For details of the planning application:

www.drax.com/press\_release/drax-submits-application-to-expand-iconic-hollow-mountain-powerstation/

## Spring appoints Carly Perry as MD - Press Release

Spring, the water sector's innovation centre of excellence has appointed Carly Perry as its first Managing Director. This marks a crucial milestone in Sprina's journey to delivering the innovation needs of the water sector. Carly has been responsible for overseeing Spring's

![](_page_41_Picture_16.jpeg)

design and development since being appointed Consultant Executive Lead in July 2021. In well under a year, Spring has evolved from concept to reality - creating new communities of knowledge and developing the platforms the sector needs to incubate innovation.

Its focus will shift to developing its Knowledge Transfer service - making it easier for teams to share learning from their projects, and giving its users access to global innovation learnings to accelerate progress across the UK and Ireland

Carly said "I'm delighted to be appointed as Spring's first Managing Director. It's so exciting to continue growing Spring from a concept in the Water Innovation Strategy to an organisation that's already delivering on its promise. The encouragement and enthusiasm we've had from all our stakeholders has been incredible. We're fundamentally a partnership organisation, and the progress we've made would have been impossible without this. We're particularly grateful for the support and guidance we've received from UKWIR, Ofwat, our founding partners and our Board.<sup>3</sup> UKWIR CEO Steve Kaye said "It's fantastic we've been able to appoint Carly to formally lead Spring into its next stage of development. Spring's success is a real testament to the dedication of everyone involved - including the direct involvement of every water company in the UK and Ireland from the beginning, the team at Sia Partners working hard behind the scenes to bring things to life and everyone who's engaged with Spring with an open mind and great ideas, especially partners from academia and the supply chain, to help give it the really strong foundations the sector expects'

UKWIR leads high-quality, collaborative research for the water industry with the aim of improving services for customers, protecting, and enhancing the environment and innovating to meet future challenges. It is a not-for-profit organisation set up in 1993 and is owned and funded by the 19 water companies in the UK and Ireland. It invests around £3 million in independent research each year - ranging from eliminating water poverty to planning for climate change to reducing leakage - all designed to help tackle the short, medium, and long-term challenges faced by the water sector

UKWIR played an integral role in establishing Spring – including securing funding from its members to match that from Ofwat's Innovation Fund and proving the supporting corporate structure and governance to allow it to start work. In December 2021, Spring was formally established as a subsidiary of UKWIR, and UKWIR retains a seat on Spring's board. For more information.

Charlie Palmer, charlie@create51.com, 07706 348177, www.create51.com

![](_page_42_Picture_2.jpeg)

Endurance is found – Press Release from the Falklands Maritime Heritage Trust The Falklands Maritime Heritage Trust is pleased to confirm that the Endurance22 Expedition has located the wreck of Endurance, Sir Ernest Shackleton's ship which has not been seen since it was crushed by the ice and sank in the Weddell Sea in 1915.

One hundred years after Shackleton's death, Endurance was found at a depth of 3008 metres in the Weddell Sea, within the search area defined by the expedition team before its departure from Cape Town, and approximately four miles south of the position originally recorded by Captain Worsley.

The team worked from the South African polar research and logistics vessel, S.A. Agulhas II, owned by the Department of Forestry, Fisheries and Environment and under Master, Capt. Knowledge Bungu, using Saab's Sabertooth hybrid underwater search vehicles. The wreck is protected as a Historic Site and Monument under the Antarctic Treaty, ensuring that whilst the wreck is being surveyed and filmed it will not be touched or disturbed in any way.

Donald Lamont, Chairman of the Falklands Maritime Heritage Trust, said: "Our objectives for Endurance22 were to locate, survey and film the wreck, but also to conduct important scientific research, and to run an exceptional outreach programme. Today's celebrations are naturally tempered by world events, and everybody involved in Endurance22 keeps those affected by these continuing shocking events in their thoughts and prayers.

"The spotlight falls today on Mensun Bound, the Director of Exploration, and Nico Vincent, Subsea Project Manager. Under the outstanding leadership of Dr John Shears, they have found Endurance. But this success has been the result of impressive cooperation among many people, both on board the remarkable S.A. Agulhas II with its outstanding Master and crew, a skilled and committed expedition team and many on whose support we have depended in the UK, South Africa, Germany, France, the United States and elsewhere. The Trustees extend to them all our warmest thanks and congratulations on this historic achievement."

Mensun Bound, Director of Exploration on the expedition, said: "We are overwhelmed by our good fortune in having located and captured images of Endurance. This is by far the finest wooden shipwreck I have ever seen. It is upright, well proud of the seabed, intact, and in a brilliant state of preservation. You can even see "Endurance" arced across the stern, directly below the taffrail. This is a milestone in polar history. However, it is not all about the past; we are bringing the story of Shackleton and Endurance to new audiences, and to the next generation, who will be entrusted with the essential safeguarding of our polar regions and our planet. We hope our discovery will engage young people and inspire them with the pioneering spirit, courage and fortitude of those who sailed Endurance to Antarctica. We pay tribute to the navigational skills of Captain Frank Worsley, the Captain of the Endurance, whose detailed records were invaluable in our quest to locate the wreck. I would like to thank my colleagues of The Falklands Maritime Heritage Trust for enabling this extraordinary expedition to take place, as well as Saab for their technology, and the whole team of dedicated experts who have been involved in this monumental discovery."

Press Release in full: https://endurance22.org/endurance-is-found

For photographs and a 90 second video of Endurance, as well as other expedition images: https://collect.wetransfer.com/board/sowc348bfrvti58ge20220307165300 Information about the Falklands Maritime Heritage Trust: https://fmht.co.uk/

## Severn Trent kicks off £20m smart metering project – Press Release

Severn Trent's £20m smart water metering project for Coventry and Warwickshire is now well underway, as the first meter was successfully installed at the beginning of March. The project, that forms part of Severn Trent's ambitious Green Recovery programme, will see over 150,000 Itron smart water meters installed in a trial to turn Coventry and Warwickshire into a smart water data region.

Severn Trent say the project will help the company understand water usage better than ever before, find and fix leaks faster and deliver water saving benefits for communities and the environment. Not only that, but it will help provide valuable insights and learnings on water usage so the industry can look to ways to save water, protecting it for the future.

Anthony Hickinbottom, Green Recovery Project Lead says: "This is such a massive moment for us, as the first smart meter going in really means this project is about to kick off, and this will be game changing not only for us, but for our communities too. By creating a smart data region, we'll be really able to understand the network, and where water is being used better than ever before and help provide water saving benefits to our customers, and environment."

"The main difference with a smart meter is that we'll be able to monitor the water flow in the area so we can identify any potential leaks much faster. And because they're smart, once they're fitted, we'll be able to see exactly how much water is being used and give our customers greater control on their water usage while providing better insights and knowledge of the network."

Severn Trent will first be installing the smart water meters on the new supply pipes the company has installed as part of the lead pipe replacement scheme. In Coventry, also as part of the Green Recovery programme, the company is also aiming to replace 25,000 customer lead supply pipes in a £78m investment to help prevent leaks on old supply pipes, and to remove any risks associated to lead

#### For further information:

www.stwater.co.uk/news/news-releases/severn-trent-kicks-off-p20m-smart-metering-project-forcov-and-w/

## Dumped 1980s and 90s cars recovered from Paisley reservoir

Nine cars dumped at the bottom of a Renfrewshire reservoir since the 1990s have been removed by Scottish Water. The rusted vehicles were revealed at Lower Glen Dam in Gleniffer Braes country park, Paisley, after water levels fell in a dry spell last year. The 'classic' cars - including a Vauxhall Carlton, Nissan Prairie and Fiat Uno - were towed out, washed down and inspected by local police. A new park gate has been installed to prevent illegal dumping in future. The removal team led by Scottish Water contractors, Georgie Leslie, included divers and environmental experts who worked with the Scottish Environment Protection Agency (SEPA), Police Scotland and the Ayrshire Rivers Trust.

Water levels at the reservoir were gradually lowered to allow fish to be rescued and potential contaminants to be soaked up. Gerry O'Hara, Scottish Water project manager, said: "This tricky operation was months in the planning to ensure every little detail had been thought of and that we got it right. Our attention now turns to getting things in the park back to normal for everyone. We're refilling the reservoir to its original level, in a controlled manner, and we're continuing to test water quality to ensure there are no issues." The nine cars recovered were a 1984 Vauxhall Carlton, a 1988 Rover 827, a 1995 Citroen AX, a 1994 Ford Mondeo, a 1989 Citroen XM, a 1988 Nissan Prairie, a 1987 Vauxhall Astra, a 1990 Peugeot 605 and a Fiat Uno from an unknown year.

### Naylor completes acquisition of £2m-turnover Tuffpipes – Press Release

Naylor Drainage has completed the acquisition of Tuffpipes Ltd, a Burnley-based manufacturer of PVC pipes for the utility industries, for an undisclosed sum. The company has over £2m turnover and 11 employees. Naylor Drainage is a manufacturer of clay and plastic pipes for the construction and

infrastructure sectors, with factories in Cawthorne near Barnsley and Methil in Scotland; it is a subsidiary of Naylor Industries plc, a fourth-generation family business, which has a £70m turnover and some 420 employees.

Naylor Group Chief Executive Edward Naylor said: "Tuffpipes is a great fit with our business and allows us to offer our customers a broader range of PVC, as well as Polyethylene, ducting products. We're looking forward to working with Neil and Amanda to maximise the potential of the Tuffpipes business." For the remainder of this year, Tuffpipes will operate as a standalone subsidiary of Naylor Drainage, with manufacturing continuing on the company's Burnley site. Tuffpipes' Neil and Amanda Tuff will remain with the business and oversee its integration into the Naylor Group. *For more information: www.naylor.co.uk/* 

![](_page_42_Picture_26.jpeg)

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## South Western Sydney Local Health District Legionnaires' disease – Residents Reminder

Several local cases of Legionnaires' disease has prompted the South Western Sydney Local Health District to remind Macarthur residents to ensure their cooling towers are being properly maintained.

Four men in the 60s and 70s have contracted the disease over a five week spell, in Camden and Narellan. All four are currently recovering. The Health District's Public Health Unit, in collaboration with Camden Council, is investigating the cases.

Investigations are continuing, but as yet they have been unable to identify a specific source for the infections. Further testing of water sources is under way.

In Australia, Legionnaires' disease is contracted through inhaling microscopic water droplets which contain one of two types of Legionella bacteria - pneumophila or longbeachae. The droplets can often be circulated through cooling systems like air conditioning (pneumophilia), which have been responsible for previous outbreaks. It can also commonly be found in soil and potting mix (longbeachae).

The recent cases are of the Legionella pneumophilia variety. Public Health Director Dr Naru Pal said it was vital that cooling systems were looked after. "It's timely to remind businesses and building owners of their obligations under the Public Health Regulation 2012 to ensure their cooling towers are properly maintained," he said. "If there is any possibility that a system is not operating correctly, it should be cleaned and appropriate disinfection procedures undertaken as soon as possible."

For more information:

https://www.macarthuradvertiser.com.au/ story/7718668/reminder-after-severallegionairres-cases-in-macarthur/

### Scientists say new satellite is a game changer for tracking how our environment is changing

Space technology has long been used to help forecast weather, spot wildfires and aide scientists' understanding of the climate crisis. But this next-generation German satellite is being called a game changer for its ability to use more than 250 colours to produce the most precise data on water, soil and vegetation in satellite history, scientists say. The Environmental Mapping and Analysis Program, or EnMAP, is capable of measuring things that would otherwise be invisible, from the degree of pollution in a river flowing through a forest to the nutrient supply within a plant.

The images EnMAP will take are so high in resolution that scientists will be able to study the environment at a previously unachievable level of detail for space-based observing systems. The highly sophisticated satellite was designed to study the environmental impact of the climate crisis, observe how environments respond to human activities and to monitor the management of the world's natural resources. "There have already been great moments,

and I can't wait to see the data ... there are so many possible implications," EnMAP Mission Manager Sebastian Fischer said a week after EnMAP was successfully launched on April 1. EnMAP's data will help scientists track and examine environmental changes in realtime whether they are natural or manmade — and potentially help to develop the next generation of long-term climate forecast models. The satellite reached its destination in Earth's orbit on April 9 — eight days after it was launched from Cape Canaveral, Florida, on a SpaceX Falcon 9 rocket. Now, scientists wait

to receive its data. More information; https://science.nasa.gov/earth-science/ decadal-sbg

Thames Water announces key milestones of its Turnaround plan Sarah Bentley, CEO, Thames Water said: "We launched our turnaround plan in March last year. It stretches over eight years and will transform our company from an underperformer to join the rest of our industry and from there we will have the opportunity to lead the way in delivering excellent customer service and generating public value."

"This announcement is the next step in this journey. Our aim is to always deliver brilliant customer service and environmental performance - it's the biggest priorities for our turnaround plan. We recognise that customers want a variety of ways to contact us so we are investing further in a range of digital channels such as web chat and social media while still prioritising our telephony channels and bringing this service back in-house and on-shore."

"In addition, since launching our turnaround strategy, I have become acutely aware that we do not offer our customers the local customer service that they want and deserve. So the change we are making today to realign our business will better serve our customers in London and those in the Thames Valley and deliver significantly improved customer and environmental performance that is tailored to the needs of each region."

The company launched its 8-year Turnaround Plan in March 2021 in order to fix the basics, raise the bar and shape the future. It has already seen a number of improvements including improving trends in water quality, complaints management and supply interruptions performance. By putting in place a new 'frontline first' focused executive team it is well placed to turnaround its performance and meet its customer and environmental responsibilities.

#### For further information:

www.thameswater.co.uk/about-us/newsroom/latest-news/2022/mar/thames-waterannounces-key-milestones-of-turnaround-plan

#### VWT UK Supplies RO Unit for Southmead Hospital – Press Release

Veolia Water Technologies' DWA Modula S-XL Reverse Osmosis Unit has recently been installed in the Bright Renal Dialysis Unit located at the Southmead Hospital in Bristol. This system was specified due to its proven reliability and compact design.

The reverse osmosis (RO) system in the Bright renal unit suddenly suffered catastrophic failure. A replacement unit was proving very difficult to source and the renal team had no option but to arrange for their patients to be moved to other dialysis units to be treated. With up to 45 patients per day relying on a dialysis station for life-saving treatment, significant pressure was placed on clinical staff as well as the patients themselves. After being contacted by the Renal team, VWT were able to mobilise immediately, installing and commissioning a temporary MDD registered RO unit to enable dialysis treatment to resume again with the renal unit. "We reviewed a number of options and

suppliers," said Brett Thompson, Lead Renal Technologist for the Renal Division of the North Bristol Trust. "However, we were aware of VWT UK products and their reliability as many of our dialysis satellite units have been using Veolia water systems for a number of years." With over 80 years of healthcare experience, VWT UK regularly provides temporary RO systems for emergency situations, as well as planned back-up requirements for other renal dialysis units.

As a permanent solution, the VWT healthcare team presented various options to the Trust and subsequently, the DWA Modula S-XL Reverse Osmosis Unit was determined to be the best solution. A compact and modular hygienic design, the Modula S-XL design includes two independent submersible pumps and membrane arrays to ensure a secure permeate supply with redundancy. The operational parameters of the water

The operational parameters of the water treatment system are continuously monitored providing the operator with remote access, via VWT's Hubgrade™ digital platform, to accurate and detailed performance information, as well as allowing the performance of the system to be benchmarked against the other renal water treatment systems in the Trust.

"The VWT UK service team were excellent," said Brett. "They addressed the issue of limited site accessibility and answered a number of difficult questions. They provided a fantastic option that conformed to Medical Device Directives. Furthermore, the system was able to measure redundancy and monitor the water system effectively."

To learn more about Veolia Water

Technologies:

https://www.veoliawatertechnologies.co.uk/

DO YOU HAVE A PRESS RELEASE, PRODUCT OR SERVICE NEWS TO SHARE?

![](_page_44_Picture_2.jpeg)

### SolidTek<sup>®</sup> appoints Aquachem DAC as sole distributor for its innovative solid chemicals range in Ireland – Press Release

Best known for its sustainable, safe, and easy to use solid paste chemicals, Liverpoolbased manufacturer SolidTek® has partnered with Aquachem DAC. They are now the sole distributor for SolidTek's® solid water treatment chemical range and dispensing equipment in Ireland.

The partnership is a perfect match, with both companies having over 40 years' experience in the industry, as well as an unrivalled passion for creating safe and sustainable water treatment solutions. Aquachem DAC will be offering a range of solid paste water treatment products to the Irish market including: Cooling Water Inhibitors; Dispersants and Cleaners; Closed Loop Products; Oxidising Biocides; Non-Oxidising Biocides; Boiler Chemicals.

Solid paste chemicals eliminate the use of traditional liquid chemicals which are stored in plastic drums and bottles, which result in tonnes of often non-recyclable waste, which are sent to landfill. Liquid chemicals are bulky, heavy to store and transport and can be hazardous.

Users can switch to solid chemicals which are small, compact, safer and easier. And it gets better – SolidTek's® solid paste chemical range comes in 100% recyclable packaging meaning their eco-credentials are second to none. Aquachem DAC based in Co. Meath, Ireland are innovators of tailored water treatment. With an impressive portfolio of clients, their water management solutions help to reduce build-up of corrosion and scale resulting in increased efficiency and a reduction in energy costs for their customers.

Steve Crick, Managing Director of SolidTek<sup>®</sup>: "We've been looking for 'the right fit' distributor in Ireland, but it was important for us to work with an organisation who was prosolid chemicals and who shared the same vision about making a difference in the water industry. We are delighted to be working with the Aquachem DAC team".

Shane Neylon, CEO of Aquachem DAC: "We are extremely pleased to be partnering with SolidTek®, their product offering is world class and partnering with them allows us to provide enhanced water treatment solutions to our customers. Water sustainability is a major focal point for Aquachem and we are always trying to promote the use of solid chemicals due to their unparalleled benefits and SolidTek® chemicals are renowned for being environmentally friendly, not only the product itself but the packing is also 100% recyclable. *For more information: SolidTek® visit www.solidtek.co.uk; Aquachem DAC visit www.aquachem.ie* 

SEND IN YOUR CONTRACTS, PRODUCTS & PUBLICATIONS NEWS TO: waterline@wmsoc.org.uk

## Welsh Water Infrastructure Supply in safe hands, with Aliaxis Protecta-Line – Press Release

A major Welsh Water infrastructure investment project that is upgrading water quality as well as reliability of service for some 37,000 South Wales homes is nearing completion, with Aliaxis' Protecta-Line barrier pipe installed on the project. The £10 million Rhymney Valley project for Welsh Water (Dwr Cymru) has been carried out by specialist contractor, Lewis Civil Engineering under Asset Maintenance Programme AMP7; underlining Welsh Water's commitment to reduce leakage and improve performance across its networks.

The Rhymney-Bargoed Water Quality Zone lies between Brecon and the Cardiff-Newport conurbation, where Protecta-Line barrier pipe has been supplied by Aliaxis in a range of sizes (up to 400mm diameter) to replace mainly existing ductile iron pipes. The 18-month long contract has seen Aliaxis produce around 75% of the barrier pipe system required in project specific batches, to guarantee just-in-time deliveries direct to the 15 km long route.

Aliaxis has also supplied large numbers of its electrofusion couplings; in addition to a number of specially designed ferrules to enable branch connections off the larger diameter trunk main, with the purpose of servicing some of the smaller local communities.

Rich Pedley, Infrastructure Segment Manager at Aliaxis UK said: "We're proud to have worked with Welsh Water on this latest project. supplying over £880k of Protecta-Line to support the construction of a safe and reliable piece of our UK utility infrastructure.' While the Rhymney-Bargoed renewal project featured the use of pipe diameters from 25-400mm, the Protecta-Line range actually extends up to 630mm. The construction of the high-performance barrier pipe uses a polyethylene core to carry the supply, surrounded by a layer of aluminium that is able to prevent any type of pollutant contaminating the water. A further PE outer layer then completes the build-up.

As a Kite-Marked system that offers protection against all known contaminants including corrosive conditions, but that is also lightweight and flexible to install and does not need cathodic protection, Protecta-Line can deliver significant savings across a scheme. Aliaxis manufactures the pipe in accordance with BS 8588 and the system is fully WRAS approved; being recognised by all the UK's privatised water companies and used by the majority of their framework contractors.

The unique design of Protecta-Line electrofusion fittings incorporates exposed heating coils to provide consistent heat transfer during fusion and to achieve maximum bonding between the materials. The fittings are lightweight, resistant to corrosion, have excellent chemical durability and exceptional fusibility.

For more information, please visit: www.aliaxis.co.uk.

![](_page_44_Picture_19.jpeg)

# Partnership with VWT UK helps to deliver results on tougher permits

Veolia Water Technologies UK (VWT UK) has recently supplied its AnoxKaldnes™ K5 moving bed biofilm reactor (MBBR) system to Southern Water's Hooe Wastewater Treatment Works (WwTW). Selected to help the site meet tougher new permit requirements in a critically short time frame, VWT UK's MBBR solution provided an effective, small footprint solution that met the required improvements in the final effluent discharge.

Located close to a large village in East Sussex, Hooe WwTW had been tasked with tightening the final effluent discharge permit figures of its site of operations. As part of this, Hooe WwTW had to meet new requirements such as a 95%ile Ammonia (NH3) permit of 12 mg/l, a 95%ile Biological Oxygen Demand (BOD) permit of 20mg/l, a Total Phosphorus (TP) permit of 0.7 mg/l and a 95%ile Suspended Solids (SS) permit of 40 mg/l. Other requirements included a 95%ile Iron (Fe) permit of 4 mg/l and an Upper Tier Iron permit of 8 mg/l.

Initially, the site planned to implement a new activated sludge process plant that would extend beyond its site boundaries. However, when planning permission was rejected for this, Hooe WwTW required an alternative solution with a small enough footprint that would fit inside the compact site's perimeter. VWT UK was selected and supplied a two-streamed AnoxKaldnes™ K5 system composed of prefabricated biochemical oxygen demand (BOD) and glass reinforced plastic (GRP) MBBR tanks, which included retention sieves, air blowers and medium bubble air grids. A prefabricated Multiflo lamella settler was also supplied from Veolia Water Projects, VWT UK's sister company. VWT UK carried out the manufacture and testing of the system's tanks offsite, significantly reducing the project's total delivery and installation time. The congested site also led to the transportation of the prefabricated solution to the site by crane to reduce the impact of deliveries, haulage and traffic within the local area. Once on site, it was then commissioned by the VWT UK team, as part of the site-wide construction, installation and commissioning overseen by Southern Water's Framework Principal Contractor, CMDP, a Costain MWHT Joint Venture. Due to the rural location of the site, VWT UK and CMDP liaised closely with local residents throughout the project to ensure any disruption to the nearby village area was limited

"The AnoxKaldnes™ K5 MBBR plant has produced excellent rates of phosphorus and ammonia removal," commented Graham Lea, Principal Process Engineer at Southern Water. "It is difficult to think of another plant that would be able to fit in the available space on site while still reliably treating up to 60 litres per second of effluent."

For more information, please visit: www.veoliawatertechnologies.co.uk/products/ anoxkaldnes-mbbr

![](_page_44_Picture_26.jpeg)

Liverpool's historic docks awarded Blue Flag Marina Award The Canal and River Trust has been awarded the international Blue Flag award for the Royal Albert Dock and Salthouse Dock marinas in Liverpool. The Trust received the award for the second year after its marinas in Liverpool received

top marks for high standards of environmental information, management, safety, and boating services.

The water quality within the docks is of the highest standard and is home to an array of wildlife including thousands of blue mussels, hundreds of eels and, during the summer months, thousands of moon jellyfish. The Trust benefited from its team of local volunteers who have assisted with keeping the docks well looked after and clear of litter. Kate Gordon, the enterprise manager said: "We are delighted to be awarded this prestigious international Blue Flag award for the second year running and to be the first marina owners in England to receive it. As a charity we are very proud of our colleagues, volunteers and partners, who look after Liverpool's South Docks to the very highest standard. Research has shown that being by water makes us feel happier and healthier, and this award really highlights how a waterspace can make a place come alive through water-based activities, daily exercise or spending time looking at the array of wildlife. There's no better place to escape and visit than the iconic docks."

Royal Albert Dock Estate Manager, Sean Morrison, comments, "For a heritage estate like Royal Albert Dock Liverpool's waterways to be awarded the international Blue Flag award for the second year in a row is an honour and testament to the hard work and dedication of everyone involved. Our partners at Canal & River Trust are to be commended for their achievement, and this award solidifies Royal Albert Dock's position as a premier global destination."

#### For more information:

https://canalrivertrust.org.uk/news-and-views/news/liverpools-historic-docks-awardedblue-flag-marina-award

![](_page_45_Picture_9.jpeg)

## Anger at plans to turn 100 acres of Merthyr green fields into water treatment works

Dwr Cymru Welsh Water have announced a plan to buy 101 acres of that green pasture, and build a new water treatment plant on a family farm in Pontsarn to replace the smaller Pontsticill, Cantref and Llwyn-on works, which it says are "aging and have become increasingly difficult to maintain".

They say a healthy supply of fresh drinking water for 700,000 customers is vital for the future, and with the three current plants nearing the end of their operational lives, work must begin on designing and constructing a brand new facility.

Martin Hennessey is from the company, he said: "We need a reliable, efficient, and up to date treatment works to meet demand and cope with the impacts of climate change. This scheme is an essential infrastructure project that will provide future generations with high quality drinking water at an affordable price." The idea of building on Pontsarn, however, has infuriated many local people. They believe that there are other sites within the county borough of Merthyr Tydfil that could be used to create a 'state of the art' modern treatment plant - others which are not in the gateway of the Brecon Beacons National Park.

Dwr Cymru Welsh Water say they have actually looked at twelve sites in detail to locate this facility, and the one at Pontsarn is the one preferred to meet the requirements of a water treatment works fit for the 21st century. The Water Authority say that if they are successful in obtaining planning permission, the works can be done in a manner that sits sympathetically in the landscape and enhances the local environment. They also want to get community input into the design of the plant.

If their proposals were given the go ahead, Dwr Cymru Welsh Water plans to turn the three current water treatment sites into community amenity facilities. They say they want to consult with residents on how best to use them for recreation and 'rewilding', so they can enhance biodiversity in a nature crisis. Those fighting to 'protect Pontsarn', are hitting back strongly. They say that the area they want to develop is already rich in rare wildlife and plant life. And any development there would desecrate their beloved landscape forever.

For further information:

https://waterprojectsonline.com/listing/dwrcymru-welsh-water/

# WMSOC MEMBERS... DO WE HAVE YOUR DETAILS?

Have your contact details changed? If you do need to update your details with us, please get in touch: CALL: 01827 289558 or EMAIL: admin@wmsoc.org.uk

# Don't miss our updates:

![](_page_45_Picture_21.jpeg)

![](_page_45_Picture_22.jpeg)

Waterline Journal linkedin.com/in/waterline-journal-0b1645170/

![](_page_45_Picture_24.jpeg)

![](_page_46_Picture_2.jpeg)

#### Government to fund study into recycling toilet water for drinking

The Government will spend £53,000 researching whether people are accepting of toilet water being treated and then pumped back into the water supply.

The tender from the Department for Environment Food and Rural Affairs (Defra) acknowledges that some recycling schemes have been 'rejected' in the USA where they have been called 'sewerage beverage' and 'toilet to tap'.

The study will look at 'public attitude and public acceptability towards water recycling (water reuse) as a source for drinking water treatment' as some households in the UK face water shortages by the 2050s.

The news comes as the water regulator Ofwat has launched a probe into 'widespread shortcomings' concerning sewage treatment works and water companies have hiked their bills by 10% this month. MPs have already blasted water companies that made £2.8billion in profit in 2021 over rivers – where sewage currently ends up – becoming a 'chemical cocktail' of sewage, agricultural waste, and plastics.

Cranfield University, which was awarded the contract in April, will 'undertake a social science study of public perceptions of water recycling' and 'provide a final report including recommendations and strategies to inform the public on water recycling.'

Drawn up in the name of George Eustice, the Environment Secretary, it also says: 'A potential source of water is the recycling (or reuse) of wastewater. More understanding is required on the public acceptability and public perception of planned recycling of wastewater for potable water use.' The study is set to come to a close on November 17.

The three water regulators Ofwat, Environment Agency and Drinking Water Inspectorate are also considering schemes that use 'indirect potable recycling' known as 'toilet-to-tap' and there are three planned sites.

Currently waste water is generally cleaned and filtered before being pumped back into rivers. Under this new plan being explored, sewage water would be treated and then pumped into the public water supply.

For more information: https://webringnet.com/defra-mulls-converting-lavatory-waste-into-tap-water-spending-53000-to-probe-public-attitudes/

![](_page_46_Picture_13.jpeg)

Japanese researchers create a 'jellyfish extermination device' A team of researchers from the Hiroshima Institute of Technology has created a jellyfish extermination device which 'sucks and crushes' them before ejecting the fragments back into the sea. An underwater robot has been built to seek and destroy ever increasing numbers of jellyfish.

Populations are increasing rapidly across the world, with jellyfish blooms associated with warmer waters and climate change. Japanese and British waters are hosting significantly growing numbers of jellyfish. This volume of jellyfish is posing a risk to the fishing industry as they get caught in nets and spoil catches. It is estimated that jellyfish cost the Japanese fishing industry more than £60m per year, with thousands of reports of damage to fishing equipment.

Engineers built a 3ft-long autonomous prototype and tested it in the laboratory, where it was found to be highly efficient. The theory is that a robot can be carried by ships and deployed in the water, where on-board ultrasonic sensors and AI technology can identify a jellyfish target and then a large hose would suck the creature into the vehicle and jets of pressurised water and a turbine shred it into pieces.

The researchers wrote up their work in the *Journal of Japan Society for Design Engineering.* 

Title: Development of Autonomous Underwater Vehicle for Small-size Jellyfish Extermination and its Evaluation

Abstract: In recent years, extermination work has been carried out due to the increase in the number of jellyfish. In this research, we design and develop an AUV (Autonomous Underwater Vehicle) and conduct a jellyfish crushing experiment for the purpose of automating jellyfish extermination work. In the design and development of an AUV, electronic parts to operate autonomously were selected, and each electronic part was placed inside the hull to create a system diagram of them.

Regarding the jellyfish extermination device, we designed and developed a device that sucks and crushes jellyfish together with water from the suction port. In this experiment, a jellyfish extermination device was mounted on developed AUV, and a crushing experiment was conducted using a jellyfish sample which is made by water and gelatine. As a result, it was confirmed that a jellyfish sample with a diameter of about 7 cm and a height of about 11 cm could be crushed to small pieces, which has average of volume 2.88 cm3, during less than about 8 seconds. *The complete article can be viewed:* 

www.jstage.jst.go.jp/article/jjsde/advpub/0/advpub\_2021.2931/\_pdf

# Canal & River Trust unlocks UK's longest river for endangered migratory fish

This May, for the first time in nearly 180 years, the UK's longest river has been unlocked for the epic spawning migration of an endangered fish, the twaite shad. An ambitious conservation project has unlocked the length of the River Severn, reconnecting ancient spawning grounds for this once-prolific fish. Four huge new fish passes now provide a route around weirs that have thwarted fish migrating up the river since Victorian times. Shad normally visit the river in May; their colloquial name is May Fish and May Day marks the official start to the shad run. This May dawns on a new era of hope for the endangered May Fish and all fish migrating on the UK's longest river.

The annual shad run was once a celebrated sign of spring along the Severn. Shad fish were known and loved by kings and commoners alike. Severn shad were ordered for Henry III's royal court in London. However in the 1840's navigation weirs were built right across the river which created more reliable, deep passage for large barges carrying industrial goods between the Black Country and the docks at Gloucester. But for shad the weirs were a barrier that suddenly and catastrophically cut short their migration. The Unlocking the Severn project, in addition to the four new fish passes alongside navigation weirs on the River Severn has seen two partial weir removals. Uniquely, the new fish pass at Diglis in Worcester includes an underwater viewing gallery allowing scientific monitoring of endangered migrating fish. Members of the public can also book a guided tour for their chance to see wild fish swimming by.

For more information:

https://canalrivertrust.org.uk/news-and-views/ news/trust-unlocks-uks-longest-river-forendangered-migratory-fish

Twaite Shad on the River Severn being released

![](_page_46_Picture_28.jpeg)

![](_page_47_Picture_0.jpeg)

# SKYROCKETING WATER TREATMENT COSTS? DISSOLVE THEOREMUTH SOLIDER® NEW SolidTek Stlidoo® Dissolver Reduces costs, risk and environmental impact

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![](_page_47_Picture_5.jpeg)

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![](_page_47_Picture_12.jpeg)

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![](_page_47_Picture_13.jpeg)

![](_page_47_Picture_14.jpeg)

![](_page_47_Picture_15.jpeg)

info@solidtek.co.uk

![](_page_47_Picture_17.jpeg)

![](_page_48_Picture_2.jpeg)

# TECHNICAL OSA

# SENT INTO WMSoc. TECHNICAL:

How can we decide what level of risk is negligible; this is the detail I am struggling hard to ascertain? Being a self-employed surveyor looking at my PI cover has made me question things in great detail but in this case the possibility of infection is my prime motive. Would a consultant advise upon level of risk for occasionally used sinks etc. and if so, how would he do it?

0,8

# ANSWERED BY THE WMSoc. TECHNICAL COMMITTEE:

This question goes right to the heart of why health and safety management is perceived as such a problem. The simplistic answer to how to decide what is a negligible risk is to carry out a suitable and sufficient risk assessment (competently). The Competent (Responsible) Person is to use the findings of the assessment to make an informed decision. While there are no hard and fast definitions of what is a suitable and sufficient risk assessment, there are many useful guidance documents and British Standards (ACoP L8, HSG274, BS8580-1:2019). Whilst all these documents provide various commentaries to assist, they also emphasise the importance of "competence" of those individuals involved in carrying out a risk assessment.

A good, suitable and sufficient risk assessment will not only outline a level of inherent and residual risk presented, but will also justify and explain how and why those conclusions have been reached.

On the question of what is a negligible risk, the HSE gives some advice in paragraph 25 of L8 (Fourth edition) published 2013 (and the associated Information Box) and the Responsible Person may very well deem outside mains-fed taps and systems without stored water and used regularly to meet the criteria, but if they are rarely used they may be considered dead legs and be of concern. Furthermore, the susceptibility of those individuals / populations who may be exposed to those water systems could significantly affect the risk, and hence, must be carefully considered as part of the process. Again, the specific risk assessment for the system will answer the question.

# DO YOU HAVE A QUESTION For our technical committee?

Sendin your question vicemail to: admin@wmsoc.org.uk

![](_page_49_Picture_1.jpeg)

![](_page_49_Picture_2.jpeg)

# LCA Spring Road Show

May 2022, Manchester, Edinburgh, Bristol and London

The LCA Spring Road Shows, that covered events in Manchester, Edinburgh, Bristol and London, were a huge success with over 350 delegates attending the 4 events representing over 90 LCA member companies.

The events had the same presentations across the 4 venues to allow a consistent message to be spread across the country to all of our members. The events were well supported by our trade stands who we thank for their continued support.

Each event started with an update for LCA members from the LCA Manager Matt Morse, who presented an update to membership numbers and stats, gave an insight into the auditing process and supplied information on the updated internal auditing documents that we will have available soon.

The second presentation was from a different LCA Assessor at each event, the content was the same with the Assessors unique insight into the challenges often seen at audit, the pitfalls that Members often fall into and some helpful tips to have a smoother audit in the future.

Nick Barsby, LCA Chairman, presented the third presentation on the challenges posed by Legionella anisa and how its prominence could be significantly under reported by the Urinary Antigen Test that only identifies Legionella pneumophila; and then only a few sero-types. Nick continued to question the potentially under reporting of other Legionella Species in a clinical setting before giving a few pointed examples where the UAT had failed to identify Legionellosis.

John Smith, Chair of the LCA Standards Committee, presented on how the LCA requirements affect staff at the coal face and we explored the concept of "moments of truth" when clients interact with staff of LCA members. From administrators to MD's and all in between; we can all be involved in a "moment of truth" for a client and its important to ensure everyone has the correct knowledge and skills to support a client at every stage.

Matt Morse then presented on the LCA requirement for escalation before giving a pointed example of how escalation at Isher Hangers helped prevent another Barrow type outbreak. Ultimately, the procedure has been designed to help members raise issues of concern and it's great to see it has been used competently by LCA members.

John Smith then re-entered the stage to discuss meaningful competence assessments and the importance of undertaking an effective assessment. John informed the room that the LCA are looking to bring in a bespoke Legionella competence workshop starting in September to assist members undertake meaningful competence assessments.

The final section of the presentations saw Chris Boyd, formerly of New York City Department of Health who presented on the Bronx outbreak in New York, the use of PCR testing to rapidly identify the source and how some local regulation in the USA evolved from the HSE guidance in the UK. The presentation highlighted the difficulties in locating cooling towers in the absence of a central cooling tower registry and how regulation improves control and communication.

Duncan Smith, HSE Occupational Hygiene Principal Specialist Inspector, then gave an update on HSE activities and enforcement. Beginning with the science and evidence gathering role of HSE research Duncan discussed the project that has developed from LCA data on the Legionella anisa issue described by Nick. HSE will be working with UKHSA to investigate the data and publish a peer reviewed paper on the results. The HSE are also joint funding a PhD research project with Sellafield focussing on various rapid test methods for Legionella; testing numerous cooling towers with a range of sampling and analysis techniques over several years to gather data to inform future guidance. Further updates were provided on remote monitoring developments. Duncan closed his session by talking at a high level about LD cases, clusters and outbreaks, ending with a discussion of recent prosecutions around the country.

The final part of the event saw a panel discussion between all speakers about potential changes to HSG 274 guidance- a questionnaire was sent out to all members and had over 40 responses with over 60 comments. Many common issues raised included expansion Vessels, PCR testing and remote monitoring where the audience felt the guidance could be clarified. Further updates on these sessions will be provided to members and the industry in due course.

![](_page_49_Picture_17.jpeg)

# **NEW** members

Since the last edition of Waterline was printed the WMSoc has approved 31 new membership applications and 2 upgrade requests. We welcome members from the following sectors of the industry: Water Hygiene – 12, Water Treatment – 9, Consultancy – 9, Facilities Management – 2, Plumbing – 1.

The following new members have given permission for their names to be printed: Jonathon Atkinson, Robert Appleton, Michael Aram, Cara Leigh Bisland-Cook, Jonathan Blandon, Jack Bonner, Stuart Bonney, Mark Chadwick, Richard Connor, Dan Constable, Alexander Dart, Paul Duff, Steve Durose, John Elphick, Aaron Nikolajs Fox, Elaine Gillion, Lee Harding, Samantha Hedges, Louise Lewis, Sammi Morland, David Reynolds, Femi Sanyaulo, David Sevier, Alan Slater, Phill Tuxford, Mark Wyatt. Vacuum based CIO<sub>2</sub> generation - the safer way Legionella control / Process Water Disinfection

![](_page_50_Picture_1.jpeg)

![](_page_50_Picture_2.jpeg)

Lutz-Jesco GB Ltd., Unit C1 Loades Ecoparc, Blackhorse Road, Coventry CV7 9FW. T: 02477 103306 W: www.lutz-jesco.com/uk E: tosh.singh@lutz-jesco.com

![](_page_50_Picture_4.jpeg)

![](_page_51_Picture_1.jpeg)

SUMMER 2022

m the Archive: This article first appeared in the August 2021 edition of Health Estate Journal

# Five key drivers for Terms of Reference review

In early 2019 a full governance review across all of IHEEM's core business activities was undertaken by Head Office. The operation and management of Technical Platforms (TP) and Boards of Registration(AE) ((BOR(AE)) was identified as a corporate risk and this, together with the recommendation to undertake a review, was discussed with and agreed by the Executive Council. As this article explains, the Engineering Council UK's licencing review in 2019 also issued a 'red alert' in relation to how the TPs were being managed.

IHEEM's CEO, Pete Sellars, says in explaining the review: "There were five key drivers that highlighted the need to review and update the Terms of Reference for our Technical Platforms and AE management arrangements, as follows:

• To meet the licencing requirements set out by the Engineering Council UK in its 2019 review, and the Institute's corporate responsibilities to the Charities Committee and all IHEEM members.

• To protect IHEEM from potential professional litigation and reputational damage.

• To ensure transparency, fairness, and inclusiveness, along with consistency across all aspects of TPs and registration boards in terms of structure, core competencies, accessibility, and levels of activity to support and update members.

• To create confidence across the system that all IHEEM activity is underpinned by robust governance and assurance, and operates within agreed standards and by appropriate codes of conduct.

• To support the 5 Year Business Plan commitment to modernise all elements of the Institute, ensuring that it is fit for purpose to respond to new opportunities and challenges."

"In March 2019," Pete Sellars continued, "I advised all TP chairs of the intention to undertake a review and the broad context was then set out for initial feedback. This subsequently formed the basis of a detailed face-to-face discussion held in July 2019, where we sought initial feedback from TP Chairs around key topics such as professional indemnity, along with trademarking, and concerns around individuals and companies operating under the IHEEM brand without having approval to do so. In February 2020 at an IHEEM Strategic Planning event, Council considered the findings of that review, and unanimously agreed that governance and assurance around TP and BoR(AE) activities should be strengthened to meet the points provided in the rationale set out above."

## A 'broad plan' developed

Following further engagement, a broad plan was developed in May 2020, and in August 2020 a Working Group, chaired by IHEEM President, Paul Fenton, was established to ensure that all members of the Technical Platforms and BOR(AE)s had a fair and equitable chance to contribute to the discussion on behalf of their respective groups. The Working Group met several times to develop and agree on a proposal to Council for a revised suite of documents based on a scope which featured a number of key issues, including:

- The role and structure of the Technical Platforms and BOR(AE)s.
- Membership.
- Independence and inclusivity.
- Assurance of professional standards and behaviours.
- Process of appointment and re-
- appointment.
- Consistency of approach.
- Transparency and Fairness

IHEEM President, Paul Fenton, said: "The Working Group spent in excess of 10 hours discussing and deliberating a wide range of issues and areas as a group, not to mention the additional time the group's members took to consult with Platform and Board members. Their input has been invaluable and much appreciated, especially during recent times, when our sector has been under such enormous strain and pressure. Although it has been a lengthy process, it is one which was vitally needed to ensure that robust governance is in place to protect both the Institute and Technical Platforms and AEs in their duties. I would like to thank the members of the Working Group for their time and commitment."

Pete Sellars added "Following the completion of this review, I am delighted that to say that the Engineering Council UK have changed the 'red alert' to 'green', which is positive news, and clearly demonstrates why this work was so important.

## New benefits

Going forward, our Technical Platform members and IHEEM AEs can enjoy a number of new benefits – including dedicated AE logos for their own use, individual AE photo ID cards provided with an IHEEM lanyard, and individual listing in our online AE directory as well as in the *IHEEM Handbook*. I'm also hoping that our platforms and AEs will play a key part in our 2021 Healthcare Estates online and on-demand conference in October. Our new multi-streaming format will be the perfect opportunity for them to share knowledge and best practice, and highlight their plans for the future. This builds on the success of our recent AE online event, 'The Importance of the Role of an IHEEM Authorising Engineer', which was well attended, with over 200 registrations.

#### **Providing confidence**

Providing confidence for clients that IHEEM's AE appointment and re-registrations process ensures due diligence and robust peer review was one of the key drivers for the review. In relation to the importance of AEs from a client's perspective, Nigel Keery, Head of Estates Operations, Belfast Health & Social Care Trust, said: "We use AE services extensively, and rely on them being the best they can be. It's extremely important that the services are offered as part of a framework and structure that assesses an individual's competence, knowledge, and expertise in their given specialism. As a client we want to know that the AE is continually learning and developing, that they are accessing the best knowledge for their discipline, and are up to date with all the legislative and best practice changes. We have to be assured that we are being given appropriate independent advice to ensure that our patients and staff are in the safest and best facilities. IHEEM's revised Terms of Reference for its Technical Platforms and AEs provide that structure and due diligence on behalf of the client. This is essential, since the role of the AE is growing and evolving as the requirements of patient care become more complex, and the use of materials becomes more demanding. Their independence is vital so that they can bring their wider experience to us and share their learning with our staff at the Trust."

#### **Highly respected AE's view**

David Harper, EngTech, FIHEEM, FWMSOC, MCIPHE, MIET, HFSOPHE, Public Health Officer, hospital engineer, and IHEEM Registered AE(Water) says of his perspective on the role of an AE and what 'the law of the land' requires: "Being a member of IHEEM in whatever capacity is a privilege and an honour in its own right, as IHEEM is respected all over the world. My career in healthcare began in Middlesex in 1967 when I was appointed Chief Superintendent Engineer. Over the years that title has changed to Estate Manager, Hospital Engineer, Senior Engineer, Head of Engineering, and Estates Manager, but in reality, whatever the title, you are still held to account by the hierarchy of the hospital. The last hospital that I worked at was Kingston

![](_page_52_Figure_2.jpeg)

District General Hospital in Surrey, where in 1979 the first outbreak of the then little-known Legionnaire's Disease occurred. "In the early days, very little was known

about this disease, especially from the engineering point of view, so we had to start from square one. Thankfully, we know a lot more nowadays, and some of the engineering solutions that were developed during those early times are now accepted worldwide and formed the basis for the regulations and legislation that we see today - for example, the Approved Code of Practice L8, Legionnaires' disease. The control of legionella bacteria in water systems, and the guidance HSG 274 Parts 1 to 3, as well as the Health Technical Memoranda and other documentation which must now be applied to healthcare buildings."

## **Hands-on experience**

David Harper continued: "Authorised Engineers, across a number of disciplines, are appointed to provide technical support and independent expert advice. IHEEM set up registers to ensure that when AEs carry out their duties in healthcare premises, they are qualified to do so, i.e. they have time served, hands-on experience, and that they have a full understanding of all the relevant regulatory and legal requirements. When any individual applies to become a registered IHEEM AE, they have to go through a peer review of their qualifications and experience, which are looked at in precise detail to ensure that they are as the court would say "fit for purpose" to carry out their AE duties. Once accepted, your certificate lasts for three years at which point

you are eligible for re-registration, when once again you are checked and peer reviewed. "To be an AE you must be totally and utterly independent. This avoids the situation whereby an employing company could apply pressure to the AE to inform a client in a hospital of something that the company might want to supply. In this way it could be deemed that the AE is being used as a salesman. If you work for a company and are an AE, you are a servant of that company, and therefore in a court you would not be counted as being totally and utterly independent. As well as being independent, all AEs must have the right level of insurance appropriate to the duties they are carrying out. It is a legal requirement that anyone who is employed by a hospital or anywhere else must have insurance to cover them personally and publicly in case of any unforeseen situation that may occur. If you work at a hospital, but are not an employee, the hospital does not insure you. You, or your employer must provide the insurance.

#### Called as an 'expert witness'

"On a number of occasions, I have been called to Crown Court as an 'expert witness' to testify where companies or individuals have been brought to trial due to failures in water systems in hospitals, resulting - in some cases - in fatalities. In every case I have been asked to help the court determine whether the client did everything to ensure that the AE was 'fit for purpose', e.g.: had protocols in place for their appointment and had adhered to them, and that the AE was competent and able to provide independent advice free from duress by an employer. In the event of guilty

verdicts, hospitals, individuals, or companies, have had to pay substantial damages.

"In summary, an AE for any discipline must be totally independent; must be insured, and must have been through an appointment or re-registration process that includes a peer review of their qualifications, experience, and knowledge.

"I was also pleased to hear that each IHEEM AE, myself included, will now be issued with a membership card, which will include their photograph, membership number, and registration expiry date. This is an important step around governance, and providing assurance to clients that the AE before them is a registered IHEEM AE in that particular discipline."

Please visit the IHEEM website for further information on the Technical Platforms and the Institute's AEs, at: https://www.iheem.org.uk/about-us/ governance/

- This article first appeared in the August 2021 edition of Health **Estate Journal** (www.healthestatejournal.com),
- the monthly magazine of the UK's
- Institute of Healthcare Engineering and Estate Management
- (IHEEM: www.iheem.org.uk) and is reproduced with their kind permission.

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![](_page_52_Picture_28.jpeg)

![](_page_52_Picture_29.jpeg)

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![](_page_53_Picture_1.jpeg)

![](_page_53_Picture_2.jpeg)

![](_page_53_Picture_3.jpeg)

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# Water Recycling and Reuse in the Food and Beverage Manufacturing Sector

Dr Yolla Mccoy – Technical Manager at Feedwater Limited

#### **INTRODUCTION**

Water recycling and reuse is key to improving water efficiency in many industrial sectors. Although there have been several government and private initiatives to assist in the implementation of recycling projects, the uptake of these projects has been somehow limited. The paper summarises findings from an extensive study that was done between 2010 - 2017 and revisited in 2021 following the significant increases in material and energy costs in the UK.

The paper will present findings from the food and beverage manufacturing sector (FBM); however, similar outcomes can be expected from other industrial sectors.

#### BACKGROUND

Water is one of the most essential natural resources in the world and the availability of fresh water supplies is vital for the survival and development of businesses, communities and the environment. For many years demographic and climatic changes have had a significant impact on the availability of fresh water supplies and it is projected that 66% of the world population might be living in areas of scarce water supplies by 2050.

In the past, concerns relating to water shortages have been restricted to arid regions. However, rapid population growth, changes in public water demand, urbanisation and climatic change are having a profound impact on water availability in countries that were thought to be insulated from the possibility of having water shortages and unmet water demands. For example, challenges associated with water security and availability versus demand are currently faced by nearly half the European Community, where it is likely that intervention is going to be needed to avoid critical water shortages by 2050. The UK, France and Italy are expected to be the most affected, due to the high recent level of population growth and Urbanisation (Carrington, 2019; EUROSTAT, 2015).

The population in the UK is expected to grow by 10 million by 2030 and 15 million by 2050 (DEFRA, 2018). This will undoubtedly have a direct impact on the domestic water demand which is likely to increase by around 365 million Cubic Meters (Mm<sup>3</sup>) of water per annum by 2050 (EA, 2013).

In addition to population growth, the following factors will significantly impact on water security and availability of fresh water supplies in the UK:

1. Population movement to big cities, particularly in the Southeast of England including London. This area is already experiencing high water stress levels

![](_page_55_Figure_14.jpeg)

#### Figure 1 - Projected water availability per capita in EU countries (m<sup>3</sup> per annum) by 2030

which are likely to increase with projected increases in the regional temperatures of around 1.3-4.6  $^{\circ}$ C .

2. Climate change is also expected to have a widespread impact on England and Wales where water deficit is anticipated to be a challenging problem in half the river basins by 2050 and longterm depletion of underground water supplies (figure 2) (DEFRA 2018).

3. Long term underinvestment in the water distribution infrastructure: This is currently contributing to significant losses through leakages and failures in the distribution network. Although significant improvements have been made in recent years, water wastage from the distribution network is still considered high (NIC, 2018).

Both DEFRA and the UK Environment Agency are expecting challenges to meet

future expansions in water demand, as it is unlikely that the future increases in water demand will be met by increases in natural fresh water supplies. In the past 10 years alternative approaches have been either evaluated or implemented by the UK Government to assist in improving water availability and resilience in the UK. This is done through minimising water wastage and improving water efficiency and are/ or will be assisted by the following schemes:

 Improving the general public and businesses' awareness regarding the value of water

2. Reviewing water costs and encouraging households to install water meters

3. Implementing strategies that will enable the sustainable growth of water provision

4. Improving the distribution network to

![](_page_56_Picture_2.jpeg)

![](_page_56_Figure_3.jpeg)

Figure 2 - Reduction in compliance with the Water Framework Directive (WFD) and Environmental Flow Indicators (EFI) against changes in river flow statistics by the 2020s (Wade et al., 2013)

minimise water wastage through leakage

5. Investing in strategies that would allow for waste minimisation and water recycling and reuse

6. Working with the industrial manufacturing sectors to improve efficiency and minimise water wastage

Special strategies have been directed to reducing water wastage and usage in the food and beverage manufacturing sector (FBM). This is mainly due to the significant opportunities of water recycling and reuse in this sector.

#### THE FOOD AND BEVERAGE MANUFACTURING SECTOR (FBM)

The FBM is one of the largest manufacturing sectors in the UK with an annual turnover of around £338 billion and £166 billion in export. The sector employs nearly 800,000 employees and contributes to around 58% of the overall R&D capital expenditure in the UK (FDF, 2021).

In addition to its direct economic contribution, the FBM has a wider and more prevalent impact on the UK economy as the sector:

![](_page_56_Figure_12.jpeg)

1. Produces more than 80 million tonnes of food per annum to satisfy the domestic and foreign markets.

2. Provides more than 53% of the total food consumed in the UK.

3. The sector is a main water and energy user and it cost the UK around £300 million in water and £800 million in energy (based on figures from 2021).

4. The only manufacturing sector that has not been affected by the economic downturn. In contrast the FBM has been growing on an annual basis to satisfy increases in public demand, with expected growth between 1-1.4% on an annual basis by 2030 (DEFRA, 2014a; FDF, 2014). It is expected that population growth will continue to drive up the demands at home and abroad.

It is worth mentioning that although COVID-19 had an impact on the consumers habits, it is expected that the long-term impacts of COVID-19 will be positive for the FBM sector (Mattason, 2020).

Food Processing		Water (m <sup>3</sup> ) used per m <sup>3</sup> or tonne product		
Cheese production	on	9.0		
Milk processing		10		
Meat processing		4.7		
Fish processing		6.0		
Poultry	Chicken	8-15		
Trocessing	Turkey	40-60		
Fruit Juice	Orange Juice	5.0		
	Apple Juice	1.2		
Vegetable proces	sing	30.0		
Soft drinks		3.7		
Beer		4.15		
Oven potatoes		10		

# Table 1 – Average water used versus final product weight or volume (WRAP, 2014)

#### WATER USAGE AND WASTAGE IN THE FBM

It is estimated that the annual water demand of the FBM sector is around 200-250 Mm<sup>3</sup> per annum which is equivalent to 36% of the total water used in manufacturing (WRAP, 2013).

The FBM include 10 main subsectors with the biggest represented by the fruit and vegetables and dairy sub-sectors (figure 3). What is unique to the FBM is the high percentage of water that is used in the preparation and cleaning processes. In some processes this can account to more than 90% of the total water used on site. If not reused this water will end up as industrial trade effluent (Table 1) (WRAP, 2013). Due to the high current and projected future water usages in the FBM a number of initiatives are currently being led by the UK Government to evaluate and improve water efficiency in this sector as detailed in the sections below.

#### WATER SAVING INITIATIVES FOR THE FBM

Minimising water usage and wastage in the FBM became a key government target more than 16 years ago with the publication of the Food Industry Sustainability Strategy (FISS).

The primary objective of the strategy was to lower water usage in the FBM by 20% by 2020 (DEFRA, 2006). The FISS did not address the water that is embedded in the products but focused on water use minimisation in areas such as: i) cleaning, ii) preparation processes, iii) cooling and iv) steam generation.

The implementation of the strategies stated in FISS relied on voluntary agreements between the UK Government agencies and the FBM. This initiative is known as the Federation House Commitment (FHC) and by 2015 had representation of around 24% of the FBM (WRAP, 2015; WRAP, 2014).

The Federation House Commitment was suspended in 2014 and from 2015 the work was passed to the Food and Drink Federation (FDF, 2021).

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![](_page_57_Figure_1.jpeg)

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The final report by the FHC stated that with the help of WRAP and associated agencies the signatories to the FHC reported water savings of 15.4% (WRAP, 2015). As shown in **figure 4**, this is only a small percentage of the overall water reduction that could have been achieved in the UK, if the above schemes were more successful.

#### *Limitations of the Government Led Water Saving Initiatives*

Four main limitations were identified in the study:

1. The voluntary nature of the initiatives and the low uptake by the FBM (less than 25%).

2. The help provided mainly focused on minimisation strategies and did not often extend to water recycling and reuse including trade effluent recycling and reuse (TERR) **(figure 4)** (McCoy, 2017).

3. Most current treatments are energy intensive and require a significant capital investment which will impact on the return on investment.

4. There is a need to improve knowledge regarding the safety of reusing recycled water in areas that are in direct contact with the food processes.

### IMPACT OF CAPITAL AND OPERATING COSTS (CAPEX / OPEX)

Case Study at a Dairy Plant (Mccoy, 2017)

Primary Treatment (DAF plant)

The case study looked at the economic feasibility of treating the site trade effluent to potable water quality with the intention of reusing the recycled water in all process applications.

The following technologies were used to treat a discharge volume of 72000 m<sup>3</sup> per annum **(figure 5)**:

- 1. pH Correction
- 2. Dissolved air floatation (DAF unit)
- (already in place)
- 3. Biological Treatment (MBR)
- 4. Reverse Osmosis (RO)
- 5. Chlorine Dioxide
- 6. Associated pumps, break tanks etc...

DAF Plant	Estimated Value (£)
CAPEX	£350,000
APEX	£170,000
Total savings from discharging treated water due to the significant reduction in COD values	£375,088
ROI	< 2years

## Table 2 - ROI of DAF unit

Parameter	Raw Water	DAF permeate (MBR influent)	MBR permeate (RO influent)	RO permeate
E.coli	N/A	N/A	Absent	Absent
Coliform	N/A	N/A	Absent	Absent
Total Bacteriological Count (CFU/ml @37 °C)	N/A	N/A	10 <sup>3</sup> - 10 <sup>5</sup>	<50
Faecal streptococci	N/A	N/A	Absent	Absent
Viruses	N/A	N/A	Absent	Absent
Cryptosporidium	N/A	N/A	Absent	Absent
FOG mg/L	N/A	N/A	Nil	Nil
Trace organic compounds	N/A	N/A	traces	Below detection limit
Taste and Odour	N/A	N/A	N/A	Same as mains water supply
Suspended Solids (mg/L)	600	50	<1	0
Conductivity (µs/cm)	N/A	N/A	2500-4300	<50
COD (mg/l)	11,000	1750	<50	<5
COD loading (Kg/day)	2612	456	<5	<5

#### Table 3 - Regenerated Water Quality

MBR/ RO/ ClO2 and Associated Systems	Estimated Value (£)
CAPEX	£900,000
APEX (mainly energy to provide aeration)	£200,000
Total savings from discharging 46000 m <sup>3</sup> of water (£1.2/m3)	£55,200
ROI <sup>1</sup>	20 years

#### Table 4 - ROI of the Biological and Associated Treatment Plants

<sup>1</sup> This does not include funding that might be available to support environmental projects.

Based on an untreated COD value of 11.000 mg/L, a discharge volume of 72000 m<sup>3</sup> per annum and the current trade effluent charging structure for the site (Mogden formula), the cost of discharging the untreated effluent would be around £480541.12 per annum (actual site figures). However, the DAF unit which was installed more than 20 years ago is achieving a significant reduction in the effluent COD values, leading to a significant drop in discharge costs. Combined with pH control and chemical flocculation and coagulation, the DAF unit is reducing the COD of the trade effluent by around 84% (a reduction from 11,000 mg/L to 1715 mg/L), savings around £375,088 in discharge costs per annum. Taking into account the capital and operating costs of the DAF unit the payback period of this treatment is around 2 years (table 2).

**Biological Treatment** 

The plant was designed to treat the water after the DAF unit to the parameters listed in **table 3**.

Based on the manufacturers' guidelines and a feed of 72000 m<sup>3</sup> per annum to the DAF plant the plant is expected to regenerate around 46000 m<sup>3</sup> of water per annum. Considering the capital and operating costs of the MBR/RO and ClO2 treatments, the payback period of the biological treatment is expected to exceed 20 years **(table 4)**.

Based on these findings, although the environmental benefits of recycling and reuse can be of huge significance there are currently limited financial incentives to support and fund such applications. This in turn will impact on the priority and resources directed to improving the efficiency of the technologies used and in improving knowledge and awareness.

![](_page_58_Picture_2.jpeg)

#### STEPS NEEDED TO ENCOURAGE WATER RECYCLING AND REUSE IN THE FBM

Significant water savings can potentially be achieved from widespread applications of water recycling and reuse in the UK. The study evaluated the FBM sector but the findings from this study will apply to other industrial processes.

The data clearly highlights the economic challenges that can currently face medium sized operations to implement biological treatment facilities to produce water of potable quality from industrial trade effluent.

Unless there are additional critical driving factors companies are often restricted to funding projects that have short term ROI (2-3 years maximum). This will make the approval of advanced water treatment projects particularly challenging.

If water recycling and reuse is to become a widespread application in the UK, more work is needed from all key stakeholders in this sector including:

1. Technology suppliers: to improve the efficiency and provide competitive ROI through lowering capital and operating costs.

2. Research community: to work with suppliers to provide alternative materials and more sustainable/less energy intensive processes.

3. UK Government: To better subsidise environmental projects and improve awareness regarding the value of water.

Without this water recycling applications will remain limited in the UK, wasting large volume of a much needed and scarce resource.

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![](_page_58_Figure_14.jpeg)

#### Figure 5 - Summary of main treatments and associated Systems (McCoy, 2017)

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# THE WATER MANAGEMENT SOCIETY AGM 5TH SEPTEMBER 2022

Water Management Society 43<sup>rd</sup> AGM - Monday 5th September 2022 13:00 – 14:00

The Water Management Society's 43rd Annual General Meeting will be held remotely on 5th September 2022 at 13:00 via WEBEX events. All are welcome to attend the AGM but only WMSoc members may vote.

Nominations are also OPEN to join council and paperwork can be found with this edition. All elected members are welcome to apply to serve on council, and representatives do so voluntarily. Elected members of council will be announced during the AGM.

SEE FULL AGM DETAILS AND BOOK ONLINE TO SECURE YOUR PLACE, OR SEND YOUR APOLOGIES TO ADMIN@WMSOC.ORG.UK.

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# WMSoc Golf Day 2022 12th May 2022, Belfry Golf Course

It was a thankfully sunny day when a small band of members and friends met at the Belfry Golf Course for the first WMSoc networking event on the 12th May. Guests were welcomed with breakfast before being put into groups for the day's golf. Everyone was eager to tee off, and with competitions of the longest drive and nearest to the pin in addition to the overall winner at stake, spirits were high.

The five teams made their way to the first tee and set off on their long walk. Enjoying the Staffordshire countryside and fresh air on their 10k walk with over 4 hours of golf on the excellent course. Camaraderie was evident from the off, and stories of bunkers, rough and near misses were exchanged in the bar later. The day was completed with a delicious three course meal and prize giving. Congratulations to Matthew Spindler who won first prize with Dan Kimber in second and Andy Ruck in third. Andy also took the longest drive prize with Steven Booth winning the closest to the pin award.

All those attending had a great day and met friends old and new. We are looking forward to organising other social events in the future.

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# 50 Shades of Grey: The realities of working in Infection Prevention and Control

#### It's another early start in the world of Infection Prevention and Control (IPC) following on from another rather restless night. The thing that has been playing on my mind a lot lately is the perception of vs the reality of IPC, and medicine in general.

Some of this has been sparked by seeing the discussion, opinions and commentary by medical colleagues on twitter linked to IPC response. I've been trying to read them as a member of the public would on this public forum. The thing that strikes me more than anything is that it is no wonder people are confused, we all post from a position of absolutes, often from very contrary stand points. What we do very poorly is communicate the nuance, discuss the technicalities and travel any middle ground. Possibly because its so hard in 240 characters, but also I think because we work with an implicit understanding that we know that nuance exists. On the face of it these conversations therefore come off as black and white positions, when in actuality IPC is very much 50 shades of grey, where there is accuracy in many of the positions in between.

So why is IPC not clear cut? Why might you get a different set of rules and experiences from one Trust to another or even one phone call to another? Well the fundamental tool of IPC is risk assessment. Every scenario includes slightly different exposures, different organisms and different patients, all of which will impact on that risk assessment. Just as no two scenarios are ever really the same therefore, no two risk assessments look identical. This also leads to disagreements on things like social media, as the experience, setting and drivers of those commenting are also just as varied.

What Do I Mean When I Talk About Risk Assessment? Risk assessment is the process we go through to identify what risks are present to patients, and from patients to staff, visitors and carers. It also includes the things we do to control those risks, things called control measures. I want to start out by saying that I believe we are all aiming for the same goal i.e. providing safe high quality clinical care. Like many things there are often multiple options to deliver this goal and individuals may use slightly different processes in order to achieve it. The below is an example of the way that I structure my thinking.

There are 2 main aspects to risk assessment:

- For the patient if an organism is detected in a site on a patient what risk does that pose i.e. an E. coli urinary tract infection if not managed well in certain patients is a risk of progressing to E. coli blood stream infection
- For other patients, staff and families what does the detection of an organism mean for others, what counts as an exposure, what would the clinical consequences of acquisition mean for those exposed?

At some point I'll do a fuller post on risk assessment in IPC and what different options there are for creating your risk assessment tool, but for now these are the kinds of things I consider when putting together risk assessments:

• Routes of transmission – how do infections spread? Water/ Surfaces/Contact/Air

## Dr Elaine Cloutman-Green

• Patient loads – when someone has an organism how much do they have, viruses usually higher numbers than bacteria

- Environmental persistence how long can an organism survive in water/air/on surfaces
- Infectious dose how many copies of an organism does it take to give an infection
- Colonised/infectious state can I carry an organism without harm or does it always make me unwell MRSA vs measles for instance
- Patient susceptibility is the patient immune i.e. vaccination/ prior infection, are they more at risk if they get infected because they have no immune system?
- Timing of infection (community vs hospital acquired)
- Endogenous vs exogenous is the infection spread from one site to another in the same patient i.e. from nose where doing no harm to a surgical wound? Or has the patient got it from outside?
- Surveillance programmes in place what kind of searching for organisms is being undertaken i.e. within the environment/ based on symptoms, or as part of routine regular testing

When I'm talking about risk assessment for the rest of this blog I'm also going to be including what we call control measures which are linked to that risk assessment. These are things you do to prevent or reduce risk i.e. wearing personal protective equipment, putting patients isolation, prophylaxis etc.

I think we need to acknowledge that as well as different information, there is also an impact from the person handling that information and making the risk assessment. As a Healthcare Scientist I tend to feel much more comfortable focussing on the organism aspects and on control measures such as ventilation. Some of my colleagues will feel more comfortable in other aspects, especially in terms of scenarios such as surgical site infections and dressing management for instance. We all cover the same ground and should have the same core fundamentals, but we should acknowledge that different people will handle information in slightly different ways. This can be a strength, as long as it's acknowledged.

# LEARNING PRETTY MUCH ANYTHING.

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# So Why Do Risk Assessments Change?

As you can see from above, risk assessments are anything but straight forward. They include a lot of information, some of which you won't always have at the start. There are some scenarios where we have quite a lot of information where responses are pretty much standardised and you would think everyone would do very similar things i.e. detection of MRSA in a surgical patient. Even for something like this that happens often and we have quite a lot of good information about what the risks and the control actions might be, there isn't a one size fits all approach. In paediatrics we manage these patients differently to how they might be treated when they become adults. This is because their risk of continuing to carry MRSA as they interact more with people and the environment means that trying to remove it with antibiotics and chemicals (decolonisation) may be less effective and they may also have delicate skin which means using these chemicals may cause skin problems. So even in a straight forward situation, setting and scenario matters.

We often get asked why the way we manage something in my hospital may look different to how it might get managed somewhere else, even at another children's hospital. This can be for a number of reasons. I may have access to resources in terms of cubicles or diagnostics that enable me the option of managing a scenario differently. My Trust is in England and the guidance in other parts of the devolved nations may be different i.e. Scotland and England don't always do things the same way. Finally, my Trust also looks after children who have complicated conditions and who may have little to no immune system, so the consequences for patients if I get it wrong may be higher than somewhere seeing other types of patients. Setting, not just organism matters.

The other thing to bear in mind is that information and settings are not static. Often in medical dramas something is either X or Y, all of the information comes at the same time. This isn't how things work in real life, information comes in pieces and the decisions you make about the next question you ask are actually as important as how you manage actions based on the data already in your possession. In some ways House was right......it could be Lupus.

Although I don't want this post to be about SARS CoV2, it is a good example of the fact the more information you have the more your decisions might change and you know more about where your risks are. Omicron has led to different risk being recognised when compared to Delta, because of impacts such as staff shortages, but also because of the amount of it that is currently circulating. This has impacted testing decisions and risk vs benefit discussions linked to patient harm. This is particularly challenging as these judgements about risk are actually being made with incomplete data sets as we don't have the luxury of waiting it out. This makes at least this IPC professional uncomfortable, as lets be honest you are unlikely to love IPC if you aren't in someway risk averse as a personality type. You don't always have the luxury of time however and therefore we need to act, do the best we can with the information we have and make sure we also capture the learning as we go to enable improved decisions next time.

![](_page_62_Figure_8.jpeg)

#### Who Pays?

So, resource matters. Everything about IPC comes with a cost. The thing is not all of those costs are financial.

Some examples of when even interventions, like putting patients in isolation can be challenging or have adverse consequences for everyone involved:

• Its hard to know once you put someone into isolation when the right time is to take them out

• Putting patients into isolation has been linked with decreases in staff time, increase in perceived concerns over care, and increase in prescribing errors

• In paediatric patients isolation can affect inpatient developmental milestones

• In adults isolation has been linked to increased levels of anxiety and depression

• Isolation can negatively impact on staff caring for patients due to isolation from colleagues and strain of dealing with sick patients single handed

Risk assessments therefore are influenced by who bears the cost. Individuals often pay the price of keeping others safe. This is a social contract that we see playing out on a much larger scale during the pandemic. Other methods to impact risk assessments, such as installation of mechanical ventilation, have a high financial cost that not all centres are able to afford. It is naïve therefore to say that any of these choices are easy, someone somewhere always bears the cost and the impacts of decisions.

After all of the above what is it that I want you take away?

• Firstly IPC is anything but easy or straight forward, no matter what some of the reporting or social media commentary makes it appear. Decisions are complicated and every single one comes with impacts, be it for patients or budgets

• Secondly, the right decision for one centre may not therefore be the right decision for another. Comparison between one centre or one set of scenarios and another are not always valid, as the needs of the patient population or risks involved are unlikely to be identical

• Lastly, risk assessments change, they change as scenarios change, they change as more information becomes available. This isn't a failing, this is responding to evolving situations and although difficult this is a strength

IPC is not black and white, it is 50 shades of grey and dealing with this is both the strength of the amazing people working in this field and the daily challenge they face, embrace and respond to!

All opinions are my own.

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# Reduce the burden of Healthcare Associated Infections 10th May 2022, Bristol

IDEXX held a workshop on 10th May 2022 in Bristol "Reduce the burden of Healthcare Associated Infections".

Healthcare-associated infections caused by Pseudomonas aeruginosa impact significantly on clinical outcomes for patients and can lead to avoidable deaths. The bacterium is often resistant to a range of antibiotics, a trait that can be passed to other harmful bacteria, exacerbating problems of antimicrobial resistance in hospitals. As well as the human costs, this places a significant burden on already stretched healthcare budgets. This workshop discussed the issues faced by hospitals, focusing on the importance of Water Safety Plans and risk assessment. Testing for the bacterium is crucial, and improved approaches to this are also covered.

The agenda covered:

- "Why is Pseudomonas aeruginosa still a formidable and ever-present adversary?" - Dr. Jimmy Walker
- "Is your Water Safety Plan fit for purpose? Including the new BS 8580 Standard"
- Dr. Susanne Lee

• "How On-Site Water Testing can contribute to a reduction in Hospital Acquired Infections and Anti-Microbial Resistance, leading to improved Patient Safety, considering the constraints on Hospital Budgets" - Dr Paul McDermott

The presentations were followed by a live demonstration of their On-Site Water Testing System followed by a very lively and engaged question and answer and open discussion session.

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# A discussion with... Karina Jones MIHEEM M.W.M. Soc MWES MITE Eta Projects Ltd.

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Today we are talking with Karina Jones who has taken time out from her busy day to speak with us. First, we asked her to **describe her career journey so far**.

Karina notes that it has been a long journey. She "came across water management through a female friend and became interested in micro-bacteria and waterborne pathogens." After asking a lot of questions during their meetings, her friend offered her an internship with her company which inspired her to learn about microbiology and explore the connection between water guality and human health, especially opportunistic pathogen control in hot & cold-water systems in the Healthcare environment. The role involved intensive specialist training, and vocational on-site learning through which she has begun to appreciate how involved and big the water management industry really is, especially in waterborne pathogen control. After all she commented "We don't think about the journey water takes before it comes out of the tap, we assume it will be clean and wholesome at all times."

Karina started her journey "several years ago as a water sampling technician attending major NHS Trust hospitals, Health Clinics and Dental hospitals" learning about dynamic risk assessments of water outlets and the different requirements in clinical high risk areas. Next, she moved to the complex layout of plant rooms and the function of water systems "which was a new world". She has spent her time learning and enriching her knowledge being actively involved in a wide range of jobs, "doing the practical aspects of tank inspections, taking samples from water systems such as calorifiers and maintaining her ongoing curiosity by asking questions such as - Why are we sampling there?" She notes that it all started from the "burning desire of wanting to know how bacteria can so quickly affect our health if we expose ourselves through vulnerability or lack of understanding of the risk " and has always been "amazed that after 48 years of knowing about Legionella bacteria and the effects it can have on our health (if we are exposed to it), and having all available guidance, we can still come across situations where a healthy person can catch Legionnaires' disease".

We asked her **what she is doing today?** Karina is now an IHEEM registered Authorising Engineer (AE) for water and is an active member of IHEEM Water Technical Platform. She is a member of the Institute of Engineering and Technology (IET) and her future aspiration is to be assessed for Chartered Engineer Status by the Engineering Council. Karina is providing independent professional advice on water management and waterborne pathogens control to Healthcare, the leisure industry, hotels etc.

So, we asked her to explain more. Karina tells us that "an Authorising Engineer provides independent professional advice and assistance on statutory requirements and HSE guidance and regulations including water audits, showing where improvements can be made. "My vision is to reassure our clients that they are in a 'safe pair of hands' we are not a 9-5 business but are always there to help and support through crisis however big or small. Communication should be maintained unbiased and open to encourage clients to ask questions without feeling uneasy about their concerns, in my view if a question exist, then there is obviously a need for clarification". "We should be here to share our knowledge to the best of our ability, showing the best way forward". She notes that "in the past the questions I have asked of colleagues have allowed me to develop and improve. I want to pass this motion forward to others."

Her goal when becoming an AE was "to ensure that water audits carried out at hospitals and clinics are done thoroughly and to ask questions to ensure we capture all relevant issues or challenges the client faces with the view to assist". Karina comments "Only when you are aware of gaps can you address them and improve the situation". She notes that many audits can be rather general, focusing on areas such as record keeping, training, checks and tests carried out through Planned Preventive Maintenance (PPM) which of course are all very important, however we must also understand why certain aspects of water safety control are not met on occasion and how we can help, what processes can be put in place to assist the client in their task of water management.

As an AE Karina is involved in Water Safety Groups (WSG) and Infection Prevention and Control (IPC) teams' meetings. The groups of professional people provide valuable support but she feels that the experts are not always involved early enough or included in building projects especially in healthcare environments. The goal should be to have WSG meetings at the earliest opportunity to sway decisions, using the combined knowledge of everyone on the team to help make the right decision on new products and installations. The "Water Safety Group should not be seen as a possible blame game but must work together for the better of the Healthcare environment" and in reality "with current communication methods there is no reason not to share knowledge and not be informed." Karina also feels the dependence on following Guidance often overlooks the need to consider the application of practicality, time, money and common sense. "The guidance is there to guide us but it's important to acknowledge limitations if they are present and use available support through our colleague's expert knowledge to make the right decision". "It's easier to ask and ensure we get it right first time than to have to fix it later".

## Next, we asked **who or what had the biggest impact on your early career development?**

Karina tells us about her friend "who's encouragement and passion persuaded her to join the industry, I am here today doing what I do due to her passion and for this reason I would like to say thank you". She notes that her friend "explained things in a way that was understandable". Karina still believes that complexity can form a barrier "once information is shared in a simple

![](_page_66_Picture_2.jpeg)

manner, actions can be taken in the correct way". There is a vast amount of guidance and statutory requirements in waterborne pathogen control and this information can be very daunting. But she feels that people involved in water management shouldn't be put off by that. "If you have the drive to safeguard human health, protect patients and staff in Healthcare environments outside of their medical needs, then it is hard work, but it's very rewarding."

Karina currently works with Eta Projects ltd. and noted that "In my personal experience, this is the first company I am involved with, where diversity and encouragement for women engineers is an open practice with visual and clear achievements reached". I am indebted to them for their support and continued encouragement to fulfil my dreams in my professional journey." Karina also names the company's Managing Director Mr. Eugene Conroy who is "a supporter of women in this industry. There are several professional women working at the company, and he feels that you need both female and male input into the business." Mr. Rick Seymour, their Director of Authorising Engineer Services has also been very helpful and supportive.

# Looking back, we ask **what advice would** you give to your younger self?

Karina feels she could have been surer of herself and notes that "the young ladies today seem to be more authoritative and are more outgoing than I was when I was young." It's perhaps not surprising that Karina wasn't confident when we realise that she left her homeland of Poland at 12 to move to Vienna, Austria, where she learnt German and finished her schooling. Aged 15 she moved to the UK and "didn't want to go back to school and study English" so instead started part-time work and learnt the language as she went along. She notes that "changing countries, learning new languages, and adopting different cultures were challenging and often required huge adjustment" and meant that she didn't have the security, opportunity or often the confidence to do things. Her advice: "just do it, how hard can it be?"

The discussion moved on to **what Karina would change in the industry?** She tells us "My biggest aim would be to make sure that good communication is setup and people are not worried about raising their concerns." She feels that people need to discuss more and not worry about being asked or asking questions. "By having a good line of communication in any organisation and working as an open team we would achieve much more and much quicker." The biggest change then would be to "have more open discussions". To appreciate and understand water safety group members' roles and challenges they are faced with, working together towards the same aim of compliance.

She also feels that "Looking at controlling waterborne pathogens it helps to understand how bacteria behave and evolve, by having a much better understanding of the characteristics of the bacteria. By doing this we will appreciate the ways to control it and eliminated it where possible. It is often taken for granted that everyone has full understanding of the bacteria we aim to control, but the Estates department staff, soft FM (housekeeping department) and clinical staff may not have the relevant information or understanding of Legionella or P.aeruginosa bacteria outside their own field of expertise. They know we need to keep the water systems clean, keep water moving and maintain water in specific temperature parameters but don't always appreciate the reasons behind these requirements."

Next, we moved on to **what are your views** regarding degree vs vocational training? Karina felt that "if you have a chance to do both you would be in the best world." Karina has developed her career through vocational on-site learning, and has pursued and still engages in every opportunity to learn, including conferences, training courses and webinars to ensure her skills and CPD are maintained. She notes that "you can do that with the backing of supportive colleagues who are willing to share their knowledge to help you and encourage you along the way." "A degree may be important but is not always essential, what is essential is to have a good understanding of what is needed on the ground and have a full appreciation of the importance of the role you play." Karina has a particular focus on some older colleagues who she feels "have vast amounts of knowledge and experience and often due to work commitments their knowledge is not passed on to the younger apprentice or engineers. That is a great shame." She

notes that "we can learn a lot from a degree, books, and the internet, we have the ability now to retrieve huge amounts of knowledge. But the practical aspect of doing things and seeing how things are done from someone with experience is being lost." She feels that "apprenticeships for young engineers should be encouraged, ... taking young people under their older and wiser engineers' wings can provide the best mixture of both worlds of education and practical experience" the aim is a more rounded professional.

## We ended our conversation with the question **do you prefer to read hard copy books and journals or are digital methods preferable**?

Katrina notes that she "has a huge number of books and likes both. When I read something, I highlight important information" either on paper or digitally. She notes that the benefits of digital are that "it is easier to read it anywhere, and you don't need to carry the books around. But with a magazine like Waterline, I like to take it with me and read when I have a few minutes spare." She has a "whole stack of Waterlines with highlighted sections in articles for future reference."

It's been an absolute pleasure to speak with Karina and get a different view on the world of water. We hope you have enjoyed the conversation.

# Quick fire round Beer or Wine? Beer Pizza or Curry? Curry Cheese or Dessert? Cheese What's your favourite vehicle? Mercedes What three things would you take if deserted on a tropical island? Sun cream and an endless supply of water. There's no need for a bikini as there will be no-one else there!

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![](_page_67_Picture_2.jpeg)

# Here is a quick roundup of work being undertaken by the various sub-committees of volunteers.

## **Events Committee**

I'm sure that you will agree it's been an exciting couple of months for the events committee. We have hosted our first WMSoc Golf Day, welcomed you to the first live event of 2022, and given you a third webinar in the 2022 series, there has been plenty going on. If you didn't come to those there is still lots to look forward to in 2022. A fourth webinar and second live event are planned in the second half of the year along with the AGM so keep checking the WMSoc e-flyers and social media for details of topics, line-ups and how to get involved.

## **Technical Committee**

Work continues apace within the Technical Committee. We are here to serve the membership and help to raise awareness of key issues and raise standards through continuing education and engagement with key stakeholders within our industry. The Technical Committee is made up of some of the best and most experienced minds within our industry who give their time for free. Use us, ask us questions and if you would like to become more involved in supporting our industry then please reach out to us.

Updates to HSG274 are in the pipeline for this year. If you have any ideas or suggestions then please let us know. CIBSE Guide G is also being updated and we will be collaborating on that. We are looking for some project support - If you have a particular expertise in legionella risk management of cutting oil systems and would like to help write some member guidance then please make contact.

A number of other projects are also in progress. Guidance on Scald Risk Assessment has been written and is currently out for peer review. A Water Feature Toolbox Talk is being written. Dental guidance is being updated. Risk Assessment guidance is being updated to include some general, high level, principles for not commonly encountered types of systems. Toolbox Talks on Method Statements and Water Softeners are being updated.

We recognise the need to support the adoption of low carbon technologies for a more sustainable future. One of our members has written a Waterline article. There are systems out there that meet current guidance and we will be seeking engagement with this industry to support development of systems that can lower energy usage and meet current and future guidelines.

We are here to help, please use us and engage with us if you can support our activities. We are not an 'old boy' network, just an experienced group of people who freely give their time to help you all. So please talk to us, ask us questions and engage with us.

## **Training Committee**

We were delighted to welcome some new and some old friends to WMSoc for the renaming of the training rooms and practical training area (PTA) to the "Sue Pipe Training Centre" please see elsewhere in this issue for the full report.

The Training and Accreditation Committee (TAC) have had some excellent response to their request for new tutors to step forward and they are currently undergoing assessment.

The WMSoc Qualification Pathways, leading to WMSoc Cert designation, have had a lot of interest with some already embarking on their journey. The on-line courses have been well received with a significant number of courses being taken already. We would like to reiterate that the links are communicated to the delegate prior to attendance and failure to complete the courses will potentially compromise the final exam results and certificates cannot be awarded until the on-line sections have been passed. Please ensure that you contact whoever books your training to ensure that you get the necessary information. Please get in touch to be one of the first to receive this new award at training@wmsoc.org.uk.

We are also updating our own internal competence checks to align with the new LCA service standards.

Lastly, we are reviewing and updating the PTA this year – please contact training@wmsoc.og.uk if there is anything you would like to see in there, or if you can think of things that we could do better?

# **Waterline Committee**

Welcome to your summer 2022 edition of Waterline. Your committee members work diligently to maintain both quality and value of each edition. We continue to hold monthly on-line meetings to ensure continuity from one edition to the next.

Thank you to all those WMSoc members who have stepped up and produced articles for this edition, to our advertisers, and to our secretariat who keep us on our toes to deliver the journal on time to members, and carry out a huge amount of work in the background.

We are always looking for offers of articles, including ones on climate change. Please let us know if you have an article which you think would be of interest to the membership by contacting WMSoc via e-mail: **waterline@wmsoc.org.uk**, addressed for the attention of Jane Edmonds.

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wmsoc1 facebook.com/wmsoc1/ water management society instagram.com/water\_management\_society/

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KEEP UP-TO-DATE by following the society social media channels:

WMSoc Secretariat linkedin.com/in/wmsoc-secretariat/

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# The Cooling Tower Specialists

Stay cool, we're on top of it.

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# What we do: Products and Services

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# Training Programme 2022

# **SPRING & SUMMER PROGRAMME 2022:**

**Tuesday 5th April** Wednesday 6th April Wednesday 20th April Thursday 21st April **Tuesday 26th April** 

Wednesday 27th April Wednesday 4th May **Tuesday 10th May** Wednesday 11th May Tuesday 17th May **Tuesday 24th May** Wednesday 25th May **Tuesday 7th June** Wednesday 8th June **Tuesday 14th June** Wednesday 15th June **Tueday 28th June** Wednesday 29th June **Tuesday 5th July** 

Wednesday 13th July Wednesday 20th July **Tuesday 9th August** Wednesday 10th August **Thursday 11th August** 

AUTUMN PROGRAMME 2022:

Wednesday 7th September **Thursday 8th September Tuesday 13th September** Wednesday 14th September **Tuesday 27th September** Wednesday 28th September **Tuesday 4th October** Wednesday 5th October **Tuesday 11th October** Wednesday 12th October **Tuesday 18th October** Wednesday 19th October **Tuesday 1st November** Wednesday 2nd November

**Tuesday 8th November** Wednesday 9th November **Tuesday 15th November** Wednesday 16th November **Tuesday 22nd November** Wednesday 23rd November **Tuesday 29th November** Wednesday 30th November **Tuesday 6th December** Wednesday 7th December **Thursday 8th December** 

**Evaporative Cooling Water Chemistry - Foundation Steam Boiler Water Chemistry - Foundation** Practical Legionella Risk Assessment Hot & Cold Water Systems - Advanced \* Cleaning & Disinfection of Evaporative Cooling Systems HTM 04-01 Water Hygiene Training: Managing & Controlling Risk of Waterborne Pathogens in Healthcare Water Systems 🔵 Temperature Monitoring, Sampling & Inspection of Hot & Cold Water Systems For Technicians ● Cleaning & Disinfection of Hot & Cold Water Systems Legionella Risk Assessment of Hot & Cold Water Systems - Foundation Legionella Control & Management for Dutyholders and Responsible Persons - Hot & Cold Water Systems Management and Control of Closed Systems Spa and Swimming Pool Chemical Control and Management Practical Legionella Risk Assessment Hot & Cold Water Systems - Advanced \* Temperature Monitoring, Sampling & Inspection of Hot & Cold Water Systems For Technicians Cleaning & Disinfection of Hot & Cold Water Systems Water Treatment Chemistry Foundation Legionella Risk Assessment of Evaporative Cooling Systems Legionella Control & Management for Dutyholders & Responsible Persons - Evaporative Cooling Systems Legionella Risk Assessment of Hot & Cold Water Systems - Foundation HTM 04-01 Water Hygiene Training: Managing & Controlling Risk of Waterborne Pathogens in Healthcare Water Systems Practical Legionella Risk Assessment Hot & Cold Water Systems - Advanced \* ● Temperature Monitoring, Sampling & Inspection of Hot & Cold Water Systems For Technicians ● Cleaning & Disinfection of Hot & Cold Water Systems Legionella Risk Assessment of Hot & Cold Water Systems - Foundation Management and Control of Closed Systems

Practical Legionella Risk Assessment Hot & Cold Water Systems - Advanced \* Cleaning & Disinfection of Hot & Cold Water Systems Legionella Control & Management for Dutyholders and Responsible Persons - Hot & Cold Water Systems Legionella Risk Assessment of Hot & Cold Water Systems - Foundation Water Treatment Chemistry Foundation **Evaporative Cooling Water Chemistry - Foundation** Practical Legionella Risk Assessment Hot & Cold Water Systems - Advanced \* Legionella Risk Assessment of Evaporative Cooling Systems Temperature Monitoring, Sampling & Inspection of Hot & Cold Water Systems For Technicians Cleaning & Disinfection of Evaporative Cooling Systems Legionella Risk Assessment of Hot & Cold Water Systems - Foundation Evaporative Cooling Water Chemistry - Advanced \* Cleaning & Disinfection of Hot & Cold Water Systems HTM 04-01 Water Hygiene Training: Managing & Controlling Risk of Waterborne Pathogens in Healthcare Water Systems Practical Legionella Risk Assessment Hot & Cold Water Systems - Advanced \* ● Management and Control of Closed Systems Steam Boiler Water Chemistry - Advanced \* Spa and Swimming Pool Chemical Control and Management Legionella Control & Management for Dutyholders and Responsible Persons - Hot & Cold Water Systems Legionella Risk Assessment of Hot & Cold Water Systems - Foundation Legionella Control & Management for Dutyholders & Responsible Persons - Evaporative Cooling Systems **Qualification Wrap Up & Exam Session** Cleaning & Disinfection of Hot & Cold Water Systems Practical Legionella Risk Assessment Hot & Cold Water Systems - Advanced \* ●

Temperature Monitoring, Sampling & Inspection of Hot & Cold Water Systems For Technicians

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![](_page_69_Picture_13.jpeg)

\* Delegates attending an advanced course should first attend the corresponding foundation course or have equivalent knowledge.

It is generally agreed that training should be refreshed on a regular basis; WMSoc recommends that training is refreshed every 3 years. The WMSoc has replaced its refresher courses with revamped training modules using the Practical Training Area (PTA); this gives attendees the opportunity to prove an ability to follow instructions and demonstrate their ability to work safely under test conditions. Anyone who attended training more than 3 years ago would benefit from attending a course currently shown on the programme to refresh their training.

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![](_page_69_Picture_17.jpeg)

ACCREDITED PROGRAMME

# **Book online:** bit.ly/WMSoc-Learning Call: 01827 289 558 or email: training@wmsoc.org.uk

The Water Management Society, 6 Sir Robert Peel Mill, Hoye Walk, Fazeley, Tamworth, Staffs B78 3QD