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# **waterline**

[www.wmsoc.org.uk](http://www.wmsoc.org.uk) ISSN 0954 7711 • Autumn 2022

## **Effective Pre-commission Cleaning of Closed Heating/Cooling Water Systems**

(Experiences of a Water Chemist)

## **Hazards Associated With Water Quality in Closed Pipe Systems**

## **The environmental impacts and effects of corrosion in water treatment**

### **PLUS**

- Microbial Induced corrosion in cooling systems and how regular monitoring can mitigate potential problems
- Life of a Water Treatment Pre-commissioning Engineer
- The Hidden Dangers in Hospital Water Systems



Tuesday 24th January  
Wednesday 25th January  
Thursday 26th January  
Tuesday 31st January

Temperature Monitoring, Sampling & Inspection Of Hot & Cold Water Systems For Technicians ●  
Cleaning & Disinfection of Hot & Cold Water Systems ●  
**Water Treatment Hot & Cold Systems EXAM**  
Practical Legionella Risk Assessment Hot & Cold Water Systems Advanced\* ●

Wednesday 1st February  
Tuesday 7th February  
Wednesday 8th February  
Tuesday 14th February  
Wednesday 15th February  
Tuesday 28th February

Management And Control Of Closed Systems  
Legionella Risk Assessment Of Hot & Cold Water Systems Foundation  
Legionella Control & Management for Dutyholders & Responsible Persons - Hot & Cold Water Systems  
Steam Boiler Water Chemistry Foundation  
Cleaning & Disinfection of Hot & Cold Water Systems ●  
Legionella Risk Assessment of Evaporative Cooling Systems

Wednesday 1st March  
Tuesday 7th March  
Wednesday 8th March  
Tuesday 14th March  
Wednesday 15th March  
Tuesday 21st March  
Wednesday 22nd March  
Tuesday 28th March  
Wednesday 29th March

Spa and Swimming Pool Chemical Control and Management  
Practical Legionella Risk Assessment Hot & Cold Water Systems Advanced\* ●  
Legionella Risk Assessment Of Hot & Cold Water Systems Foundation  
Temperature Monitoring, Sampling & Inspection Of Hot & Cold Water Systems For Technicians ●  
Water Treatment Chemistry Foundation  
Evaporative Cooling Water Chemistry Foundation  
**Water Treatment Steam Boiler Systems EXAM**  
Cleaning & Disinfection of Evaporative Cooling Systems ●  
Cleaning & Disinfection of Hot & Cold Water Systems ●

Tuesday 18th April

HTM 04-01 Water Hygiene Training: Managing & Controlling Risk of Waterborne Pathogens in Healthcare Water Systems ●

Wednesday 19th April  
Tuesday 25th April  
Wednesday 26th April

Temperature Monitoring, Sampling & Inspection Of Hot & Cold Water Systems For Technicians ●  
Practical Legionella Risk Assessment Hot & Cold Water Systems Advanced\* ●  
Evaporative Cooling Water Chemistry Advanced\*

Wednesday 3rd May  
Tuesday 9th May  
Wednesday 10th May  
Tuesday 16th May  
Wednesday 17th May  
Tuesday 23rd May  
Wednesday 24th May

Cleaning & Disinfection of Hot & Cold Water Systems ●  
Legionella Risk Assessment Of Hot & Cold Water Systems Foundation  
Legionella Control & Management for Dutyholders & Responsible Persons - Hot & Cold Water Systems  
Management And Control Of Closed Systems  
Legionella Control & Management for Dutyholders & Responsible Persons - Evaporative Cooling Systems  
Practical Legionella Risk Assessment Hot & Cold Water Systems Advanced\* ●  
**Water Treatment Cooling Systems EXAM**

Tuesday 6th June  
Wednesday 7th June  
Tuesday 13th June  
Wednesday 14th June  
Tuesday 20th June  
Wednesday 21st June

Temperature Monitoring, Sampling & Inspection Of Hot & Cold Water Systems For Technicians ●  
Legionella Risk Assessment Of Hot & Cold Water Systems Foundation  
Cleaning & Disinfection of Evaporative Cooling Systems ●  
Legionella Risk Assessment of Evaporative Cooling Systems  
**Water Treatment Closed Systems EXAM**  
**Legionella Risk Assessment Cooling Systems EXAM**

Tuesday 4th July  
Wednesday 5th July  
Tuesday 11th July  
Wednesday 12th July  
Tuesday 18th July

Cleaning & Disinfection of Hot & Cold Water Systems ●  
Management And Control Of Closed Systems  
Practical Legionella Risk Assessment Hot & Cold Water Systems Advanced\* ●  
Legionella Risk Assessment Of Hot & Cold Water Systems Foundation  
Temperature Monitoring, Sampling & Inspection Of Hot & Cold Water Systems For Technicians ●

Tuesday 5th September  
Wednesday 6th September  
Tuesday 12th September  
Wednesday 13th September  
Tuesday 19th September  
Wednesday 20th September  
Tuesday 26th September  
Wednesday 27th September

Legionella Control & Management for Dutyholders & Responsible Persons - Hot & Cold Water Systems  
Legionella Risk Assessment Of Hot & Cold Water Systems Foundation  
Water Treatment Chemistry Foundation  
Steam Boiler Water Chemistry Foundation  
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 Hot & Cold Water EXAM**

Tuesday 3rd October  
Wednesday 4th October  
Tuesday 10th October  
Wednesday 11th October  
Tuesday 17th October  
Wednesday 18th October  
Tuesday 24th October  
Wednesday 25th October

Evaporative Cooling Water Chemistry Foundation  
Steam Boiler Water Chemistry Advanced\*  
Practical Legionella Risk Assessment Hot & Cold Water Systems Advanced\* ●  
Legionella Risk Assessment Of Hot & Cold Water Systems Foundation  
Cleaning & Disinfection of Evaporative Cooling Systems ●  
Temperature Monitoring, Sampling & Inspection Of Hot & Cold Water Systems For Technicians ●  
Management And Control Of Closed Systems  
Legionella Risk Assessment of Evaporative Cooling Systems

Tuesday 7th November  
Wednesday 8th November  
Tuesday 14th November  
Wednesday 15th November  
Thursday 16th November  
Tuesday 21st November

Cleaning & Disinfection of Hot & Cold Water Systems ●  
Legionella Control & Management for Dutyholders & Responsible Persons - Evaporative Cooling Systems  
Practical Legionella Risk Assessment Hot & Cold Water Systems Advanced\* ●  
Legionella Risk Assessment Of Hot & Cold Water Systems Foundation  
Evaporative Cooling Water Chemistry Advanced\*  
HTM 04-01 Water Hygiene Training: Managing & Controlling Risk of Waterborne Pathogens in Healthcare Water Systems ●

Wednesday 22nd November  
Tuesday 28th November  
Wednesday 29th November

**Legionella Risk Assessment Healthcare EXAM**  
Legionella Control & Management for Dutyholders & Responsible Persons - Hot & Cold Water Systems  
Spa and Swimming Pool Chemical Control and Management

Tuesday 5th December  
Wednesday 6th December  
Thursday 7th December

Cleaning & Disinfection of Hot & Cold Water Systems ●  
Temperature Monitoring, Sampling & Inspection Of Hot & Cold Water Systems For Technicians ●  
Practical Legionella Risk Assessment Hot & Cold Water Systems Advanced\* ●

*\*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.*

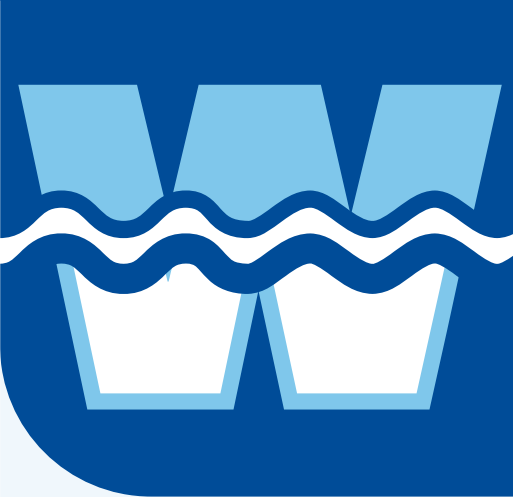
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# waterline

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The Water Management Society is governed by a Council of Management which has the responsibility for the day-to-day supervision of operational and financial control. It meets bimonthly, and the executive officers meet more frequently.

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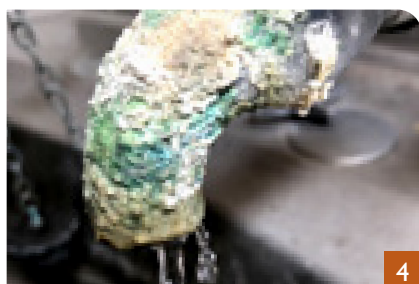
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All Full members of the Society can apply for election to the Council. Elections are held at the AGM annually, and final selection is made by ballot if necessary. Additional members may be co-opted. It only remains to be pointed out that the responsibilities and obligations of Council members require a clear and definite commitment in terms of time and effort.

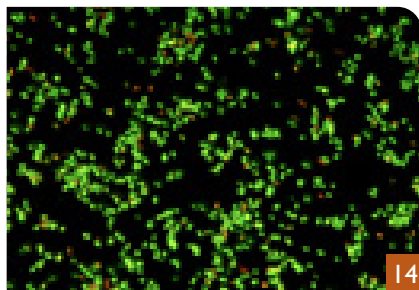
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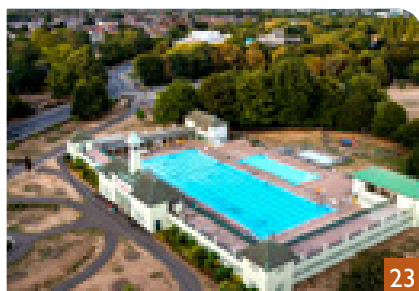
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Book your advert slot by **Friday 18<sup>th</sup> November 2022** and submit your content by **Friday 2<sup>nd</sup> December**.  
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## waterline GRIME SCENE



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# PipeLine

Ian Penney, Chairman WMSoc

Hi

Like so many have done before me, I'd firstly like to thank the previous Chair, Ian E Kershaw for his leadership of the Society for the past 2 years. I would like to thank all the Council Members that are stepping down after their recent time on Council, David Bebbington, Sophia Kloda and Emma Jorgenson and thank them for their contribution to the society. I would also like to welcome the new Council members Anthea Davies and Pamela Simpson and hope they will enjoy their time on Council and be able to apply their life experiences to enrich the technical guidance and direction of the WMSoc Council.

I was very surprised, to say the least when I was approached and asked if I would consider being the Chairman for a 2-year tenure. I suppose it's more like 4-years when you add the year before as Vice-Chairman and then like Mr Kershaw will now do, a year as Past-Chairman. I must admit, I was also a little apprehensive. I've sat on the Council for a number of years and I think I've seen at least 5 different 'Chairman', all different in some ways but all the same in one crucial way, they've all had the desire to preserve the integrity of the Society and make sure that its main direction/focus is for the benefit of its membership. I'm of course intending to continue that with my own dedication to the membership.

As well as being the new Chairman, I'm also on the Waterline sub-committee & the Events sub-committee. These sub-committees deliver the quarterly published Waterline Journal and the 2-3 conferences (and webinars introduced during COVID) throughout the year. They are invaluable ways the WMSoc can interact with its membership and gain feedback from our members through 'Letters to the Editor' and the 'Feedback Forms' handed in during conferences. It's from these and other forms of membership feedback that we try and steer the Society in a direction that most satisfies our membership. Legionella Control, Water Safety Plans and Water in Healthcare have all been prominent topics for the Society in the past and will remain topics that are covered as new and interesting developments happen.

However, the uses of water and the associated need for various forms of water treatment are not limited to these areas here in the UK, there's the whole rest of the world. As you're aware, our Society has recently interacted with a similar society in Australia (Legionella Management Advisory Group) and as part of my tenure I would like to continue to reach out to other likeminded bodies, 'knowledge' and 'good ideas' don't have man made boundaries.

To finish, I'm very pleased to report that we have moved to new premises, with the greatly improved 'Sue Pipe Training Centre', things are looking good, why not join us for some training.  
Best Regards

Ian Penney



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## Letter to the Editor

*I was asked to contact you after I recently noticed a concerning recommendation in an article recently published by yourselves.*

*The Summer 2022 Edition published an article on Microbiological Testing of water. This article shows a photo of a medical wash basin with a plastic bag over the top of the tap and wash basin.*

*The concept is to stop usage of the outlet for a period of time before taking a water sample and confirming its microbiological levels for Pseudomonas.*

*Pseudomonas is covered in the Department of Health's guidance document HTM 04-01 Part C and HTM 04-01 Part B. The documents give recommendations for post-flush samples to be taken to show a live indication of Pseudomonas presence however I feel this has been greatly misinterpreted in the article.*

*'HTM 04-01 Part B - Appendix D Testing for P. aeruginosa – Paragraph D7, gives a recommendation:*

*'To maximise the recovery of these free-floating planktonic bacteria, water samples should be taken:*

- a. during a period of, preferably, no use (at least two hours or preferably longer); or*
- b. low use.'*

*The article suggests that an issue had arisen after staff were asked to take samples and all results came back negative. The article then suggests the most likely reason was due to it not being a post-flush sample. This could be a possibility however I would suggest starting with the staff, are they trained to take samples and were they tested in a UKAS Lab in the correct time span and temperatures.*

*The article suggests the idea of putting a bag over the wash basin and outlet over night to stop use and 'ensure a true pre-flush sample is collected'. This is not the guidance given in the HTM as it only suggests Lower Use or a period of two hours minimum.*

*The bag is unlikely to physically stop someone using the basin where signage could achieve the same level of control for the outlet.*

*The bag would most likely cause a humid greenhouse environment that also could allow harmful bacteria or viruses and opportunistic pathogens to get into the outlet from the waste. The addition of the bag could be seen as a breach of the Air gap recommended by the Water Supply (Water Fittings) Regulations as the Bag creates a clear connection from the above ground drainage to the domestic water supply.*

*In addition is the bag sterile?*

*When looking at this we must bear in mind that routine sampling and testing for Pseudomonas Aeruginosa would only be completed in an Augmented Care setting, most likely caring for immunosuppressed patients.*

*Majority of augmented care patients require additional controls to reduce risks from bacteria, funguses and viruses as far as reasonably practicable.*

*Taking a wash basin out of action when a room is in use reduces a very important part of infection control, hand hygiene. Often the best control measure for reducing transmission.*

*My interpretation is that the sample should be a true reflective sample but ideally be pre-flush. A flush of an outlet is based on flow rate and length of time open. This ensures a draw-off of the entire pipe run or dead-leg based on temperature. In healthcare this would be to a temperature of <20°C within 2 mins or +2°C from the cold water inlet to the building or Cold Water Storage. And >55°C within 1 min. So typically a flush would be fully opening an outlet for at least two minutes. It is unlikely routine hand washing would achieve a full flush unless used many times in a short duration of time. So I would say it's reasonable to suggest speaking to staff asking to avoid using an outlet for a duration of at least two hours but not to restrict total usage as this would not show a live system sample of the outlet, but instead a pre-incubated sample. How could anyone interpret higher samples as being a risk to patients when normally the outlet would have been used several times giving a lower risk to patients.*

*The idea is to look for the presence of bacteria and control the risk, the goal is not to achieve a high count, a low count would show the same. Only a post-flush would show the extent of the issue.*

*The article also shows plates with growth at different time intervals, I must question if the plate samples were taken on an outlet with a bag over it, if so it is possible the contamination or at least the high level was actually caused by the use of the bag.*

*This being my first issue of the magazine after becoming a member, I was disappointed to see such illogical ideas and wondered the state of the industry in its entirety.*

*After continuing to read the following article in the issue I was very impressed. The article on Authorising Engineers and even the core baseline to the concerning article shows a great push in the right direction.*

*I was relieved that you contacted me as it reaffirmed that Waterline and the W.M.Soc is here to educate.*

*Nothing here was done with ill intentions, and confirmation that it will be raised in the next issue is outstanding.*

*Please do not hesitate to contact me if you have any questions.*

*Kindest regards  
Dennis Coates*





# Appreciation of David Bebbington

It is with regret that we announce David Bebbington's decision to retire from the Water Management Society Council as a result of a recently diagnosed illness.

David joined the Society in 1999 and was elected to Council in the same year. He has given continuous service to the Society as a Council Member until his retirement this year. He was elected Chairman in 2008/09 and became a Fellow in 2009 and an Honorary Fellow in 2022.



David's achievements have been earned through hard work and the drive and determination to succeed by giving service to those he met along the way in the chemicals industry and subsequently in the water management and water hygiene industries.

He went to Fairfield Secondary School in Widnes where his academic talent was never recognised. Consequently he left school at the age of 15 and went to work in the chemical plant at Bush Boake Allen, producers of fine organic chemicals, where he did Advanced City and Guilds in chemical plant operation. Subsequently he went to work in the laboratory on a reduced salary to enable him to do day release and complete an ONC and HNC course on a day release basis. He then worked for British Gas for two years in the laboratory at Garson Gas Works, completing his GRIC (Graduate of the Royal Institute of Chemistry) Part 1, also on a part time day release basis. He then left work to complete ARIC (Associate of the Royal Institute of Chemistry) Part 2 on a full time basis at John Moore's University. His wife, Pam, supported him during the period at university.

After completing his ARIC he went to work at Mersey White Lead in Warrington where he worked on PVC stabilisers.

After a short time at Mersey White Lead he left to join Dearborn Chemicals (later to become Grace Dearborn) as a Water Treatment Consultant. At this point, David and family were moved by Dearborn to Littleborough to give closer access to the territory (East Lancashire and West Yorkshire) for which he was responsible. By this stage in his career, he had become a Chartered Chemist and Chartered Scientist.

He subsequently joined Dearborn's Aquatech Division managing a team of six Service Chemists who looked after the company's smaller customers, covering both the commercial and institutional markets. His territory was principally East Lancashire and West Yorkshire but also ranged from Anglesey across to Newcastle.

Grace Dearborn was acquired by Betz in 1996 and traded as BetzDearborn until 2002. During this period, David left Aquatech to join the Training Department providing training for customers. After 2 and a half years in the Training Department he was made redundant in April 1999 just before he was 55 years of age. He carried on working for BetzDearborn in his own capacity providing water treatment services for BetzDearborn customers. BetzDearborn became part of GE (General Electric) in 2002, trading as GE Betz. Subsequently David formed his own company and started providing training services for the Water Management Society as well as continuing his work for GE Betz, which later

changed its name again to GE Water & Process Technologies.

In 2007, David had a major medical issue (rupture of the oesophagus) and decided to stop working for GE and work only for the Water Management Society, which he has continued to do for the last 14 years. In total he has worked for 63 years.

In providing independent services to the Society, David became a Member and in his 23 years of membership has given much wise council based on extensive experience as well as working to improve the services the Society gives to its members.

In addition to joining Council, he became an active member of both the Technical Committee and the Training and Accreditation Committee (TAC).

He chaired the TAC for many years and has played a big part in developing new training courses to meet the ever changing needs of our members. He has also worked on keeping many of the Society's training courses up to date. He guided the Society in assessing a variety of training course accreditation options and has chaired the WMSoc CPD (Continuing Professional Development) Committee. He has driven the CPD Scheme for members and produced the 'CPD Road Map' to help members follow the scheme. It is this work that has kept him fully up to date with present trends in the industry.

Throughout this, he has been a lead tutor on many of the WMSoc training courses as well as an examiner for the Society.

The WMSoc produces a range of Guides and Codes, in which David has been involved, including most of the 'Other Systems' Guidance documents on the management and control of Legionnaires' disease, which are freely available to members as downloads from the WMSoc website. Other WMSoc publications with which David has been involved include the updated Guide to Legionella Risk Assessment, the WMSoc position statement on competence, and the recent update of the Code of Practice for Cooling Water Treatment.

He has addressed all of these projects in which he has been involved in a totally unbiased manner and has therefore been able to ensure that WMSoc courses and publications remain independent.

In spite of his untiring dedication to the work of the Society, David has also found time to develop many other interests. He ran a Folk Club at the Red Lion in Frodsham, Cheshire, and he used to sing with a chap called Ian Woods. The duo was called 'The Poachers'. His claim to fame is that he sang on the same bill as Frankie Vaughan at a venue in Basingstoke raising money for the Boys Club organisation. At that time he played the recorder and also taught himself to play the flute. He has been secretary of Rochdale Artists for 35 years. He is an avid bird watcher, an excellent artist and a lover of music.

David has made a major contribution to the development of the Water Management Society and our members in his 23 years of service, with sage advice and guidance on technical and educational issues. He has played a big part in the education of many people, both society members and non-members, who work in our industry. His retirement leaves a huge chasm to be filled by those who must continue the future development of the WMSoc. In a richly deserved recognition of his outstanding contribution, David was awarded the Society's 2022 Sue Pipe Lifetime Achievement Award. We give him our heartfelt thanks and our very best wishes.

# Effective Pre-commission Cleaning of Closed Heating/Cooling Water Systems (Experiences of a Water Chemist)

Alan J. Edwards MRSC, F.W.M.Soc.

***‘Pre-commission cleaning as it is applied to heating, cooling and other pipework systems, is the process of bringing the system to a satisfactory state for commissioning and on-going maintenance of water quality’.***

***(Ref. BSRIA BG29:2021 Section 1).***

The objective is to provide clean metal surfaces which will accept the deployment of the follow-up routine chemical corrosion inhibitor.

Inadequate cleaning typically leads to in-service fouling and corrosion problems, even when the follow-up maintenance water treatment is being diligently applied and monitored. In those cases where the routine water treatment is being less than diligently applied and monitored, fouling and corrosion can be expected anyway.

These facts make it harder for investigators to pinpoint the root cause of such problems. This situation is exacerbated where there is a dearth of recorded information which is often the case when the treatment application is deficient.

All of the ingredients exist here then for disputation and acrimonious litigation.

To avoid such situations the cleaning companies are increasingly being retained to carry out the post-clean routine maintenance water treatment at least for the period between pre-commission clean (PCC) and handover to the building owner [‘Practical Completion’ (PC)]. This arrangement has the advantage of narrowing down the list of potential culpable parties.

The objective of this paper is to examine ways in which the PCC can succeed or fail.

BG29 provides much sound guidance on the planning and operation of a pre-commission clean (PCC) for newly constructed systems. All reputable cleaning service provider companies claim to adhere closely to the recommendations of this important publication. Despite this there are reliable reports of a significant number of post-clean issues with fouling and corrosion. In recent years I have been engaged by users of these cleaning services to carry out a number of forensic investigations into ‘what went wrong’ when post-clean fouling issues have arisen. In this context I have been granted access to the relevant paperwork; in particular the pre-work Method Statements issued by the retained cleaning companies and the corresponding cleaning team’s worksheets.

## Appraisal of PCC Methodology

I normally commence this type of investigation by reviewing the key tasks required of the contracted cleaning company.

Section 1 of BG29 states that ‘Pre-commission cleaning is usually achieved through a process of flushing and

chemical cleaning .....’.

Section 2.2.3 of BG29 lists the typical stages of a clean as:

- 1) Dynamic flushing – to remove loose solids.
- 2) Biocide wash (where appropriate).
- 3) Removal of surface oxides – for systems with mild steel components.
- 4) Effluent disposal/final flushing.
- 5) Neutralisation (for inhibited acid cleans only).
- 6) Passivation (of metal surfaces).
- 7) Corrosion inhibitor and biocide dosing (‘final chemicals’).

Based on my experience I have noted that post-clean fouling (invasion of suspended solids) can occur due to mishaps at any of the above stages, for example:

## Dynamic Flushing

As far as I can judge the principles and practical application of the initial ‘Dynamic Flush’ of the system pipework is well understood and the planning and execution are usually sound. This is perhaps not altogether surprising as the vast majority of the personnel engaged in the planning and conduct of the PCC are heavily engineering biased.

The ‘Achilles heel’ here seems to be the cleaning of plant items such as low loss headers and thermal storage (‘buffer’) vessels, where the recommended flushing velocities for pipework are not possible. These units tend to turn into ‘dirt pockets’ whereby the disturbed loose particles accumulate requiring specific follow-up action to physically remove via the bottom drain. At these points also the velocity of the chemical cleaning fluid (during the subsequent chemical cleaning stage) across the surfaces is relatively low, thereby reducing the cleaning effect.

Some years ago, I supervised a number of LTHW pre-commission cleaning projects (where the plant included large (20 cubic metres+) buffer vessels). The cleaning team successfully tackled this problem by post-clean water jetting of the internal surfaces which removed the chemically softened oxides (which would have contaminated the system on entering service) as a fine slurry, which was flushed to drain. The underlying vessel surfaces were observed to be in pristine condition.

The omission of this degree of thoroughness led to the eventual suspended solids invasion of some of the systems I have studied.

## Dynamic Flushing

I have formed the impression that as far as the chemistry side of the PCC is concerned the same cleaning companies are in general perhaps not quite as assured. For what it’s worth here are my thoughts on the two aspects of the chemical cleaning programme, viz:





### a) The Biocide Wash

BG29 (ref section 7.2.1) recommends that consideration be given to applying a biocide wash between the initial dynamic flush and the surface oxide cleaning stage and typically a biocide wash is carried out even if it is not certain that the system pipework contains biofilm.

No advice is given in BG29, however, as to what type of biocide to employ. For some reason it has become conventional for cleaning companies to employ a **non-oxidising** biocide for this purpose. Anyone who has tried to strip biofilm with a non-oxidising biocide will not need telling how ineffective it is even when applied at very high doses.

In HSG 274 the HSE stipulates the use of **oxidising** biocides such as chlorine or chlorine dioxide for the purpose of biofilm removal and the procedure is very clearly described. It takes approximately 5 hours in contrast to the frequent several days timing for non-oxidising biocide washes in closed system PCCs. Over many years of applying this procedure it has proven to be very effective.

My question is: *'Why is this proven method of biofilm removal being ignored by the PCC cleaning companies?'*

### b) The Chemical Cleaning Stage

When suspended solids invasion issues have arisen; on an examination of the cleaning team's paperwork I have typically found deficiencies which may be due to an inadequate addressing of one or more of the various factors which are listed in Section 7.1.4 of BG29 as having a bearing on the effectiveness of the clean. These are:

- Type of deposits
- Thickness of deposits
- Surface condition of the deposits (i.e. are they hard or soft)
- Choice of cleaning agent
- Concentration of cleaning agent in the cleaning fluid
- pH of the cleaning fluid
- Temperature of cleaning fluid
- Duration of cleaning period

#### Type/Thickness/Surface Condition of the deposits

This will tend to vary depending on the 'life story' and fabricatory material of the pipework, e.g. length of time in pre-clean wet layup; the effectiveness of the wet layup treatment regime.

#### Choice and concentration of Cleaning Agent

A wide choice of PCC cleaning agents is available from the chemical manufacturers, but a careful reading of their product data sheets will inform that not all are suitable for **the removal of surface oxides** and obviously some formulations will be superior to others for this purpose.

These data sheets typically advise that the product in question will be effective from a particular concentration upwards 'depending on the nature and degree of adherence of the deposit'. This type of wording implies that the onus of deciding on the concentration of the particular chemical lies with the company actually **applying** the chemical, i.e. the cleaning contractor.

However, in my dealings with cleaning contractors who

have been experiencing PCC issues I have noted that they appear to lean rather heavily on the advice of the chemical supplier despite the fact that the chemical supplier is usually somewhat remote from the project in hand.

Traditionally chemical cleaning companies would not normally embark on a chemical cleaning project without first checking in the laboratory that the concentration of the proposed cleaning agent was likely to be successful at solubilising the deposit type specific to the particular project.

Such checks need not require particularly sophisticated equipment – much can be learnt from the use of simple bench-top beaker studies, viz: the suspension of specimen pre-prepared metal pieces (coupons) in a stirred beaker containing various concentrations of the cleaning fluid (normally the chemical cleaning agent diluted with mains water). The use of such equipment provides invaluable insight into the likely performance on the plant and with this type of information I have always been able to accurately predict the outcome of the in-plant cleaning procedure.

In every case in recent years where I have been asked to investigate when PCC issues have arisen, I have formed the impression that such preliminary basic checks have not been carried out.

In such cases I have personally carried out bench-top testing using the cleaning concentration cited in the pre-work method statement and found it to be inadequate to effect complete cleaning of the test specimens. By the same token I have noted that increasing the concentration of cleaning agent has usually had a marked effect on the rate and effectiveness of cleaning.

On then repeating the in-plant cleaning programme using the enhanced dosage complete removal of all surface oxides has been confirmed by reference to the post-clean samples appearance and analyses.

#### Iron Saturation Limit

Chemical manufacturers often cite an 'iron saturation limit' which applies to their particular cleaning agent formulation with the implication that their product will remain active provided this limit has not been reached. In my opinion this figure is misleading as it presupposes that the iron 'awaiting' solubilisation is accessible to the cleaning agent. However, when this iron is bound within an often difficult to penetrate deposit it is plainly not accessible. If this fact is coupled with a too low concentration of cleaning agent (identified by the preliminary bench-top testing referred to earlier) then the situation arises whereby a plateau is reached coincident with an iron value in the cleaning fluid which is below the iron saturation limit. This circumstance will tend to persuade the cleaning team that a genuine plateau has been reached. This is why the correct concentration for the job in hand needs to be pre-identified.

#### Plateau Validation

BG29 (Section 7.1.4) refers to monitoring of dissolved iron levels until they plateau and remain stable even when more cleaning chemical is added ..... (to) confirm that the cleaning product is not saturated ..... (demonstrating that) there are no remaining iron oxides in the system.

In other words when a plateau is achieved it must be simultaneous with the presence of **active** cleaning agent otherwise it cannot be validly claimed to demonstrate that all surface oxides present have been removed.

*I would personally add to these criteria that the pre-determined optimum concentration of cleaning agent should be in use, as my beaker studies have shown that it is quite possible for 'active' cleaning agent to be present but at too weak a concentration to solubilise any more surface oxide.*

### pH of the Cleaning Fluid

More often than not when investigating cases where an inadequate PCC is suspected the evidence from the cleaning team's worksheets is that the cleaning had been terminated prematurely at a point which they mistakenly regarded as a genuine plateau but which was evident from their final pH reading (8.0+) that the cleaning agent was in fact saturated.

What I mean by this is that when the cleaning agent type they were using is fully active the cleaning fluid exhibits an initial pH of approximately 6.0, but when it is saturated the cleaning fluid pH rises to 8.0+.

### Cleaning Fluid Temperature/Duration of Cleaning Period

The rate of most chemical reactions speeds up with increase in temperature and this is also true of cleaning reactions. However, it is usually impractical to heat up the PCC cleaning fluid and indeed it has been found

that circulating at ambient temperature is satisfactory for most purposes and will normally (provided the correct cleaning agent at the correct concentration is used) ensure a complete clean within 24 hours.

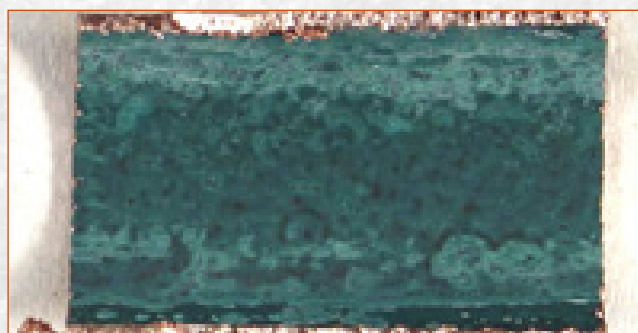
### Passivation Stage

Following a chemical clean and subsequent flush out, the immediate addition of the routine corrosion inhibitor (and biocide) will normally ensure metal passivation. However, as backflushing of the terminal units (which may be over a prolonged period) is typically practised following the chemical clean stage there is an ever-present potential of diluting the routine treatment due to continual replacement of the water in the system. Occasionally I have encountered cases of this occurring, tending to produce elevated iron values (and hence potential suspended/settled solids). It is not unknown for this situation to produce a loss of passivation which if not swiftly countered can get out of hand. It is vitally important therefore that this stage is closely monitored **and recorded**.

Finally, I can state with complete assurance that in all cases of post-clean fouling where the principles and practice described in this paper have been adhered to the remedial (repeat) cleans have met with complete success as evidenced by the post-clean system water appearance and analyses. Most importantly I would not personally consider using any cleaning agent that did not pass the 'bench-top test' as discussed in this paper. (See figures 1, 2 & 3).



**Fig 1 – Mild Steel Test Coupon following 12 hours part immersion in a stirred chelant based cleaning agent at 3% concentration**



**Fig 2 – Section of Copper Tubing with corrosion products (Test Specimen)**



**Fig 3 – Same Specimen after 6 hours immersion with stirring in 2% ammoniated citric acid solution**



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# event report e

## WMSoc Which Direction Now? A 360° view of water management

Tuesday 21st June 2022

Drayton Manor Hotel, Tamworth

The event was held at Drayton Manor in Tamworth on the 21st June. 95 members attended to hear the presentations from our industry experts and meet with our trade stand sponsors.

The day was kicked off by Ian Penney, WMSoc vice chair, who welcomed everyone to the event. He introduced Matt Morse of Dragonfly Water Consultancy who gave an interesting presentation on the updated BS7592:2022. He covered how standards are updated with BSI and then went on to identify the key changes in this Legionella sampling guidance presenting some key dos and don'ts of sampling, highlighting the need to plan and be prepared for the activity. The presentation covered both routine and investigative sampling and finished by noting that respiratory protective equipment (RPE) was important when taking samples, especially in systems that are believed to be Legionella positive.

Following Matt, Ian E Kershaw, chair of WMSoc, stood in at the last minute for Paul McDermott and presented his view on Remote Monitoring, Are we nearly there yet? Ian presented the current challenges of monitoring water systems including access, environmental concerns over travel and wasted water costs, before exploring the remote monitoring offering. Whilst remote monitoring may offer travel time and money advantages, and provide improved visibility on system usage, the systems are not without their own set of challenges. In particular, Ian noted that the data provided from these systems can identify new issues with systems which were previously thought to be compliant, which in turn can increase management costs.

The third speaker was Peter Alesbury of the Royal Botanic Gardens, Kew, who presented on What does an Authorising Engineer really do? The talk proved to be a very interesting insight into the role of an Authorising Engineer (AE) covering aspects such as competence and the appointment of an AE which is often by the Authorised Person (AP) which can cause conflict of interests in some organisations. Peter explained the complex setup of Kew Gardens and how the role of AE worked to manage that, along with all teams, covering rainwater harvesting, building water systems, irrigation systems, ponds & rivers and water features to ensure visitors remained safe.

The final presentation of the morning, Confessions of a Plumber, the 2022 remake, was delivered by Sarah Oliver, "Sarah the Plumber". She gave an amusing presentation covering her experiences as a female plumber. She noted there was a general lack of information provided to plumbers about the risks of Legionella and although she would reduce dead-legs if possible, she noted that this may not represent the norm. She also had concerns about new "green" technologies such as heat pumps, in particular their low temperature settings and the trade-off between scald and Legionella risk. She felt that much more education could be provided to plumbers to give a better understanding of the situation.

The afternoon comprised two roundtable discussions with the presenters from the morning, along with four WMSoc council members working as moderators.

### Roundtable One - Monitoring and Testing

The discussions in the monitoring and testing sessions were exclusively around the presentation delivered by Ian E Kershaw which discussed the installation and use of remote water monitoring technology. The pros and cons of the installation of these systems were discussed at length. It was generally agreed that the introduction of this technology is a positive step which will provide users with increased knowledge of the systems that they are managing. It also allows for detailed temperature profiles to be built, areas of low use to be identified and robust record keeping to be demonstrated. However, there were lengthy discussions in both sessions around what a "compliant" system looks like when this technology is installed, as there is no specific guidance available on this currently. It was generally agreed that future additions of the Approved Code of Practice L8 and associated Health and Safety Guidance (HSG) documents will include information on managing remote monitoring systems. However, it was pointed out that there is information in the current guidance that can be applied to managing these remote systems now. It was agreed that remote monitoring does not always have to be used as a permanent feature and using this temporarily can be a helpful diagnostic tool where there are issues within systems. Members of the panel advised that planning the installation of these systems carefully is of high importance, as users of these systems have found remote monitoring has highlighted issues within properties which have been thought of as compliant previously. Therefore, a staged approach to installation would be sensible. There were also discussions about which buildings to use this technology in. It stands to reason that a more complicated building would need a more robust and complicated monitoring system and whilst remote monitoring may be a sensible addition to a hospital it may not be required in a lower risk setting. In summary, the question posed in the presentation was "are we nearly there yet?" and the conclusion of the discussion was that the technology is, however how we take and use the data it generates still needs some work. The WMSoc have created a working party to discuss these issues with the Health and Safety Executive and will report further in due course.

### Roundtable Two - Skills and Competence

Two speakers from the morning session, Sarah Oliver and Peter Alesbury were quizzed about their experiences and it was refreshing to have Sarah's view as a domestic (household) plumber and Peter's, from his various roles both inside and outside of Healthcare. It was ascertained that there needs to be a clear differentiation between the skill





sets required of a domestic plumber and those of one that works in commercial buildings – could this be something that WaterSafe could drive? There was also a very grey area regarding tenanted buildings with Landlords and the legal ramifications for domestic plumbers, as these would be covered by ACoP L8 for Legionella. The most recent plumbing NVQ only contains a very basic awareness for Legionella and plumbers that were trained previously may not have covered this at all in older modules.

Another gap was regarding knowledge around water regulations and water fittings and the implications of poor design, where often the plumber's advice is ignored. It was felt that some of the building regulations were outdated, and possibly could even be interpreted as contradicting the water regulations. Hygiene and tools were discussed, with a need to have some form of water hygiene card outside of the municipal water industries, similar to the CSCS card.

With regards to competence, the top question was regarding who should check the competency checker? One of the issues was not knowing what you don't know. Continuing Professional Development (CPD) was discussed at length and how this can assist in showing ongoing learning. It was felt that there needs to be a good mix of knowledge, training and experience with some form of peer review. Without all these components of competence in place it was considered possible that sufficiently informed judgement would be challenging to

achieve. This all needs to be recorded, audited and to be proportionate.

A brief discussion was held regarding the knowledge and experience of the end-user, in Peter's case he is a vastly knowledgeable end-user, but not all end-users are as equally equipped and ensuring end-users are sufficiently trained and competent to apply sufficient judgement is notably important.

Communication was also key and the role of Water Safety Groups in sharing knowledge and responsibilities, these are now being seen outside of Healthcare, with Peter's example of Kew gardens being a prime example. They have been able to gain assistance from their laboratories and horticultural staff with Legionella compliance – for example, they have many, many meters of water hoses which could potentially be a risk to visitors without correct controls.

The LCA reported that they intend to run workshops to assist in competence reviews which will be advertised on their website in due course.

The WMSoc would like to thank all the speakers and delegates for sharing their experiences and assisting such useful debates and for attending the event. We hope that you all enjoyed the day!

## WATER MANAGEMENT SOCIETY HAS MOVED!

The Water Management Society has been operated from the Mill in Fazeley since 2005. This Summer the team have moved to a new location, still in the Tamworth area. This new building will offer a new and improved Practical Training Area along with newer facilities for our students and staff including dedicated parking spaces.

The team has been excited about this move, working in the background to improve the equipment and water systems in our PTA to meet the needs of students both today and in the future. We are looking forward to welcoming you to our new site in the near future.

**WE HAVE  
MOVED TO:**

Water House  
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*From the Archive:* This article first appeared in **waterline** Spring 2016

# Hazards Associated With Water Quality in Closed Pipe Systems

By Chris Parsloe & Dr Pamela Simpson

**Pre-commission cleaning of closed circuit pipework systems and the subsequent monitoring of water quality are essential in any building. The implications of getting these wrong can be catastrophic. The resulting problems include disruption to occupants whilst systems are re-cleaned or, in the worst cases, complete closure of buildings whilst entire systems are ripped out and replaced due to early failure.**

**But it seems that although the risks associated with open systems (where the circulating water might come into contact with humans) are generally appreciated, there is less awareness of the problems that can affect closed systems.**

A closed re-circulating pipework system is one which, as the name implies, is closed i.e. the water in them is not exposed to the atmosphere and is not significantly depleted due to evaporation or draw-off. The water is permanently enclosed and typically spends all of its time being heated, cooled and re-circulated in the process of delivering heating or cooling. All systems serving terminal devices from radiators to fan coil units or chilled beams are examples of closed systems.

The potential problems start during construction. In large buildings, heating and cooling circuits can include pipes that are over a metre

in diameter. In an ideal world, these pipes would be installed in a clean, debris free condition but in practice, nothing can be ruled out.

Hard hats, coke cans, plastic bags and even dead foxes have all been found inside systems. If left undetected, when the pumps are switched on, items such as these can cause major damage to expensive boilers, chillers and pumps. The smaller particles can be just as bad. Some modern control valves have clearances of less than half a millimetre. This means that sand, grit, jointing material or welding slag can cause blockages and consequent heating or cooling dead spots.

## Danger not ended

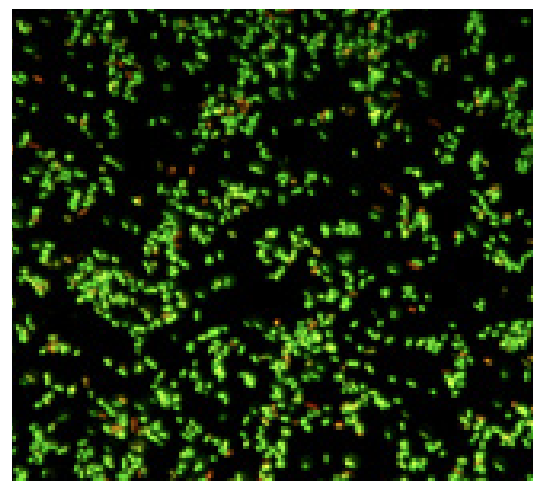
All of this debris should therefore be removed by dynamic flushing of the system during pre-commission cleaning. But successful removal of these items does not end the danger.

Most closed re-circulating systems are constructed, predominantly from carbon steel pipe. Carbon steel has the significant advantage of being both strong and cheap. However, as we should all remember from our school science days, in the presence of oxygen and water it will corrode rapidly i.e. within hours. Our high strength steel is replaced by low strength semi soluble particles of soft brown rust or, if the supply of oxygen is limited, black magnetite. Thick walled steel pipe has some tolerance built into it and can survive for a while. Thin walled steel has less.

Dynamic flushing of pipework involves circulating highly oxygenated water through the pipes at high velocity. Hence, as we're removing the problem of system debris we are potentially encouraging corrosion. As a result, following the dynamic flush, some form of chemical clean is usually essential to remove corrosion products from the surfaces of steel pipes.

## Corrosion process potentially controllable

In theory, once the system is put into operation, the corrosion process should be controllable. If there is no replacement of the water in the system, the oxygen in the water should gradually become depleted thereby stifling the corrosion. Furthermore,



*Pseudomonas spp. biofilm development on surfaces of pipework*

corrosion inhibitor chemicals can be added to further reduce the rate of corrosion.

However, corrosion protection regimes can go wrong and water quality monitoring is therefore essential.

For, example whenever water is lost from a system, whether due to system modification or to replace a component, fresh oxygenated water is drawn in whilst water containing valuable corrosion inhibitor is lost. This combination can be sufficient to initiate a burst of corrosion.

Furthermore, inhibitor levels can drop even without water being taken out of the system. The active ingredients of inhibitors can be used up in developing protective layers on pipes or reacting with oxygen in the water. But, even more shocking is the realisation that some inhibitors can provide a food source for bacteria - and not just any bacteria. The bacteria we can find in closed systems can initiate catastrophic damage on a scale equal to or worse than that caused by simple debris or oxygen induced corrosion.

## Many types of bacteria present

All natural sources of water (including mains water) contain many different types of bacteria, some of which may multiply and lead to problems within closed systems if they encounter suitable conditions for growth. Mild steel, stainless steel and copper are thought to be particularly prone to microbial influenced corrosion (MIC).



*Tubercle formation within a closed hot and cold water system*

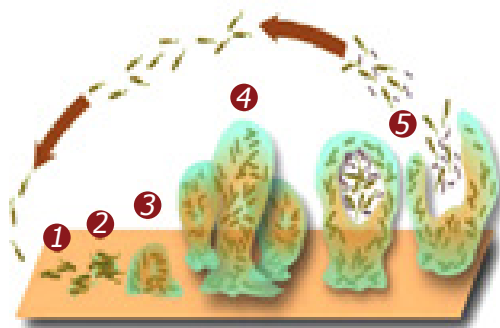




*Corrosion pits associated with microbially influenced corrosion*

For MIC to occur, it is necessary for some types of bacterial species to colonise the metal surface. The extracellular material produced by rapidly multiplying aerobic bacteria species eg *Pseudomonas* spp develops into a biofilm (i.e. slime) which produces both aerobic and anaerobic zones.

The anaerobic conditions enable anaerobic bacteria such as sulphate reducing bacteria (SRB) to multiply and a potential difference is established between different areas of the metal surface. SRB metabolise naturally occurring sulphate in the water to produce sulphuric acid under bacterial clumps. This results in accelerated, localised pitting corrosion and eventual perforation of the pipe. Corrosion by SRB can cause significant damage to surfaces, in particular where pipework may have bends, uneven surfaces, abrasions, or joints and welds.



*The formation process of a microbial biofilm*

### Increasing electrolytic corrosion risk

Other bacteria of concern are nitrate/nitrite reducing (NRB) and nitrite oxidising bacteria. These bacteria can cause rapid loss of nitrite-based

corrosion inhibitor from the system and so increase the risk of electrolytic corrosion. Also, the ammonia produced by some of these bacteria when metabolising nitrite can lead to stress corrosion cracking of brass fittings if present at significant levels.

During the pre-commission cleaning stage of any new build, it is important to prevent microbial presence wherever possible and to avoid areas of low flow rate or dead legs where bacteria can multiply, settle and develop biofilms unhindered by circulating biocide chemicals.

### Biocide wash

For many systems the precaution of a "biocide wash" is included as part of the pre-commission cleaning process.



*Scale, biofilm, and corrosion deposits within pipework*

This involves circulating a biocide disrupting chemical through the system to destroy any biofilms that may have developed during the construction process.

Bacteria related problems and their potential to incur major costs on the system owner should never be forgotten or under-estimated. As an over-riding principle it should be remembered that it is much, much easier and cheaper to maintain microbiological control within a closed heating and cooling system than to clean up a badly fouled system containing biofilm.

Microbiological control can be achieved by:

- Ensuring the system is free of suspended solids and debris which may be utilised by bacteria as an energy source.
- Carefully managing biocide dosing and maintaining records of the treatment efficacy.
- Regularly monitoring and sampling the system water content in a



correct fashion (refer to BS 8552 water sampling of closed systems).

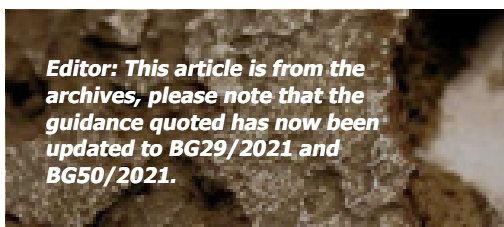
- Maintaining good flow around the system to ensure that biocide treatments are properly circulated.

### Using and appropriately qualified contractor

It can be seen that pre-commission cleaning and on-going monitoring of water quality incur too many potential pitfalls to be left to installing contractors or building maintenance contractors. It is usually essential that a properly qualified pre-commission cleaning or water treatment specialist contractor is involved in these activities.

BSRIA Guides BG29/2012 *Pre-commission cleaning of water systems* and BG 50/2013 *Water treatment for closed heating and cooling systems* provide an explanation of the procedures, tests and monitoring regimes that need to be adopted. However, proper implementation of this guidance requires an organisation that can draw on expertise across a range of specialisms including pipe system design, pre-commission cleaning, water treatment chemistry, corrosion and microbiology.

This is essential if monitoring is to be carried out at appropriate intervals and the results interpreted in a way that identifies potential risks as soon as they occur so that any necessary remedial actions can be taken before things get out of hand.



**Editor: This article is from the archives, please note that the guidance quoted has now been updated to BG29/2021 and BG50/2021.**

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# event report e

## WMSoc AGM report 2022

Water Management Society HQ - Webinar, Monday 5th September 2022

The Water Management Society AGM was delivered remotely for the third time this year on 5th September 2022. Virtual attendance continues to be high with more members from remote areas of the country able to attend the event.

The outgoing chairman, Ian E Kershaw, delivered details of the Society to those members present and dispatched the legal affairs with ease passing control to Ian Penney as chairman for the coming two years. Full minutes of the AGM can be found on the member's portal for review.

David Bebbington and Sophia Kloda both stood down from council this year leaving 2 spaces along with Giles Green, Caroline Summers and Stuart Nixon standing down in rotation and offering themselves for re-election. Following a member's vote prior to the AGM where 8 names were put forward, our existing council members were re-elected to council along with Anthea Davies and Pamela Simpson. We would like to welcome both Anthea and Pamela to the Council and we will find out more about them in a future issue.

Each year Council reviews the membership list and identifies individuals who qualify for Fellow status, having been a member for more than 10 years and having contributed significantly to the society or the industry as a whole, and this year we were pleased to award this status to Stuart Nixon.

Finally, the Sue Pipe Lifetime Achievement Award is given on an exceptional basis to those persons who have shown a commitment and unique achievements both for the Society, the industry as a whole and also in support and development of others over many years. We are delighted this year to present this award to Mr David Bebbington and thank him for his dedication to the society and in particular the training organisation over the past 23 years and wish him all the very best in his retirement.

It should be noted that these membership grades cannot be applied for and care is taken that the honour is carefully bestowed.



David Bebbington (left)

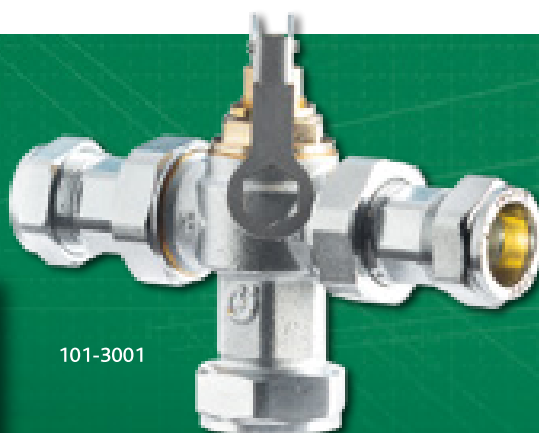


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# Waterscan

## NEWS FROM THE WHOLE FIELD OF WATER AND ITS EFFECTIVE MANAGEMENT

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.

### Spain's new beach rules

Authorities in Vigo, in the northern Galicia region, have passed the rather strict legislation that bans 'physiological evacuation on the beach or in the sea'. In layman's terms that's weeing or pooing. Any person, adult or child, caught abusing the new law is liable to a fine of up to €750.

Town officials are to install public lavatories on beaches, in high season, to accommodate demand. Vigo's beach bylaws include fines for using soap in water on the beach or in facilities for washing such as showers or footpaths, throwing waste of any kind on the sand, or using grills, gas cylinders or other fire hazards.

There is scepticism over whether the ban on people using the sea to relieve themselves is enforceable. One twitter user said: "How easy it is to issue prohibitions and how difficult it is to enforce them." Spain is cracking down on drunk, disorderly and inappropriately dressed tourists in general this year, with some local authorities singling out British tourists as part of the problem.

### Two shark attack fatalities hours apart in Egyptian Red Sea resort

Two women were killed in shark attacks, within 600 metres of each other and only hours apart. The first victim has been named as Elisabeth Sauer, a 68-year-old pensioner from Austria who was walking in shallow water while using a snorkel with fins not far from the beach. She had told her partner, an Austrian of Egyptian descent, "I'll go back in for a moment." Video footage shows her desperately trying to get towards safety with the aid of a flipper as the waters around her turned scarlet red. A Mako shark was identified as the likely killer.

Suffering from the loss of an arm and a leg, she somehow made it ashore and it was there that she was then taken to the private Nile Hospital where she could not be resuscitated, according to an Egyptian official. She is believed to have died from 'painful shock' - most likely a heart attack.

Egyptian authorities confirmed that another woman was pulled out of the sea later that day after eyewitnesses said her lifeless body was found on a reef in Sahl Hasheesh, south of Hurghada. The woman's identity has not been revealed but she is believed to have been a Romanian tourist who was staying at the hotel, Premiere Le Reve. Authorities have closed several beaches across the Red Sea coast and banned temporarily water sports and fishing. It is not clear if the authorities believe that the attacks were by the same shark.

### Marmolada glacier collapse in Italy kills seven

At least seven people were killed after being caught in an avalanche sparked by the collapse of a glacier in the northern Italian Alps. Emergency officials said eight others were injured in the collapse, with two people suffering serious injuries. Rescue teams using helicopters and drones have been searching for 15 still missing.

Four of the seven killed have been identified by rescuers, three of them Italian, including two mountain guides. A video of the incident showed an ice mass collapsing down the slopes of Marmolada, the area's highest mountain.

"An avalanche of snow, ice and rock which in its path hit the access road when there were several roped parties, some of which were swept away," emergency services spokeswoman Michela Canova said. "The definitive number of mountaineers involved is not yet known," she added.

The injured hikers, including two people left in critical condition, were taken to a number of hospitals around the area, rescue officials said.

### Record coral cover on parts of Great Barrier Reef

Marine scientists monitoring the Great Barrier Reef say they have recorded the highest levels of coral cover in 36 years in the north and central areas, but warned any recovery could be quickly overturned by global heating.

The Australian Institute of Marine Science's annual long-term monitoring report says the fast-growing corals that have driven coral cover upwards are also those most at risk from marine heatwaves, storms and the voracious crown-of-thorns (COTS) starfish.

Global heating is accepted by scientists as the reef's biggest long-term threat.

In the northern parts of the reef, the monitoring data showed coral cover averaged 36% - a record high, with the lowest levels in the region at 13% recorded in 2017. Coral cover averaged 33% in the central area - another record high compared to the 2019 low of 14%. In the southern region, the average coral cover dropped from a 2021 estimate of 38% to 34%.

About half of the 87 reefs surveyed for the report were carried out before the most recent bleaching event unfolded in February and March this year.

### Melting ice puts Endurance at mercy of scavengers

Endurance, the long-lost vessel of Sir Ernest Shackleton, the Antarctic explorer, is at risk of being targeted by treasure hunters because of climate change, the Government has said.

The ship was discovered in March this year, more than 100 years after it sank in 1915. It has been named as a Historic Site and Monument (HSM), and a 1,600ft protection zone has been placed on it.

Amanda Milling, the minister responsible for the polar regions at the Foreign Office, said: "At present, its best protection is its location 3,000 metres below an ice-covered Weddell Sea, in the Southern Ocean."

"That may not be for ever, not least due to climate change and shrinking sea ice. That is why we have commissioned the UK Antarctic Heritage Trust (UKAHT) to work with experts to prepare a conservation management plan, and to consider whether additional protection measures are needed.

A permit it now required to visit the ship and the UKAHT will decide any restrictions and responsibilities that will be placed on those who go near Endurance.

### Indian minister falls sick after drinking water from 'holy' river

An Indian minister who drank a glass of dirty water from a 'holy' river to prove to locals that it was safe to drink was hospitalised after falling ill. Bhagwant Mann, Chief Minister of Punjab, was airlifted to New Delhi after downing the polluted water from the Kali Bein. A video showing Mann scooping up a glass of water and downing the filthy liquid has since gone viral.

A couple of days after drinking the water, Mann started to complain of a stomach ache. He was taken to the Apollo Indraprastha Hospital in Sarita Vihar and was admitted overnight. Medics said Mann had developed an infection and was treated by a multi-disciplinary team.

Around 80 villages and six towns sit along the banks of the 165km river, into which their cumulative wastewater flows. In March Mr Mann was elected as chief minister of Punjab on a platform which focused on providing safe drinking water for residents. The region has India's highest incidents of cancers, believed to be caused by contaminated water as a result of industrialisation.





### Drought is killing badger populations

Badger populations in some areas could soon be extinct because of the drought, campaigners warn. Daytime sightings of the nocturnal mammal have risen as they travel further afield to find food and water. Harder ground has made it difficult to dig up earthworms, their main diet, the Badger Trust said. Those wishing to help can leave out water, nuts and fruits, the trust said.

The toll has fuelled calls to halt badger culling. A spokesman for the trust said: 'We are seeing significant pressure being placed upon badgers in the heat, many of whom, particularly younger individuals, are not surviving. Dehydration and hunger are unfortunately claiming many lives and badgers are now at significant risk of localised extinctions in cull areas.'

'The killing of badgers in already dwindling populations will leave too few badgers to sustain viable populations.' The trust and other animal welfare organisations have called on Natural England to end intensive culling in their areas. New licences are set to be announced on September 1. *Editor: Every year my local allotment is attacked by badgers who destroy and eat our sweetcorn crops. Not mine though – protected by a chicken-wire fence!*



### Bravery award for soldier for rescue through sewage

A Berkshire soldier who dived into a sewage filled canal and waded through it to the far bank, to save a man's life after a suicide bombing, has been honoured for his bravery. Private Lewis O'Connor's act of courage came after he was deployed to Afghanistan on Operation Pitting.

Soldiers helped evacuate thousands of Afghans and British nationals from Kabul Airport as the Taliban seized control of the country. Lewis from Bracknell had only just completed his basic training at the time.

The 25-year-old, who serves with 2nd Battalion the Parachute Regiment (2 PARA), was at the airport when a suicide bomber targeted those trying to escape. He immediately raced to help - knowing that a second attack could be possible.

He has been honoured with a Queen's Commendation for Bravery. The citation for the award reads: "Against expert advice and fully aware that a secondary explosion or attack was possible, he jumped down into the canal and waded to the far bank to reach a grievously injured Afghan man lying on the far side. Single-handedly, he lifted the man out of the water and up onto the wall so he could receive critical medical care." Lewis said: "When I arrived after the bomb it was chaos, but my training kicked in and my first thought was to prevent further injuries and save lives. I jumped straight into the canal to pull an injured person out and then searched in the canal for other casualties."

"We were warned that there could be another IED, but for me it felt like the right thing to do to ignore that risk to try and help people. I don't see what I did as bravery, I just did my job; anyone else in our Company would have done the same."

### Wet wipe 'island' in the Thames prompts call for flushing ban

Wet wipes should be avoided unless really necessary and never flushed down the lavatory, a minister has urged the public, amid concern they are blocking sewers and worsening river pollution. The Government is considering a ban on wet wipes containing plastic in a bid to cut the pollution caused by them being flushed down the lavatory. However, Rebecca Pow, the environment minister, has warned that a ban on certain types of wet wipes could have unintended consequences if people continued to flush non-plastic varieties, which could still block sewers. "What I would say to everybody is if you don't need to use a wet wipe, don't, but also don't chuck them down the loo," Ms Pow told the House of Commons. Wet wipes constitute around 90 per cent of the materials in "fatbergs", a build-up of grease and household waste that can block sewers and increase overflows into rivers, according to the water industry.

A metre-high mass of wet wipes on the banks of the Thames near Hammersmith, west London, has grown to the size of two tennis courts, according to sonar and laser scans of the riverbed.

While the water industry has backed a "fine to flush" standard, it only applies to wipes that are intended to be a replacement for toilet paper, including baby wipes. Campaigners say this causes confusion about how to dispose of other wipes, including make-up wipes, which will not specify whether they are flushable and may advertise themselves as biodegradable.

Ms Pow was challenged in the Commons by Fleur Anderson, the Labour MP, who has tabled legislation to ban plastic wet wipes. Ms Anderson said current packaging was "very confusing for the public" and that people "want to do the right thing".

She called on the Government to "move ahead" with its proposed ban on plastic in wet wipes, following a consultation which ended in February. Around 90% of the 11 billion wet wipes used annually in the UK contain plastic, and end up in rivers and on beaches when flushed.

### Drinking water used to cool servers

Drinking water is being used by data centre firms to cool their power-hungry facilities in and around London, Thames Water has revealed. The water company is launching a probe into how much drinking water is being used in this way by data centre operators, as the Thames region enters a hosepipe ban.

Data centres house and power the millions of computers, known as 'servers', that are required to make the internet work – but they emit huge amounts of heat 24/7. For this reason, they have to be kept cool to prevent overheating, and water offers a cheaper method of doing this than powerful refrigeration systems.

Data centres are generally expected to use industrial water or seawater, which are unsuitable for public consumption, so as to avoid using drinking water.

It's unclear which data centre companies are using drinking water for cooling methods. Thames Water's strategic development manager John Hernon said it has launched a review into the practice of cooling data centres with drinking water.

As data centres tend to generate a lot of heat, big providers usually try to move them to cooler countries in order to save on energy bills. Microsoft has put its data centres underwater in Scotland to keep them cool, while Japanese experts have used snow as a natural cooling method.

'We know there is increased demand for data centres and we have started a targeted exercise to understand how much water is used by them,' Mr Hernon said. 'It isn't necessary for data centres to use drinking quality water for cooling. We want to look at how raw, non-drinking water can be used and re-used. That's why we want to engage with these businesses as early as we can so we can influence important processes requiring water from the outset.'

Thames Water said it would like data centre firms to use 'non-drinking water if possible. We fully appreciate this might not be simple and could require testing in relation to equipment it comes in contact with to ensure it does not have a detrimental impact.'

### Bird flu outbreak on Farne Islands risks massive sea-bird deaths

A bird flu outbreak on one of the UK's most important habitats that could kill tens of thousands of seabirds has been described as an "unprecedented wildlife tragedy". Rangers working on the Farne Islands, off the Northumberland coast, have donned protective suits and so far collected more than 3,000 dead birds for incineration. However, there are concerns that many thousands more have succumbed to the disease and fallen off cliffs into the North Sea.

The Farnes, which are looked after by the National Trust, are an internationally important habitat for 23 species, including puffins, with 200,000 birds living there. Cliff-nesting birds seemed to be the worst-affected by the bird flu outbreak, with guillemots, kittiwakes and young puffins – known as pufflings – among those recovered.

Rangers working for the trust have been removing the bird carcasses to prevent further contamination. For their own safety, they wear white hazmat suits, gloves and masks.

The islands have been closed to visitors since early July as officials try to stem the spread of the disease during the birds' breeding period. As of the end of July there is no indication as to how the outbreak may be resolved, nor if and when visitors could return.



Common Guillemots, Farne Islands, Northumberland



### Water firms sold off reservoirs to developers

According to Andrew Sells – who was head of Natural England between 2014 and 2019 – current water issues could have been partially curtailed had it not been for a sell-off of reservoirs. Dozens have been given up by water companies over the last 30 years – while no new ones have been built. Writing for *The Telegraph*, Sells said the sell-off, with no replacements, was evidence of water companies putting profits before water resilience.

Thames Water, Severn Trent and Southern Water are among those to have sold off some of their reservoirs in recent years.

Mr Sells conceded that some reservoirs had reached the end of their working lives.

He claimed that Thames Water has sold off 25 reservoirs since the 1980's, including a reservoir in Cheshunt which was sold in 2006 to developers to build 249 flats. He added that Southern Water planned to decommission 43 of their 93 pre-1900 reservoirs by 2030.

Sir John Armitt, the chair of the National Infrastructure Commission said: "It has been three decades since the last major supply reservoir was built in England, and the situation we are facing this summer indicates what we can expect to happen with increasing regularity."

Water industry sources said companies faced pressure from Ofwat to close old facilities to save money, as well as scrutiny from the regulator over the financial benefit of opening new ones. Water companies say they face widespread opposition in building new reservoir facilities, despite a recognition they will be increasingly needed under drier conditions as a result of climate change. Thames Water has spent more than a decade attempting to construct a £1 billion reservoir to serve more than eight million people in Abingdon, Oxfordshire. The plans were first rejected by the government in 2011 and have been the subject of local opposition.

There are plans for a handful of new reservoirs across the country, but only one – the £100 million Havant Thicket project, near Portsmouth – actually has planning permission.

### Some turtles that live longer have a lower chance of dying each year

Turtles and tortoises are known for their longevity, but when living in captivity, many species seem to have a rate of ageing that approaches zero – and in some, the rate even has a negative value.

A species' rate of ageing refers to how much more likely individuals are to die the older they get. For most animals the rate increases rapidly as they grow older, but when it comes to some populations of turtles and tortoises in captivity, the rate decreases as they grow older, at least for certain periods of their lives.

"We're detecting a slight decrease in the risk of death," says Fernando Colchero at the University of Southern Denmark. "We need to rethink the way we see evolutionary theories of ageing."

Unlike most animals, turtles and tortoises carry on growing throughout their lives. In many species, the larger the females grow, the more eggs they lay each year. This means they could in theory get more of an evolutionary benefit than other animals from living and reproducing for longer. To investigate, Colchero's team analysed a large set of figures on the lifespans of individual animals at zoos and aquariums. The information was collected by an international non-profit organisation called Species 360, which Colchero helps to run.

The researchers analysed data from nearly 26,000 individuals to calculate the ageing rate for 52 species of turtles and tortoises, ensuring they had at least 100 animals of each sex, as values often differed between the sexes. About three-quarters of the species had a slow or negligible rate of ageing for either males or females. Two species had negative rates of ageing, including both sexes of the black marsh turtle from South-East Asia, and females of the Greek tortoise.

In a separate analysis, Beth Reinke at Northeastern Illinois University and colleagues used existing field studies of 77 species of reptiles and amphibians living in the wild and found that some populations of turtles, salamanders, and tuatara, also had very slow ageing rates.

Studying these and other animals with low or negligible ageing rates could shed light on how to increase human longevity, says Colchero.



Black marsh turtle

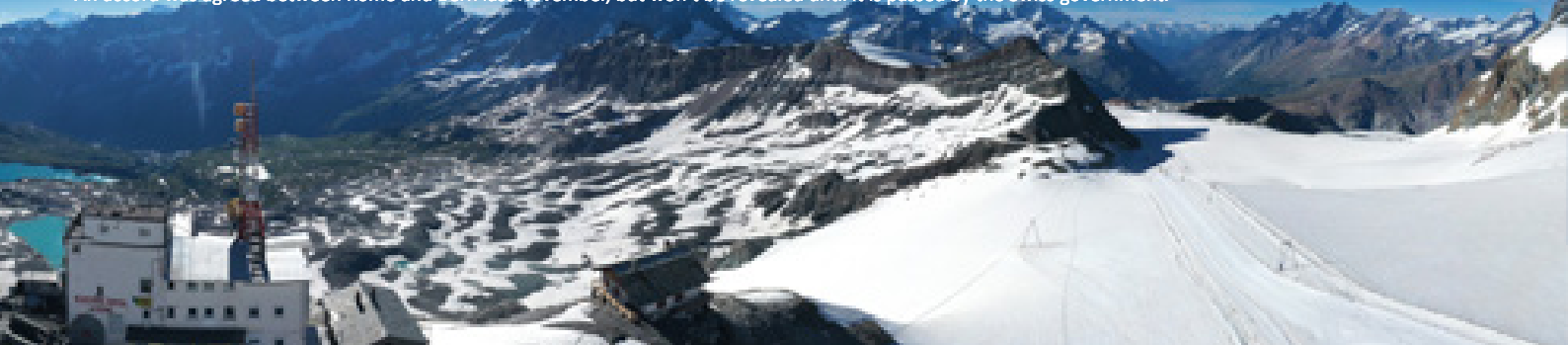
### Melting glacier in Alps shifts border between Switzerland and Italy

A melting glacier in the Alps has shifted the border between Switzerland and Italy, putting the location of an Italian mountain lodge in dispute. The borderline runs along a drainage divide – the point at which meltwater will run down either side of the mountain towards one country or the other. The Theodul Glacier's retreat means the watershed has crept towards the Rifugio Guide del Cervino, a refuge for visitors near the 3,480-metre (11,417ft) Testa Grigia peak – and it is gradually sweeping underneath the building.

Where the Italian-Swiss border traverses Alpine glaciers, the frontier follows the watershed line. But the Theodul Glacier lost almost a quarter of its mass between 1973 and 2010. That exposed the rock underneath the ice, altering the drainage divide and forcing the two neighbours to redraw around a 100-metre-long stretch of their border.

Years of negotiation have delayed the refuge's renovation – the villages either side of the border have not been able to issue a building permit. The works will therefore not be completed in time for the scheduled opening of a new cable car up the Italian side of the Klein Matterhorn mountain in late 2023. The slopes are currently only accessible from the Swiss ski resort of Zermatt.

An accord was agreed between Rome and Bern last November, but won't be revealed until it is passed by the Swiss government.

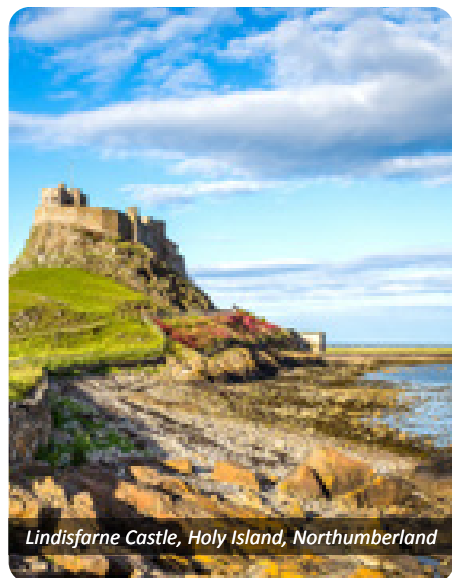






### Holy Island fishing ban proposed

Proposals to ban fishing off the north Northumberland coast would devastate a local community, it has been warned. Holy Island's fishermen and residents said the plans would halt a thousands-of-years-old local industry. Northumberland county councillor Colin Hardy said designating the surrounding waters as a highly protected marine area (HPMA) would be a "major problem", and that Holy Island risked losing families and turning into a museum. The government said looking at socio-economic impact was a "key part" of its assessment of the sites. However a spokesman for the Department of Food, Environment and Rural Affairs (Defra) said that Lindisfarne was a "highly biodiverse" area, home to 40 threatened or important species, HPMA's would see commercial and recreational fishing banned, along with dredging, construction, and anchoring, the Local Democracy Reporting Service said. In a statement, opponents of the plans said the designation was "both misguided and inequitable". They said the situation should not be viewed as "fishing against environment" as local fishermen had always worked in a small-scale and sustainable way "to protect the resource on which they and their families depend".



Lindisfarne Castle, Holy Island, Northumberland

### Harbour porpoises flourishing in the Thames

The Greater Thames Estuary is a critical habitat for the harbour porpoise, and greater protection for marine mammals in the busy waterway is essential, according to a new report by ZSL (Zoological Society London). Published on Wednesday 17 August, the report confirms that the Thames Estuary is an important habitat with significant densities of porpoises present in the area. Acoustic and visual surveys conducted by ZSL and Marine Conservation Research International (MCRI) in Spring 2022 along the south-east coast of the UK - from Suffolk to Kent - found several groups of porpoises, with a significant number residing in the outer Thames where the river meets the sea. Harbour porpoises are notoriously shy animals, often evading human presence, making them hard to see – and even harder to count. However, the small cetaceans use echolocation clicks at a very high frequency (around 120 kHz - more than six times higher than human hearing) to communicate with each other. This unique communication method gave researchers an opportunity to detect them, employing specialist equipment including a hydrophone array, to pick up the porpoises' sounds and provide accurate information on their presence. Two surveys, conducted over a seven-year period demonstrated high numbers of porpoise in the Thames Estuary with 31 individual detections of porpoise groups and 16 sightings (of these encounters, seven were both seen and heard) recorded in spring 2022. At just under two metres in length, the harbour porpoise is Europe's smallest cetacean. Their small body size, coupled with life in temperate waters means that they must feed almost continuously to maintain their high metabolic rate. The reasons behind their presence in the Thames estuary requires further research, but the team believe that a good source of fish and use of the estuary as a nursery to raise their young could be two of them. Due to their hypersensitive hearing, harbour porpoises are easily disturbed by noise in the water from human activities such as boat engines or construction noise. They are also threatened by bycatch in fishing gear.

### Water companies should be compelled to report on the number of dogs poisoned by sewage in rivers, say MP

Liberal Democrat MP Wera Hobhouse (Bath) said the worst firms should be named and shamed amid concerns sewage is harming dogs and other animals swimming in waterways. The Environment Act 2021 requires water companies to make a "progressive reduction" in dumping raw sewage in waterways after concerns were repeatedly raised in Parliament. Speaking in the Commons, Ms Hobhouse said: "There are now fears that dogs swimming in rivers will be poisoned by sewage. Will the Secretary of State make it mandatory for water companies to report on the number of dogs and animals poisoned in their rivers, and name and shame the worst offenders?" Environment minister Rebecca Pow replied: "We've been very clear about our work to crack down on pollution in rivers; we've just launched our targets which have got all the details in there and our storm sewage overflows discharge plan consultation." She encouraged Ms Hobhouse to raise her points via the consultation.

### Plea to use water for essentials only in July heatwave

South East Water director Douglas Whitfield said the firm is urging people to use water for "essential" purposes only during the second half of July, as rising heat levels has seen demand hit unprecedented levels. "What we're worried about is keeping up with customer demand." South East Water supplies 2.2 million people across Hampshire, Berkshire, Surrey, Sussex and Kent. "What we're seeing across our area, but particularly in the Kent region as the temperatures are climbing this week, is demand going to very high levels. In some cases higher than we've ever seen before. Really the problem for us this week is being able to physically pump the water into the system fast enough to keep up. My plea is for customers to really think carefully about their water use this week, not to use the hose to water the garden, and use water for essential use only, while this really hot period is on." He said he expected it to be a "short-term" issue. Surface water levels are "concerning", but ground levels are well stocked up over the winter. Water shortages may only arise if the summer continues to be dry, or it may be an issue for next year if we also have a dry winter, he explained.

### Rhine drought leaves Germany on brink of shipping closure

The Rhine is on the brink of being closed to shipping traffic as water levels plunge towards "extreme" lows in a major blow for the German economy. (As at mid-August).

Water levels at the town of Kaub, a bottleneck point in one of Europe's most important transport arteries, have fallen beneath one metre as a heatwave grips the continent. Forecasts suggest levels could soon reach 80cm, which would trigger an extreme alert and mean many vessels can no longer pass through. The timing is particularly painful because of the energy crisis in Europe. Barges frequently use the Rhine to deliver fuel to factories and coal to German power plants. Major companies based on the Rhine include chemical giant BASF, which uses it for cooling and transportation at its Ludwigshafen plant south of Frankfurt, and steel behemoth Thyssenkrupp.

The river runs for 766 miles, passing through Switzerland, France, Germany and the Netherlands. It is used by an estimated 6,900 vessels with a transport capacity of 10m tonnes.

Other European rivers are also being affected by lack of precipitation and high temperatures. The Po – Italy's longest river – has dried up amid the most severe drought in 70 years.



Rhine near Kaub showing extremely low water level



## Police unhappy at snitching on neighbours during hosepipe bans

Water companies are asking residents in areas affected by water shortages to alert them if they spot people breaching the rules.

However, police leaders have expressed concern that having neighbours reporting on one another could result in arguments and even violence that they then have to mop up.

Ken Marsh, chairman of the Metropolitan Police Federation, said his colleagues were already stretched enough and would not welcome any extra work generated because of the hosepipe ban. He said: "These are civil matters, so not a matter for the police. But obviously if disorder breaks out as a result of people snitching then we will have to respond, but it is extra work that we could do without, frankly."

Southern Water, as an example, has asked customers to "gently remind" their neighbours, family or friends if they are seen flouting the ban on using hosepipes or water features in Hampshire and the Isle of Wight.

It said it would initially speak to anyone reported to the company, but warned they could face a fine of up to £1,000. It is understood that the company is relying on reports from the public to enforce the rules.

## Fatal alligator attack on Florida golf course

An 80-year-old woman has been killed after she was attacked by two alligators after falling into a pond at a US golf course. The incident happened at the Boca Royale Golf and Country Club near the victim's home in Englewood, Florida. The woman was pronounced dead at the scene. A statement from the local sheriff's office said: "Two alligators were observed near the victim and ultimately grabbed her while in the water."

Although an official cause of death has not yet been confirmed, the Florida Fish and Wildlife Conservation Commission (FWC) sent a specialised trapper to the scene of the incident, where two alligators – one nine-feet long and the other nearly eight-feet long – were removed from the pond and euthanized.

The death is the third in the US as a result of alligator attacks this year, following the discovery of a man's body in a lake in Largo, Florida in May and another male killed after being dragged into a pond in Myrtle Beach, South Carolina in June.

## Wimbledon loos go gender-neutral

Signs were put up by organisers near the All England Club's main gates, just prior to the 2022 tournament, to announce that gender-neutral lavatories have been introduced for the first time. Not everyone was pleased with the development, with one long-time female fan saying: 'Wimbledon is about tradition, it doesn't have to follow every fad.' Single-sex toilets will still be available throughout the grounds.

In addition this summer it was also confirmed that "Mrs" and "Miss" titles would be scrapped from the female champions' honours board.

Last year organisers did away with his and her towels for the players, instead handing out the same-coloured towels to men and women competitors for the first time.

These were some of the last remaining male-female distinctions after the club committed to equal pay in 2007. For the subsequent 15 years a debate has raged as to why pay should be equal when men play "best of 5 sets" and women play "best of 3 sets".

Go to <https://payjustice.co.uk/blog/equal-pay-for-equal-work-at-wimbledon/> to join that debate!

## Netherlands' flood defences at risk from drought

The Netherlands introduced emergency plans to shore up flood dykes early August, as the government declared a drought. Ministers have promised to divert water to protect dykes, peatlands and other vulnerable nature areas.

A substantial number of the dykes are made of peat which dries out during droughts. A dry peat dyke becomes lighter, susceptible to breaking and can allow the water it has been holding back to push through and flood the area that was under its protection. The Netherlands is particularly susceptible to droughts because it is largely below sea level, and currently there is no rain forecast throughout August.

Protecting against the collapse of the dyke system has been made a priority of The Hague to cope with rising sea levels, and the announced plans focus on preventing irreversible damage to dykes and nature areas, before fresh water is used to maintain drinking water.

Farmers have been told to spray crops with surface water.



## Sizewell C gets green light in boost for Britain's nuclear power push

Kwasi Kwarteng has overruled officials and granted planning permission for the Sizewell C nuclear power plant despite concerns it will reduce water supplies available for households. The Business Secretary approved the scheme in July against the recommendation of the Planning Inspectorate, arguing that the "very substantial and urgent need for the proposal outweighs the harms".

He pointed to the Government's plan to boost Britain's energy security with a new generation of nuclear reactors and said Sizewell C would make a "substantial contribution" to that goal. However, the decision faces a potential legal challenge following warnings that the area of Suffolk the plant will be built in lacks the necessary water supplies and that wildlife habitats will be damaged. In a report to Mr Kwarteng, the Planning Inspectorate said approval for the plant should not have been granted unless concerns about water supplies and wildlife habitats had been resolved. Sizewell C would have two pressurised water reactors, compared to Sizewell B which has one, meaning more water will be needed to cool the plant. A supply will also be needed for construction. Northumbrian Water, which owns Essex and Suffolk Water, says local supplies in Blyth are currently not enough to meet the plant's needs during construction or operation. The utility company has agreed with French energy company EDF that the problem can be addressed during construction by drawing saltwater from the ocean with a temporary desalination plant.

To secure a permanent water supply for the completed plant, Northumbrian may need to transport water from another catchment area in Suffolk. Potential options include a new pipeline that would divert water from the River Waveney, importing supplies from neighbouring suppliers, reusing wastewater and creating new reservoirs. If those proposals fail, EDF has suggested it will consider building a permanent desalination plant.

## EDF cuts output at nuclear reactors as French rivers get too warm

The French energy supplier EDF is temporarily reducing output at its nuclear power stations on the Rhône and Garonne rivers as heatwaves push up river temperatures, restricting its ability to use river water to cool the plants. The majority-state-owned company, Europe's biggest producer of nuclear energy, said it would extend output cuts at several power stations on the two rivers as the hot spell continues – but that a minimum level of output would be maintained to keep the grid steady.

EDF warned in early August of potential output cuts at its nuclear power plants Tricastin, St Alban and Golfech in coming days due to high temperatures in the Rhône and Garonne rivers. It started imposing production restrictions in mid-July at Tricastin, St Alban and Bugey on the Rhône and Blayais at the mouth of the Garonne amid sweltering temperatures.

A spokesperson said that the company was lowering production "for a few hours" where possible but not shutting the reactors completely. After the 2003 heatwave, France's nuclear safety authority (ASN) set temperature and river flow limits beyond which power stations must reduce their production, to ensure the water used to cool the plants will not harm wildlife when it is released back into the rivers.



Tricastin nuclear power plant, Saint Paul Trois Chateaux, France



## Thames Water accused of hiding emergency plant issues

The Environment Agency (EA) on 4th August accused Thames Water of hiding problems at its emergency back-up plant that is meant to protect thousands of households from drought. Thames Water only informed the EA that their desalination plant was not working on 20th July, the day after the UK hit a record 40C temperature. The desalination plant, which was built to provide drinking water to nearly one million people and cost bill payers £250 million, was revealed to be switched off despite a looming hosepipe ban across the capital. Officials have now threatened regulatory action after the water company earlier this year gave assurances that the plant could be used during shortages in drought plans submitted to the EA. The plant in Beckton was built in 2010 to provide drinking water for 900,000 Londoners in case of drought or water shortages. But it has never been run at full capacity and will be switched off until at least next year. The capacity problems are thought to be down to the position of the plant on the estuary and the tidal effects on the levels of salinity of the extracted water. The Environment Agency has told Thames Water to come up with ways to cut more household demand to offset the loss of the plant, and asked it to explain why the plant will be under maintenance for so long. Failure to maintain the facilities needed for a drought could affect the company's performance rating. Government sources said it was "baffling" that Thames Water had failed to fix issues at the plant over the last decade.

## Hot weather won't save pools and lidos from closure

Outdoor swimming pools and lidos could be forced to close at any time throughout the summer, because of a national chlorine shortage - with several already forced to suspend the sale of season tickets.

The historic lido in Cheltenham, along with Portishead Lido, near Bristol, said in July that they couldn't guarantee being able to remain open in the face of the shortages and have therefore suspended season ticket sales.

Others warned at the time that they might have to shut within weeks.

Joe Stanhope, a trustee at Historic Pools and operations director for Jubilee Park Lido in central Lincolnshire, said: "Pools will only have a couple of weeks' supply of chlorine at best and everyone is struggling to obtain more. If they can't get chlorine they will have to close."

Chlorine shortages have seen bills double this year, on top of soaring energy cost, higher wages and a shortage of workers such as lifeguards.

The chlorine shortage is blamed on production cuts in China, Brexit, US and the Ukraine war.

## Scientists discover world's largest bacterium, the size of an eyelash

Scientists have discovered the world's largest known bacterium, which comes in the form of white filaments the size of human eyelashes, in a swamp in Guadeloupe. At about 1cm long, the strange organism, *Thiomargarita magnifica*, is roughly 50 times larger than all other known giant bacteria and the first to be visible with the naked eye. The thin white strands were discovered on the surfaces of decaying mangrove leaves in shallow tropical marine marshes.

The discovery was a surprise because, according to models of cell metabolism, bacteria should simply not grow this big. Previously scientists had suggested an upper possible size limit about 100 times smaller than the new species.

"To put it into context, it would be like a human encountering another human as tall as Mount Everest," said Jean-Marie Volland, a scientist at Lawrence Berkeley National Laboratory who co-authored the study.

Microscopic analyses established that the strands were single cells. Closer inspection also revealed a strange internal structure. In most bacteria, the DNA floats around freely inside the cell. *Thiomargarita magnifica* appears to keep its DNA more organised inside membrane-bound compartments throughout the cell. The bacterium was also found to contain three times as many genes as most bacteria and hundreds of thousands of genome copies spread throughout each cell, making it unusually complex.

Scientists are not yet sure how the bacteria evolved to be so big. One possibility is that it adapted to evade predation. "If you grow hundreds or thousands of times bigger than your predator you cannot be consumed by your predator," said Volland.

## Major diarrhoea outbreak after playing in splash pads and ingesting faecal matter – CDC Report

Dozens of people fell sick at a Kansas wildlife park after ingesting contaminated splash pad water, a Centers for Disease Control and Prevention investigation has found. Two outbreaks, that sickened 27 people in total, occurred days apart and involved two contagious bugs — shigella bacteria and norovirus — the CDC said in a recent Morbidity and Mortality Report.

Shigella bacteria causes shigellosis, and results in bloody diarrhoea, fevers, and stomach cramps, while noroviruses cause diarrhoea, vomiting, and stomach pain. People can catch both bugs from ingesting contaminated water.

While some of the investigation's findings are specific to the Kansas outbreaks, others may stop people getting sick from splash pads — a general term for an outdoor play area that sprays water onto people.

The outbreaks occurred in June 2021; a shigella outbreak involving 21 people — aged between one and 15 — who had visited the park on June 11 2021 and a norovirus outbreak with six cases — aged between one and 38 — who visited the park on June 18 2021, the CDC said. The splash pad was temporarily closed on June 19 2021.

All 27 cases had gotten splash pad water in their mouth, the CDC said. Playing in the splash pad, which included jets, tipping buckets and slides, wasn't linked to getting sick, it said.

Splash pads are generally for people younger than five, and kids are more likely than adults to contaminate the water due to poor toileting skills, the CDC said in the report. Diapers don't prevent water from contamination.

The CDC recommends people take measures to avoid spreading or catching germs like not pooping in the water, and hourly toilet breaks. "Sitting or standing on jets can rinse poop off your butt," the CDC says.

Chlorine, in the correct concentration, can kill shigella and norovirus, but many splash pads don't use it. US splash pads aren't regulated and don't always require disinfectant. With splash pads, though, it can be difficult to maintain the correct amount of germ-killing chemicals when water sprays into air.

*Editor Note 1. Splash pads (also known as interactive fountains, spray pads, spray parks, or wet decks) are aquatic venues that spray or jet water on users. Splash pads are usually designed so that standing water does not collect in the water play area to reduce the risk of drowning.*

*Editor Note 2. I have to admit that some of the words used in the CDC report made me smile — especially the phrase "jets can rinse poop off your butt." I can't envisage the UK Government's public health bodies using similar terminologies!*

## Clampdown on councils cashing in on beach huts

The Government is to close a loophole which allows councils to sell assets such as beach huts to themselves in what have been called 'dodgy deals'. The move will stop a plan by Bournemouth, Christchurch and Poole council to sell its 3,605 beach huts to a company which is owned by the local authority. The council had provoked outrage in recent months by bringing forward proposals to sell the huts to a 'special purpose vehicle' for £54million.

The SPV would have been owned by the council, funded mainly by debt, allowing the council to exchange the one off £54million payment for the rental income of around £5million per year.

The change of rules will mean that 'unlocked funds' can only be earmarked to pay for 'transformation projects' where the authority does not still retain some direct or indirect control of the assets.



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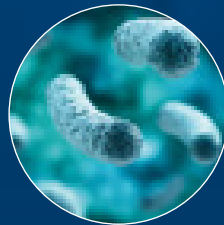
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## Water covered planet discovered

Researchers in Canada have discovered an exoplanet—a planet orbiting another star—just 100 light-years from Earth that's probably covered in water. TOI-1452 b orbits one of two small stars in a binary system located in the constellation of Draco "the dragon." That's the northern sky as seen from Earth, close to the Plough.

Published in The Astronomical Journal on the 24th August, the study reveals a world that's slightly greater in size and mass than Earth and is in the "habitable zone" of its star between the frost line and the "boil zone" where liquid water can exist. The authors believe it could be an "ocean planet," a planet completely covered by a thick layer of water. They compare it to Jupiter's moons Ganymede and Callisto and Saturn's moons Titan and Enceladus, all of which are suspected to have subsurface global oceans.

Its location is fortuitous because Draco is a circumpolar constellation that's always visible at night in the northern sky. It's also close enough for its atmosphere to be studied. "Our observations with the Webb Telescope will be essential to better understanding TOI-1452 b," said René Doyon, Université de Montréal Professor and Director of Institute for Research on Exoplanets (iREx) and of the Observatoire du Mont-Mégantic (OMM), who was involved in the space telescope's NIRISS component. "As soon as we can, we will book time on Webb to observe this strange and wonderful world."

The study reveals a planet that's around 70% larger than Earth. It orbits one of two red dwarf stars that, in turn, orbit each other. That may sound bizarre, but it's much more common than our solar system's sole star. It took more than 50 hours of observation to estimate the planet's mass, which is believed to be nearly five times that of Earth. The scientists believe it to be rocky, like Earth, but instead of water making up 1% of the Earth's mass, on TOI-1452 b it may make up to 30%.

## Salmon and sea trout numbers lowest on record in Wales

Salmon and sea trout numbers are at the lowest levels since records began in the 1970s, new figures from Natural Resources Wales (NRW) show. They also reveal that 91% of Welsh salmon rivers are deemed as at risk of losing salmon populations altogether. NRW has said more needs to be done to improve water quality.

Records for salmon and sea trout populations have been kept consistently since the 1970s. Statistics for 2021 revealed not one of the 23 salmon rivers in Wales were categorised "not at risk" or "probably not at risk" of losing their population.

NRW has also said stocks are now at risk of failing to maintain sustainable salmon populations in the future but there was no magic solution to repopulate rivers.

For sea trout rivers, 61% have been classified as at risk, 24% of rivers were deemed probably at risk and 12% were probably not at risk. But none of the sea trout rivers were categorised as not at risk.

Natural Resources Wales has said falling fish populations is not just a trend in Wales and the UK but across Europe. Principal fisheries officer Ben Wilson, said: "These declines are replicated in most other countries across the North Atlantic, where populations have declined over the past few decades. This has been most evident for salmon, but recently a sharp decline in Welsh sea trout stocks has also occurred particularly in south and south west Wales."

Salmon and sea trout require high quality freshwater to thrive and act as an indicator of the environmental quality of rivers. NRW said it has seen anglers "react positively" to its Catch and Release byelaws introduced in 2020 but said more needs to be done to improve river water quality. It also says every fish that reaches its spawning ground or is returned safely to the water after being caught could contribute to improving fish populations.

## Urgent polio boosters for London children

All children aged one to nine and living in Greater London will be offered a polio vaccine after the virus was detected in sewage. The virus, which can cause paralysis, has been found 116 times in London's waste water since February.

The urgent immunisation campaign will see nearly a million children offered the vaccine - including those already up to date with their jabs. Parents and carers will be contacted by their GP within the next month.

Polio is seen as a disease of the past in the UK after the whole of Europe was declared polio-free in 2003.

However, what is happening now is slightly complicated as the samples detected are linked to a polio vaccine used in other countries. Parts of the world still dealing with polio outbreaks use the oral polio vaccine - which is safe, but uses a live virus. This gives a huge amount of immunity, but has the potential to spread from person to person in areas where not a lot of people are protected.

This becomes a problem if it continues to spread, as the safe form of the virus used in the vaccine can mutate and evolve until it can once again lead to paralysis.

The UK Health Security Agency (UKHSA) says most of the samples detected are the safe vaccine form of polio, but "a few" have mutated enough to be dangerous.

A polio virus was first detected in sewage from north and east London in February. In April and May mutated versions were picked up, suggesting the virus was evolving. The alarm was raised in June after a series of positive virus tests at Beckton Sewage Works, which serves north and east London, and that there was evidence of transmission in a small number of people.

A meeting of the government's vaccine experts - the Joint Committee on Vaccination and Immunisation - recommended a rapid booster campaign for children aged one to nine.

The aim is two-fold. First to reduce the risk of any child catching the virus and being paralysed and also to raise immunity levels so the virus finds it harder to spread.

## Bacteria can remove plastic pollution from lakes

A study of 29 European lakes has found that some naturally-occurring lake bacteria grow faster and more efficiently on the remains of plastic bags than on natural matter like leaves and twigs. The bacteria break down the carbon compounds in plastic to use as food for their growth.

The scientists say that enriching waters with particular species of bacteria could be a natural way to remove plastic pollution from the environment.

The effect is pronounced: the rate of bacterial growth more than doubled when plastic pollution raised the overall carbon level in lake water by just 4%.

The results suggest that the plastic pollution in lakes is 'priming' the bacteria for rapid growth - the bacteria are not only breaking down the plastic but are then more able to break down other natural carbon compounds in the lake.

Lake bacteria were found to favour plastic-derived carbon compounds over natural ones. The researchers think this is because the carbon compounds from plastics are easier for the bacteria to break down and use as food.

The scientists caution that this does not condone ongoing plastic pollution. Some of the compounds within plastics can have toxic effects on the environment, particularly at high concentrations. The findings are published today in the journal *Nature Communications*.

## Toxicity alarm after harmful levels of blue-green algae found in Windermere

Visitors and locals alike are being warned after algae, which is potentially lethal to pets, was spotted around waters in the Lake District.

Three different locations on Windermere as well as one part of Bassenthwaite Lake have all confirmed the presence of blue-green algal blooms The Lake District National Park Authority has issued a warning in the wake of the sightings on Windermere.

Blue-Green Algae is a naturally occurring environmental phenomenon which becomes more likely during periods of warm, dry weather, and when combined with high phosphorous levels, which come from sewage outflows, septic tanks, and agriculture.

The Environment Agency (EA) says bloom- and scum-forming blue-green algae can produce toxins that can kill animals. It can cause rashes in humans if it comes into contact with the skin, and illnesses such as nausea, diarrhoea and vomiting, if swallowed.

The Lake District National Park Authority has issued a warning in the wake of the sightings on Windermere. A spokesman said: "It's impossible to tell if the algae are the dangerous kind just by looking at it, so it's best to not enter the water if you suspect there are algae. Please look out for signs on lake shores and call the Environment Agency on 0800 80 70 60 to report your sighting. Do not enter, drink or swallow the water. Also keep children and pets away from the water."





### Killer whales attacking great white sharks for their offal

A single pair of killer whales have been attacking and killing great white sharks off the coast of South Africa in order to remove and eat their livers and hearts. They have been named Port and Starboard. According to research published in the African Journal of Marine Science, the sharks have been avoiding sites where they have aggregated for many years in order to not bump into the two deadly orcas. Researchers found that since 2017, eight white shark carcasses washed up on beaches in the Western Cape, near Gansbaai. Seven of the eight had their livers removed, and some their hearts as well. The wounds on the bodies were distinctively orca-caused.

Gansbaai, located around 60 miles east of Cape Town, was previously a great white hotspot, attracting tourists for boat tours and cage diving. In the aftermath of these discoveries, the researchers noticed tagging data indicating that the great white sharks were leaving this region, swimming away from Gansbaai.

In their absence, the hierarchy of the local ecosystem has changed, seeing the arrival of another predator called the bronze whaler shark. These bronze whalers are also being attacked by the orcas, who are indicating a level of experience and skill in hunting large sharks. However, balance is crucial in marine ecosystems, for example, with no great white sharks restricting cape fur seal behaviour, the seals can predate on critically endangered African penguins, or compete for the small pelagic fish they eat.

### Water saving tips follow emergency fear of drought meeting

Representatives from the Government, water industry, farmers and river campaign groups, held an emergency meeting on the 26th July to discuss measures to mitigate the worst impacts, ahead of a possible drought alert in August.

Advice from the water industry, backed by the Government, includes letting your lawn turn brown and using dry shampoo to wash your hair. Other advice includes being proud to have a dirty car, taking shorter showers and using the same mug to drink from all day without washing it.

The Government is trying to prevent widespread hosepipe bans as drought looms for England, particularly in the south and east. England has had the driest first six months of the year since 1976, and only 20% of average rainfall in July, mainly falling in northern regions.

That said, a number of water authorities are preparing to apply for drought orders which will empower them to introduce hosepipe bans. Southern Water has applied and others such as Thames Water say a ban is likely. In Yorkshire the Environment Agency has applied for a drought order for the Holme Styles reservoir to protect wildlife.

Water companies cannot escape their own issues of failing to curb leakages, with losses of some 3.0 billion litres of water per day, which would fill more than 900 Olympic swimming pools. A national hosepipe ban might save up to 1.5 billion litres, only half of the water company losses.

### Italy suffers major drought

Italy is experiencing an intense, protracted heatwave with temperatures higher than 40C in parts of the country by early July. With little rain a drought has hit northern regions particularly hard, where a parched Po River, Italy's longest waterway, is wreaking havoc on everything from farming and hydroelectric power to supplies of drinking water.

Fabrizio Curcio, the chief of Italy's civil protection department, said that the Po was up to 80% lower than usual as a result of rainfall being 40-50% beneath the average of recent years and snowfall being down by 70%. The drought has also spread to the Arno River in Tuscany and the Tiber and Aniene, both in Lazio, and is blighting several lakes, including those in the south.

As an example of responses from Authorities, Milan is turning off some 50 public fountains amid warnings of daytime water rationing as Italy battles one of its worst droughts in decades. The measure, which comes after the wider Lombardy region declared a state of emergency, targets about half of the city's 100 decorative fountains.

Fountains hosting fish and plants are exempt from the rule, as are the 580 drinking fountains. Residents in the business and fashion hub have also been urged to reduce water use at home as much as possible.

In addition, inhabitants and business owners have been told not to set their air conditioning units below 26C in order to conserve energy, after parts of the city were last week hit by power cuts, believed to have been caused by a surge in the use of air conditioners amid high temperatures.



Piazza Cadorna, Milan, Italy. June 2022. Fountains closed due to the drought emergency.

### Spider crabs swarm Cornish beaches

Thousands of spider crabs have converged on the beaches of Cornwall due to rising sea temperatures. The migratory creatures swarmed in the shallow water in St Ives, shedding their shells before returning to depths of up to 90 metres (300ft).

The crustaceans are instantly recognisable for their long legs and pincers, but they are harmless to humans. However, their presence at Porthgwidden beach was enough to put many bathers off entering the sea.

Experts say while it is not unusual to see them in British waters, mass gatherings are becoming more common in the summer because of the rising sea temperatures linked to the climate crisis.

These common spider crabs – *Maja brachydactyla* – usually gather in huge numbers in shallow water to protect themselves from predators while they wait for their new exoskeletons to thicken and toughen up.

Local fishermen are concerned that they will replace the UK's brown crab, but experts in the field said that they would co-exist, and that the spider crab won't out-compete brown crabs, as spider crabs are "slow moving, less robust, and less aggressive than brown crabs."



Spider crab off the North Cornish coast



## Royal Navy reveals new testbed ship XV Patrick Blackett

The Royal Navy on 29th July unveiled a unique testbed ship to support trials of the latest tech and autonomous systems. The ship is expected to take part in Royal Navy and NATO exercises in the future. The 42m, 270-tonne vessel arrived in Portsmouth this week and is named after former Royal Navy sailor and Nobel Prize winner Patrick Blackett. The ship has been named XV Patrick Blackett to honour the British physicist who won a Nobel Prize for Physics in 1948. Patrick served in the Royal Navy in the First World War and made a major contribution in the Second World War. The addition of this experimental vessel will allow the navy to be able to carry out more trials at sea to enhance the Fleet's operations and ensure the UK stays at the leading edge of naval warfare. XV Patrick Blackett will enable NavyX to experiment without the need to place demand on other navy ships, many of which are deployed permanently away from UK waters. The ship which can reach speeds of 20 knots, will have a crew of five Royal Navy personnel and will be adaptable to specific trials or experiments it's carrying out including testing drones and autonomous vessels and AI decision-making. Colonel Tom Ryall, Head of NavyX, said: "The arrival of this vessel is a pivotal moment for NavyX's ability to deliver output for the Royal Navy." NavyX is the Royal Navy's Autonomy and Lethality Accelerator, which rapidly develops, tests and trials cutting-edge equipment, with the aim of getting new technology off the drawing board and into the hands of our people on operations at a pace.

## River Dee barbecue boats banned by council

Controversial plans to put barbecue boats on The Groves in Chester have been thrown out by Cheshire West and Chester Council. The plans had been submitted to the council and planning permission had been given back in May. A petition organised by local businesses and individuals and signed by thousands of people including Chester MP Chris Matheson called on the council to reconsider the plans. Concerns were expressed about the prospect of allowing the development to go ahead on the only public moorings on the River Dee in Chester. Now Cheshire West and Chester Council has taken the decision to reject the proposal, which would have seen two barbecue boats, a safety boat and a floating pontoon with a kiosk placed between the Bandstand and the Chester Boats mooring. The rejection has been made on the grounds that such a development would not be in keeping with the historical character of this thriving tourist hot spot in Chester, which is popular with visitors and residents alike. The applicants had advised the council that the boats would have had a barbecue in the middle, with alcohol on sale at the kiosk for anyone on the boat apart from the skipper to consume. Chester MP Chris Matheson had signed the petition, warning that plans to put barbecue boats on the River Dee would create "mayhem" and be a danger to other river users. He also expressed concern about the idea of trusting people to stay sober while skipping the donut-shaped boats.

## UK sea level rise speeding up - Met Office

Sea levels are rising much faster than a century ago, reveals the Met Office's annual look at the UK's climate and weather. The State of the Climate report also says that higher temperatures are the new normal for Britain. Conservationists warn that spring is coming earlier and that plant and animal life is not evolving quickly enough to adapt to climate change. The report highlights again the ways climate change is affecting the UK. It explains that the UK is warming slightly faster than the average pace of global temperature increase. The Met Office assessed climate and weather events for 2021 including extreme events like Storm Arwen that caused destructive flooding. Sea levels have risen by around 16.5cm since 1900, but the Met Office says the rate of rise is increasing. They are now rising by 3-5.2mm a year, which is more than double the rate of increase in the early part of last century. This is exposing more parts of the coast to powerful storm surges and winds, damaging the environment and homes. Around 500,000 homes are at risk from flooding, scientists say. Extreme sea levels during Storm Arwen last November were only avoided because it hit during a lower than usual tide, explains Dr Svetlana Jevrejeva from the National Oceanographic Centre. "While the coastline always changes, climate change and sea level rise are exaggerating those changes; the scale, rate and impact will change and it will change dramatically quite soon," she explained.

## Safe to swim in sea, says expert after suspected shark attack

Sea swimmers should not be deterred from having a dip, an expert has said after a suspected shark attack off the Cornwall coast. Marine biologist Hannah Rudd said the incident during a snorkelling trip was an "incredibly rare event". Organisers Blue Shark Snorkel said a person was injured on a group dive and walked off the boat for treatment. The victim said in a statement it was a "freak event" on 28 July and sharks should not be judged by it. The snorkeler was taken to the Royal Cornwall Hospital in Truro for treatment, South West Ambulance Service said. Ms Rudd said: "I don't think this should stop anyone from getting in the water this summer. Please go out and enjoy the beaches responsibly and enjoy the sea in all its salty goodness." She encouraged anyone interested in getting "up close" with sharks to "give it a try" with a professional operator. She added that although "you are entering a wild environment with an apex predator", it was "important to stress" how rare attacks were. "I'm sure the dive master there will give you a briefing on the code of conduct," she said. "That will include keeping a safe distance, not touching unnecessarily, not chasing them and if you feel unsafe in the water just alert your dive master and they will safely remove you from the water." Being in the water with "these highly majestic" animals was an "absolutely incredible experience", she said. "Despite this incident they [blue sharks] are really good role models for challenging the stereotypes that sharks have endured for decades."



Aerial panorama of Penzance, Cornwall, England

## NEW members

Since the last edition of Waterline was printed the WMSoc has approved 27 new membership applications, 1 upgrade request and 2 group memberships. We welcome members from the following sectors of the industry: **Water Hygiene – 10, Water Treatment – 5, Consultancy – 3, Facilities Management – 3, Building Services – 2, Utility – 1, End user – 1, Healthcare – 1, Manufacturer – 1.**

**The following new members have given permission for their names to be printed:**

Paul Abbott, Jamie Braithwaite, Danny Brown, Christopher Clubb, Dennis Coates, Trevor Edwards, Joe Ellis, Darren Etasse, Marcus Fearon, Nicholas Fox, Mark Fry, Neal Godwin, James Groves, Craig Jenkins, Henry Laver-O'Sullivan, Callum Maclean, Jamie McSloy, Iain Mount, Harrison Philips, Ashley Prebble, Benjamin Rouse, Lewis Shipp, Gary Smith, Gary Taubert.



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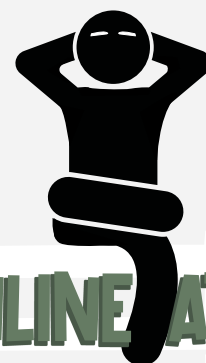
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# THE ENVIRONMENTAL IMPACTS AND EFFECTS OF CORROSION IN WATER TREATMENT

Lori Clark, Barry Higgins (Technical Director), Aquachem DAC

**The environmental impacts and effects of corrosion in water treatment; an important but forgotten aspect of corrosion which is often overlooked by industry specialists and environmental experts.**

Corrosion in water systems can mean a reduction in efficiency, it can incur costly maintenance & repairs, and in some cases cause plant shutdowns but as a collective, throughout all sectors, the consequences of the corrosion process have become a major problem with many experts estimating that the cost of corrosion amounts to billions of euro every year. [1]

In this article we look at how corrosion in water systems (*mainly closed systems*) is affecting not only the actual system but how it impacts the environment and what's being done to help reduce the negative environmental impact and economic loss.

## Understanding Corrosion

The word *corrode* is derived from the Latin “*corrodere*”, which means “to gnaw to pieces.”

Corrosion is the deterioration of a metal by reactions with its environment, where the environment is the whole surrounding area in contact with the material. Corrosion, in an aqueous environment, occurs when oxygen enters the system and mixes with the metal and water; creating a “rust” on the surface of the metal.

In the water industry nearly all metals can suffer from corrosion, it is of particular concern in closed loop systems as there is no blowdown, allowing the corrosion products to build up leading to deposition which can worsen the corrosion.

Most of the time corrosion issues are only detected after a failure has occurred which is too late to take preventative action, and so it is vital that corrosion is monitored and maintained.

In 2021, BSRIA updated their Guides to BG29/2021 and BG50/2021. In closed heating and cooling systems, water treatment comprises a number of techniques, including:

- Pre-treatment of fill water
- Removal of dissolved gases
- Chemical water treatment
- pH management
- Solids removal and filtration
- Galvanic anode cathodic protection / electrochemistry
- Bacteria and biofouling inhibition by biocides

## Factors that Affect the Rate of Corrosion

There are several factors which influence the rate of corrosion and whether it will form in a system, including (but not limited to):

- Aeration (dissolved oxygen in water)
- Flow
- Temperature
- Composition (deposits / hardness / pH)
- Water treatment
- System design

Out of them all, aeration is the most important as corrosion can be prevented by excluding the combination of air & water from the surface of the metal, however, unfortunately, there are always ways for oxygen to enter the system. Oxygen can enter the system through leakage, pump seals, poor maintenance, make-up water or design / installation failure. Luckily nowadays corrosion-protective coatings & technologies are not only more readily available but are a more practical and sustainable way of providing a barrier between the metal and its “environment”.

Flow is also an important factor; in *moderate* flow conditions the effect of corrosion is usually minimal as protective barriers (inhibitors) have the chance to absorb onto the surface. Under *low* flow conditions, suspended soils are given the chance to deposit onto the surface, leading to blockages or, if bacteria is present, microbial influenced corrosion. However, if there are very *high* flow rates, erosion corrosion (occurs when oxygen is in the system) or cavitation (occurs due to formation of steam bubbles in deaerated water) can occur. The temperature can also accelerate the rate of corrosion in closed loop systems as the oxygen has nowhere to escape. In mild steel, the rate of corrosion is about 0.05-0.15 mm year<sup>-1</sup> at 288 K. When the temperature gets closer to 343 K, the rate of corrosion is 1.8 times greater and thus the corrosion rate goes up by 0.09-0.27 mm year<sup>-1</sup>.

Scale deposits and microbial activity also need to be mentioned as these both can cause operational problems due to them reducing the heat transfer efficiency. The continuous fouling of heat exchange surfaces and system piping with corrosion by-products will reduce the systems efficiency and result in higher operating and equipment costs.

With the ongoing demand on supply, it is vital that the limited water supplies we have are utilized and recycled correctly. In a closed loop water system, water is constantly recirculated with very little water being lost, which is one of the biggest advantages of these systems. However, they need to be maintained to ensure everything is being done to minimise the risk of corrosion.

## The Effects of Corrosion

Every industry has some form of heating and chilled system





and depending on the size of facility there can be some serious consequences. If corrosion is not identified at an early stage, it can cause plant shutdowns, reduction in efficiency, loss or contamination of product and costly maintenance.

No matter the size of a facility, plant failure has big consequences especially when it comes to the cost of getting equipment back online:

- All corroded parts need to be replaced and possibly re-designed to allow for corrosion
- Equipment adjacent to corrosion source may need replacing
- Technical experts are required to find a solution and repair the system
- Loss of production & product
- Possible contamination of goods
- General maintenance required to make good any repairs.

### The Environmental Effects

Climate change is high on the agenda for most industries these days and more engineers are focusing on delivering sustainable products and systems which are helping minimise the environmental and societal impact.

Whilst it may not be widely talked about, corrosion in cooling and heating water systems can have a negative impact on the environment. Inhibitors are used in closed systems to help mitigate the risk of corrosion, commercially available corrosion inhibitors have toxic properties and can have a damaging effect to the environment if released.

In large industrial, power, or chemical plants the environmental impact of corrosion can be severe. As the systems efficiency decreases additional energy is required to keep the system going, this will put additional strain on all systems and could result in plant shut down or worst-case scenario - a fire.

There is also the physical aspect of the corroded material to consider. Once it has been removed from the system, along with any other damaged materials, it must be transported and disposed of correctly and not taken to the landfill / dump.

When you consider the harmful impacts happening every day, worldwide, never mind the day-to-day issues; higher energy usage, higher water usage, additional labour & transport, you can see why corrosion mitigation & control is still one of the hot topics for researchers in industries & academia.

We are now seeing manufacturers & infrastructure owners focusing on end-of-life management and making early considerations with respect to corrosion in the design and planning stages.

### The Economic Impact of Corrosion

**Apart from the environmental consequences, economically the global cost of corrosion exceeds €2.27 trillion, or 3% of global GDP. [2]**

While this is not only corrosion in water systems, it shows just how significant the economic and environmental impact of corrosion is.

Research has shown that approximately 1/3 of these costs can

be reduced if there was a broader use of corrosion resistant materials. Studies carried out by The Battelle Panel show that since 1975, the industry has eliminated 35% of avoidable corrosion by improved practices and reclassified 15% of unavoidable costs as avoidable. [3]

New and improved corrosion technology results from research and development, and with advancements in corrosion technology and techniques evolving at such a high rate, there are always new innovations coming onto the market. The proper application of methods to control corrosion (e.g., coatings, inhibitors, and cathodic protection) reduces the cost of corrosion individually and globally and makes a positive contribution to the overall carbon footprint.

### Corrosion Control

Increased consumer awareness has allowed corrosion prevention products to develop and improve significantly. Through the application of existing or emerging technologies, advances are being made in all methods for corrosion control and its application. These prevention methods include temporary and permanent coatings, material selection, inhibitors, cathodic protection, and design.

#### Design

Each closed system differs depending on several factors including size of facility and application. When designing the system consideration should be given for the mechanical and strength requirement, together with an allowance for corrosion.

#### Material

The design of a system should take into account the materials to be used for various components within the system.

At design stage it is important that the correct metals that make up a system are given thought. At construction stage and pre-commissioning stage that the most suitable cleaner, inhibitor and biocide are selected. For commissioning and hand over it is vital that the water treatment company is aware of all the metals in the system so they can formulate a site specific water treatment plan for the site.

The implications of adding a high or low pH corrosion inhibitor to a system with aluminium is detrimental.

#### Inhibitors

The technique of adding inhibitors to the environment of a metal is a well-established method for controlling corrosion. A corrosion inhibitor may act in a number of ways: it can restrict the rate of the anodic process or the cathodic process by simply blocking active sites on the metal surface.

Alternatively, it may act by increasing the potential of the metal surface so that the metal enters the passivation region where a natural oxide film forms.

#### Cathodic Protection

The protection is achieved by supplying electrons to the metal structure to be protected. There are two ways to cathodically protect a structure; by an external power supply or by appropriate galvanic coupling.

On the ground there are several modifications to the environment which can help control corrosion:

- Lowering the temperature can slow down the rate of corrosion
- Adjusting the concentration of a corrosion solution will reduce the rate of corrosion
- Removal of oxygen or oxidizers in most environments decreases corrosion rate, but it is not favourable for active—passive metal or alloys since they require oxidizers to form and maintain protective films.
- Avoid high velocities as this will increase the rate of corrosion.

**To help reduce the cost and the environmental impact of corrosion, and enhance the sustainability of materials, the use of any or all these methods are recommended and could lead to savings from 10 - 35% of the cost of corrosion. [4]**

### Monitoring Corrosion

Most heating and cooling systems are continuously in use so it can be difficult to get access to inspect the system, luckily there are a number of methods available to help monitor the effects of corrosion while the systems are operating. It is essential that there is some form of corrosion monitoring in place to allow the onset of corrosion to be detected as early as possible.

There are a number of ways to monitor the effects of corrosion, but by far the most popular way is through the use of corrosion coupons. This is when the metal “coupons” are installed into the system for 3 – 6 months and when removed the coupon is measured and compared to the initial weight. It is a popular choice due to its effectiveness, it being relatively inexpensive, simple to install and less invasive, however there are limitations to this technique:

- The rate of corrosion can only be measured once the coupon is removed – which could be too late in some instances
- The corrosion rate is only measured as an average during the duration it was installed, not providing further analysis to show peak times it could have occurred
- Short term studies usually yield high corrosion rates which are not representative of the actual system

An alternative to using corrosion coupons is the use of an online corrosion monitor. This uses a probe which communicates to its own individual software and displays accurate, graphical information regarding the corrosion rate in the system.

Every few hours data can be sent to a device (either stationed onsite or remote) which allows site engineers to see if any form of corrosion is starting to develop, giving advanced warning and ample time to act and resolve the issue.

With continued advancements being made in the field of corrosion, even more technologies are becoming available to help reduce corrosion costs and the risk of system failure.

### Conclusion

Corrosion has always been an issue, especially in the water treatment industry, but in recent years with the increasing focus on sustainability and environmental issues it has become something that needs to be addressed by both individuals and corporations.

The cost of corrosion can be extremely high for some businesses and vary from industry to industry. There are several factors which could increase the cost of corrosion within a business including:

- Equipment being designed to last longer = more usage and maintenance
- New government regulations could prohibit the use of time-honoured methods of protection because of safety or environmental damage
- For the consumer, corrosion costs are incurred for purchases of corrosion prevention and control products, maintenance and repair, and premature replacement.

Fortunately, advances in technology are being made every day and with a central focus on corrosion, new, environmentally friendly, corrosion prevention methods will be available to the wider market sooner rather than later.

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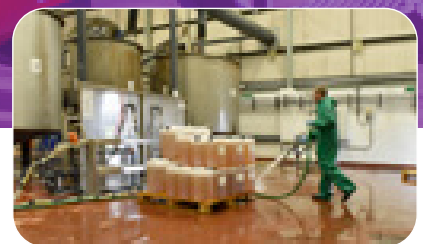
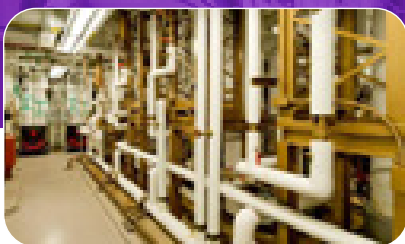
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# event report e

## From the Cradle to the Grave - The lifecycle of water management

Wednesday 8th June 2022

University of Greenwich, London

The meeting was opened by Dr Liz Whelan who introduced the topic, welcomed everybody present in the room and online. Liz gave a fascinating potted history of this historic World Heritage Site.

### Governance – Getting it Right First Time

**Elise Maynard, Director, Water Management Society**

Elise discussed the various Legislative and guidance documents which are applicable to water safety for all buildings and how they should be applied at the design and concept stages, especially for new healthcare buildings. This should include any CQC registered facility, including primary care and dental facilities. She advised that there are several new British Standards which have been written by a team who are actively involved in water management – these include:

- BS 8680:2020 Water quality. Water Safety Plans. Code of Practice
- BS 8580-1:2019 Water quality, risk assessments for Legionella control. Code of practice.
- BS 8580-2: 2022 Water quality, risk assessments for *Pseudomonas aeruginosa* and other waterborne pathogens. Code of practice.
- BS 7592: 2022 Sampling for Legionella bacteria in water systems - Code of practice (revision).

The process of risk assessment and the associated hierarchy of control is to remove or minimise the likelihood of harm. Elise showed examples of Contamination, Amplification, Transmission, Exposure and Susceptibility within new build designs and explained the costs of getting this wrong.

### Design Components of Water Systems

**Dr Ayse Cagla Balaban, Lecturer in the Built Environment, University of Greenwich**

Cagla discussed the importance of water management in the built environment. – only 1% of the water on Earth is usable and thus supply, demand and the environment are crucial. Her field of study relates to mains water supplies.

With regards to the source of water supply - precipitation, surface water and ground water can be very polluted. The choice of source depends on location, quantity, quality and cost. Cagla introduced some key design terms i.e., “max flow, average flow and max probable flow” these are important when designing pipework. Essential units include “intake, intake main, pumping station and transmissive main”. The treatment system must be able to remove colour, taste and bacteria thus reducing the hardness, iron and corrosive qualities. The distribution system must deliver high water quality and pressure – the latter must be sufficient for fire-fighting equipment. System design is important for health; requiring good pressure, flow and low noise as water velocity can be very loud. To minimise bacterial growth, pipework must be as short and direct as possible with adequate insulation of pipes and tanks, choices of materials and tanks with lids. The future could include composite materials, nanomaterials, or

smart materials – these are projects that are being worked on currently by her PhD students.

### Waterborne Bacteria/Maintenance and Controls

**Dr Elaine Cloutman-Green, Consultant Clinical Scientist, Great Ormond Street Hospital**

Elaine discussed clinical risk assessments and how they differ vastly from a Legionella risk assessment i.e., the patient is at the heart of the former, the latter tends to be an engineering exercise. The hierarchy of controls for any risk assessment requires elimination of the risk as the first and most important step, followed by substitution with a safer option. If elimination is not possible, only then should control be an option. The environment includes air, surface and water e.g., taps, sterile water and equipment. Micro-organisms can contaminate the environment via aerosols, droplets etc. but it is important to also consider how long they can survive on surfaces, which can be hours or even days. Transmission routes are typically via hands, showers and drinking (or aspiration) and also via poorly maintained or ill-used equipment. Guidance is useful as a baseline but are not always helpful for clinicians and they can also stifle innovation as they are often interpreted as law. Interestingly approximately 60% of *Legionella pneumophila* clinical infections are not currently sero-grouped (sg). Traditionally sg1 has been assumed to have the highest virulence, but other sgs and species have been implicated in outbreaks. Thankfully nosocomial infections are relatively few.

Augmented care has no fixed definition but likely to include:

- Severely immunosuppressed – transplant and oncology
- Organ support – critical care, renal, respiratory, cystic fibrosis
- Breaches in dermal integrity – burns

The augmented care environment is different due to longer lengths of stay, indwelling devices, underlying conditions, immune status, susceptibility and numbers of daily encounters/manipulations.

*Pseudomonas aeruginosa* is ubiquitous, thrives in biofilms and can survive up to 48 hr on surfaces. It is an opportunistic pathogen and causes high numbers of bacteraemias. These are increasing year on year and are still a main cause of infection. Many outbreaks have been reported in the literature and the publication rate is still increasing – highly antibiotic resistant strains are also increasing. Many other Gram negatives are being reported as causing outbreaks and there are also other organisms such as fungi and non-tuberculous mycobacteria being reported. Exposure can include splash, but poor cleaning can also be a source. Drains are a source of contamination and amplification; the real requirement is to control the management of the equipment and surfaces in the vicinity.

### Drains and Disease

**Dr Mike Weinbren, Consultant Microbiologist and Infection Control Doctor, NHS Scotland Assure & King's Mill NHS Trust**

Mike reviewed some history of water contamination, such as



the contribution of John Snow and his discovery of the source of cholera from a communal water pump. Transmission of *P. aeruginosa* via water was identified and reported in the 1960s but was not taken seriously as a risk until 2012 when several babies died and this was reported in the media. The focus is now on the periphery of the water system, such as taps and showers. Deaths linked to intravenous Total Parenteral Nutrition formulations were traced back to splashing from a drain in a sink in the aseptic preparation unit. The learning outcome is that sinks should now be placed outside the preparation area.

The wastewater system can be a conduit for transmission of faecal bacteria, *P. aeruginosa*, and viruses. As waste material is expelled into the soil stacks, contaminated air rises – this was demonstrated in the SARS outbreak in Hong Kong. The U-bends need to be full of water for them to be effective, but if they are not used, they can dry out. The water in the U bend can also become contaminated, however, so if back-splash is created then nearby surfaces are likely to become contaminated. Antibiotic resistance is also transferred via this route and blockage exacerbates the problem. Positioning of shower drains is an issue within healthcare as contamination can easily backslash onto the surroundings. Mike noted that if bacteria have sufficient nutrients, they will form biofilm and he shared a number of images demonstrating splash of up to 2 metres. A CDC report has shown 20% of infections are related to the water supply <sup>(2)</sup>.

With regard to design, elbow taps and correct fitting and placement of wash handbasins (WHB) close to patient beds – issues are still occurring. Storage areas do NOT need WHB! Hand detergent should not be placed above the tap outlet as it can drip down and provide nutrients and paper towels should not be placed above the WHB as fragments can block the drain. Taps should be mounted on the integrated plumbing solutions (IPS) panel with sufficient activity space and there should be no overflow and no plug. Many clinical and food items have been found in drains as well as excess sealant.

Human factors have a major impact, one study placed a video camera above a WHB and clearly showed that handwashing accounted for only 4% of activity. Cleaning is really important and training should be provided, but no-one is training the clinical staff in correct usage. Kitchen activities i.e. filling of water jugs have also been demonstrated to have a lack of staff awareness of how waterborne bacteria can spread from base of the jug coming into contact with the drain as it is filled.

Kearney *et al.* <sup>(1)</sup> recommend removing the hazard as a primary measure and if this cannot be done, then to isolate the hazard – engineering is the least effective policy and guidelines are not always effective. This reiterated Elaine's advice earlier. Mike advised that staff need to be trained to report blockages as disinfecting drains can be hit and miss – due to maximum permissible concentrations, contact time etc.. He showed examples of chemotherapy patients losing hair and it blocking the shower drains. Toilets should be rimless as biofilm is harboured out of reach of cleaning implements. 90-degree bends have been plumbed into macerator waste outlets. Kitchen water spray taps have contaminated salads. Maintenance equipment (spanners, screwdrivers etc.) is often used from dirty to clean.

Looking to the future – Antimicrobial Resistance (AMR) related outbreaks are significantly increasing year on year so

logically the removal of WHBs should reduce Gram negative colonisation. The second recommendation of the O'Neill report <sup>(3)</sup> is to improve hygiene and prevent spread of infection by handwashing, however, this is failing. With all the new Hospitals being built in UK – what learning will be transferred – have we returned to Victorian times?

### Putting Learning into Practice

#### Alyson Prince, Built Environmental Infection Control Specialist

Alyson further confirmed the problems caused by opportunistic waterborne pathogens i.e., that they form biofilms, cause infections, are difficult to treat, they spread and become antibiotic resistant. Hospital uses of water are vast and need to be managed appropriately.

Hospital projects require appropriately trained Infection Prevention and Control (IPC) staff to input throughout each phase in order to:

- Link the clinical risk profile to that of the environmental data
- Provide insight into test results – if we are looking for it, what does it mean?
- Understand other clinical disciplines, what is it we are doing in the space?
- Provide input at all stages of installation, commissioning process
- Ensure water quality is suitable for the risk level of clinical service delivery

With regards to legislation and guidance – how can it be applied in practice? HBN 00 09 "Infection control in the built environment" hasn't been revised since 2013 but nevertheless projects require IPC input on concept, feasibility, drawings, detail design, contract, construction, pre-handover inspection, commissioning and post project surveillance. Potential problems resulting from poor collaboration lead to poor design, maintenance and schematics, including change of use and too many water outlets installed without insight.

Other key aspects for good design practices are:

- Procurement of equipment and service
- Logistics and workflow
- Contractor selection for ongoing maintenance
- Service redesign/relocation
- Refurbishment
- New build concept to completion
- Bed allocation and design of high-risk patient areas
- Selection of fixtures and fittings

Alyson asked, "How can space be risk assessed without detailed knowledge of the clinical usage?" and advised that the Scottish SHFN 30 Part A manual has a very useful planning process example.

What can IPC and clinical teams do?

- Attend Water Safety Groups!!

- Ensure equipment and systems in their remit are being maintained, ideally with photographic evidence.
- Ensure routine testing and maintenance is carried out.

Water safety is a collective responsibility and a partnership, it is important to have good awareness, be competent and communicate well – from the top to the bottom. Engineers also need to collaborate, follow method statements, communicate in a timely fashion and perform appropriate remediation. For technical commissioning, buildings can be live a full year before pressure testing and thus contamination can ingress at any point. Ideally, systems should be left water-free for as long as possible but when filled, it is vital that temperatures are correct, schematics are accurate and data monitored. The WSG should be advised of any exceptions.

Modern methods of construction require that equipment arrives clean and is installed correctly. The water safety risk assessment should be initiated at the start of the project and reflect the clinical activity for that building or area. It needs to be reviewed regularly and referenced in the WSP as there can be significant legal ramifications of when it goes wrong.

#### **Research to support the outbreak response** **Dr Ginny Moore, Scientific Lead, Biosafety, Air and Water Microbiology Group, UKHSA**

Ginny discussed how applied microbiology research has helped UKHSA better understand how the indoor built environment can contribute to transmission of infection.

##### *Specialist Aerobiology:*

Ginny showed images of specialist aerobiology equipment used by UKHSA to investigate outbreaks of infection and to assess risk. For example, specialist aerobiology has been used to assess the aerosolization of respirable droplets from domestic spa pools and to investigate heater-cooler units as a source of invasive *Mycobacterium chimaera* infection.

In this case, they were able to demonstrate the aerosolization of potential pathogens, including *M. chimaera*, from within heater-cooler units and identify specific areas of aerosol release. The data was communicated to various manufacturers and design changes have since been implemented. The study also highlighted difficulties associated with the disinfection of these units and different disinfection protocols were researched.

##### *Model Systems:*

Following several high-profile incidents of *P. aeruginosa* infection, studies were carried out to investigate the formation of biofilm on tap components. These studies were carried out using a dedicated “tap rig” which initially incorporated taps fitted with different designs of flow straightener and, subsequently, solenoid valves made from different materials.

Similarly, and as a result of a Carbapenemase-producing Enterobacterales (CPE) outbreak, the team developed a model sink and drainage system. This incorporated different designs of sinks with differing drain positions and could also mimic blockages within the drainage system. Their research confirmed that sink design can minimise dispersal of potential pathogens present within the waste trap and/or drain hole of a sink and demonstrated that efficient drainage is essential to minimise splash-back and transmission of drain-associated pathogens. Subsequent studies assessed the efficacy of

chemical disinfection in reducing contamination within sink waste traps. Results suggest that chemical disinfection provides a short-term solution only. Model systems can be very useful for pre-concept research.

Ginny’s team have numerous research publications in the literature and were recently awarded funding to design and build a full-scale research ward, which is now complete and looking for projects!

#### **Understanding drinking water biofilms and their impact on water quality**

##### **Dr. Kat Fish, Postdoctoral Researcher, University of Sheffield**

Sheffield Water Centre has 150+ researchers. Kat’s area of research focusses on water distribution systems but the challenges are very similar to those for in-premise plumbing. Water quality failures are increasing, often due to complex and ageing systems and to biofilms, which are overlooked in policy and practice.

##### *Studying Drinking Water Biofilms at Full-scale*

Researchers at Sheffield have designed and built a full-scale, representative drinking water distribution system experimental facility and can insert coupons to enable biofilm analysis (based in Civil and Structural Engineering, at the University of Sheffield). Smaller versions of this experimental system have been developed for use on-site at operational treatment works and within operational distribution systems. Biofilm monitoring devices have also been developed to enable evaluation of water quality impacts on biofilm growth rates, also within operational drinking water systems.

Integrated biofilm analysis utilises state-of-the-art techniques to determine cell concentration and viability (flow cytometry), microbiome characterisation (molecular analyses) and physical/chemical composition of the biofilms.

Kat presented an overview of the team’s world-leading biofilm research to date examining interactions between biofilm growth, mobilisation (by increasing shear stresses) and water quality, in particular the impact of hydraulics, disinfection, coatings and carbon upon these.

##### *Some research highlights:*

- Low varied flow hydraulic regime - lowest discolouration, lowest biofilm cell numbers and highest Extracellular Polysaccharide (EPS)-per-cell, compared to a Steady State (consistent flow) or High Varied Flow. PODDS (Prediction of Discolouration in Distribution systems) is a research consortium, steered by water company partners, addressing the use of hydraulic regimes to manage discoloured drinking water. It has resulted in lower operational costs and improved water quality.
- Temperature – looking at low water temps in relation to climate change i.e., 8°C and 16°C showed that varied flow is better at reducing discolouration, but this is more obvious at higher temperatures <sup>(4)</sup>.
- Assimilable Organic Carbon (AOC) analysis shows different rate and structure of biofilm formation, when biofilm is subsequently mobilised, this then impacts the AOC concentration in the bulk-water, demonstrating the cyclical nature and impact of biofilms on water quality downstream.





- Chlorine – greatest discolouration response at high chlorine residuals, but this has no impact on fungal cells. It did, however, select out resistant bacterial strains. Low chlorine had high EPS and the lowest discolouration response.

Looking to the future, the group will be undertaking the following projects:

- Examining different disinfection regimes and their impact on biofilms (WIRe PhD)
- Rapid pathogen detection (in collaboration with Sellafield Ltd and HSE)
- Biologically stable drinking water
- Biofouling monitoring
- Hydraulics of intermittent supply and self-cleaning velocities

Kat noted that biofilms are critical and studies require an holistic approach, balance, collaboration and translational research. We need to be considering the impact of upstream biofilms on our downstream premise plumbing and water quality, understanding these interactions is critical.

#### **Multidisciplinary studies in wastewater by medical microbiologists and engineers** **Fusun Ozyaman**

Fusun provided a summary of research into novel bacterial detection materials and methods such as Artificial Intelligence (AI) and Raman technologies.

At least 1500 “new” pathogens have been identified since 1970 both viral and bacterial. Detection of virus in waste-water can give an early indicator of community spread. Waste-water epidemiology (WBE) is a powerful tool to monitor pandemics, detecting viral RNA. Some of the newer techniques are listed below:

- Droplet digital polymerase chain reaction (ddPCR)
- AI can be used for reading Gram stains and bacterial culture plates
- Matrix-Assisted Laser Desorption/Ionization-Time of Flight (MALDI-ToF)
- Whole genome sequencing

**Raman spectroscopy** can be used for antibiotic susceptibility testing and can be combined with AI for processing data and machine learning. Surface enhanced Raman spectroscopy is more sensitive and newer techniques include Laser (optical) tweezers.

**Bdellovibrio bacteriovorus** is a predatory bacterium that can invade a number of Gram-negative bacteria and can be used as a surface coating.

**Quorum Quenching** has been shown to prevent the building up of biofilm by disrupting the chemical signalling between bacteria.

**Microbial self-healing concrete** is based on the bacterial-induced calcium carbonate precipitation. In nature, a lot of bacteria are capable of precipitating calcite ( $\text{CaCO}_3$ ).

#### **Summary:**

Several themes were noted from the conference:

- Disconnections exist throughout the whole design and build process from the architects, designers through to the building users.
- There are very few people who understand guidance and its application, especially where that guidance is contradictory as it has been superseded.
- There is a definite need for more study days to educate designers, architects and specifiers.

Could the problem be that staff are not being listened to at the design stages - who is the client and who has input at the planning stages? Clinical staff are too busy managing patients, but their behaviour affects water quality. Such behavioural aspects are paramount and pro-active management needs to be put in place to enable key staff to attend meetings. Very little water hygiene training is provided during early learning for any clinical staff and this will affect behaviour due to an overall lack of understanding of the various hazards linked to water.

The whole building needs to be reviewed, not just the sinks, showers and drains. Guidance is useful but there are gaps as they can conflict and very little is available in clinical terms. Sadly, derogations can over-ride common sense at times.

There is a clear need to invite all disciplines to future events to attain better communication with development of educational tools that can be shared by professional bodies to their respective silos.

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- Report by Elise Maynard

# Microbial Induced corrosion in cooling systems and how regular monitoring can mitigate potential problems

Catherine Allen BSc Hons, Tintometer Inc.

## ACKNOWLEDGMENTS

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## Abstract

Microbes, as with all lifeforms, have optimal conditions in which they thrive. Unfortunately, for water treatment specialists, these conditions are just what we find in open and closed water recirculating systems. Microbes are especially abundant in open recirculating systems due to the concentration of nutrients through the cycling of dissolved solids by evaporation as well as suspended solids being blown in.

In cooling water systems, the wet surfaces are prone to microbiological growth, which in turn can lead to the formation of a biofilm. If left untreated, the biofilm can result in biofouling causing a reduction in plant life and plant efficiency.

Biofouling issues need to be controlled, although the methods of control vary depending on whether the microbes are in a planktonic or sessile state. Sessile microbes are responsible for biofilm formation.

Once biofouling has occurred in a system, even mechanical cleaning cannot remove all traces of a biofilm. Previously fouled surfaces are more susceptible to colonization as residual biofilm materials promote growth and reduce lag time between biofouling episodes.

While the effects of biofilm in a system are well known, it is important to keep in mind:

- Biofilms can act as an insulating layer and the performance of the heat exchanger deteriorates in correlation to the thickness of the biofilm
- Microbial Influenced Corrosion (MIC) occurs when the microbes act as catalysts for conventional corrosion
  - The presence of the microbes prevents corrosion inhibitors from reaching and passivating the systems metal surfaces
  - Corrosion reactions are accelerated by microbiological

interactions

- Microbial metabolites can be corrosive to the metalwork
- The most common category of MIC bacteria are sulfate reducing bacteria (SRB's)

In this paper, we will investigate the methods in which a large microbiological population in cooling water systems is undesirable and why regular monitoring can minimize the detrimental effects on the system.

## Introduction to Microbial Induced Corrosion (MIC)

Corrosion, irreversible deterioration of a metal, is estimated to cost global industry a staggering \$2.5Trillion annually.<sup>1</sup> The latest figures estimate that 15-35% of that figure could be saved by the implementation of better corrosion controls.

Metal alloys used in the water systems of industrial processes and structures are susceptible to corrosion and the rate and type of corrosion can be determined by several factors. These include:

- Microbiology
- Water Chemistry
- Metallurgy
- Electrochemistry

For the purposes of this paper, the author will concentrate on Microbiology, but the reader should take note that to fully understand and mitigate against corrosion, all four of these elements need to be understood in complex water systems.

Natural waters contain a diverse mixture of microbes, some of which are ubiquitous, and when a metal surface is immersed in water, corrosion and biofilm formation both begin almost immediately.

Corrosion that is caused, or influenced, by microbes is known as Microbial Induced Corrosion - it is also referred to as Microbiologically Influenced Corrosion, Bio-corrosion, or MIC. In literature, it is shown that MIC is not caused by the direct interaction of microorganism with the material but by the reaction of the medium in the area of the biofilm, and in particular from the metabolites of the microbes in question.<sup>2</sup>

MIC can be observed wherever and whenever an influx of organic

substances occurs and suitable surfaces are available for the colonizing of microorganisms that form biofilm. The temperatures of the media play more of a secondary role, as the relevant microorganisms are active within a temperature range of approximately -20°C and 120°C. The ideal temperature, however, is at 10°C to 40°C. Hence, the operational temperature of cooling water systems is within the ideal range that makes them prone to MIC.<sup>3</sup>

## Biofilms

The microbial population in waters can be general divided into two populations:

1. Planktonic (free-floating)
2. Sessile (immobile)

The same species of microorganisms can be found in both populations – Table 1 shows some of the most common microbes found in cooling systems.

In addition to those listed in Table 1, there are many other types of planktonic bacteria in a cooling water system. These planktonic forms come together to form a sessile aggregate that adheres to the inside of the system's pipework. These sessile bacteria then produce a slime, extracellular polymeric substance, which forms a matrix of DNA, proteins and polysaccharides. The result is a substance that forms a protective layer around the population of bacteria. Biofilm development is normally isolated into three distinct stages of development:

1. Attachment: Bacteria can adhere to surfaces in several ways. This includes variations in metallurgy allowing attachment sites on surfaces, chemical nutrients or a lack of biocide. The primary method of adhesion is through weak Van der Waals forces and hydrophobic effects.
2. Growth: Once initial colonization has occurred, population size increases exponentially. Other bacterial species and inorganic components of the water system contribute to and constitute the complex biofilm layer.
3. Dispersal: Bacteria within the biofilm secrete enzymes and break free of the biofilm itself, becoming planktonic once again. This enables the biofilm to spread to other parts of the water system.



Microbe	Effected Part	Effect
Sulfate Reducing Bacteria	Heat exchangers, Deck, Basin	Converts Sulfate to H <sub>2</sub> S; Causes corrosion
Shewanella	Heat exchangers	Dissolves Fe/MN oxide protective layer
Gallionella	Heat exchangers, Deck, Basin	Converts soluble iron salts into iron oxide; can form voluminous deposits
Leptothrix	Heat exchangers, Deck, Basin	Converts soluble iron salts into iron oxide; can form voluminous deposits
Thiobacillus	Heat exchangers, wood	Converts Sulfur or Sulfides to Sulfuric Acid
Pseudomonas	Heat exchangers	Produces exopolysaccharides that promotes biofilm formation
Legionella	Human being	Produces Pneumonia-like symptoms
Brown rot fungus	Wooden structure	Biodegradation of wood
White rot fungus	Wooden structure	Biodegradation of wood
Soft rot fungus	Wooden structure	Biodegradation of wood
Blue Green algae	Heat exchangers, Deck, Basin	Reduces heat transfer in heat exchanges

**Table 1:** Types of microbes affecting cooling towers.

**Source:** *Influence of Microbes in Cooling Tower: A Review*; Ranjana Tewari, S K Mehta, Pujan Vaishnav<sup>4</sup>

Once formed these biofilms can generate aerobic and anaerobic conditions. The anaerobic conditions enable anaerobes such as sulfate reducing bacteria to multiply, and a potential difference is established between different areas of the metal surface.

SRB, such as *Desulfovibrio*, reduce sulfur compounds like sulfate, sulfite, and thiosulfate to hydrogen sulfide. SRB are thought to be the most prolific contributor to MIC and a major cause of corrosion in open and closed water cooling systems. SRB use several mechanisms of corrosion including cathodic depolarization, anodic depolarization, production of corrosive iron sulfides, sulfide induced stress corrosion cracking and local corrosion.

The presence of SRB is normally indicated by a reddish or yellowish nodule on metal surfaces that, when broken, exhibits black corrosion byproduct. If hydrochloric acid is added to the black deposit, hydrogen sulfide will be released giving off a "rotten egg" odor.

The presence of SRB can contribute to accelerated, localized pitting corrosion and eventual perforation of the pipe. Corrosion by SRB can cause significant damage to surfaces, particularly where pipework may have bends, uneven surfaces, abrasions, or joints and welds. In addition, the amount of nitrite, often used as an anodic corrosion inhibitor in cooling water systems, can be reduced by SRB and therefore in closed heating and chilled systems where nitrite is used SRB must be controlled.

While it is possible to control the MIC process, the corrosion programs that are utilized by water treatment companies are not always effective: Inhibitor levels can drop, be used up and/or provide a source of food for bacteria and other organisms. For example, nitrite-based corrosion inhibitors feeding nitrite reducing bacteria (aka NRBs). It is essential that water quality is monitored, and that microbiological control be at the forefront of any water treatment program.

There are several ways in which microbiological control can be achieved, these include:

- Reduction or elimination of suspended solids
- Biocide dosing
- Maintaining water movement throughout the system (elimination of dead legs etc.)
- Monitoring and sampling of the system on a regular basis.

#### Microbiological analysis of cooling water

A 2016 report estimates that there are approximately 1 trillion species of microbes on Earth with most of those yet to be discovered.<sup>6</sup> When it comes to cooling water, there may be hundreds of species present at any one time, with some of those being very difficult to measure.

It is considered best practice to use "Indicator Organisms" to gain a general overview of the microbiological condition of the water. This translates to: *if the level of general bacteria is kept under control, one can assume your system will be kept microbiologically under control.*

Traditional methods for these tests have adopted standard agar plate count methods. These are still used in laboratories today and their results are required to fulfil regulatory guidance in many countries. However, the plate count method requires the Operator to: have access to a laboratory; a filtration set up; and training for how to count the results. Because the lab test is cumbersome, an easier method was required for routine monitoring. This is why agar-based dipslides have become so popular.



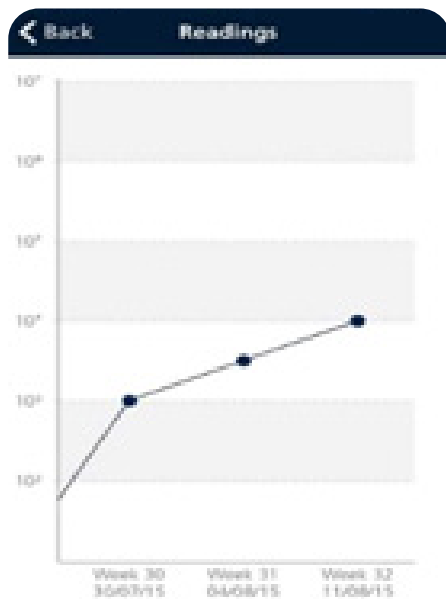
**Figure 1:** The left photo shows a cleaned low-carbon steel corrosion coupon with SRB growing on it and producing concentric rings of corrosion. The right photo is a water washed Type 304 stainless steel 5/8 inch condenser tube that has pits and dark spots.<sup>4</sup> **Source:** *Understanding and Detecting MIC in Cooling Water Systems*; Paul R. Puckorius<sup>5</sup>



## Dipslides

Agar Dipslides now form part of many legislative guidance papers in terms of routine microbiological monitoring. There are many different types of agar dipslides available for various species. Dipslides are great tools for monitoring for a number of key reasons:

- Relatively inexpensive
- Easy to use – widely considered a “Do-It-Yourself” microbiology test
- Full Results are available within 2-5 days (application dependent). Because the user has access to the test, checking for early indication (e.g. after 24 hours) is possible
- Allow for trend analysis



**Figure 2:** Shows increasing contamination of bacteria on TTC dipslide, demonstrating how trends can be tracked and illustrated.

While there are a lot of advantages to dipslides, users should keep the following in mind:

- Dipslides will only measure the number of Planktonic (culturable) aerobic bacteria in a sample.
- Dipslides will not measure:
  - bacteria that will not grow on the type of agar media being used
  - bacteria which require a different incubation temperature
  - bacteria that are not actively growing at the time of sampling
  - bacteria with special growth requirements
  - bacteria growing inside biofilms (sessile).
- The correct temperature for incubation forms an integral part of any microbiological test and it is a general misconception that “hotter is better” or “the hotter the incubator, the faster the results”. Neither of these statements are true and in fact, incorrect temperatures can result in misinterpretation of results.

Dipslides should be incubated to best

replicate the system from which the sample was taken so that a “true” picture of the general microbiological condition of that system is given. Given the correct conditions, Bacteria can reproduce exponentially, doubling in number in as little as 20 minutes. To help encourage growth, we want to duplicate the environment they are currently surviving as much as possible.

To use humans as an analogy – we are incredibly good at self-regulating our body temperature to 98.6°F (37°C), but our environment can have a direct impact on our ability to maintain that ideal temperature. If a person is simply placed in a desert climate, without proper supplies and protection, they will ultimately end up with heatstroke, which can cause death. Similarly, if you place someone in an arctic climate, hypothermia sets in and will lead to death. A person will not thrive in either condition, because we are not able to regulate our body temperature to an optimum level. This applies to all organisms, including those we are trying to detect in a cooling system.

For example, samples taken from a cooling water sump will have come from an environment where that temperature is approximately 30°C (86°F). The tests methods for testing bacteria from a cooling water are therefore designed to be at the same temperature for optimum results.

The dipslides and agars described below only demonstrate the capability of some of the more popular variants.

## Common Types of dipslide available

### TTC Dipslide

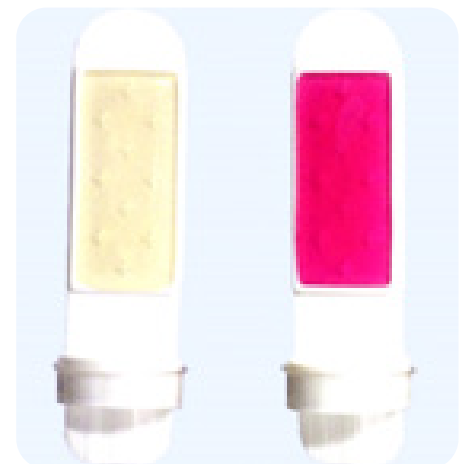
The most common type of dipslide in use is a dual-sided slide that allows convenient enumeration of aerobic microorganisms (TVC or total viable count). The dipslide is prepared with nutrient TTC agar on both sides and is used for general-purpose cultivation of aerobic organisms, which can be obtained from surfaces, fluids or the air. The TTC additive in the nutrient agar reacts with enzymes produced in aerobic respiration to produce a color change from white to red, allowing easy enumeration.

### TTC / Rose Dipslide

The TTC/ROSE dipslide allows convenient enumeration of aerobic

microorganisms (TVC) including yeasts and molds in a single test. The dipslide is prepared with nutrient TTC agar on one side (responsive to aerobic microbes) and a Rose Bengal agar with chloramphenicol, which selects for yeasts and molds, typically used in the food industry.

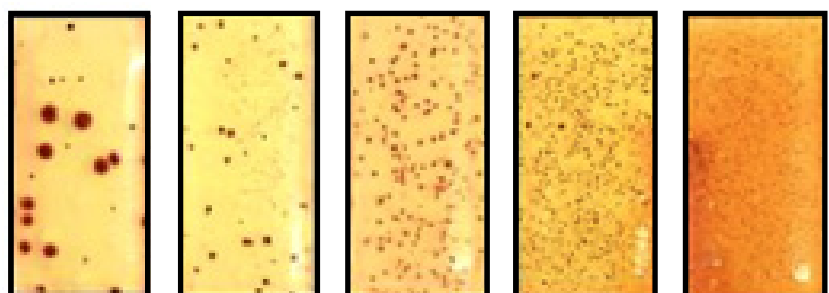
The Rose Bengal agar, as its name suggests, gives this side of the slide a distinctive pink coloration, making it easy for the user to identify which side is which. The TTC/ROSE dipslide is also ideal for use in the detection of hydrocarbon utilizing microorganisms found in fuel storage. These microorganisms cause blockages to fuel filters and the acidic metabolites can cause tank erosion. The TTC additive in the nutrient agar reacts with enzymes produced in aerobic respiration to produce a color change from white to red, allowing easy enumeration. The Rose Bengal agar will show growth as white, white/pink or yellow/green spots dependent on the type of yeasts or molds present.



**Figure 4:** Shows both sides of the TTC/Rose Bengal

## Sulfate reducing bacteria (SRB)

A 21-day SRB test is recommended for reference purposes, but shorter tests can provide equal confidence for routine management of the water system provided enough samples are collected and analyzed. The standard method typically uses a modified Postgates broth or modified API RP-38 medium which is inoculated with 1 ml of sample and incubated under



**Figure 3:** Shows increasing contamination of bacteria on TTC dipslide.

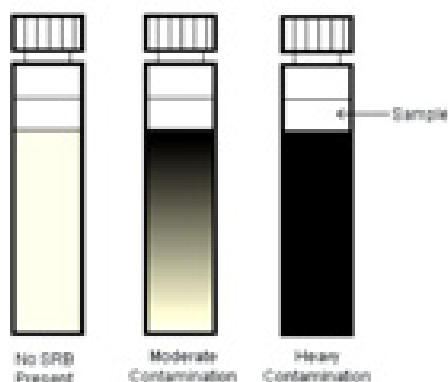


anaerobic conditions at 30°C for 21 days.

The shorter tests contain a straw-colored Citrate medium, which reacts to the production of hydrogen sulfide to give a semi-quantitative result after incubation at 35°C for 5 days. The SRB test is used specifically to indicate the presence of bacteria, which under the correct conditions, are able to produce hydrogen sulfide. Hydrogen sulfide is a colorless gas, which is extremely corrosive to ferrous and non-ferrous metals.

Results are determined by the spreading black precipitation from the inoculation point through the agar. When testing samples already high in sulfide there may be a sudden blackening of the medium, in which case, contamination can be judged by the advancement of the blackening further into the medium. The results are semi-quantitative.

The photos below show varying degrees of contamination from a closed circuit water system:

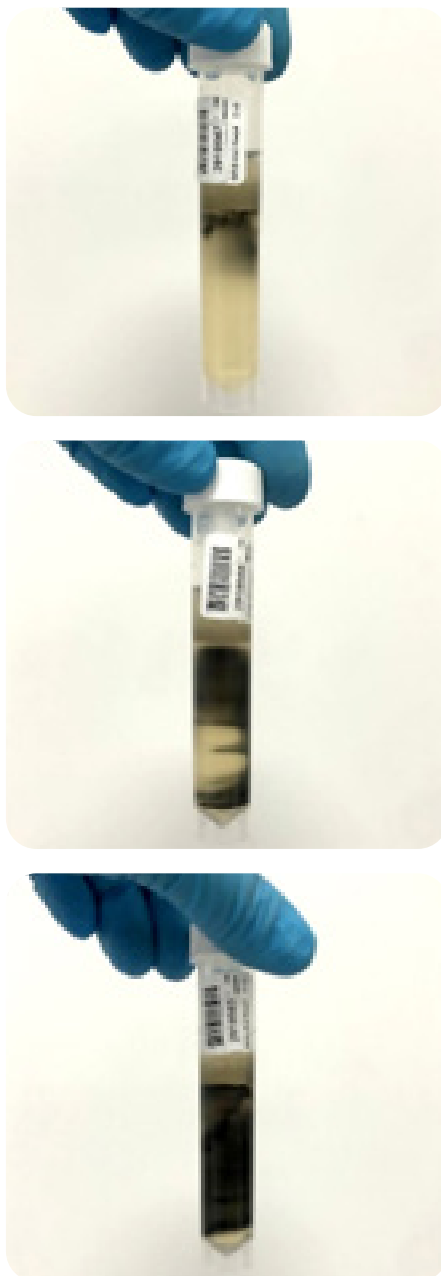


**Figure 5: SRB Results**  
Microbiologically Influenced Corrosion. 1st ed <sup>7</sup>

#### Azide spot test

This test is used to confirm the presence of SRB on a metal surface. This test is done on the spot of the corrosion site. A solution of this reagent is placed onto the metal surface for testing. Using a concentrated light and a magnifying lens, nitrogen bubbles are seen to evolve when sulfides are present. The rate of bubble evolution is indicative of the degree of sulfide contamination.

This test is primarily performed in a laboratory and using a microscope for easier visualization.



**Figure 6: Varying degrees of contamination in SRB 5 day tube test**  
Source: Authors customer results



**Figure 7: High rate of Nitrogen bubble evolution showing, indicating positive indication of SRB**  
Source: *Microbiologically Induced Corrosion*; Ibraheem, Ameer K <sup>8</sup>

#### Conclusion

Cooling water systems can be ideal homes for waterborne microorganisms due to their materials of construction, operational temperature, operational pH and a number of other factors. These waterborne organisms contribute to corrosion of the system in their accountability for MIC.

A number of measures can be put in place to control MIC including regular flushing, eliminating dead legs, biocidal treatment, and inhibitors. These preventative actions should all be done in conjunction with regular and consistent monitoring.

Monitoring of indicator organisms is used to determine overall system health, and more specific testing can be done on species particularly associated with MIC - including SRBs.

This monitoring is required at a frequency, which if interpreted correctly, can identify risks quickly allowing remedial action to be taken to minimize any potential damage to the system integrity.

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## ANSWERS TO THE ARTICLE IN OUR SUMMER 2022 ISSUE

### THE AUTHORISING ENGINEER (WATER): QUESTIONS WHICH SHAPE OUR FUTURE NEEDS



- 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?

- **A1:** The Authorising Engineer is referred to within the Healthcare Technical Memorandum 00 (HTM-00), (Section 3 – Professional Support & Operational Policy, 3.16 / 3.17)
- **A2:** Complex water systems within environments such as hospitals pose a number of management challenges in regards to water hygiene. One of the key difficulties is ensuring the competence of the staff members managing said premises; a single person such as an estates and facilities manager may not have the required expertise to overcome the issues faced in such an environment. Additionally in house hospital maintenance teams tend to be multi-skilled personnel rather than specialists in one particular task, resulting in some of the nuances involved in water safety often being missed. The aim of water safety group, and the development of a water safety plan is to provide a number of specialist inputs in to the site (or trust's) management of water safety of a whole. Utilising a Microbiologist and Infection Control / Prevention staff, alongside representation from facilities, estates and housekeeping, ensures that a wider view to water hygiene is considered. Further to this, the addition of representation from departments using water for specialist purposes such as Dialysis and Sterile Services ensures that the specialist knowledge required to maintain these systems safely is also present. Essentially, a water safety group and plan provides key specialist knowledge, representation and oversight to the water management process.
- **A3:** Identified in 2021, Legionella antarctica is a species notable for its tolerance to cold water temperatures. The strain was discovered in Antarctica by a research team led by Sho Shimada MD PhD of Toho University. The species has evolved the capability of sustaining growth in temperatures between 4 – 25 degrees Celsius. While the only recorded discovery of this species is on the Antarctic continent, this presents a significant challenge to the traditional method of temperature based controls should it be detected in domestic water systems.
- **A4:** The latest British Standard for the risk assessment of Pseudomonas aeruginosa, BS 8580-2:2022 was released earlier this year and aims to provide a step by step guide to conducting a risk assessment for this waterborne pathogen. The document covers a wide range of premises and water system types such as swimming pools, rather than the typical healthcare setting.

*We have selected to publish the answers above from Jack Bonner, Technician member. There is no CPD activity in this issue, but it will be back in the Winter edition.*

## course in brief W262

### Management and Control of Closed Hot, Cold & Chilled Water Systems

This City & Guilds accredited training course is aimed at those who are responsible for closed systems: including managers, owners, facilities managers and maintenance personnel. Anyone carrying out treatment, routine sampling, testing, and inspections of these systems, including service providers, and those who are considering carrying out their own monitoring work or checking/replacing outside contractors.

The course gives delegates an understanding of what a closed system is, provides information on the correct management and chemical control of these systems, and explains the importance of monitoring and discusses the options & frequencies that this work needs to be completed.

The day includes a demonstration in the Practical Training Area on how to undertake the chemical testing required and a discussion on the results and sampling methods required.

**This course forms part of the Water Treatment Hot & Cold and Closed Systems qualification pathway.**

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# event report e

## NECLFG meeting

1st September 2022, Royal Station Hotel, Newcastle

The 1st September saw another meeting of the NECLFG held at the Royal Station Hotel, Newcastle. We had an interesting presentation on cleaning & disinfection using Silver Hydrogen Peroxide by Paul Wash and Vicki Wilson the joint sponsors from Roam Technology and Safesol. There then followed a presentation on the Opuz software by SMS Environmental, BS8580-2 & BS7592 by Nick Barsby, Chair of the LCA with a final presentation by Duncan Smith on the current activities of the HSE.

As usual the after event event was 'jolly good fun' - say no more!

The next meeting will be held in Darlington on the 24th November, sponsored by ENWA and, as always, we are constantly looking for sponsors/speakers at our events so if you would like to get in touch you can contact me directly via my email: [lan.e.kershaw@outlook.com](mailto:lan.e.kershaw@outlook.com)

## INDUSTRY UPDATE

### Water Regs UK



#### Defra Consultation on UK Mandatory Water Efficiency Labelling

Defra has launched its consultation seeking views on their plans to introduce mandatory water efficiency labelling across all UK nations. Defra propose to label water using products such as taps, showers, toilets, dishwashers and washing machines. The consultation sets out the:

- proposed approach
- products covered by the label
- label design and features

- label display
- standards to support the label

Defra says the responses will shape the development of processes, guidance and secondary legislation.

The consultation closes on 25th November 2022.

<https://consult.defra.gov.uk/water-efficiency-labelling/water-efficiency-labelling/>



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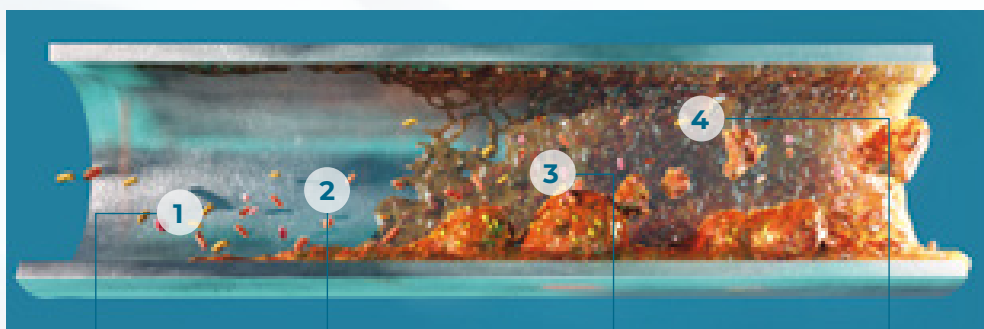




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# WMS

## THE WATER MANAGEMENT SOCIETY

# TOOLBOX TALKS

### Why test steam and hot water boilers and steam boiler systems?

HSE INDG436 Safe management of industrial steam and hot water boilers, A guide for owners, managers and supervisors of boilers, boiler houses and boiler plant, states:

Routine testing of boiler controls, limiting devices and feed water quality is essential to ensure the boiler continues to be safe, reliable and efficient. The routine tests recommended by the manufacturer should be carried out as a minimum. However, in certain circumstances, more frequent testing may be needed. For example, where the water quality is poor and there is a high dependence on water treatment, more frequent testing of the water and blowdown of the boiler may be required.

## HOW TO COLLECT A BOILER SAMPLE

These tests and the results should be recorded or logged (either electronically or manually) and must include:

- the results of the test and comparison against required values;
- identification of the operator;
- the date of the test; and
- any corrective action taken, if necessary.

Clear written instructions of how and when to carry out routine tests should be kept on site.

### What samples should be taken and analysed from steam boiler systems

Procedures and equipment may be needed for chemical and physical sampling of a number of samples including raw water, make up water (after pre-treatment plant), boiler feed water, boiler water, steam (saturated and/or superheated) and condensate return.

### Sampling:

For most applications all parts of the sampling equipment should be made of stainless steel, however copper is sometimes used for low pressure steam boilers and hot water systems. Sample points for shell boilers should be located at least 150 mm below the normal working level and for hot water systems in the return line to the boiler. Sample line lengths should be minimised and horizontal lines avoided as far as practicable. Sample lines should be small bore to maximise flow rates.

Cooling should generally be carried out for samples withdrawn from systems operating at temperatures greater than 50°C and final sample temperatures are

in the range of 25°C to 30°C, to ensure the safety of the sampler, and to obtain a representative sample in the case of systems operating in excess of 100°C.

Suitable PPE should also be used when sampling-as identified by the task risk assessment-as many of the samples in addition to being hot will also be a high pH (caustic).

**Note:** Sample coolers and their coils must be rated at the full system operating temperatures and pressures. Shell and hot water boilers may use lower grade cooling water but high pressure boiler systems may require a higher quality cooling water such as demineralised water.

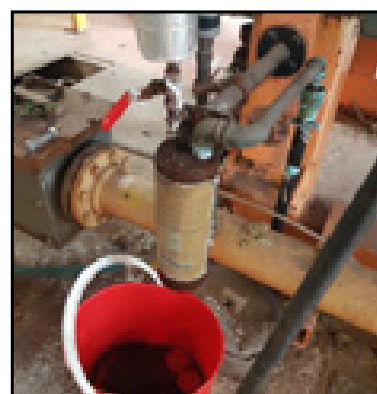
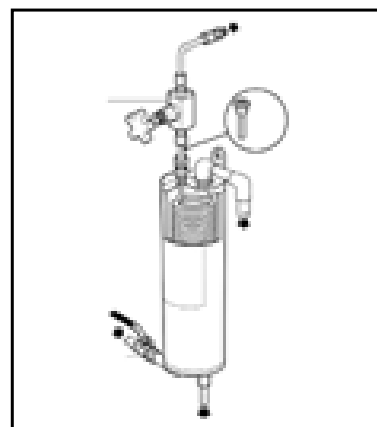
When using a sample cooler open the cooling fluid inlet valve fully and ensure cooling fluid is flowing to drain prior to sampling. Open the sample-regulating valve slowly until process fluid stream starts to flow. Then allow sample to run to waste for a suitable period of time to purge the stagnant process fluid in the sample line. Regulate the sample flow until a stable desired temperature is achieved, then collect sufficient volume of sample in a suitable container. When the sample has been obtained reverse the process and firstly close the sample-regulating valve and then the cooling fluid inlet valve.

Samples should be taken in clean, containers or bottles that are tightly stoppered after sampling to minimise contamination from the atmosphere.

Sample volumes should be adequate to carry out all the required analyses, typically 0.5 to 1.0 litre. Sample containers should be filled completely.

This is of particular importance when sampling for oxygen scavengers (such as sulphite, carbohydrazide, diethylhydroxylamine (DEHA) etc.), carbon dioxide, iron(II) and ammonia.

Sample type, sampling point, date, time, temperature, pressure, and name of the person taking the sample, should also be recorded, where relevant.



## HOW TO COLLECT A BOILER SAMPLE

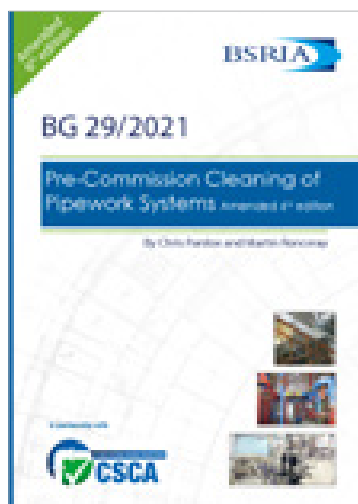


# Life of a Water Treatment Pre-commissioning Engineer

Anthony Neasham

It is often the case that water treatment companies are the last service providers to visit site prior to building handover to the customer, and this is where the issues often become apparent.

From the initial tender stage it is a common theme that specifications have not been designed with current guidance 'Pre-Commission Cleaning of Pipework Systems Amended 6th edition BG29/2021' in mind. In fact, we consistently see many specifications for new heating and chilled pipework systems referring to the now well superseded AG 1/2001 guidance!



BG 29/2021 gives in-depth information and guidance ranging from project award, to exactly what shall be required when the engineers arrive on site, such as prestart survey information and exact requirements of fill water, flushing and drain point requirements. Why, then, is this guidance still often completely or largely ignored?

Also, now more than ever water is considered a precious resource, especially in the current climate where much of the UK is in drought. Why is closed-loop pre-treatment cleaning (CPC), which requires less water usage, not

considered more? A discussion for another time maybe?

Some of the issues faced by pre commissioning water treatment engineers on a daily basis include inadequate mains water supply for flushing, inadequately sized or missing flushing points on flow and return pipework and systems not fully completed from an installation point. These are just a snapshot of some of them!

Table 3 of BG29/2021 provides guidance on the recommended minimum mains water supply required for flushing.

System volume (litres)	Minimum mains size (mm)
<2000	25
2000 to 10,000	40
>10,000	50

The correct sized fill water supply pipe is a crucial part in ensuring that the commission cleaning process is carried out successfully and effectively.

On many occasions engineers arrive on site to commence works, even after the prework survey specifying the minimum required mains size, to find a 15mm mains supply only! This is insufficient to achieve the necessary volumes of water to be flushed through the system to carry out an effective flush of the systems.

This can be overcome with the supply of a temporary tank and pump to boost water pressure but often leads to a delayed start

of works to already very tight commissioning schedules which can have a knock-on effect on other planned works.

The most common problem faced by commissioning companies on-site is systems being incomplete on arrival to site, which is responsible for by far the biggest delays and causes many issues. Examples of incomplete systems include systems not being filled correctly or vented, terminal units not installed, by-pass valves not installed across sensitive plant and equipment, sub-branch pipework not completed, dosing pots/ sidestream filtration units installed incorrectly and, occasionally, crossed pipework, to mention but a few.

A cynical person might sometimes wonder are water treatment commissioning companies only there to put boots on the ground and satisfy commission start deadlines.

To improve the effectiveness of the cleaning process, the entire system should be complete and filled and vented prior to works commencing. Systems that are not filled and vented correctly are likely to suffer from increased rates of corrosion due to high oxygen levels, especially steel pipework, and will affect recording of accurate flow rate measurements.

Where terminal units have been installed without flushing by-passes the risk of blockages during the flushing process from installation materials is increased which can prolong the flushing process.

We find it quite common for dosing pots to be incorrectly installed, but why? When the question is asked a typical response from mechanical installers is 'we know it's incorrect, but that's what the drawing shows'. Incorrectly installed dosing pots can prevent chemicals be dosed to systems which can cause further delays while other methods of dosing the systems are explored.

Isn't it about time, we all started questioning what we know is wrong from the start!

Any part of the system that cannot be cleaned as part of the commissioning process, for whatever reason, must be documented. The possible implications of incompletely installed systems and the effectiveness of the commission clean should be discussed with the site commission management team prior to commencing works.

Why is it still the case that many of the same issues occur time and time again? "Education, education, education" was how labour leader Tony Blair set out his priorities for office in 1997. Should we be considering the same statement when dealing with pre-commission cleaning?

There can never be enough expert training and knowledge sharing to drive improvements in understanding the implications of poorly designed systems, systems not ready for commission stages and the fact that the "water treatment engineer" does not carry a magic wand!

So, until all parties involved in the design and installation of closed loop systems fully understand the true importance of a correctly designed and installed system ready for works to commence- we shall battle on and do what we do best to get the client over the finish line.



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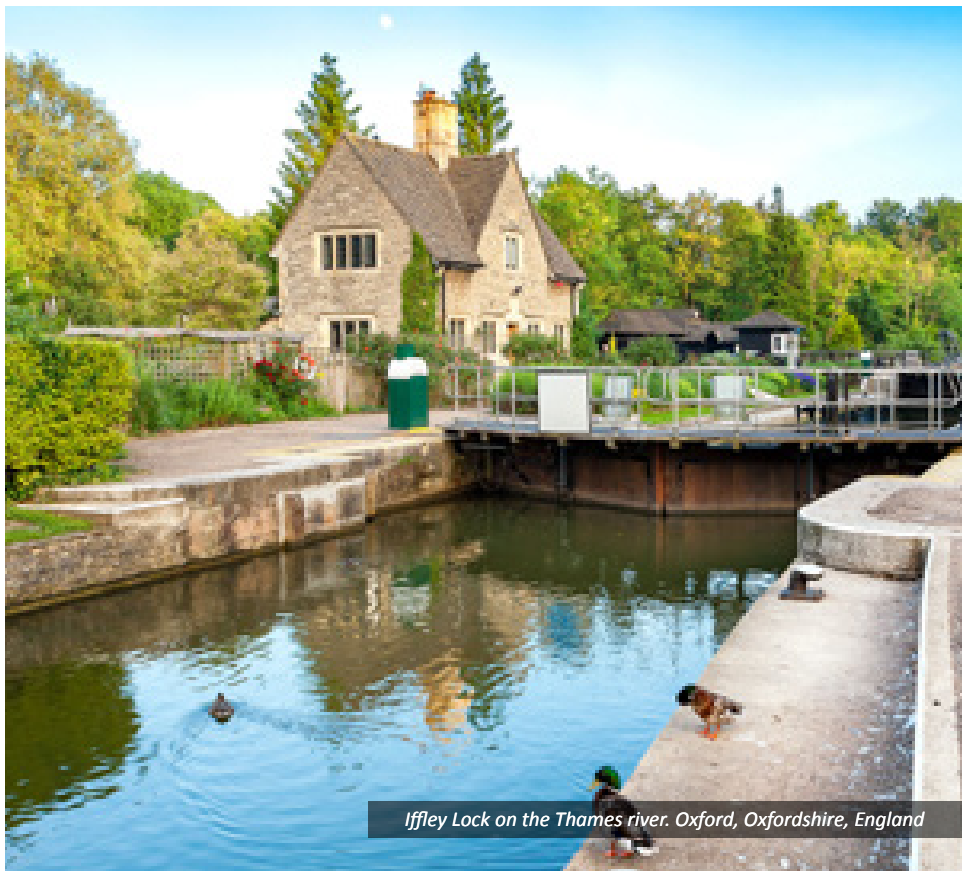
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# CONTRACTS, PRODUCTS & PUBLICATIONS

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.



Iffley Lock on the Thames river. Oxford, Oxfordshire, England

## Following in the footsteps of Britain's great canal engineers

The following is from the Canal and River Trust website:

From flights of locks, to reservoirs and 250-year-old tunnels and soaring aqueducts, we have awarded contracts to JN Bentley and Kier to carry out large-scale construction and engineering projects across our 2,000 miles of historic waterways over the next decade.

The new contracts, replacing the current national contract with Kier, have a potential total value of approximately £500m and are our largest ever award of waterway engineering works. Playing a pivotal role in helping us protect and preserve our canals, reservoirs and river navigations, the contracts will commence in August 2022, with an initial mobilisation phase.

The canal network has been rediscovered and is today used by more people than at any point in its history. As well as being navigated by boats in the same way as during the Industrial Revolution, the network is also gearing up to play a pivotal role in the resilience of towns and cities, helping them to mitigate the effects of climate change.

Covering the north and south of the network respectively, JN Bentley and Kier will carry out the largest restoration and repair projects and will work on our most complex assets such as reservoirs, embankments, culverts, tunnels and aqueducts – including responding to dynamic situations, such as flooding or canal breaches. Later this month (August), a range of contractors will also be appointed for delivering fewer complex works.

Malcolm Horne, our chief infrastructure and programmes officer, said: "Built 250 years ago as arteries of the Industrial Revolution, today Britain's canals are the world's finest network of working industrial heritage. They now play an equally important role in society as corridors for nature, tackling health inequalities and improving community wellbeing, as well as supporting jobs and local economies.

To learn more about the Trust:

<https://canalrivertrust.org.uk/news-and-views/news>

## Swift response from Veolia Water Technologies UK helps Bridgnorth Aluminium avoid lost production – Press Release

For Bridgnorth Aluminium protecting against Legionella contamination and managing the water quality of its cooling tower system is essential to its operations. As part of a long term partnership, Veolia Water Technologies UK (VWT UK) has assisted with water treatment and compliance services at the specialist's production site in Shropshire. For almost a decade, Veolia Water Technologies has worked closely with Bridgnorth Aluminium to provide servicing, chemical supply and Legionella compliance for its cooling towers and process water treatment systems. VWT UK was originally awarded the contract following a competitive tender. Bridgnorth Aluminium was impressed by the level of reporting VWT UK could offer as well as a package of measures to optimise the control and management of its cooling tower systems.

If not managed correctly, cooling towers can pose a particular Legionella risk. If the cooling water is contaminated, it is possible for Legionella to be dispersed over a wide area in the water vapour and potentially expose people on-site or in neighbouring areas. Therefore, ensuring effective protection against Legionella is a priority for Bridgnorth Aluminium. Highly effective control of the chemical dosing is required to maintain the correct biocide reserves as well as protect the water systems from scaling and corrosion. VWT UK provided a package that was designed to help Bridgnorth Aluminium ensure they were covering all aspects of their Legionella compliance. Internet-enabled controllers are a key tool VWT UK recommend for improving control of cooling towers systems both for Legionella compliance and also monitoring improved efficiency. These controllers allow real-time remote monitoring, data logging and analysis by both VWT UK engineers and the on-site team from any connected device.

A representative of Bridgnorth Aluminium commented: "The remote monitoring capabilities have proven to be extremely valuable, specifically in one instance when we experienced an issue with the plant and biocide levels in the water dropped below the specified level." On this occasion, the connected controller sent an alert to the VWT UK team and site personnel. The VWT Service Support Manager for Bridgnorth Aluminium used the remote access capability to view the system status. The plant operators were contacted and supported in making additional checks. The source of the issue was identified as an oil leak and the team was able to recommend corrective action to elevate the dosing and bring the system under control. A VWT UK engineer visited the site the next day. Additional measures were put in place to allow the site to continue operating safely until the necessary maintenance work could be completed. This swift response meant that there was no need to halt production, avoiding lost revenues and costs of up to £250,000 per day.

For more information about Veolia Water Technologies UK visit:

[www.veoliawatertechnologies.co.uk](http://www.veoliawatertechnologies.co.uk)



### Environment Agency monthly regional reports for England on water situation

Monthly local reports on rainfall, soil moisture deficit, river flows, groundwater levels and reservoir levels are available online. The reports reveal that water shortages are currently a particular issue in East Anglia and Devon and Cornwall. These reports collect information from the Environment Agency, the Met Office and water companies that measure and monitor:

- the amount of rain that falls
- how dry the soils are and how much rain they can soak up
- the amount of water flowing in rivers
- the amount of water stored below ground in aquifers and above ground in reservoirs

They also present the outlook for river flow and groundwater.

Reports for previous months are available on the UK government web archive.

### Don't Swim on a Whim! New water industry campaign to remind public of the dangers of unauthorised swimming in reservoirs, Water UK Press Release

This summer, Water UK is reminding the public of the dangers of unauthorised swimming in reservoirs with a simple message – don't swim on a whim!

With temperatures hitting new highs and the start of the school summer holiday, many will be looking for ways to pass the day and stay cool. While reservoirs can look enticing to swim in, they do contain several hidden dangers. These include:

Dangers below the surface – reservoirs are nearly always man-made and likely to have heavy machinery under the water and strong, dangerous currents

Cold water temperatures – even on hot days, the water can be very cold, and you could experience cold shock upon entering the water. This can affect even the strongest swimmers

Remote locations – reservoirs are sometimes in remote locations, meaning it could take longer for emergency services to reach the location should anyone get into trouble. Water companies want to keep everyone safe and it's important to check the rules in the local area. Some water companies – such as Welsh and Anglian – have organised recreational activities at their reservoirs which are supervised and require registration in advance, while entering the water is strictly prohibited at others.

For more Water UK news visit:  
<https://www.water.org.uk/news-item/dont-swim-on-a-whim/>

### Mabey Hire secures Scottish Water contract for another 4 years – Press Release

Mabey Hire is delighted to announce that it has successfully retained its preferred supplier status for the next four years on Scottish Water's SR21 framework, making it one of two suppliers for the Hire of Trenching and Shoring Equipment. The company has been supporting Scottish Water since 2007, with the renewal of this latest framework contract enabling the temporary works specialist to further develop and maintain its relationship with Scottish Water as a trusted partner.

Speaking about the achievement, Dave Garden, Sales & Marketing Director at Mabey Hire, said: "We're very excited to have been awarded this framework and are looking forward to continuing our relationship with Scottish Water, working closely with them and their partners in the water utilities sector and supporting their future trenching and shoring requirements. It's been a huge team effort to deliver a successful outcome in what was a very rigorous and enlightening tender process – a big thank you and congratulations to all of the Mabey Hire team."

The new framework contract will run from 1st July 2022 for four years.

As an award-winning temporary works specialist, Mabey Hire has over 60 years' experience in the construction industry, designing and implementing temporary groundworks support schemes with a range of groundworks equipment available for hire.

To find out more, please visit:  
[www.mabeyhire.co.uk](http://www.mabeyhire.co.uk)

### A report by the Chief Inspector of drinking water (DWI) Drinking Water 2021

The Drinking Water Inspectorate annual report Drinking Water 2021 provides an overview of the quality of public and private water supplies in England and Wales. It comprises of the following:

#### Chief Inspector's Letter to Ministers (England and Wales)

The letters from the Chief Inspector to the Ministers in England and Wales contain a high level overview of findings for the year.

#### Public water supplies - Annual Summary Reports

The reports cover England and Wales and summarise the testing and results of water quality tests, events and technical audit activity.

#### Quarterly Reports

Presentation Slides and Recordings  
Covering England and Wales separately

#### Private Water Supplies

Presented as separate reports for England and Wales and publishing numbers and types of supplies, a summary of monitoring results and case studies.

Company performance data  
Top 50 events in England and Wales in 2021

To view or download the full report visit:

<https://www.dwi.gov.uk/what-we-do/annual-report/drinking-water-2021/>

### The Armitage Shanks Water Safety Forum – Press Release

Thought leaders from across the healthcare and water safety sectors recently joined Armitage Shanks to discuss the impact of a new British Standard, BS 8580-2, and its implications for those involved in preventing the spread of waterborne infection.

The new standard, which deals with risk assessments for *Pseudomonas aeruginosa* and other waterborne pathogens, is seen as an important tool in the fight against bacteria that has the potential to cause serious health problems in hospitals, care homes and other environments.

Hosted at the manufacturer's London Design & Specification Centre, the Water Safety Forum brought together a panel of experts from disciplines across clinical infection control, microbiology, engineering, and hospital water services management.

The forum examined what the standard will mean for multi-disciplinary teams in healthcare environments, as well as the need for greater awareness and training of infection control across all healthcare staff – from cleaning teams, facilities and maintenance, right through to clinicians and stakeholders.

The forum also discussed the importance of properly designed and maintained handwash stations, and the role of manufacturers like Armitage Shanks in engaging with the water safety community to create innovatively designed products that are guided by scientific evidence.

Elise Maynard, an independent adviser for water safety and a member of the BS 8580-2 panel served as the forum chair. Elise stated: "With the steady rise in antibiotic resistance, it's vital we do all we can to prevent the spread of harmful waterborne pathogens like *Pseudomonas*

*aeruginosa*, and this is particularly important in healthcare settings where patients, who are often immunocompromised, face serious risk. This new standard provides clear guidance on effective risk assessment of waterborne pathogens to water safety groups and equally importantly, to anyone who may utilise water. It emphasises the importance of multi-disciplinary teams and clear communication regarding infection control."

Anil Madan, Non-Residential Marketing Manager at Armitage Shanks, said: "As a manufacturer, we are committed to serving both the needs of our users and the requirements of the unique environments they operate in. That's why it was important for us to create this forum, in which leading minds from across the industry could come together to discuss the introduction of BS 8580-2 and its implications for water safety and the wider healthcare sector."

For the latest insights, research and guidance on water safety, download your free copy of Armitage Shanks' Looking Deeper Journal, here: <https://www.idealspec.co.uk/resources/whitepapers.html>



Looking Deeper Journal  
12th Edition - Autumn  
2022





## Groundwater monitoring underpins management of the Great Fen – Press Release

In 2001, five organisations came together to set out a vision for the Great Fen, with the aim of providing a more sustainable future for the area. In many respects, this work focuses on restoration by managing water levels, so a network of monitoring wells has been established.

Follow the link at the bottom of this abbreviated article to the complete report by Wendy Strain from OTT HydroMet who will explain how this monitoring programme is helping to achieve the ambitious goals that have been set for the Great Fen.

The Great Fen covers 14 square miles of land that is being restored to wild fen over a 50-100 year timescale, creating a huge nature recovery network, providing a Living Landscape for fenland species including threatened fen wildlife, such as bitterns and otters. A mosaic of different wetland habitats has been established to support a wide variety of wildlife, such as dragonflies, butterflies and amphibians. This habitat is also suitable for flowers and other plants, some of which are found almost nowhere else in the UK, such as the Fen violet and the Fen woodrush.

In 1630 a group of wealthy landowners set out to drain the fens for agriculture and to minimise winter flooding. Many of the local people were fiercely opposed to the draining, believing it would deprive them of their traditional means of livelihood from wildfowling, fishing and reed cutting, and a group known as the 'Fen Tigers' vandalised the dykes, ditches, sluices and reedbeds. Nevertheless, by the end of the 17th Century the drainage project was complete.

In the 1800s, conscious of the likely shrinking effect of draining the peaty soil around Whittlesea Mere, landowner William Wells instigated the burial of a measurement post at Holme Fen, which was anchored in the bedrock and cut off at the soil surface. Today, around 4 metres of the post is showing above ground, recording the ground subsidence since 1852. The ground level at Holme Post is now 2.75 metres below sea level – one of the lowest land points in Great Britain.

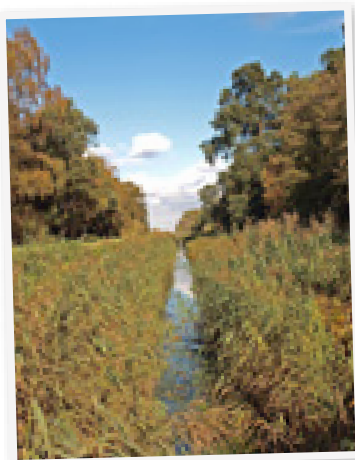


Photo: These two posts in Holme fen record the wasting away of the peat which once covered much of the fens.

The full report is available at:  
<https://envirotecmagazine.com/2022/08/17/groundwater-monitoring-underpins-management-of-the-great-fen/>

## KP Snacks benefits from standardised approach to Water Treatment and Management

Working in partnership with Veolia Water Technologies UK (VWT UK), KP Snacks has successfully implemented a standardised approach to water treatment, management and compliance across its seven manufacturing sites. A significant achievement, this has helped to simplify many complex processes and allowed the sharing of solutions and best practice across the group.

KP Snacks has worked with Biochemica, now part of VWT UK, since 2014. VWT provides a wide range of water treatment services to KP Snacks including boiler water and effluent treatment chemicals, legionella control and risk assessment, water system cleaning and disinfection as well as water hygiene inspections.

VWT has been working with KP Snacks to standardise its processes and service delivery across each of the seven KP sites across the country. The water management processes had evolved based on the requirements of each site, including three new factories that had been acquired since the contract was awarded eight years ago. This meant there were significant variations between the different sites. While the KP Snacks team had not encountered any particular issues, it was agreed that improvements could be made through standardisation.

One of the technologies that has been introduced as part of the standardisation is an online electronic logbook. The barcode-based system allows all relevant assets and equipment on each site to be tagged. These tags are then scanned during routine service visits, simplifying the inputting of the data and results. It also enables tasks to be automatically scheduled.

In addition, rolling out this technology across all sites provides comparable data that can be viewed as required depending on the user. Each site team can view the collated data for its assets while those at group level, such as the health and safety team, can see the relevant data from all sites. The VWT team can also view and track all the results to help improve its service.

Alison Sydenham, Category Manager: Non-Food at KP Snacks said: "For us the benefits are clear. Firstly, it reduces the number of suppliers that we need to deal with, providing us with a single point of contact for all our water treatment and management. This has helped us to consolidate our processes and also achieve time and efficiency savings by eliminating unnecessary tasks. Finally, it has allowed us to make comparisons between sites, enabling further improvements and the sharing of best practice among teams. The level of service and technical support we have received from VWT has been excellent. The relationship has become a real partnership, which is exactly what you want from the organisations you work with."

To find out more about VWT UK's services and technologies visit:

[www.veoliawatertechnologies.co.uk](http://www.veoliawatertechnologies.co.uk)



## Cambridge AI liquid sensor business welcomes Governor of Queensland – Press Release

InferSens, a leading edge AI and machine learning sensor technology business is honoured to have welcomed Her Excellency the Honourable Dr Jeannette Young AC PSM, Governor of Queensland to its new headquarters at the St John's Innovation Centre in Cambridge, UK.

InferSens currently applies its expertise in tinyML – an emerging branch of machine learning that shrinks deep learning networks to fit on tiny, low powered hardware – to simplify and automate Legionella risk monitoring in properties.

The purpose of the Governor's visit is to focus on innovative and leading start-ups in Cambridge, Europe's largest technology cluster.

Her Excellency the Honourable Dr Jeannette Young AC PSM, Governor of Queensland, said: "We are delighted to have visited InferSens in Cambridge to discover their ground-breaking work in artificial intelligence and machine learning enabled water flow and temperature sensors."

Colin Payne, CEO of InferSens, commented: "We are extremely pleased to have welcomed the Governor of Queensland on an official visit to our new headquarters. It is a great honour for our company. InferSens' first application is around using our technology to automate Legionella risk monitoring, supporting the maintenance of safe water systems, and preventing outbreaks such as Legionnaire's disease, a global public health concern. The Governor is the former Chief Health Officer of Queensland, and we were therefore delighted to be given the opportunity to explain our application to her."

InferSens' non-invasive technology, which involves a small, highly affordable sensor clipped onto a pipe, can generate and monitor real time critical data in relation to the flow and temperature of any liquid. Sensors can be deployed on any sized pipe, including national infrastructures. The ability of the technology to significantly reduce the current costly, and inefficient practices of recurrent manual testing of public facing water infrastructures massively reduces the scope for waste, meaning that it will also greatly contribute to environmental and sustainability improvement achievements by its clients.

For more information contact:

<https://www.infersens.com/news/#:~:text=InferSens%2C%20a%20leading%20edge%20AI,Cambridge%2C%20UK>

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### Aquaspira delivers sustainable drainage solution for flagship housing development in Suffolk – Press Release

Aquaspira has successfully designed and delivered a sustainable solution to attenuate 910 cubic metres of storm water at the new 241-home Barsham Vale development in Beccles, Suffolk. The development comprises of two, three and four-bedroomed homes, bungalows and apartments. The company was handpicked by Hopkins Homes, the largest housing developer in East Anglia, to design and install a multi-leg tank, small and large diameter pipes under the roads with associated access units. The 500 metres of composite steel reinforced pipes will attenuate storm water and mitigate flood risk. Mark Wilkinson, Head of Technical from Hopkins Homes, said: "Aquaspira has worked with us on four or five developments and we asked our consulting engineers to specify Aquaspira at Barsham Vale because it would provide a lower carbon solution, minimise land take and reduce programme time. An accredited and adoptable solution is vital and Aquaspira provides this, the added benefit is that the three metre sections of pipe help with the ease of installation."

The team was keen to minimise the impact of the construction on the existing local community. Due to the lightweight nature of the product, transport movements were halved compared to a traditional concrete solution. This, along with the reduced excavation, decreases vehicle emissions, helping to enhance construction site sustainability. Jonny Johnson from Aquaspira said: "This is an adoptable private housing project within Anglian Water. We were able to deliver the ideal solution, including a space saving multi-leg water attenuation tank, access points and a range of diameter pipes for under the road network. We used composite steel reinforced pipes, including large diameter pipes, which along with the multi-leg tank can hold a vast amount of storm water under the new estate roads. This minimised the land take required for the SUDs and the safety issues associated with surface level storage. As our products are far lighter weight than traditional concrete this more than halved the number of transport movements and depth required for installation. We reviewed the soil conditions, depth and flotation to ensure the ground conditions were suitable. As part of the service we provide we produced loading calculations to BS 9295:2020 which confirmed that the products were suitable and adoptable for this application."

For more information please contact:

Victoria Walker, Director, VW Communications  
Telephone: 07413 563905

Email: [victoria@vwcommunications.co.uk](mailto:victoria@vwcommunications.co.uk)

### New HydroTap UltraCare reduces the risk of dispensing legionella and other bacteria in drinking water by 99.9%

Leading drinking water system manufacturer Zip Water has for the first time launched a system designed to reduce the risk of dispensing legionella and other bacteria in drinking water by 99.9%.

Developed specifically for the healthcare and aged care markets, or anywhere additional peace of mind is required, Zip HydroTap UltraCare uses an innovative combination of four protective barriers to provide the ultimate safeguard against waterborne bacteria and viruses. An enhanced version of Zip's market-leading HydroTap, it delivers instant filtered boiling and chilled water and is set to advance the delivery of drinking water in locations where there is high-risk to end users.

Of the four protective barriers, the first is Zip's MicroPurity filtration. The 0.2 micron, carbon-free filter reduces cysts by 99.99%, while also ensuring that existing protective levels of chlorine remain in the water supply.

SteriTouch, a market-leading antimicrobial additive that reduces surface bacterial by 99.99%, is the second barrier. It is inside key components within the water path, as well as being embedded in the touch pad of the Classic Plus.

The third barrier is the inclusion of a Zip MicroPurity UV-C LED module for chilled water dispensing. This disinfects water as it is dispensed, reducing the chance of recontamination and common waterborne bacteria.

The final element is the HydroCare service plan, which ensures the HydroTap UltraCare always performs to the highest levels of hygiene, efficiency and reliability with tailored service plans, a bespoke sanitisation regime and filter replacement.

"We're proud to be able to bring such an important – and called-for – product to the health and care market, which will transform the way they deliver water," comments

Mark Brindley, Product Manager at Zip Water. "Our aim is to support the duty holder within these sensitive environments to control exposure to legionella, as set out in the HSE's Approved Code of Practice and guidance on regulations. Independent tests have demonstrated that this 4-barrier system does exactly what we set out to achieve; to safeguard vulnerable users against possible bacteria found in water systems. Testament to this, HydroTap UltraCare is already receiving positive feedback from users across the world."



Photo: The NEW Zip HydroTap Touch Free Wave (<https://specify.zipwater.co.uk/ultracare>)

For more information visit:

[https://specify.zipwater.co.uk/ultracare?utm\\_source=pressrelease&utm\\_medium=pr&utm\\_campaign=ultracare\\_pr&utm\\_term=2022&utm\\_content=](https://specify.zipwater.co.uk/ultracare?utm_source=pressrelease&utm_medium=pr&utm_campaign=ultracare_pr&utm_term=2022&utm_content=)

### South West Water asking customers to cut water usage – Press Release (July)

Right now, demand for tap water is higher than normal and we haven't had much rain. During peak times, we're treating and pumping an additional 50 million litres a day, that's the same as supplying two extra cities the size of Exeter.

It's been a dry start to the year, we've had less rainfall and our rivers are notably low. It's predicted to get hotter and we're expecting demand to further increase. We plan for these increases and overall our reservoirs are looking healthy. We need your help to save water and reduce demand.

We can't do it alone. If every one of our customers saved just 5 litres of water a day, that would total 10 million litres saved! Help keep the water flowing, rivers thriving and save money this summer.

There's only so much water we can treat and pump to your homes, schools, businesses and hospitals. High demand puts a stress on the network and means some customers can experience low pressure. Help keep demand down and the water flowing for everyone this summer.

What improvements have SWW carried out: We've doubled capacity since 1976 and opened two Cornish reservoirs since 2007.

We're also improving, and investing, the connectivity of our network to give more flexibility in supply. As well as this, we have reduced water consumption at our own sites.

To ensure we meet our levels of service for customers in the future, we're currently working in partnership with Bristol Water and Wessex Water to explore opportunities of shared water resources, and we're investigating new long-term strategic schemes to our supplies to ensure they are resilient to future droughts.

Our Water Resources Management Plan is available to read: the Plan covers both South West Water and Bournemouth Water following the merger in April 2016.

We've halved leakage levels in our region, and have one of the lowest levels in the industry. We know there's more work to do. As part of our plans for the future, we're investing c£50million to help us achieve a further 15% reduction in leakage by 2025.

We're building a state-of-the-art training facility for our team and we've also formed a new team, dedicated to looking at how we'll achieve the 15% minimum reduction target. As well as investing in our people and supply chain, we've made significant investment in technology. We're using remote sensing technology. These are acoustic logging devices which are placed on the network and listen for leaks 24/7. We're also trialling remote video link applications with customers which is helping us diagnose and resolve issues.

More information at:

<https://www.southwestwater.co.uk/advice-and-services/save-water/save-5-litres/>

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### Güntner wins German innovation award

Güntner's new Mini COMPACT Air Cooler has been announced as a winner at the prestigious German Innovation Awards. This is the third year running that the company has won the award, having previously been recognised for its Dual COMPACT Air Cooler in 2020 and its Cubic VARIO Air Cooler with UV-C in 2021.

"It's a great honour to win this award yet again," said Michael Freiherr, Güntner Managing Director. "Innovation is part of our company DNA. We talk about being 'Always a solution ahead', but for us it's more than just a slogan. We're in constant dialogue with our customers and we understand their needs." The Mini COMPACT Air Cooler, launched in January this year, caters for cooling requirements in small grocery shops, restaurants, canteens, and similar small-scale use cases. It is more energy-efficient and cheaper to run than traditional solutions for those applications. And it can also be used with a wide range of refrigerants – formerly, different models were required for different refrigerants.

The new casing measures just 124mm in height, making it Güntner's flattest Air Cooler to date. Its downward-pointing fans allow it to be mounted flush against the ceiling, maximising space and preventing dirt from accumulating on its upper surface. Cleaning and maintenance is straightforward thanks to an easy-to-open fold-away tray.

"We rethought the whole air cooler from the ground up, not just in terms of efficiency and sustainability but also functionality, technology and design," said Herbert Schupfer, Head of Future Solutions at Güntner.

Three years of testing in a special Güntner lab resulted in a new defrosting technology that cuts optimised defrost heating costs by up to 30% for ventilation and 50% for defrosting. "For the end customer, that means the air cooler pays for itself within one or two years, just through the reduced energy capacity needed for defrost," said Freiherr. "And of course there's a considerable sustainability benefit, too."

Güntner offers ten Mini COMPACT Air Cooler variants ranging from 0.4 to 2.2kW output. Each variant comes with a terminal box wired ready for connection and a three-year warranty.

For more information about Güntner brand, visit: [guntner.com](http://guntner.com)



Photo: Güntner Mini Compact Air Cooler

### Toughest targets ever introduced will crack down on sewage spills – Press Release

Water companies will face the strictest targets on pollution from sewage ever under a new plan to tackle sewage discharges in our waters, set out by government on the 26th August.

The government's plan will require them to deliver their largest ever environmental infrastructure investment - £56 billion capital investment over 25 years - into a long term programme to tackle storm sewage discharges by 2050. The plan frontloads action in particularly important and sensitive areas including designated bathing waters and high priority ecological sites.

The targets will mean they need to take measures such as increasing the capacity of their networks and treating sewage before it's discharged to protect public health and prevent pollution, whilst massively reducing all discharges. Failure to meet these targets could see them face substantial fines or having to return money to customers.

The government has also been clear that companies cannot profit from environmental damage. Ofwat have outlined that water companies must be transparent about how executive pay and dividends align to delivery of services to customers, including environmental performance. The government supports Ofwat's recent proposals which would provide extra powers for enforcement action against companies that don't link dividend payments to their environmental performance, or who failed to be transparent about their dividend pay-outs.

*Editor: The year 2050 as a deadline to tackle storm sewage discharges is 28 years into the future, and will undoubtedly shock many people as to this envisaged timescale.*

*The Press Release in full is available at: <https://www.gov.uk/government/news/toughest-targets-ever-introduced-will-crack-down-on-sewage-spills>*



### AI liquid sensor business attracts new backers – InferSens Press Release

InferSens, a ground-breaking Machine Learning based sensor business, has attracted substantial new investment setting it up for success in the FM and building services sectors. RO Capital Partners, the RO Group's venture capital arm, led the investment round in InferSens alongside the Oxford Innovation EIS Growth Fund and Bruce Melizan, the former MD of Interserve's support services division. The new funds will be used as growth capital and to bring the product to market. The InferSens product is new and unique – essentially a small sensor device that can be attached to any pipe, non-invasively monitoring the flow and temperature of any liquid. The product generates meaningful, live, and easily accessible data at a cost substantially below comparable existing technology. That makes it of real interest to building owners and managers, as well as service providers, who are required to scrutinise the flow of water in properties for Legionella. Historically, checking for Legionella has involved the manual monitoring of water outlets, a laborious and environmentally wasteful process. InferSens offers a significantly more efficient and effective process, with a fixed monthly fee charged per sensor.

The InferSens product can be deployed on any sized pipe, potentially including national infrastructure, providing a clear growth path for the business, and neatly intersects Machine Learning, the Internet of Things (IoT) and cleantech. The ability to cut down on the manual testing of flow in pipes and unnecessary routine flushing massively reduces the scope for waste, meaning that the tech will significantly boost environmental and sustainability scores for its users.

Colin Payne, CEO of InferSens, said: "I am delighted that InferSens has been oversubscribed for its funding round, a real recognition of our cutting-edge technology at the interface of IoT sensing and on-device Machine Learning. This critical milestone for the business will enable the commercial launch of our ML-powered flow and temperature sensing technology, initially targeting the major global challenge of keeping buildings safe from Legionella".

For more information about InferSens please visit: <https://www.infersens.com/> or contact: John West / Llew Angus, Belvedere Communications.

Telephone: +44 (0)203 687 2756

Email: [info@belvederepr.com](mailto:info@belvederepr.com)

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# waterline





### Aquaspira wins the 2022 Pipeline Industries Guild Innovation Award – Press Release

Aquaspira Ltd, a leading pioneer of large-scale, composite steel-plastic drainage pipes and flood attenuation systems, has won the prestigious Pipeline Industries Guild award for Inspiring Innovation, Cost-Saving and Efficiency for its SmartSense intelligent pipeline system. The award recognises innovation in the industry and is awarded to the best new idea for increasing efficiency and reducing costs in the pipeline sector. SmartSense is the latest in Aquaspira's expanding product range and is the result of a two-year research and innovation programme in collaboration with the University of Birmingham. The SmartSense concept is to develop the next generation of drainage pipe systems that incorporate a high proportion of recycled materials and have the latest in sensor technology embedded into the product. The result is a low-carbon pipeline system that is capable of monitoring and evaluating its own performance as well as the ground that surrounds it, including how it is installed. Phillip Clisham, Technical Director and The Guild's Communication Panel Chair, presented the award and said: "The world is changing fast and the whole industry is under pressure to reduce the carbon costs of the industry's operations as well as the embedded carbon cost of the things that we build."

"This means that we are under pressure to use thinner-walled pipes which rely more heavily on the quality of their embedment for support whilst also being driven towards using selected as-dug material for pipe embedment, rather than importing ideal processed material. The combination means that the quality of construction is going to be more important than ever, particularly for large diameter pipes. AquaSpira's approach is to develop a pipe that can tell you whether or not it has been installed properly."

Dr Paul O'Regan, Technical Director of Aquaspira adds, "This is the driving concept behind our innovation. If we can monitor the long-term condition of both the pipe and the ground we can improve pipeline integrity, save maintenance costs and reduce the risk of having poorly installed systems – mitigating problems across the lifetime of the product." <https://www.aquaspira.com/info@aquaspira.com>

### Davidstow, Cornwall cheese firm pollution fine

One of the UK's biggest cheddar cheese suppliers has been fined more than £1.5m after admitting a host of pollution and odour charges. The Dairy Crest Ltd plant at Davidstow, Cornwall, polluted the local area over a five-year period up to 2021, killing fish and creating strong odours. The firm, which produces Cathedral City, Clover and Country Life, said the issues had been rectified. The company was fined a total of £1.52m at Truro Crown Court on 23rd June. The judge said £272,746 costs had already been paid. The court heard the incidents led to odours so bad that they stopped local residents from sleeping, leaving them with headaches and vision problems. Waste was also discharged several times into the River Inny, killing fish. The river is used for breeding Atlantic salmon and is home to native wild brown trout and smaller species like bullheads and loaches. Prosecuting, Richard Banwell from the EA said the firm failed to notify the agency about incidents. The firm previously said the offences arose after commissioning new processes, unique in the UK.

Following the hearing, a company spokesperson said: "Once again, the company would like to express its sincere apologies to those who have been affected."

They added that "considerable work has been undertaken to rectify the historic issues to which the prosecution related" and that the company "remains committed to supporting its local communities and becoming a better neighbour".

The biggest employer in north Cornwall, it employs 195 workers and operates 24 hours a day, buying 1.3 million litres of milk from around 370 local farmers daily.

Sentencing, Judge Simon Carr said there were senior and middle management failures and a culture of bullying and intimidation at the firm's waste water facility.



### First UKAS accreditations under Compost Certification Scheme – Press Release

The United Kingdom Accreditation Service (UKAS) has awarded the first accreditations under Renewable Energy Assurance Ltd (REAL)'s Compost Certification Scheme (CCS). Following the successful conclusion of a 12-month pilot assessment programme, three certification bodies have been granted UKAS accreditation against both REAL's CCS and the internationally recognised ISO/IEC 17065 product certification standard:

- Aardvark Certification Ltd
- NSF Certification Ltd
- Organic Farmers & Growers CIC

First conceived in 2007, the CCS has been developed by REAL as a quality assurance and end-of-waste scheme for compost derived from (predominantly green) waste materials that is used in the farming, horticulture, and growing-medium manufacturing industries. In addition to allowing compost producers to achieve end-of-waste status for their products, goods bearing the CCS conformity mark have proved that they meet stringent quality criteria and do not harm the environment. The CCS provides a framework for the independent assessment and certification of compost to PAS 100, the Compost Quality Protocol, and the Scottish Environment Protection Agency's regulatory position statement on composting. Announcing the awards, Justyna Staff, Head of Certification Schemes at REAL said: "Congratulations to the three certification bodies who all successfully completed the pilot programme and are now accredited to ISO/IEC 17065 for certifying against the CCS requirements. Accreditation by UKAS reflects the competence, impartiality, and performance capability of these organisations, while also demonstrating the CCS provides reliable services to industry. We are extremely proud that the Scheme has reached this important milestone in its development – all CCS certificates are now UKAS accredited, which will give consumers even greater assurance that they are receiving a reliable, quality product."

More information on CCS: <https://www.ukas.com/resources/latest-news/real-compost-certification-scheme/>



## waterline Research Papers SCIENTIFIC PUBLICATIONS NOW AVAILABLE ONLINE!

Research papers can now be found on the Waterline website on the Research page.

Follow the weblink here: <https://bit.ly/WaterlineRP>

# How to save 50% of your time on legionella risk assessments

GMS Services is one of the UK's main water hygiene companies. Carl Ollerton, Technical Director, is responsible for all staff and general operations. He partnered up with LegionellaDossier to ensure a future-proof approach to legionella control: digitising legionella risk assessments and control.

## Safe and compliant buildings

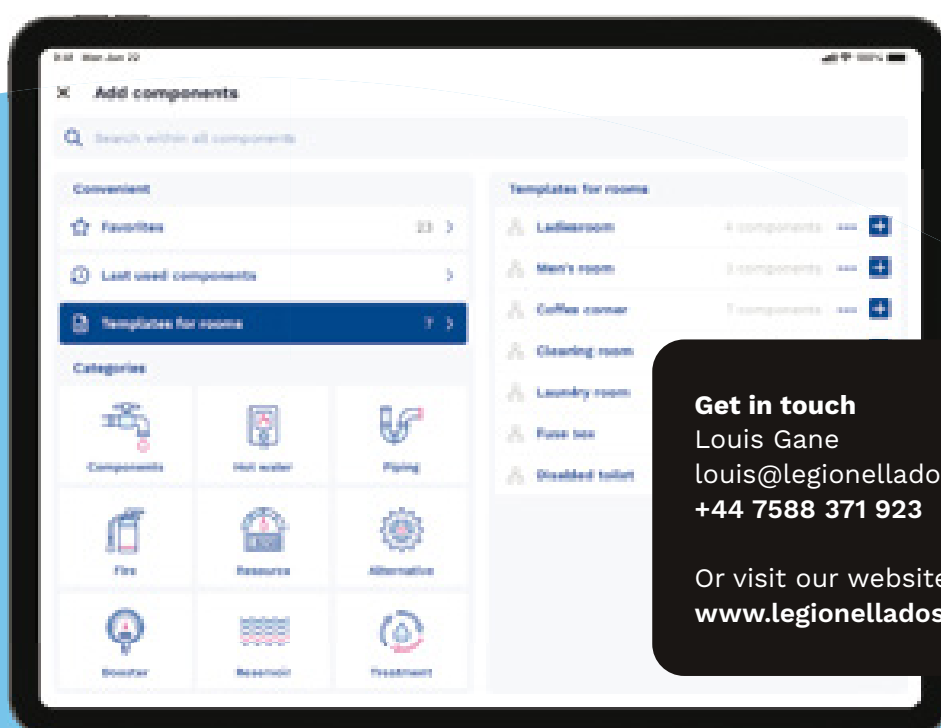
Through our LD-Inspect software solution, we offer you the chance to save 50% of your time spent on risk assessments, while ensuring you remain compliant with L8 and HSG274 part 2. Our goal is to assure that every building in the world is safe and compliant. So, when will you join?



**The risk assessment process has become much smoother and easier for everyone. 95% of every risk analysis is now captured and completed on-site.**

**Curious to find out more?**

Then check out the interview with Carl!



### Get in touch

Louis Gane  
[louis@legionelladossier.com](mailto:louis@legionelladossier.com)  
**+44 7588 371 923**

Or visit our website for more information  
[www.legionelladossier.com](http://www.legionelladossier.com)





# TECHNICAL Q&A

SENT INTO WMSoc. TECHNICAL:

I am trying to determine what the actual upper and lower control parameters for closed water system analysis would be. Is this kind of information available in BSRIA BG50? I know the list is quite long but my company would like to put action limits on results for the full BSRIA recommended analysis.

Q:

A:

ANSWERED BY THE WMSoc. TECHNICAL COMMITTEE

The latest version of this guidance note was released in 2021.

The issues that are of most interest to you are:

- Table 2.4.4 Worth looking at as an overview
- Table 4.1.1 (page 36 is the list of active chemicals that are used in water treatment formulations for water treatment in closed systems, by the chemical name and not by company product names).

The reality is that the BSRIA document is a guidance note based on the industry overall and is not therefore, specific to your systems.

It is really the responsibility of your water treatment service provider to specify the levels of their inhibitor that is to be maintained in the water, or to provide you with training to carry out the tests in house. Clearly, they should also provide the acceptable range of chemical levels to be maintained in the system water, to provide you with a reference point.

Obviously, the results are only valid on the day of the sampling and test, and are carried out with a field test kit, so not as accurate as a laboratory analysis. However, as this is a closed system with minimal water losses and therefore minimal make up, the treatment levels will logically show little change over time unless there is a loss of water in maintenance or a leak etc..

It may be that the company have a service agreement in place with you to carry out periodic testing, and in that circumstance there should be a report provided to you after each visit specifying what the results show, what those results mean, and specify any actions that may need to be taken.

## DO YOU HAVE A QUESTION FOR OUR TECHNICAL COMMITTEE?

Send in your question  
via email to: [admin@wmsoc.org.uk](mailto:admin@wmsoc.org.uk)



# The Hidden Dangers in Hospital Water Systems

Roy Sullivan, Senior Consultant, Water Hygiene Centre Ltd

Due to their complex design and often considerable size, hospital water systems can harbour a multitude of pathogens and microorganisms. Amongst the most common in healthcare water systems are gram-negative bacteria such as legionella, with other lesser known organisms such as mycobacteria. Fungi and mould may also be present, if less abundant.

Water Safety Groups [WSG] need to be aware of the multiple water hygiene threats that could potentially colonise their water systems and result in dangerous bacterial outbreaks amongst vulnerable populations. Where there is a foreseeable risk from any waterborne pathogens, then a suitable action plan including appropriate control measures must be put into place via the Water Safety Plan [WSP] and the WSG.

HTM04-01 provides a limited overview of possible potential waterborne pathogens, though whether this is adequate could be debated as the focus remains primarily on Legionella and Pseudomonas aeruginosa. Pathogens found within hospital water systems are highlighted as follows.

## Introduction

Legionella remains the most well-known bacteria present in healthcare water systems due to media attention and ongoing management practices over many years. There are now some 70 species identified.

Significant Legionella contamination of a water system can result in people contracting Legionnaires' disease [LD] - a form of atypical acute pneumonia. LD results in fever, muscle pain, and nausea and can cause death if left untreated in the worst cases.

Risks are dependent upon a combination of factors including:

- The bacteria being present in sufficient numbers
- Suitable conditions i.e., temperatures between 20°C and 45°C
- A source of nutrients i.e., scale, corrosion
- A means of disseminating aerosols
- And significantly in healthcare sites, the presence of vulnerable people who have compromised immune or respiratory systems or other factors i.e., smoking increases their susceptibility to Legionella infection.

Comprehensive guidance is present in the form of ACoP L8 and the associated HSG274 publications and particularly HTM04-01, updated during 2016.

HTM04-01 is comprised of 4 Parts:

- Part A - Design, Installation and Commissioning
- Part B - Operational Management
- Part C - *Pseudomonas aeruginosa*, advice for augmented care units
- Supplement Performance specification D 08: thermostatic mixing valves (healthcare premises)

## Pseudomonas aeruginosa

In the UK the role of water in the transmission of *Pseudomonas aeruginosa* has come under particular scrutiny following the death of one infant in Londonderry and three infants in a Belfast hospital in 2012.

It has the potential to cause severe infections, especially in patients compromised by an underlying disease, age or immune deficiency. i.e., the augmented care wards found within many healthcare sites. *P. aeruginosa* has also shown resistance to antibiotics and has a virulence which means it can thrive in varying environments and with varying levels of nutrients.

Unlike Legionella, where the source of the bacteria i.e., the incoming water supply, is clear, the origin of *P. aeruginosa* may be:

- Via the water system, particularly within the last two metres of pipe work before the point of discharge;
- Via the end user coming into contact with the outlet, following washing hands in contaminated water;
- From surfaces contaminated with water;
- From contaminated equipment.

Given this variety, the challenge for the Water Safety Group [WSG] and Infection Prevention and Control teams [IPC] is to risk-assess operational practices to minimise contamination from any of these potential sources.

HTM04-01 Part C published in 2016, addresses *P. aeruginosa* in augmented care settings and stresses the importance of the WSG and WSP in the routine management of this pathogen.

## Stenotrophomonas maltophilia

Stenotrophomonas infections have been associated with disease and mortality in severely immunocompromised individuals. Whilst *S. maltophilia* is not a virulent organism, it is naturally resistant to many broad-spectrum antibiotics. Risk factors associated with *S. maltophilia* infection include HIV infection, malignancy, cystic fibrosis, neutropenia, mechanical ventilation, central venous catheters, recent surgery, trauma, prolonged hospitalisation and prolonged broad-spectrum antibiotic use. Robust infection control procedures will ensure the spreading of the pathogen can be controlled.

## Mycobacterium chimaera

Infection with Mycobacteria is very rare but can be fatal and these outbreaks usually involve sternal wound infections, plastic-surgery wound infections or post-injection abscesses but also in patients undergoing dialysis treatment. There are also significant concerns relating to contaminated heater-cooler units [HCU] used in theatre during cardiothoracic surgery.

The HCU function is to regulate the temperature of the blood perfusing the patient using water in the HCU tanks to indirectly raise or lower the patient's body temperature. Whilst there have been no reported NHS cases since 2015, HCUs must be operated and decontaminated according to



the manufacturer's instructions, and in conjunction with a risk assessment approved by the WSG and IPC team.

### Other pathogens of concern in hospital water systems

Waterborne outbreaks or clusters have also been seen in recent years throughout Europe for a multitude of pathogens, including Rotavirus, Cryptosporidium, Norovirus, Campylobacter, Giardia and others. Written guidance within the UK may be limited to infection control practices and lesser known bacteria are not typically discussed within Water Hygiene forums, however your IPC lead can best advise on controlling the potential proliferation and spread of these pathogens.

### Conclusion

WSGs have many factors to consider when addressing water hygiene in their buildings, and issues and responsibilities relating to less well-known waterborne pathogens are perhaps not yet fully understood. We should, however, be optimistic in dealing with the myriad of other bacteria which inhabit our water systems.

Great strides continue to be made in the management of *Legionella* and *P. aeruginosa* and our findings should be used to aid the development of robust methods and useable guidance in the risk minimisation of 'other bacteria' within our water systems.

## INDUSTRY UPDATES

### CSCA



A vote with 5 nominees from five representatives of CSCA member companies was held for a place on the CSCA Management Committee. CSCA is delighted to announce that Shaun Abbott of Smoothflow won the vote and joins the CSCA for our next Management Committee meeting in December 2022. A huge thank you to the other 4 nominees for their enthusiasm and commitment to the aim of the CSCA, a non-profit organisation for companies who actively support and demonstrate a sound approach to the control of water quality in closed systems.

CSCA are planning a face-to-face event in London in March 2023 and auditing of CSCA service providers is ongoing.

Current membership is 24 Foundation member companies, 8 Sponsor members and 22 Service provider members giving a total of 44 different companies with CSCA membership.

[www.cscassociation.org.uk](http://www.cscassociation.org.uk) Tel: 01827 219508

## Legionella Control Association



LCA re-registration period ended on 31st August 2022 and we would like to thank all those members who completed their re-registration promptly. LCA Membership numbers are currently 370 full members, 22 applicants, with 9 members currently suspended and 3 members recently terminated due to not responding to company audit actions or request for company audit, despite much chasing.

LCA AGM was held online on 13th October 2022 and the revised LCA Bylaws presented at this AGM. The new vice Chair replacing Garry Kerin, is John Smith who will take over as Chair from Nick Barsby in October 2023.

We would like to express our sincere thanks to our former Chair and Vice Chair Garry Kerin for his 5 years' service. Garry will continue with the Management committee but stands aside as Vice Chair as per the bylaws after his time of service. We wish John all the best in his position of Vice Chair from October 2022.

John Lane has retired as an LCA assessor after more than 20 years and John McKerron (Scotland) will retire in December 2022. We welcome 4 new assessors to the LCA team, with 2 having been recruited in the South and 2 in the Northeast and Scotland.

Work continues on the proposed Competence Assessment Workshops, with the provisional program having been presented to LCA Assessors & members of the LCA Management Committee in September 2022. More news to follow on these before the end of the year.

The first LCA Autumn conference, Sitting on the (Of) fence – Areas where members may be committing criminal offences but don't know, was held on 11th October at the Cavendish Conference Centre, London with the second event, with the same programme, being held on 1st November at the Royal Station Hotel, Newcastle. See our advert on page 29 for full details.

### UKAS



#### The launch of UKAS CertCheck

In June UKAS was extremely pleased to launch CertCheck, our free-to-use online database of UKAS accredited certification for management systems. The purpose of UKAS CertCheck is to provide quick and simple assurance that a user's supplier holds the valid and current certification that they claim to,

helping to ensure a robust supply chain. UKAS CertCheck can be accessed at: <https://certcheck.ukas.com/> and you can find out more about it at: <https://www.ukas.com/resources/latest-news/ukas-launches-certcheck/>.

# event report e

## Water Management Society Water Reflections Webinar Series

Thursday July 14th 2022 - Introducing BG 50/2021 Water Treatment for Closed Heating and Cooling Systems  
By Mike Hunter, Hosted by Garry Kerin

### Overview and opinion of BG50 Webinar by Mike Hunter

The webinar was based on the BSRIA provided presentation outlining the objectives of the document and to run through the significant changes between this new release and the original BG 50 2013 document, the first of its type produced by BSRIA. The differences were relatively minor in some ways but obviously the use of technology and strategic changes in the operation and maintenance of closed systems are a significant addition to the efficacy of the release. In many ways I believe that this has been a success and the result is a more realistic approach to water treatment of these types of systems. Hopefully we managed to demonstrate that in the webinar, and it is a superior document to the first (2013) release in many ways,

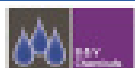
In reality most closed systems are little trouble to operators and water treatment (WT) professionals from a maintenance perspective in as much as they require little attention other than an analysis to ensure that the conditions are good (or acceptable) on a relatively infrequent basis, often carried out by a water treatment company. However, when there are problems, they are very "noticeable" in that heating and chilled systems fail to make the correct temperatures, this provides complaints from tenants and often this results in major works to remediate the situation, often resulting in costs to the landlord/owner. This situation has led to numerous legal problems and major works to rectify the situations, and the new document does outline a number of different options to help with these situations.

My feelings from the questions that resulted from the webinar were

that the audience seemed to be asking questions more linked to the operational side of the water treatment programmes, and potential remediation strategies, rather than the need for the changes in commissioning, handover procedures etc, where presumably BG29 was being used, than any issues that may have come from the new document.

I believe that in many ways this indicates that there is a knowledge gap in field that identifies more of a training need for the WT people and probably the maintenance personnel operating the systems in buildings. The overview from the document is that it really should only be a last resort to drain, flush, refill and treat a problem system, rather than find some form of on-line cleaning procedure using filtration, cleaning solutions and addition of the correct maintenance inhibitors as required to reduce the potential for systems to deteriorate further and operate to design specifications. This is very much more cost effective than replacing the whole heating or cooling system after all!

The whole document production was managed by David Bleicher and John Smith who played an excellent "lead role" in keeping the direction and timelines in play. They also kept the team in line and made the deadlines to produce it in a reasonable time, despite the obvious difficulties of working remotely in the pandemic. In fairness I must accept some criticism for not mentioning in the webinar, the amount of team input from everyone who contributed to the rewrite of BG 50. The guide was authored by Pam Simpson, who pulled together the best of the information available from the team and provided an excellent and improved document versus the original! It was not easy!



## INDUSTRY UPDATE

### UKHSA



#### Expansion of polio sewage surveillance to areas outside London

UKHSA and MHRA are expanding polio sewage surveillance to a range of areas outside of the capital.

Following the findings of poliovirus in sewage samples collected from the London Beckton Sewage Treatment Works, which covers parts of North and East London, the UK Health Security Agency (UKHSA) working with the Medicines and Healthcare product Regulatory Agency (MHRA) are now expanding the surveillance to a range of areas outside of the capital.

This is on a precautionary basis to determine whether the virus is spreading to other areas. To date, sewage sampling has been conducted in London and Glasgow, and no polio virus has been detected in Glasgow.

The additional sites where the sampling will be rolled out are Sewage Treatment Works covering parts of Birmingham, Blackburn with Darwen, Bradford, Brighton and Hove, City of Bristol, Bury, Castle Point, Leeds,

Leicester, Liverpool, Luton, Manchester, North Tyneside, Newcastle upon Tyne, Gateshead, Nottingham, Preston, Salford, Sheffield and Watford.

Dr Vanessa Saliba, Consultant Epidemiologist at UKHSA, said:

No cases of polio have been reported and for the majority of the population, who are fully vaccinated, the risk is low.

We are now expanding the sewage sampling nationally to areas that are at highest risk of new poliovirus importations and areas most likely to see spread of poliovirus from London. We are in touch with public health colleagues in these areas and will work closely with local areas as the need arises.

In the meantime it is vital parents across the country check their children are fully vaccinated for their age.





# Water Quality

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IT'S ALL HANGING IN THE BALANCE?

ONE DAY CONFERENCE

COSLA CONFERENCE CENTRE, EDINBURGH

THURSDAY 1<sup>ST</sup> DECEMBER 2022

## PROGRAMME:

09:00 Registration & Refreshments

09:45 Welcome & Introduction by Chair  
*Jonathan Waggott, WMSoc Council member*

10:00 Remote water monitoring - A practical guide  
*Warren Bradshaw, Strategic Compliance Manager (Legionella) DIO*

10:35 Microbiological methods - How to interpret and explain  
*Bjorn Nielson, ALS Global*

11:10 Coffee break

11:45 NHS Scotland Assure - What is it and how does it work?  
*Ian Storrar, Head of Estates NHS Scotland*

12:20 Scald Risk Assessment  
*TBC*

13:00 LUNCH

14:00 Roundtable 1: Remote monitoring and testing methods  
*Warren Bradshaw & Bjorn Nielson*  
*Moderators: 2x TBC*

14:45 Roundtable 2: Guidance and Compliance  
*Ian Storrar & TBC*  
*Moderators: 2x TBC*

15:30 Summary & Wrap-Up  
*Jonathan Waggott, WMSoc Council member*

16:00 Close & networking

SEE ALL THE DETAILS & BOOK ONLINE AT:

<https://bit.ly/WMS-EVENTS>



THE WATER MANAGEMENT SOCIETY

## 6 CPD POINTS FOR ATTENDANCE

*The WMSoc reserves the right to alter speakers and/or titles of papers if circumstances dictate.  
The views and opinions expressed in the event are solely those of the speakers and do not necessarily  
represent those of WMSoc*

# Remote monitoring - you might get more than you bargain for!

By Sarah Levett BSc (Hons) CMktr, Head of Marketing for IoT Solutions Group

Inarguably, one word that has hugely increased in popularity since March 2022 is “remote”: remote work, remote meetings, remote learning... Many organisations and individuals have embraced the power of completing tasks away from a physical location and have reaped the various benefits (more on that later).

The sensing of water systems using technology has been around for decades. Still, it wasn't until early this century that wireless communication options allowed sensing to be deployed at a much larger scale. In addition, battery power and other remote power supplies have become more efficient and affordable in recent years, supporting deployments at locations where no mains power is available. Sophisticated data analysis tools have also become more innovative and more readily accessible. Alongside cloud platforms and improved connectivity (such as LPWAN, see info box), data can now be recorded and accessed from virtually anywhere.

One remote monitoring system combining these elements is IoT, or the Internet of Things. The Internet of Things can be described as “systems of interconnected devices that pass data and insight, allowing informed decisions to be made”. Consumer examples of IoT include smartwatches or intelligent home thermostats that share insights accessible from your phone or computer. These insights help you decide whether to head out for a walk to top up your daily step count or turn down the heating in a room that isn't used.

IoT is a popular remote monitoring system across many industries, but it is most widely used in the water industry for smart meter monitoring. Remote water temperature monitoring for detecting Legionella growth conditions is also increasing in popularity.

By the definition of the word remote, these systems are great for monitoring locations that are difficult to access. We have seen this as a key driver in the adoption of water temperature monitoring for Legionella risk.

Water hygiene consultants who had previously driven hundreds of miles each month to do a 20-minute test are now only going to these locations once a quarter. They are maintaining their specified monitoring regime but are also significantly reducing their travel time and vehicle use; a clear sustainability benefit.

There have also been other, more unexpected, benefits. Many of these benefits come from having a more regular, consistent water temperature measurement at a much higher sampling rate than can be achieved with manual testing. Through intelligent data analytics, systems designed for monitoring water temperature (such as that developed in the info box) have also been shown to have the ability to solve the following challenges.

## Determine the flow rate

If you know the water-metred entry to a building, you can attribute (as a percentage) how much goes to specific areas of the pipe network in real-time and subsequently manage supply and demand.

## Detect water leaks

Systems that analyse the changing water temperature over time can identify leaks down to just a few millimetres per day. This proactive detection means that

## IoT remote water temperature monitoring – what is it and how does it work?

Specially designed temperature sensors are clipped onto hot and cold pipes at sentinel points. By sensing the surface temperature of a pipe and comparing it with the ambient temperature (whilst adopting the laws of mathematics and thermodynamics), the system can infer the water temperature within that pipe.

This data can then be automatically relayed to a cloud platform for analysis via a battery-powered LPWAN (Low-power wide-area network) modem designed for long-range communications without mobile phone signal or Wi-Fi.

leaks can be detected and remedied quickly to reduce costly damage and repairs.

## Identify scald risk

Scald risk is of particular concern in settings such as health and care establishments. Receiving alerts when the water reaches dangerous temperatures allows the problem to be addressed swiftly.

## Monitor hot water supply

Monitor the hot water distribution to each tap and pre-empt customer complaints before they happen. These insights are particularly useful in the leisure, housing and hospitality sectors.

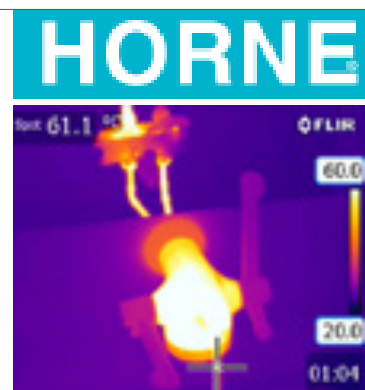
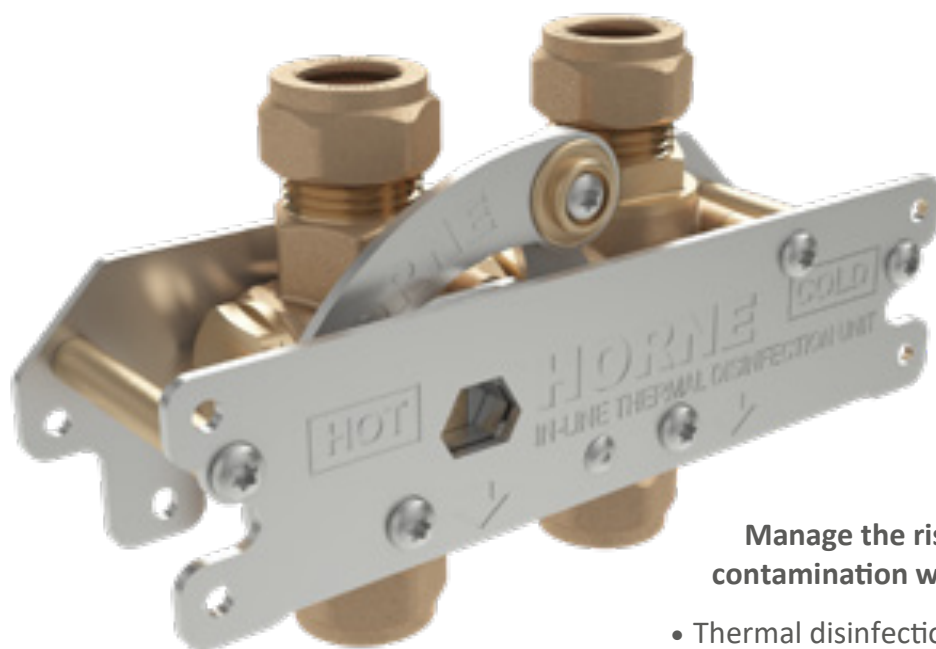
## Make substantial sustainability gains

Reducing travel time and associated fuel use may be a key driver for adopting remote monitoring, but solutions like this also allow for setting benchmarks. In addition, campaigns to tangibly reduce water usage can also be designed and monitored, helping to deliver a proactive and targeted approach to sustainability, with measurable impacts.

Combining all of these outputs shows how the power of intelligent monitoring can deliver clever data insights, above and beyond the challenge that the solution was initially designed to solve. Often, technology developers can also add in other functionality or devices into the system for a minimal extra cost but significant additional insights.

However, there should be a caveat here that implementing technology for technology's sake is rarely a good idea. Success in technological implementation comes from clearly defining the challenge to be solved by this solution. So, what is it that you actually need to know? How will this information benefit your organisation and your clients/end users? And is it going to deliver a clear ROI?

All the scenarios above demonstrate excellent use cases on their own but together make a more compelling argument for technology adoption. You can't predict or manage what you don't know, and who knows what new insights or nuances, and resulting benefits, you might discover about your water system through the power of remote monitoring.



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# A discussion with...

**Dennis Kelly** Director Pro LP Consulting Ltd

*Interview by Jemma Tennant, The City of Edinburgh Council*



**JT:** *As you know, the first time we met was in 1998, when I showed up for an interview for the role of Technical Sales Engineer with Houseman and thankfully you gave me the job - 24 years later.... how do you think the water treatment industry has changed?*

**DK:** There is definitely more external authority involvement than there ever was. There's more British Standards – e.g. boiler water operations, more guidance documents and more HSE involvement.

Additionally I think there are now a lot of end users, principally in water hygiene, that are employing compliance managers which were never there before. And not just for water but for all sorts of things. And as the role of the compliance manager has become more common and more important we are seeing more audits and performance reviews - which is a good thing. The days of simply working on the chemistry, saying we are better than the other company and trying and get the contract, sometimes on price, are no longer here. Competency now plays a much larger role. The ability of contractors to correctly deliver the required services is a huge consideration as it should be.

I'll give you an example, we are currently having issues at a hospital where the disinfections have been done by a plumbing contractor who doesn't know how to do them properly. When I reviewed the method statement it was clear they didn't know how to do it correctly, so we had to redo a lot of things. My advice is to always go to a water hygiene contractor that really knows

what they are doing because they will then complete the disinfection correctly.

I have a theory, some might disagree with it, but I think it's easier to be a water hygiene contractor that employs plumbers than to be a plumbing contractor that employs water hygiene technicians. Water Hygiene contractors have attention to detail, a level of competence and should offer their staff continuous training. I was recently asked to deliver training to a well known contractor who heavily invest in training their staff. It was tricky as I didn't think I could train them anymore than they already knew. So I sat down and listed questions and I showed them examples of real life risk assessments that were flawed. We essentially had a workshop day and it appeared that they took a lot from it. We need more of that investment in training and competency because some of the risk assessments I see are still appalling.

**JT:** *Going back to the old days when we had to compete against the "cheap and cheerful" contractors, do you think there is now more of a move towards people wanting to spend more to ensure quality, or do you think we are still driven by price?*

**DK:** There is definitely more of a move towards quality. That is apparent through my involvement in the tendering processes for a number of clients who haven't gone for the cheapest.

Obviously, the NHS are the drivers behind the Authorising Engineer process - not just for water but for ventilation, decontamination, electrics, medical gas, etc - and that concept of AE is now spilling out from the NHS to the non-NHS marketplace - I've had discussions with universities and hotels chains, and I think they are beginning to see the value of having an AE. In these discussions we often talk about the word compliance. I don't like to use the word compliance because that's a big word in this industry, and it can mislead people. However, if you have an external expert who has no interest in the financial or commercial aspects, when these organisations have a commercially uninvolved third party telling them they have to do something it is more difficult for them to ignore. When they have a commercial organisation telling them to do something they can always say "you're

just manufacturing sales opportunities" or "you're trying to get more business out of us". That still does go on and we know that companies still do this, but it is definitely changing. So when a third party comes along and says "no you need to do this" they invariably find a way to do it.

And this is another change that's come on from when we worked together - box ticking. It's moved from box ticking, which it was in many cases, and still is for a lot of water hygiene companies, to actually knowing what the box means, and not ticking it unless it's right. In the risk assessment process training is a great example of this. There is often a question "have they been suitably trained" and it's a box tick but there's no description of what that training is, when they were last trained, was the course appropriate, how often they have refreshers, how they train new staff. There is very little "digging in". In my opinion this is no longer acceptable.

**JT** *If you were choosing a service provider, what would your one look like?*

**DK** Someone that pays a lot of attention to the competence of their staff and does so on an ongoing basis. Someone that properly trains new staff, and mentors them - there needs to be more mentoring in our industry.

In the past there would be technicians that took temperatures and disinfected tanks and if we got a lot of risk assessment work, we used to make one of the technicians a risk assessor. We can't do that anymore. With regard to training the industry is a bit light in recommending how often you should do these things - market norm is about every three years. Service providers should also know the limit of their capabilities and not take on anything that they don't understand or aren't good enough to do. A classic example is when plumbers complete disinfections. They have done this for years. I've had a recent situation where I've asked to see the plumbing company's RAMS and they were absolutely hopeless. Nothing about monitoring disinfection chemical dose rates, how much chemical was actually added, how they would get rid of the chemicals, so I sent it back and within an hour everything was there. It had been corrected but I am not convinced they actually knew what they were doing. There is a difference between



writing it down and actually doing it and doing it properly. Service providers should stick within their boundaries and be big enough to say “we can’t do this.”

The other thing I would like to see is more communication. There is a thing in the NHS called the Duty of Candour. The duty that people have to be open and honest irrespective of whether it is bad news or good news. I feel we should do that within our industry, delivering of the news has to be done correctly. I think some companies worry that if they’ve done a bunch of disinfections and they get positive legionella result then they will be seen to have failed. The companies won’t tell the client because they don’t want to deliver bad news. We’ve seen contractors putting chlorine in their legionella samples to get the results the clients are looking for.

We also need ongoing communication. And proper management of contractors – do you sit down with them and have minuted meetings and action points? This should be done at least once a year. Some clients do this now and it makes a huge difference.

The money side of it should be separate, the cost is the cost and people need to be prepared to pay more. The cost of entry to the market going back to the early days was a mop, a bucket and a bottle of chlorine that was it - you could cycle to the jobs on your bike and then send out an invoice. It’s no longer like that.

I don’t think the industry polices itself properly either. Take Gas Safe for example – if a plumber installs a gas boiler incorrectly, it could result in a prison sentence. We don’t have anything similar to this in the water industry and this needs to change. Not surprisingly, many end users and suppliers are questioning the benefit of the current registration organisations – and although I believe they have a huge part to play in the future of regulating the industry, we have a way to go.

***JT Dennis I am sure you’ve had a lot of roles during your career in water treatment, which role gave you the most challenges.***

DK They all had challenges. The higher you went up the management line the more challenges, and pressures you had

as a supplier. You had to have profit lines, and there were ways of doing that, cutting corners, employing lesser trained staff. The focus for many years was profit and price and it was very difficult to deliver the level of quality that should have been delivered.

I had an interesting example recently – A service provider had won a tender to risk assess bank branches and wanted me to risk assess some branches in Scotland. They offered me £50 per assessment. Obviously I said no. The branches were all over the country and they had no concept of the geography. But they had bid and won that work at that kind of level and now they had to deliver. So there were always challenges when you were managing organisations with the profit motive and winning work at an acceptable level of profit.

There is now a move more towards quality and that is helping. One of the groups that doesn’t get trained and should get trained in large organisations is procurement. Take for example a hospital – there is a huge network of people responsible for water - there is infection control, the clinicians, cleaners – arguably the lowest paid people in hospital are the most important - there are water treatment contractors, plumbers, AEs, estates, project staff, a huge matrix of people that all touch the process to a greater or lesser extent and they require to have a level of understanding, and someone has to control that.

All I can do as an AE is help point out things we need to do either more correctly, or better, or things that aren’t being done but need to be done and it’s easy to do that because I don’t have the purse strings. But convincing, and getting the end users to do that, is always a challenge.

One of the biggest challenges I have now in this role is training of plumbing contractors. The reason I am doing it is because they are bidding for work and winning work, but don’t have the training. So I am asked to train them on what is expected when they are working with water systems. It has made a big difference. However when the contractor is really busy they subcontract. And they subcontract to someone else who hasn’t been trained and they don’t have a clue, so we lose that battle.

What I do now is try and make sure the

clients’ level of understanding is good but so also is the contractors’ levels. I now spend about 40% of my time talking to infection control clinicians and doctors and project people, and am spending less time with operational estates staff.

***JT The industry is changing with new technology – what are your views of remote monitoring and what do you think are the pros and cons?***

DK It’s a great idea and the products that are available on the marketplace now are improving. They obviously rely on internet based communication and there are still places in the country that don’t allow that to work properly but technology is definitely driving changes in the industry.

In general I think it’s a good thing but it needs to be installed correctly and in the right places. It’s not a “fit and forget” which a lot of people think it is. Things may still need to be calibrated and checked and things still break down. You don’t want to run the risk of getting great readings when in reality you aren’t. I don’t always see them as a replacement for the real thing. A remote monitor isn’t going to tell you a sink is no longer in use and it’s a dead leg although flow monitoring is now becoming available. It might not tell you when the sink is blocked however. There are things you might miss by not having the human input.

Technology is advancing now to the extent that it can tell you if a tap has been turned on or if it’s been flushed or not and that’s hugely important as one of the most important things is keeping water moving.

I’ve seen some new products that can monitor biofilm build up in hospital water systems in real time and it looks very impressive. We are making great advances. We’ve been monitoring biofilm in large industrial estates and for power station cooling systems for 20 odd years now with biofilm monitors that you could slot into a one foot diameter pipe. However, there was nothing you could put into a 15 mm copper pipe, but there is now. And I think that will help hugely. A real trick for people who are trying to reduce risk is for them to become proactive rather than reactive, and anything that can aid the proactivity is hugely important.

So the pros of remote monitoring may be cost savings, can monitor remote sites, better oversight, and a higher level of compliance. The cons are it's not fit and forget. You still need human input albeit less. You still need calibration. Without that human input you may miss things.

**JT If you could go back to your younger self and offer advice what would it be?**

There is the obvious stuff like spending more time with the family.

Professionally I think I've learned a lot about how water works in buildings but it took me a long time to get there, and I am learning new things every day. I can see the day coming when there will be professional qualifications for what we do and I believe there are already places that do this. There is one NHS trust that I work with that has a direct connection with a local college and they have input into courses specifically in water. So if I could change something, I would read more and learn more rather than learning ON the hoof. And we all do that, you get the core skill set, but I would spend more time on that to be better prepared and have a better understanding of the marketplace before I went out there.

There's the old phrase "I wish I knew then what I know now". I look back at the things I did in big buildings with Houseman and think "did I really do that?"

Maybe older, more experienced people should be used more in the industry for the younger people coming through for mentoring and training. I think that exchange of knowledge and experience from people in the industry doesn't really happen to the extent that it should. We are still relying on people learning on the

job. Knowledge transfer could and should be better – not wait until you're 50 to start getting it right but get it right when you're 30. I would tell myself to spend more time book learning and academically approaching the job and be more prepared to learn from older people, to buy into their experiences and learn from them when I was younger.

**JT Finally, what do you think is the biggest challenge the industry faces today?**

DK Competence is really important. You will always find someone who will do the job cheaper or an employee who will do things for less money, but are they competent?

One of the biggest challenges the industry faces today is risk assessments – industry is facing a huge decision about whether we continue to focus on legionella only risk assessments or move towards microbiology in total. My experience is that the guidance that came out on Pseudomonas risk assessments has left the marketplace confused. I am not sure that the guidance is very practicable. I don't think there is anyone in the marketplace who is 100% qualified to do the type of risk assessment that is being asked for in the guidance. Saying that, I believe it is a big step in the right direction.

In England and Wales in 2018 there were 11 nosocomial cases of Legionnaires' disease recorded. Yet there was over 4,000 reported Pseudomonas infections and a lot of those would have been linked to water. That doesn't consider other water borne infections. 11 cases versus 4,000 and we've got law written around those 11 but not around those 4,000.

Hospitals are already moving towards microbiology of water systems as opposed

to solely being concerned about legionella so I think there are changes coming and those changes will demand different skill sets in the marketplace - and I think that will be a big challenge for the industry. It will definitely happen in healthcare because it has to. People are catching bacterial infections that may be linked to water systems and it's not from Legionella - E.coli, Enterobacter, Salmonella, Burkholderia, Elizabethkingia, Stenotrophomonas etc etc etc. We need to do something about these as much as legionella.

## Quick fire round

**JT If you were stuck on a desert island what would you take?**

**DK Apart from my yacht? Something to make fire, multiple cases of Tennent's lager, books, and something to catch food with.**

**JT Beer or wine**

**DK I'd like to say wine because it's more posh but it's beer for me.**

**JT Pizza or Curry**

**DK Curry, no question.**

**JT Cheese or sweet?**

**DK Cheese for me.**

**JT Favourite vehicle**

**DK A Bedford TK Lorry. I drove trucks and had an HGV as a student.**



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# Committee roundup – Autumn 2022

## Events Committee

The events committee helped to stage the on-line AGM on the 5th September which some of you attended. For those that were unable to join, the Chairman's report is published on page 17 of this issue and the full recording can be found online in the member's area.

Looking to the future, we will be delivering a face to face event in Edinburgh on the 1st December, see page 61 for further details.

## Membership Committee

Our membership meetings are held every 2 months with our last one in early August.

On average there are about 20 applicants with some of them being upgraded.

We have had more interest from further afield like new members from the Channel Isles who wish to use the online resources to help them keep up to date with the industry.

One of the new membership categories is for students which you can find out more about on the WMSoc website.

Continued professional development is strongly encouraged within this society and we have a new head person Ian E Kershaw who is responsible for approving new members basis on CPD.

A new video is being put together to help promote a better understanding of joining.

There is a competency definition available online which can be found on the member's page.

The persons who have been elected fellows were named at the last council meeting at the beginning of September.

Finally, it has been suggested that after our golf social went well that if there was enough interest to play 5-a-side football then a match would be held somewhere convenient for all to attend.

## Technical Committee

It's been a busy couple of months for the technical committee.

Thank you to everyone who responded to the request for suggestions to put to the HSE for the forthcoming updates to HSG274. We collated this information and had a great meeting with the HSE to discuss. Our feedback was much appreciated and was broadly in line with the HSE's own thought. Further collaboration will take place when the time is right.

Document 046 on Risk Assessment has been updated to include information on conducting "first principles" risk assessments - hopefully this will help members but there is no substitute for competence!

We are in the final stages of producing guidance on Scald Risk Assessment, this has to go through a couple of validation stages with industry regulators but should be published soon. A working party has been formed for Remote Monitoring technology and we are working, in collaboration with the HSE, and will be releasing a guidance document in the next few months.

We are also working with various groups to help further the adoption of low carbon technologies such as Heat Pumps. Guidance needs to be followed but we hope we can help safe adoption of alternative technologies.

## Training Committee

We are pleased to announce that we have two new independent tutors joining WMSoc, Ian Wall (The Water Hygiene Consultancy Limited) and Chris Brown (Insource-consulting). There are others currently going through the onboarding process and we will update you on their progress. In addition, WMSoc is reviewing all the courses to ensure that they are representative of current best practice and are relevant to the industry requirements. There are a couple of new courses likely to be developed as part of this review. The first exam for the WMSoc Qualification Pathways, leading to WMSoc Cert designation, is programmed for November 2022. Please get in touch to be one of the first to take (and pass!) the exam and receive this new award at [training@wmsoc.org.uk](mailto:training@wmsoc.org.uk).

WMSoc has successfully passed its annual LCA audit Water Management Society Limited ([legionellacontrol.org.uk](http://legionellacontrol.org.uk)) and is one of only a handful of independent training organisations for service providers.

We are pleased to announce that WMS has moved to Water House, 5/6 Fairway Court, Amber Close, Tamworth, B77 4RP, and they have a new suite of training rooms and a brand new and completely revamped Practical Training Area with many new pieces of equipment to assist the delegates. See page 13 for more information.

The TAC will also be welcoming a new Chair for 2023 and we will report more in the Winter edition of Waterline.

## Waterline Committee

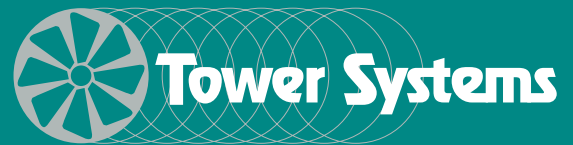
Welcome to your autumn 2022 edition of Waterline. Your committee continue to hold monthly on-line meetings to ensure continuity from one edition to the next, and to ensure that each edition reaches you in a timely manner. This edition covers the period of global heat waves, followed by droughts, food shortages, a dramatic rise in fuel and food costs....and torrential rain and flooding. Some of the Waterscan section's short articles cover July drought news and August flooding. The drought news, although now dated, is included as a reminder of some of the fairly useless 'suggestions' as to water savings proposed at the time.

Thank you to all those WMSoc members who have stepped up and produced articles for this edition, to our advertisers, and to our secretariat. We continue to look for offers of articles. 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](mailto:waterline@wmsoc.org.uk), addressed for the attention of Jane Edmonds.

Finally, following the convention of a 3 year term as Chair of a WMSoc committee, and as Waterline Editor, the winter edition will be the last under my editorship. The time has flown by. A new chair/editor has been proposed and will be introduced to members in the winter edition.

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7. Clean up the area
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10. Identify the cause of the leak

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