The Journal of the Water Management Society

THE WATER MANAGEMENT SOCIETY

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waterline

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Sample Matrix Types
why does it matter to me?

The Lessons to be learned
from Contaminant Leaks into Cooling Water

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- Water as a global resource
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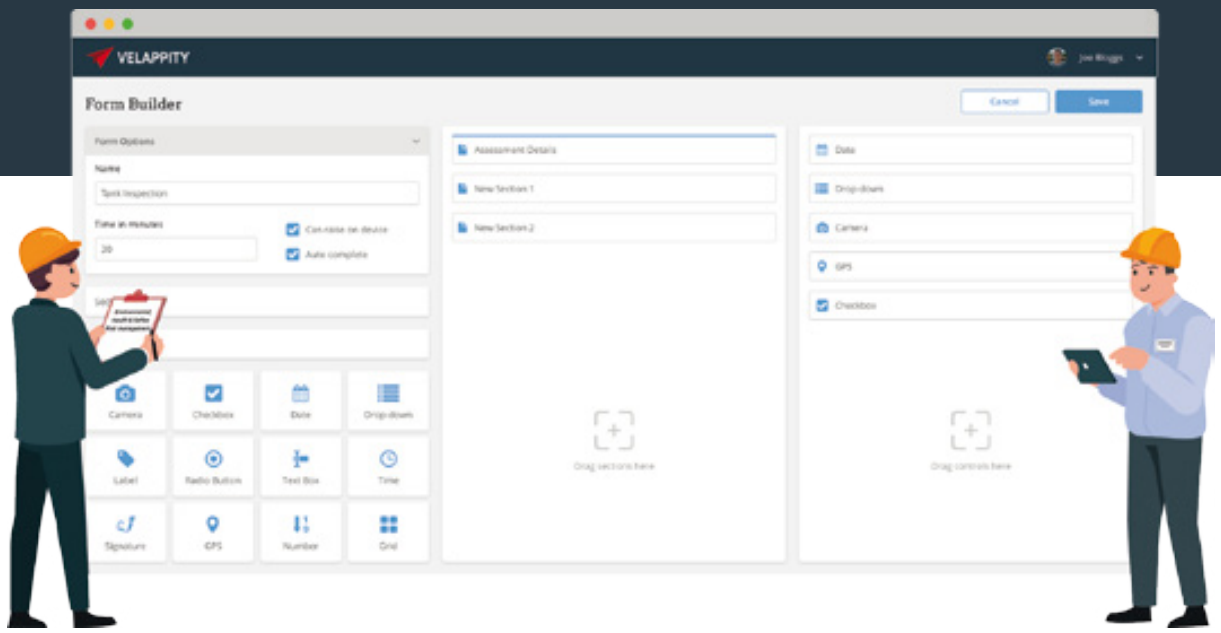

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Alan Watson, Managing Director and Owner
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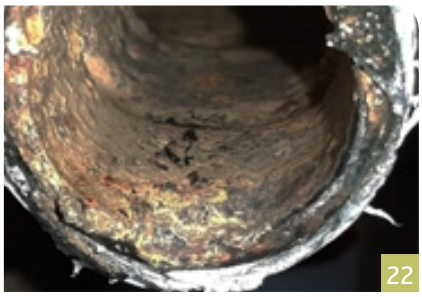

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IN THIS ISSUE

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THE WATER MANAGEMENT SOCIETY

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HSE Legionella Water Treatment Contractor Inspection Programme

By Duncan Smith, HSE

Introduction

Between 2012 and 2018, HSE undertook a series of proactive interventions to reduce the risks from wet evaporative cooling systems. These interventions were impactful, as the degree of non-compliance reduced over time. However, it was evident that a small number of dutyholders struggled to achieve sustained compliance due to poor or inadequate service provision.

In early 2019, HSE carried out a novel intervention targeting Water Treatment Contractors (WTC). The aim of the intervention was twofold: to raise standards via advice, education and promotion, and also to take enforcement action where it was appropriate to do so (in accordance with HSE's Enforcement Policy Statement and Enforcement Management Model).

HSE recognise raising the standards amongst WTCs should have significant gearing effect and should also assist dutyholders to achieve sustained compliance.

Methods

Intelligence from the previous wet evaporative cooling system interventions was used in the targeting of WTCs. Head office visits were undertaken to examine the policies and procedures involved in the planning and delivery of services, as well as on demonstration of competence.

Inspectors used bespoke operational guidance drafted for the intervention. This required Inspectors to probe specific aspects of service provision and also ensured consistency of approach.

Main Findings

Of the 24 inspections completed, greater than 1 in 3 WTCs were judged to be in material breach of law and it was necessary for the Inspector to write to the WTC to secure improvement.

By far and away the single biggest issue found was in relation to the adequacy and suitability of respiratory protective equipment (RPE) required for system cleaning when there was a risk of aerosol generation during activities such as jetwashing. Material breaches relating to RPE accounted for more than 1 in 2½ of all the breaches found and these issues were evident at more than 1 in 4 of all WTCs inspected.

Other highlighted concerns related to the Legionella risk assessment process, cleaning techniques and training/competence of staff.

A detailed report on the intervention is being prepared and will be added to the Legionella Webpages on the HSE website soon.

Recommendations

Whilst the results of this intervention do not indicate the need for a larger intervention at this time, however, the quality of WTC service provision should be kept under review by HSE.

Existing advice and guidance on RPE for cleaning activities needs to be more prominent and disseminated more widely within the Legionella control industry. Appendix 6 of HSG53 (Respiratory protective equipment at work. A practical guide: www.hse.gov.uk/pubns/priced/hsg53.pdf) advises that a particulate respirator with an assigned protection factor (APF) of 20 would be the minimum acceptable protection level for airborne micro-organisms and that for cooling tower cleaning using high-pressure hoses, a powered respirator with full facepiece or hood/blouse might be the most suitable because of the work rate and wet conditions. Further guidance can also be found in various COSHH Essentials direct guidance sheets:

- R3 UK Standard Assigned Protection Factor 20 (APF 20): www.hse.gov.uk/pubns/guidance/rpe3.pdf
- SR01 Cleaning and disinfection using a low-pressure washer: www.hse.gov.uk/pubns/guidance/sr01.pdf
- OCE19 Pressure cleaning – external structures: www.hse.gov.uk/pubns/guidance/oce19.pdf

BSI update

On 23rd January 2020 BSI held their kick-off meeting for the new BS 8580-2. This is intended as a code of practice for risk assessing waterborne pathogens other than Legionella (which is covered in BS8580-1:2019). WMSoc have a representative on this working group but if you represent any other interested stakeholder organisations then please contact BSI directly.

Letter to the Editor

Dear Editor

WMS have dedicated this page to the immense reaction from the membership to Sue Pipe's passing - a selection of these accolades are printed below:

"Her name will be remembered in this industry for a long time"

"Over the last three or four years I had sent Sue articles/letters to the editor for publication, or otherwise, in Waterline. I was always guaranteed to receive a prompt reply with a request, by Sue, to edit my content or grammar. This was always done in such a way that the email didn't need an emoji, I just knew there was a smile and a wink associated with it.
As it happens, I have kept all of those emails and tonight, to avoid my company deleting 'old emails' as part of their policy I forwarded them to my personal account where I shall archive them and treasure those interactions. It is clear that I am not alone in realising the enormity of Sue's loss to the Society"

"She has always been there and is irreplaceable"

"Sue WAS the WMSoc's heart and soul. She will leave a void in all of our lives"

"Whenever I think of the WMS and in particular Waterline, I think of Sue Pipe. She was totally dedicated to the Society"

"I've not known Sue for long but in the short time I have been at the Water Management Society I always found her to be incredibly welcoming and supportive. It's clear to see the positive impact Sue made within the Water Management Society and that she will be sorely missed by many, on both a personal and professional level"

"It was only recently that I sent Sue a Christmas Gin Hot Toddy recipe and she sent a typically terse reply, which really made me smile"

"Sue has been a dear friend for over 20 years and a stalwart for the Society for even longer. WMS would not have made it past the eighties without her"

"One of the WMSs most significant individuals has left us"

"A real foundation rock for the society"

"Sue was a really great person and for so long the oil that kept the water in WMSoc calmly managed and flowing"

"Sue was always supportive, organised and helpful right from my very early days of joining the WMSoc"

"Sue was the mainstay of WMSoc from the very beginning. The Society would never have flourished without her total devotion – particularly in the earlier days"

Water as a global resource

Caroline Summers, Myriad Compliance Ltd

When many of us think of our planet and the environment we think of the rising sea levels and increasing warmer temperatures. Most believe this to be a pressing issue concerning us all and realise the need to focus on planning for a different future.

This article will address the way in which we manage water as a resource through changing our behaviour, and how the industry will need to adapt to this challenging situation for water supply and the removal of contaminants in waste water.

Traditionally most countries collect fresh water through the water cycle, i.e. rainwater running into rivers, lakes etc. With warmer temperatures being reached for longer periods during the summer and humidity levels too low, the earth is drying out. The good news is that water is a finite resource, but instead of harvesting rainwater we will increase the use of desalination from the oceans and recycle wastewater from sewerage water, both of which are more complex and expensive operations.

The demand for domestic water supply has doubled since the 1960s due to the rising population, while the agricultural industry still demands the largest percentage of water in order to keep up with food supply (World Resources Inst).

The cost of producing clean and safe drinking water with the removal of contaminants in wastewater is rising. A quarter of the world's countries are facing high water stress where 80% of the available water is consumed, in particular South Africa, India and Italy with the Middle East and Northern Africa being the highest regions. (Water Resources Institute 2020) These areas are naturally more dry being so close to the equator.

In the South West of America, the Colorado River supplies 40 million people serving numerous farms and has recently reported a 20% reduction in the flow to outreaching reservoirs during the last century. These are providing freshwater and hydropower to homes and have been impacted by the decrease in rainfall and snow to supply the river while warmer temperatures have added significantly to its reduced flow. (Advancing Earth and Space Science 2014).

With demand overshadowing supply the need to drill for groundwater has been brought to the forefront to replenish supply. During the period 2004 -2013 the water drilled under the ground accounted for 50 km^3 of the 65 km^3 freshwater loss (Advancing Earth and Space Science 2014). There will be a greater focus on recycling water as the demand for freshwater increases. However there is always the risk of pollution. Pollution in freshwater consists of bacteria, organic matter, chemicals and salts and 80% of wastewater today goes untreated (UN Tackling global water pollution 2019).

In 2016 an assessment in Latin America, Africa and Asia exposed severe bacterial pollution in one in three of its rivers, one in seven had severe organic material and one in ten had severe salinity content (UN Tackling global water pollution 2019). There is a higher economic cost to treating water this way but our attitude to conserving water needs to change to recognise it as an essential natural resource that we need to survive.

Back in the UK and during the 'big stink' in London 1858 Sir Joseph Bazelgette was responsible for the creation of a brick Victorian sewerage system. The system could cope with 4 million people but due to huge present demand the sewer currently overflows into the Thames when it rains.

The Thames Tideway Tunnel which is a new 25 km super sewer system has reached the half way point of completion; hopefully completion in 2024 will replace the system currently in place. The project runs from the west to the east of London.

Ammonia and bacteria levels are affecting the river ecology by disrupting the balance between plant and animal life. The reduction of oxygen reduces fish population and bacteria levels can cause disease. There has been significant green space created and regenerated along the Thames during the project to counteract this issue. By this time you may ask how much this is costing? Well, £3.8 billion will be needed to complete the project, whilst another £1.1 billion was allocated for preparation work. All thanks to Thames Water customers.

So, in the future there needs to be less reliance on rainwater supplies and more consideration put into rethinking the ways to recycle water supplies to an increasing global population.

Resources

World Resources Institute 2020
www.wri.org/blog/2020/02/growth-domestic-water-use

Advancing Earth and Space Science 2014
agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2014GL061055

UN Tackling global water pollution 2019
www.unenvironment.org/explore-topics/water/what-we-do/tackling-global-water-pollution

Advancing Earth and Space Science 2017
news.agu.org/press-release/colorado-river-flows-will-keep-shrinking-as-climate-warms/

PipeLine

Colin Brown, WMSoc Chairman

2020, An interesting year!

I think it is safe to say that 2020 is not playing out quite as we all expected. As with so many of us, our plans at the Water Management Society have had to become flexible and change due to the restrictions put in place by our government to keep us all safe. That being said, we are all still working in the background to provide you with a number of services that you rely on and are still planning events and training for later in the year when we all hope that life will be that little bit more normal.

With regards to our events program, I know that many of you were disappointed when our spring event was postponed. We have now taken the difficult decision to also delay our AGM planned for June, and to hold only one event this year. This event, which will be branded "20:20 Vision for the Future, and Learning from the Past", will be held in Manchester on the 25th September and will commence with our AGM, followed by an interesting line-up of presentations from across the industry.

I will be ending my tenure as chairman at this event, a little later than originally planned, and passing the baton to Ian Kershaw. It would be lovely to see as many of you as possible at this event, and we have delayed the AGM to allow as many of our members who may be self-isolating at the current time to be able to join us. One of the key orders of business at the AGM will be the nominations to WMSoc Council. Every year one third of the total number of ordinary members of WMSoc Council retire, normally on the basis of length of service, and may make themselves available for re-election at the annual AGM. However, Council is always looking for fresh input, and if you have the time and dedication to attend meetings every 2 months at the WMSoc offices in Fazeley, Tamworth*, we encourage you to apply. It should be noted that Council attendance is expected and monitored, and membership of Council is on a voluntary unpaid basis. Whatever is discussed during these meetings will remain confidential.

Council members are expected to contribute to and join sub committees wherever possible e.g. Technical, Events, Membership, Waterline, Training. Where appropriate the sub-committee meetings will be conducted by WebEx Conference Call or occasional face-to-face meetings to maximise productivity whilst minimising disruption to your professional commitments. You should have already received your council nomination form for this year and if you have any questions or would like to apply, please contact Water Management Society secretariat on *01827 289 558*.

Next year we hope to be able to return with three events delivered around the country, and we are always on the look-out for interesting presentations and speakers. If you have any suggestions or ideas of topics you would like to see covered in future WMSoc events please get in touch.

As a member of the Water Management Society I am sure you are already aware of our range of unique resources which are offered to help members develop core skills, enhance proficiency, and help towards continuing professional development in relevant fields. Perhaps you have more time to make use of these resources than normally, and they include many technical documents which have been updated by our technical committee this year with the inclusion of toolbox talks to give overviews of key elements of water management. To download these documents simply login to the members area and take a look, and whilst you are there please check that the contact details we have for you are up to date, to ensure you continue to receive Waterline and email updates from us efficiently.

As you can imagine we are keen to offer these valuable resources to an expanded audience. If you know of any colleagues or clients who you feel would benefit from our technical expertise, advice and practical training to strengthen their careers and become part of our great network of water management professionals please do encourage them to apply online to become a WMSoc member at **www.wmsoc.org.uk** or contact us on *01827 289 558* or **membership@wmsoc.org.uk**.

One of the Water Management Society's other core activities is training and by offering non-commercial and unbiased training with expert tutors at Fazeley, Tamworth, we aim to raise standards within the water industry. For those not in the Fazeley area we have the possibility for our tutors to come to you to offer the same level of training at your site. Don't forget that training should be refreshed every 3 years to ensure you keep your expertise up to date. Please see the back page for a comprehensive list of our training courses, although these dates may be subject to change as this unprecedented situation continues to evolve.

And finally, to Waterline. We hope that you enjoy this issue and find the articles inspiring and educational and maybe even controversial. If you have any water management related, non-commercial, articles, please send them to **waterline@wmsoc.org.uk** for inclusion in a future edition. To advertise in Waterline please contact us on *01827 289 558*.

We are looking forward to seeing as many of you as possible attending our event this year. Learning, networking and continuing your professional development; we encourage you to continue interacting with us to ensure that we meet the needs of your membership. We are here to serve you as a community so please get in touch.

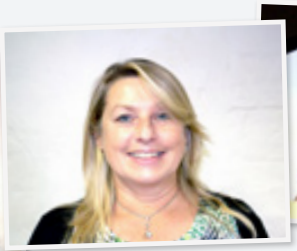
Colin Brown, WMSoc Chairman

***The WMSoc council is currently observing the self-isolating recommendations from the government and holding virtual meetings wherever possible.**

Some of our WMSoc Training Tutors

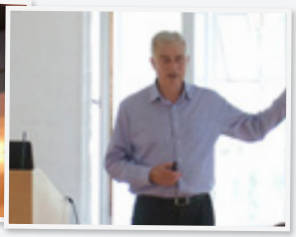
David Bebbington

Simon Hughes



Elise Maynard

Matt Morse



John Newbold

SAMPLE MATRIX TYPES - WHY DOES IT MATTER TO ME?

Nick Barsby, ADEY

What's a matrix type?
A matrix is the specific type of a sample; for instance a type of sample is a water, but this can cover a wide range of matrix types, from Drinking Water through to Untreated Sewage.

What do UKAS say?
Accredited organisations (laboratories) will be expected to have sufficient validation data to demonstrate the capability of the method for the matrices detailed on their schedule of accreditation. Prior to the testing or sampling, and during contract review, the accredited organisation (laboratory) should establish that their methods/validation data match those for the specified matrix to be tested and are suitable for their customers' specific requirements.

What are the UKAS Sample Matrix Types?
In May 2019 UKAS produced an updated list of sample matrix types that laboratories can claim accreditation against, these are:

Healthcare Water	Treated Sewage	Land Leachate
Process Water	Untreated Sewage	Prepared Leachate
Recreational Water	Ground Water	Surface Water
Drinking Water		

Do I need to tell the laboratory my sample matrix?
Yes! The matrix is a critical part of the sample submission and testing process. This should be clarified at the quotation stage to ensure that the laboratory can process the samples, or find an appropriate subcontractor (if applicable).

Why is it important?
Matrix type is important for numerous reasons.

First and foremost, your laboratory is accredited against certain matrix types within a sample type. If you send a sample to a laboratory outside of their accreditation approval their ability to analyse the sample could come into question.

When a laboratory performs a validation study for their UKAS accreditation they do this against specific matrix types and as part of this UKAS submission the laboratory provide precision, bias and uncertainty of measurement data. This forms part of the accreditation process.

If a laboratory were to process a Treated Sewage sample on a Drinking Water method it would have significant implications on the original sample and could lead to damage to the analytical instrument, carryover contamination or breaches of Quality Control data.

What happens if I submit a sample matrix that's not accredited?
If you submit a sample to a laboratory with a matrix that they are not accredited for then your test result will not hold UKAS accreditation. The laboratory could still provide a result for this matrix type, but the accuracy of this result could be affected.

Why are UKAS introducing Sample Matrix Types?
Laboratories have always had specific methods for specific tests and types of samples. The labs have also held accreditation against certain matrices. The change to customer requirements on matrix type has been driven to improve the end user's data set.

In the past a laboratory could have attained UKAS accreditation for Legionella on a Drinking Water and claimed UKAS accreditation for a wide range of Water types; even if the method was not fit for purpose. Now, with Sample Matrix level accreditation and reporting, labs can only claim accreditation against sample matrix types they have been validated against.

The change means that end users can have greater confidence in the data that the analytical laboratory provides, even if it does place an additional burden on the Water Treatment company.

When did sample matrix types become important to UKAS?
Every year UKAS audit the laboratory and review how they are performing against the ISO 17025 standard. As part of the 2017 update to the ISO it's now even more critical to make sure that clients of laboratories understand the implications of applying the right test to the right type of matrix.

UKAS issued a proposed set of sample matrix types in June 2014 through a Technical Guidance Bulletin; from this point all laboratories had a reference point to "standard" water matrix types. This Guidance has been revised in May 2019 with the addition of a Healthcare matrix for hospital specific tests, such as Dialysate Waters, Endoscope waters and the like.

How do I know what Matrix type my sample is?

UKAS have provided a useful reference guide to sample matrix types that can be found below; if you are unsure about the classification of your matrix type then speak to your laboratory before submitting samples.

Water Matrix	UKAS Matrix Synopsis	Example
Healthcare Water	Water that serves in any level of the provision of healthcare where particular requirements beyond the basic need for wholesomeness are necessary.	Dialysate Water
Recreational Water	Water used for recreational purposes. Can be split into two discrete sectors – Man made or Natural.	Swimming Pool
Process Water	Water that serves in any level of an industrial/manufacturing process, with the difference from trade effluents being that they are not discharged to a wastewater system.	Cooling Towers
Saline Water	Water that contains a significant concentration of dissolved salts.	Sea Waters
Trade Effluent	Liquids discharged to the wastewater system from industrial processes and ultimately to either controlled waters or to sewer.	Production Facilities
Untreated Sewage	Liquid waste from domestic or industrial establishments that is carried away in sewers or drains for dumping or for treatment to convert it into a form that is not toxic.	Crude Sewage
Treated Sewage	Liquid sewage that has been remediated prior to discharge.	Treated Effluent
Prepared Leachate	Leachate that has been prepared by the laboratory.	WAC Leachate
Land Leachate	These types can often be extremely contaminated, coloured and malodourous and are often some of the most challenging water matrices to analyse due to the complexity of their composition.	Landfill Leachate
Drinking Water	Water of sufficiently high quality (wholesome) that it can be consumed or used without risk of immediate or long-term harm.	Regulated Tap Water
Surface Water	Water which is open to the atmosphere and subject to surface runoff. Water that runs across the top of soil or bedrock without infiltrating through either material.	River Water
Ground Water	Water that does not run off, and is not taken up by plants, but soaks down beneath the ground surface into soil pore spaces and ultimately into the fractures of rock formations.	Borehole Water

GAIN A CPD POINT BY ANSWERING THESE QUESTIONS ON THIS ARTICLE

Q1: What does UKAS stand for?

Q2: When was the UKAS Guidance on Sample Matrices last updated?

Q3: What are examples of Healthcare Waters?

Q4: How often do UKAS visit laboratories to review their performance against ISO 17025?

Q5: How many water matrix types are there as of May 2019?

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

The answers will be published in the Summer 2020 edition. Extra CPD points will be awarded to members who provide extra research and/or evidence and to those members whose answers are accepted for publication in Waterline.

1 cpd point

NEW members

Since the last edition of Waterline was printed the WMSoc has received 35 new membership applications from the following sectors of the industry:
Water Hygiene – 13, **Water Treatment** – 11, **Utility** – 1, **Manufacturer** – 2, **Consultancy** – 3, **Building Services** – 1, **Laboratory** – 1, **Local Authority** – 2, **Healthcare** – 1.

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Waterscan

NEWS FROM THE WHOLE FIELD OF WATER AND ITS EFFECTIVE MANAGEMENT

Florida Keys residents fear rising sea levels

By 2045, the sea level in the Florida Keys will rise 15 inches, according to a projection by the U.S. Army Corps of Engineers. As a result, the city of Key West, for example, would see more than 300 tidal flooding events per year.

The flooding that currently wreaks periodic havoc on the city's small business hubs would occur regularly. Key West already suffers from flooding during extreme high tides, with water washing into streets, businesses, and homes, particularly when those tides combine with rainfall.

The flooding will worsen as the sea level rises, threatening the county's primary economic driver: a $2.2 billion tourism industry that attracts almost 3 million people to the Keys each year. Moreover, the intrusion of salt water that can accompany rising sea levels threatens the region's unique ecosystems and the Keys' primary freshwater supply. And storms riding on higher seas can flood larger areas, putting more residential and commercial property at risk.

Officials in Munroe County carried out a study to see how the 311 miles of road that the County is responsible for, would be affected. It found that the cost of keeping just one three-mile stretch dry by 2045 would top £98m. The county has balked at the cost. Officials are considering a boat service for those who wish to remain but have predicted that 36% of the population could be displaced by 2060.

Egypt and Ethiopia reach agreement on River Nile dam

Ethiopia and Egypt say they have reached an agreement on a key aspect of the vast dam that Ethiopia is building on the River Nile.

There have long been fears that The Grand Ethiopian Renaissance Dam - Africa's biggest hydro-electric project - due to begin operation later this year, could spark a war with downstream states Egypt and Sudan who are afraid it will reduce their water supplies.

Few details have emerged from the latest round of talks in Washington, but both Ethiopia and Egypt said that basic agreement had been reached on the filling process. Egypt has long pressed for the dam to be filled gradually over several years in order not to jeopardise the water flow that is vital to its economy.

A joint statement said that the final agreement could be signed in February, but that has now been delayed.

A salvaged 15th Century ship has "significant potential" to do for Wales what the Mary Rose did for Portsmouth, an archaeologist says

One of the men who is restoring it said it will be the world's largest ancient ship rebuild project. Toby Jones, project curator for the Newport Mediaeval Ship project, said 2,500 timber pieces had to be restored before the ship could be rebuilt and put on show.

The team working on it say they hope it could finally be put on public display by 2025. They estimate it could attract up to 150,000 visitors a year to Newport, boosting the south Wales economy by £7m a year. Mr Jones said: "The Mary Rose is the world's 16th Century ship, the Vasa in Sweden is the world's 17th Century ship - Newport will be the world's 15th Century ship. Newport will be in that top level of important ships on display around the world. There'll be nothing else like it in the world. The Mary Rose and Vasa were never taken apart, they were conserved and put on display whole - we have the largest ship that has ever been attempted to be put back together."

It is 18 years since builders discovered the remains of the ship in the banks of the River Usk. Historians believe the Basque country-built vessel, launched around 1449, was involved in the wine trade between Portugal, the Iberian Peninsula and Bristol. It is thought the 30m long, 400 tonne medium-sized boat was having a refit in a Newport inlet between 1468 and 1469 when its moorings broke. A lot of the oak planks and iron were salvaged before the tide hid the stricken ship, but a third of the ship succumbed to its muddy grave.

Archaeologists have been focused on preservation in the 18 years since the ship was unearthed but now their attentions are turning to reassembly. "We think we could start reassembly in three or four years," said Dr Jones. "There's no book to follow so we'll have to make it up and hope it works."

Historians can only begin putting the ship back together when a home is found due to the size of the reassembly project. Newport Museum in the city's shopping centre is a possible option but no final decision by Newport council has been made.

The 27th January 2020 was Thomas Crapper Day

The Plumbers Company celebrated the 110 years anniversary of his death, on this day, and published a short biography of the man whose name makes people smile.

Thomas Crapper was born in 1836 in Thorne, in Yorkshire. Sometime between 1851 and 1860, Thomas made his way to London and during this period was trained to become a qualified plumber by his older brother George Green Crapper who had established himself earlier. By 1866 Thomas had premises called Marlborough Works in Chelsea and also by the early 1870s, Thomas was trading as Thomas Crapper and Company as a Plumber and Brass founder.

By the 1880s, Crapper & Co.'s reputation was such that it was invited to supply the Prince of Wales (later Edward VII) at Sandringham, Windsor Castle, Buckingham Palace and Westminster Abbey with sanitary ware and services. The company remained by Royal Appointment to Edward when he became King and was also warranted by George V, as Prince of Wales and once again as King.

In 1904, at the age of 68, Thomas decided to retire and passed the firm on to both his nephew George Crapper, a plumber and his business partner Robert Marr Wharam. On 27th January 1910, Thomas Crapper died aged 73. Various incarnations of the Thomas Crapper & Co business have existed since this time, and it is still going strong and is now based in Huddersfield, West Yorkshire.

It is a widely-held belief that Thomas Crapper designed the first flush toilet in the 1860s. It was actually 300 years earlier, during the 16th century, that Europe discovered modern sanitation. The credit for inventing the flush toilet goes to Sir John Harrington, godson of Elizabeth I, who invented a water closet with a raised cistern and a small downpipe through which water ran to flush the waste in 1592. He built one for himself and one for his godmother; sadly, his invention was ignored for almost 200 years: it was not until 1775 that Alexander Cummings, a watchmaker, developed the S-shaped pipe under the toilet basin to keep out the foul sewer odours.

Latest news on gender neutral toilets

Gender-neutral bathrooms should be scrapped because they make women feel "uncomfortable", a peer has claimed. Speaking at a House of Lords debate, Lord Lucas argued that single-sex facilities were safer for women and described the unisex lavatories in the Department for Education's Westminster offices as "deeply unpleasant." He added: "What is the justification for making women feel unsafe, where now they feel safe?"

"Some institutions have converted their ladies and gents communal toilet facilities to gender-neutral. Others have converted changing rooms similarly. Is this desirable or justified? What research as to people's needs is it based on? Has anyone – and women in particular – been consulted?"

Lord Lucas went on to argue that the gender-neutral facilities disadvantage women who do not, for reasons of discomfort or religion, "wish to find themselves in an enclosed, unobserved space with men." He continued: "There are a number of very strange men in this world; I think it entirely reasonable for women to want a separate space."

The peer blamed a culture of "wokeness" for the introduction of unisex toilets at places such as the Old Vic theatre in London, which recently converted all of its male and female lavatories to gender-neutral toilets.

Meanwhile schools have been warned by the Crown Prosecution Service that they could face legal action if they fail to allow transgender pupils to use the lavatory or changing room of their choice. Following draft guidance from the Equality and Human Rights Commission schools have introduced gender neutral lavatories in recent years, but some schools then had to reverse the decision following a backlash from parents, action that might be open to legal challenge.

Editor: For the older reader "wokeness" is a state of being aware, especially of social problems such as racism and inequality.

Naked swimming sessions cancelled at sports centre without consultation, say naturists

Swimmers who stripped off once a month at Alton Sports Centre have been told a new replacement building cannot host the sessions as its pool is overlooked. East Hampshire District Council, which owns the building, said the naturists had been invited "to share their views during the planning process". Everyone Active, which manages the facility, has apologised to those affected.

A naturist who had attended the sessions for the past three years with a group of about 34 others, said those who had attended the final session; "were very dismayed indeed" by the decision. He accused the centre's management of "not engaging with or discussing the issue in any way with the naturist users of the sports centre during the construction of the replacement building".

The council issued a later statement which said: "Whilst we haven't consulted with the naturist group directly, they were given the opportunity to share their views during the planning process. We held a number of public forums during the consultation which the general public and local clubs were invited to attend."

An Everyone Active spokesman, David Lowe, said; "The new centre has been built to Sport England specification in such a way to showcase all areas of the building," He added the sessions had to be cancelled as the new building included "a substantial amount of glazing", including "floor to ceiling" windows along two sides of the main pool, making it visible from the cafe, reception, climbing and soft play areas.

"Efforts were made to source alternative venues and the club are still welcome to utilise all facilities at the new Alton Sports Centre, including swim sessions under our company clothing policy," he continued.

Australia culls five thousand camels to save vital water supplies

A five-day cull in January resulted in 5,000 camel deaths, as Aboriginal communities in the region reported large groups of camels damaging towns and buildings. "They are roaming the streets looking for water. We are worried about the safety of the young children", says Marita Baker, who lives in the community of Kanypi.

Camels aren't native to Australia - they were brought over by British settlers from India, Afghanistan and the Middle East in the 19th century. Estimates of numbers of camels vary but there are thought to be around six hundred thousand of them across the central parts of the country. They can damage fences, farm equipment and settlements, and also drink water which is needed by people who live there. They also emit methane, a greenhouse gas which contributes to climate change.

The slaughter took place in the area of Anangu Pitjantjatjara Yankunytjatjara (APY) - a sparsely-populated part of South Australia which is home to a number of indigenous groups.

"There is extreme pressure on remote Aboriginal communities in the APY lands and their pastoral (livestock) operations as the camels search for water," says APY's general manager Richard King. "Given ongoing dry conditions and the large camel congregations threatening all of the main APY communities and infrastructure, immediate camel control was needed," he added.

Pyrenees glaciers to disappear by 2050

Glaciers will vanish from the Pyrenees mountain range within the next 30 years because of climate change and pollution, scientists have warned. Glaciers have already shrunk by half in the past 20 years in the mountains on the border between France and Spain, according to a new report by scientists who monitor them for the local environmental group Moraine. "Pyrenean glaciers are doomed," said Pierre René, an expert on glaciers. Mr René said it was impossible to give an exact date for their disappearance, but predicted that it would happen by 2050.

The glaciers feed rivers and contribute to biodiversity. Their ice also helps keep mountainsides stable. "We are seeing the disappearance of the symbol of the Pyrenean landscape in the high mountains," Mr René said. He added that mountainsides may begin to crumble without the "cementing effect" of glacier ice, making climbing and hill walking more dangerous.

The report by the group, which has measured the length, surface area and thickness of nine of the 15 glaciers in the French Pyrenees for 18 years, says they are now shrinking at an annual rate of 3.6 hectares (nearly 8.9 acres). The surface area of the nine glaciers now totals 79 hectares (195 acres) compared with 140 hectares (346 acres) 17 years ago.

Greece plans to build sea barrier off Lesbos to deter migrants

The Greek government has been criticised after announcing it will build a floating barrier to deter thousands of people from making often perilous sea journeys from Turkey to the Aegean islands on Europe's periphery. The administration unveiled the measure on 30th January, following its pledge to take a tougher stance on undocumented migrants accessing the country.

A 2.7km-long netted barrier will be erected off Lesbos, the island that shot to prominence at the height of the Syrian civil war when close to a million Europe-bound refugees landed on its beaches. The barrier will rise from pylons 20 inches above sea level and will be equipped with flashing lights to demarcate Greece's sea borders.

Amnesty International slammed the plan, warning it would enhance the dangers asylum-seekers and refugees encountered as they attempted to seek safety. "This proposal marks an alarming escalation in the Greek government's ongoing efforts to make it as difficult as possible for asylum-seekers and refugees to arrive on its shores," said Massimo Moratti, the group's Research Director for Europe.

Nearly 60,000 migrants reached Samos, Lesbos and Chios in 2019, double the numbers recorded in 2018. This has led to severe overcrowding in migrant camps on the island. The Greek Prime Minister has called on the other EU countries to help deal with this latest crisis, as they did when the migration crisis started in 2015. However populist movements have made mass immigration a 'toxic' subject for political parties within the EU, particularly in those countries due to elect new governments in 2020.

Bamboo loo paper in the Amazon top 10 for 2019

Chris Forbes, from Perth, Scotland, founded The Cheeky Panda with wife Julie Chen in 2016 after seeing bamboo being harvested on a visit to her parents in China. They discovered the 100% sustainable crop could produce toilet roll boasting 65% less carbon than rivals.

Launched with a £10,000 start-up from friends and family, the product has become an eco-friendly, must have, hot product, after it appeared on the Amazon top 10 sales list of the year for the first time in 2019.

Chris said: "We knew we wanted to launch a green business, and bamboo gave Julie the idea that became The Cheeky Panda. Bamboo grows so quickly, around a metre a day, and it needs to be harvested every year so the impact on the environment is minimal. It was mad that we have the most sustainable plant on the planet and yet it isn't being used for tissues so we thought we would do something about it."

The Cheeky Panda range includes bamboo toilet tissue, facial tissues, kitchen towels, pocket tissue and baby wipes. All packaging is either biodegradable or recyclable. The firm also has a completely plastic-free subscribe-and- save option available via the website.

Because bamboo is hypoallergenic (unlikely to cause an allergic reaction) the lavatory rolls are being tested in an NHS hospital in the hope it could reduce infections. Bamboo tissues are available from other suppliers.

Derry Eden Project

A Northern Ireland version of the Eden Project's Cornish visitor attraction could open by summer of 2023, the team behind the plans has said. The £67m Eden Project Foyle includes walled gardens, tree-top and floating walkways and a water activity centre on a 250 acre site on the banks of the River Foyle.

The Eden Project is now looking to secure funding for the Derry project. Organisers say construction would begin within 18 months if funding is secured.

The team behind the project - Eden Project International and Foyle River Garden, a charitable trust that will own and operate it - say the project would create around 170 jobs and support a further 2,000 plus jobs locally when open. They say it will be "a beacon of cultural tourism and a community asset helping to drive social, economic and environmental regeneration" and estimate it to be worth £62m to the local economy annually.

Neanderthals liked to be 'beside the seaside'

Findings from the Grotta del Moscerini cave, near a beach in central Italy, suggest that Neanderthals enjoyed spending time at the beach, and may have dived into the Mediterranean Sea to gather Clam shells for use as tools. They also collected volcanic rock from the beach and coastal waters.

It was already known that these ancient humans used tools, but knowledge of their ability to utilise coastal resources was less clear.

Scientists examined 171 modified shells, most of which had been worked on to be used as scrapers. Nearly three-quarters of the shell tools had opaque and abraded exteriors, in keeping with what you would expect to see in shells that had been washed up on a sandy beach. However the remaining shells had shiny, smooth exteriors and were slightly bigger. They appear to have been plucked directly from the sea floor as live creatures.

Researchers say the findings join a growing list of evidence that Neanderthals in Western Europe were in the practice of wading or diving into coastal waters to collect resources long before the appearance of Homo sapiens who continued and expanded this activity.

Tiny sea creature shells shrink by up to 75%, since 1870s

The shells of tiny sea creatures are shrinking in acidic oceans caused by climate change, the National History Museum (NHM) has discovered, after comparing specimens from a 150-year-old expedition.

The Challenger Expedition, which circumnavigated the globe between 1872 and 1876, was the first oceanography mission ever undertaken, discovering 4,700 new species and carrying out the first large scale bottom dredges, water trawls and water temperature measurements.

Specimens brought back from the voyage were housed at London's Natural History Museum (NHM) and scientists have compared old samples of single-celled organisms called foraminifera, to the same species living in the same area today. The tiny creatures, which are an important component of plankton, were found to have shells that were up to 76% thinner than those collected in the Victorian era.

Scientists believe this is happening because oceans continue to become more acidic as they soak up carbon dioxide from the air. Dr. Stephen Stukins, senior curator of micropalaeontology at the NHM said: "It is not about the shells being dissolved but that the creatures are struggling to build them (in the first place). This will affect the larger creatures that consume this plankton and the predators that feed on them".

Deaths after Russian hotel flooded by boiling water

At least five people including a child died in the Russian city of Perm when a broken heating pipe flooded their hotel rooms with scalding water, investigators said.

The accident happened on 20th January in a small private hotel in the basement of a block of flats in the industrial city in the Urals region. "At least five people died and a further three were taken to hospital with burns," said the Investigative Committee, which looks into major incidents.

Those who died were all staying at the Karamel hotel, which has five single and double rooms, according to its website. The hotel did not have an emergency exit while the water pipe that burst dated to 1962, the building's managing company said.

Hot water is piped under streets at a high temperature to supply homes in Russia and when these pipes burst, the scalding water and steam can cause fatal accidents, with cars sometimes plunging into holes that open up in roads. Investigators have opened a criminal investigation into the alleged provision of dangerous services to consumers.

Oleg Melnichenko, a Russian lawmaker, said in light of the deaths the parliament should consider a ban on hotels or hostels in basements.

Moscow resorts to fake snow in warmest December since 1886

Moscow was so warm in December 2019 that the government had to resort to sending trucks filled with artificial snow to decorate a new-year display in the city centre. Videos of the delivery for a snowboarding hill went viral as observers noted the irony of bringing snow to a city that spends millions each year on its removal.

The Moscow region is in the throes of one of its warmest winters since temperatures began to be systematically recorded 140 years ago. The temperature in the Russian capital rose to 5.4C on 18 December, topping the previous record for the month set in 1886. Moscow was six degrees warmer in December 2019 relative to the monthly long term average for December. At new-year, parks and forests were snowless and empty, without the usual cross-country skiers riding in the woods or children sledding down snowy slopes.

Concerns are growing about the effects of global warming on Russia. Permafrost under the country's northern towns is slowly melting, and receding Arctic ice is driving hungry polar bears to forage in urban areas. The thaw in the northern permafrost has even set off a "gold rush" for mammoth ivory by making the tusks previously buried in ice more accessible to prospectors.

The day of the robot frog

The world's first living robots have been created using stem cells from frog embryos, or as scientists are calling; an 'entirely new life-form.' The embryo cells are taken from the *Xenopus laevis* frog, leading to the little bots being dubbed "xenobots." These millimetre-wide "xenobots" can move toward a target, perhaps pick up a payload (like a medicine that needs to be carried to a specific place inside a patient) -- and heal themselves after being cut.

Researchers are hoping that at some time in the future they could be programmed to move through human arteries and scrape away plaque, or swim through oceans removing toxic microplastic. In theory, because they are alive, they can replicate and repair themselves if damaged.

Dr Joshua Bongard, at the University of Vermont, said: "It's a new class of artefact: a living programmable organism."

Research results have been published in the *Proceedings of the National Academy of Sciences*.

Swimming pool scaffolding down after 17 years

A historic swimming pool can be seen without scaffolding for the first time in almost two decades after costly roof repairs were finally finished. Moseley Road Baths, which first opened in 1907, is the oldest of Britain's five Grade II listed swimming baths. Fixing the roof at the Birmingham baths cost more than £800,000.

The Gala Pool area will serve as an arts venue while its long-term future is considered, Historic England said. A second pool is still used for swimming. Historic England approved a grant of more than £700,000 and the building's owner, Birmingham City Council, provided £100,000. With the roof repairs completed, work can start on restoring other parts of the Gala Pool's infrastructure, including the balcony area, alongside ongoing repairs and maintenance elsewhere in the building.

Now it is weatherproof, events and fundraising activities could take place while a permanent use and further funding are being sought. They are the only baths in the country built before 1914 to have continuously hosted swimming since they opened, said Historic England.

There were originally three entrances to Moseley Road Baths dividing visitors into men's first or second class washing baths and swimming pools, with a third entrance to the women's washing baths. It was several years before women were allowed to swim and the pools were then segregated with a men's side and a women's side. When it opened, water in the pools was not heated and one pool was boarded over during winter and used for dances, concerts and social clubs. Rare fixtures and fittings are still intact, including an almost complete set of 46 private washing rooms. The washing baths, or "slipper baths" as they were known, were still being used until October 2004.

Wreck of the Titanic hit by submarine

A court has heard that the wreck of the Titanic was struck by a submarine last year - information kept secret by the US government.

New legal papers produced in January reveal that the remains of the Harland & Wolff-constructed passenger liner, which lies on the floor of the Atlantic Ocean in two pieces, was hit by an underwater vehicle hired by a British Company.

Adventure firm EYOS Expeditions, based in the Isle of Man, took a group of scientists from Newcastle University to the site of the Belfast-built ship's final resting place last July. It has emerged that during the trip, their £27m two-man Triton submarine made contact with the wreck after the pilot lost control due to "intense and highly unpredictable currents".

The Titanic sank after hitting an iceberg on its maiden voyage in 1912, with the loss of over 1,500 lives. Dozens of expeditions to the site have been carried out since its final resting place was discovered 35 years ago.

Rob McCallum, who led the EYOS expedition, insisted that any damage caused to the wreck could only have been minor. He said: "We tried to keep away from the Titanic but we had to go close to deposit two science samples. We did accidentally make contact with the Titanic once, while we were near the starboard hull breach, a big piece of the hull that sticks out. Afterwards we observed a red rust stain on the side of the sub. But the submersible while underwater is essentially weightless - it's not a battering ram."

Last week US firm RMS Titanic Inc. revealed plans to cut open the wreck and remove the famous Marconi wireless system, known as the "voice of Titanic". The plans are fiercely opposed by US government weather agency, the National Oceanic and Atmospheric Administration (NOAA), which is responsible for protecting deep sea wrecks.

In papers filed at the District Court of Eastern Virginia, RMST allege that the NOAA knew the EYOS submarine struck the Titanic but officials failed to inform the court.

400-year-old aqueduct is London's 'best kept secret'

The New River is neither new, nor a river. Built when Shakespeare was alive, the aqueduct is Thames Water's oldest manmade asset, pre-dating some of London's more famous historic sites like Buckingham Palace and St Paul's Cathedral by decades. More than 400 years later, it remains a vital artery supplying drinking water to 700,000 Londoners.

Around a dozen people are responsible for the maintenance of the 25-mile river, which rises at Chadwell Spring in Hertford and ends at the East Reservoir at Woodberry Wetlands in Stoke Newington. It used to end at New River Head in Islington, but the route has been shortened and straightened over time. An incredible feat of early 17th Century engineering, the New River follows the contour of the Lee Valley, falling only a few centimetres as it gently meanders through rural, residential and industrial areas. Along the way it feeds into the water treatment works at Hornsey Wood and Coppermills, as well as helping to top up the King George VI and William Girling reservoirs.

The original spring provided 10 million litres a day to the capital but, as demand grew during the Industrial Revolution, this increased to 102 million litres a day when the New River was connected to the River Lea in the 1700s. That doubled in the 1800s with the construction of pumping stations to abstract water from deep wells. In addition, a series of boreholes were dug in the 1990s to enable surplus treated water to be stored in the chalk aquifer and then pumped into the New River when extra water is required.

Today the New River provides eight per cent – around 220 million litres a day – of the water London needs, and doubles as a quiet retreat for walkers and wildlife lovers. Sixty-five per cent of it is open to the public. Inner city schools are encouraged to come along and learn about wildlife. It's as close to the countryside as some of the children have ever been.

Turks and Caicos Islands' reef being ravaged

One of the largest reef systems on Earth, the Turks and Caicos Island's barrier reef, teems with wildlife like friendly wild dolphins, and attracts more than a million tourists a year. But underneath the water's stunning surface lurks a deadly disease, silently ravaging the corals which keep its denizens alive and protect the islands' pristine coastline from storms and erosion.

Stony coral tissue loss disease (SCTLD) has been dubbed the biggest threat facing the tiny British territory's marine environment, and the most virulent coral sickness the world has ever seen. "This is a serious problem, if not a crisis," says Don Stark of local NGO the TC Reef Fund (TCRF). "We've already lost many coral heads - and they're not coming back."

It is not just these islands, 600 miles (965km) south-east of Miami, that are affected. Since the disease first appeared off the Floridian coast in 2014, where it has now impacted 100,000 acres, it has made its way through the Caribbean into several countries including Jamaica, Belize, the US Virgin Islands and the Dominican Republic. Its rapid-fire spread and high mortality rate have seen it wipe out some of the region's most important reef-building corals, sparking additional fears for tourism and those who rely on the ocean for a living.

The disease is treatable but treatments are labour intensive. For its part, the government says it is "seriously weighing the best course of action". A spokesman said authorities were consulting international experts on the ramifications of putting antibiotics in the water. The malady typically appears as small patches of white exposed skeleton and is recognisable by its breakneck contagion, usually killing corals within weeks of them becoming infected.

Desalinated water to be sold as a health drink

Seas are expected to become increasingly important sources of freshwater in the future. Already there are around 18,000 desalination plants producing potable water globally, with around half of all desalted water being produced in the Middle East and North Africa.
Now a company based in the French Riviera, Ocean Fresh Water, plans to produce 750,000 bottles of desalinated seawater per week and market it as a health drink in Europe, Japan and China. It is said to contain 78 "marine minerals" and could be the next health craze. However, there is concern over its production method in terms of environmental issues such as greenhouse gas emissions and briny wastewater, as can be generated by desalination plants. Currently mineral waters are derived mainly from underground sources or springs without need for desalination.
Ocean Fresh Water plans to pump water from 300m below the surface to a ship, *Odeep One*, where the water will be desalinated 'using a technology that will preserve its nutrients,' and then bottled on board. After 6 months operation in the Mediterranean processing water for the European market, the ship will relocate to the Philippines coast to produce water for the Asian market.

Call for Scottish water trawler ban

Campaigners are calling for a ban on fishing by trawler within three miles of Scotland, to replenish fish stocks. Any change in the law would have an impact on boats that trawl for langoustine or dredge for scallops near to the shore, but the campaigners say that ultimately it will lead to more employment opportunities and an increase in fish stocks.
The campaigners are a consortium known as the Open Seas coalition. The group includes angling bodies, eco-tourism firms, scallop divers, coastal communities and salmon conservation boards. If enacted, the ban would protect some 18,000km of mainland and island coastline and 13,790 sq. km of sea.
This action is broadly supported by the National Trust for Scotland. Stuart Brooks, the trust's head of conservation and policy, said there should be a restriction of all mechanised fishing within that coastal zone, except for places where there was sufficient evidence inshore fishing was safe. "Fundamentally, it's about the sustainability of our fisheries, and the people and wildlife that depend on them," he said. "Marine tourism now employed more people than fishing", he added.
The Open Seas coalition cites an expert study for the Scottish government that said a three-mile closure could produce up to 2,707 extra jobs after 20 years, and at least £1bn of additional income, because it would boost fish stocks and other industries.

Atmospheric rivers blamed for UK's torrential rains

Britain is being deluged by "atmospheric rivers" delivered on the jet stream, the Met Office has said. These 'rivers' are long streams of vapour up to 300 miles wide, blowing in from the west and dumping extraordinary volumes of water on the UK.
Experts believe the west-east band of high-altitude winds was pointed directly at the UK in February for the first time in years, enabling a "conveyor belt" of non-stop rain. This phenomenon can be exacerbated by relatively mild temperatures that force extra moisture into the air.
It can create streams of airborne water vapour approaching across the Atlantic before condensing into heavy rain as they hit hilly parts of Britain.
Meteorologists are warning that the UK is likely to face increasingly severe flooding as a result of these atmospheric rivers in the future, as climate change takes hold.

Trawler ban to protect kelp forests

A campaign to restore a large underwater kelp forest has been helped by an agreement to ban trawler fishing off the West Sussex coast. A new bylaw, passed in January by the Sussex Inshore Fisheries and Conservation Authority, will exclude trawling from a 117 sq. mile area, agreed by the Sussex Inshore Fisheries and Conservation Authority.
The kelp rewilding project seeks to recreate sea life habitats, an aim supported by Sir David Attenborough. The bylaw will now go to the Environment Secretary for approval.
Forests of kelp once stretched along 25 miles of the West Sussex coastline from Selsey to Shoreham, and extended at least 2.5 miles seaward. The kelp forest provided habitat, nursery and feeding grounds for seahorses, cuttlefish, lobster, sea bream and bass. It also locked up huge quantities of carbon, improved water quality and reduced coastal erosion by absorbing the power of ocean waves, campaigners said. They added that the kelp had been ripped from the seabed by dragging nets from trawling vessels.
The Help Our Kelp partnership, comprising the Blue Marine Foundation, Marine Conservation Society, Sussex Wildlife Trust and Big Wave Productions, said it wanted the bylaw to be signed off quickly before another year of trawler damage. Charles Clover, executive director of the Blue Marine Foundation, said: "This is an initiative that tackles climate change and overfishing impacts all at once, the first of its kind in the UK. This is exactly what we need to be doing in marine habitats all over the world."
Kelp, which can grow up to 2 ft. a day, removes up to 20 times more carbon than the world's forests per acre.

Message to Russia – "We are out there"

Russian "adventurism" has increased over the last decade, said the head of the RAF, Air Chief Marshal Mike Wigston, as the first of Britain's new submarine-hunting aircraft arrived in the UK. He added that the new planes will send a strong signal to Russia that "We are out there."
The new Poseidon maritime aircraft, equipped with anti-ship missiles and torpedoes, will track hostile targets above and below the waves. The plane is the first to be delivered of nine ordered from Boeing in 2015. The aircraft can carry up to 129 sonobuoys, small detection devices which are dropped from the aircraft into the sea to search for enemy submarines. The sonobuoys relay sounds such as propellers and engines back to the aircraft, which can then deploy an array of weaponry to attack the identified target.
The primary mission of the new fleet will be to protect the UK's submarine-based nuclear deterrent and will be central to NATO missions across the North Atlantic, co-operating closely with the US and Norwegian Poseidon fleets.
One way of countering threats has been by pooling of resources between friendly nations. There is an agreement in place with Norway for Poseidon fleets to share bases and engineering expertise.
Another four aircraft will be delivered this year with the final four expected in 2021.

Brexit battle lines over fishing rights

Spain, France and the continuing EU members around the North Sea have ensured that the fishing industry has a special status in the EU negotiating mandate. Even though many other EU countries have no coast let alone a fishing fleet, they have signed up to this as well.
During the last week of February the two sides crystallised their positions. Michel Barnier, the EU's chief negotiator, put fisheries in the context of the free trade deal he wants to secure. The EU mandate emphasises the scarcity of fish and the need to manage stocks responsibly, and the sharing of data and research. On that, there's no disagreement, although the current Common Fisheries Policy has often failed to live up to those ambitions.
In short, Brussels and its member states want to see very little change, and no unilateral UK right to vary from the status quo. And the leverage? "The terms on access shall guide the conditions set out in other aspects of the economic part of the envisaged partnership". That is: access to EU markets.
The British proposal is for annual negotiations, similar to those with Norway. And Britain would, from 2021 onwards, negotiate a share-out of northern North Sea quotas directly with Norway. The UK government rejects the EU Common Fisheries Policy which calls for maintaining national shares on the historic basis as they stood in the 1970s.
EU boats licensed to fish in UK waters would have to comply with UK rules. "The UK is open to providing for the creation of a forum for co-operation on wider fisheries matters... such as data-sharing, science, control and enforcement". There would be an agreed mid-way of settling disputes, and a right to suspend the licensing agreement.

Diver killed in great white shark attack off Australia

An experienced scuba diver killed by a white shark off Western Australia's southern coast this January was at home in the ocean, his grieving wife said. Gary Johnson had just entered the water when he was attacked near Cull Island, close to West Beach in Esperance.

His partner Karen Milligan said: "We would go out diving in our boat whenever we could, most weekends. We were always aware of the risks and often told each other that if we were attacked by a shark that would just be unlucky."

Milligan said Johnson had been completely against shark culling and she still maintained that position. "If fish stocks were better protected, then the risk to people in the water would be reduced," she said.

In a social media post from November 2017, Johnson said he was often asked whether he was worried about sharks. "I personally wear a shark protection device (many don't) just because it gives me peace of mind, much like buckling up a seatbelt in the car," he wrote. "I can honestly say that in my nine years diving in Esperance (most weekends – weather permitting) I have only seen one shark – a bronze whaler who showed absolutely no interest in me."

WA fisheries minister Peter Tinley would not comment on whether Johnson had been wearing a shark protection device. "They are no different than anything else that we put around ourselves for protection, like a motorbike helmet," he told reporters. "It is not a fail-safe system, sometimes it doesn't work ... about nine out of 10 times it does work."

Water is unexpectedly disappearing from the surface of Mars

The gradual disappearance of the water happens when sunlight and chemistry turn water molecules into the hydrogen and oxygen atoms that they are made up of. When they are broken down, Mars's weak gravity is unable to keep hold of them and they disappear off into space. The speed of that process suggests that Mars could lose its water more quickly than previously thought.

The planet was once flooded with flowing water but now what water does exist is frozen in its ice caps. Though various formations on Mars show that it was once much wetter, that water was lost into space, and Mars gradually turned into the largely arid place it is today.

The new discovery is published in the journal Science. It was found using the Trace Gas Orbiter probe that was sent to the red planet on board the ExoMars mission, run by the European Space Agency and its Russian counterpart Roscosmos. Instead of staying as expected on the Martian surface, the water is being carried up in much larger than projected proportions to an altitude of more than 80km, hanging in the planet's atmosphere.

That atmosphere contains up to 100 times more water vapour than its temperature should theoretically allow and water is also much more able to escape during the planet's warm and stormy seasons, researchers found. But there is some water left on its surface, which could be key both for the discovery of life already there and the chances of humanity moving to live on Mars. While the water in the atmosphere represents only a tiny amount of the water on the planet, the researchers say it could potentially find its way into space if it floats high enough up in the atmosphere, and that could lead the planet to dry out yet further.

Killer whales swim 'remarkable' 4,000 miles from Iceland to Sicily

Conservationists have described as "remarkable" a journey made by a pod of killer whales from the icy seas off Iceland to the comparatively balmy waters around Sicily. The orcas have astounded researchers by making the epic 4,000-mile odyssey from the North Atlantic to the Mediterranean in just a few weeks. Although distributed across the globe, the species favours cold waters and sightings in the Mediterranean are rare, apart from a small population that lives around the Strait of Gibraltar. It is not known whether the pod is disorientated, simply following prey, or is on the move for some other reason. Starting their journey in November, the pod is believed to have left the coast of Iceland, swum down the east coast of Britain, through the English Channel and then past Spain and Portugal to the Strait of Gibraltar.

The five orcas were spotted off Genoa in early December, becoming local celebrities. Their dorsal fin markings were recognised by researchers in Iceland, who know the adults as Riptide, Zena, Dropi and Acquamarin. There was sadness, however, when the fifth member of the pod, a calf, died – its mother cradled it in her mouth for several days, as if trying to resuscitate it.

After lingering off the coast of Genoa for more than two weeks, the killer whales then proceeded south along Italy's Tyrrhenian coast towards Sicily, where they were spotted by fishermen in the Strait of Messina, which divides Sicily from the toe of the Italian boot.

Colorado River is drying up

The river, which provides water to more than 40 million people from Denver to Los Angeles, including Las Vegas and San Diego, and farmers and industry throughout the area, has seen its flow fall 20% since the last century.

During the past 30 years abstraction rates have continued to rise along with the rising population. US householders have historically used, by global comparison, excessive volumes of water, and their current, reduced, daily target of 100 US gallons (~380 litres) per person in Los Angeles is still three times the average per person consumption rate of 130 litres in the UK.

Now it appears that the volume of the annual snow pack that feeds the river is in decline, allowing more heat to enter the environment rather than being reflected back into space. This creates a vicious cycle of more evaporation and further reduction in available water.

Making problems more critical for the region is that the south-west of the US has been under drought conditions for much of the last two decades, with Lake Powell and Lake Mead, the two major reservoirs, barely half full.

Atlantic rowers cross ocean in wooden boat

Two British rowers have completed a 3,000-mile Atlantic Ocean crossing in a wooden boat. Phil Pugh and Paul Hopkins, of Tyneside, took 70 days to make their way from the Canary Islands to Antigua in the Atlantic Dream Challenge. Dozens of teams took part, but the pair were the only ones to tackle it in a wooden boat.

They were aiming to raise £30,000 for the Tiny Lives baby charity and the Fire Fighters Charity. Mr Pugh's son, Tom, was born prematurely and spent several weeks in care at the Royal Victoria Infirmary in Newcastle, which is supported by the Tiny Lives trust. Mr Hopkins is a firefighter.

Speaking to BBC Newcastle after completing their challenge, businessman Phil Pugh said: "We have typical rowers' bums - very spotty with bed sores - and there are other parts on the underside of our bodies, you don't really want to talk about which are really, really sore. Bringing tears to your eyes is an understatement. The first shower was fantastic. There must've been an inch-worth of salt in the shower tray. All the bits are getting better."

Paul Hopkins said he had endured a painful festive period suffering from gout. "The worst mile for me would've been the one on Christmas Day. My foot had swollen up and I knew I had 12 hours of rowing with gout. The first hour of that wasn't fun."

"Phil and I didn't have any family come out to Antigua. We weren't sure about what type of welcome we'd get. The people here and the yachting community have been absolutely outstanding. When we rode into the harbour there were flares, horns were sounding and there were nearly 200 people on the quayside to welcome us. We're like little celebrities."

From hell to high water

Since the Australian spring there have been fires - sometimes hundreds at once - burning across New South Wales, Australia's most populous state.

Firefighters have battled mammoth blazes daily during the state's longest bushfire season. More than five million hectares have burned, in conditions worsened by years-long drought and record heat. Dozens of people have died across the country.

Things finally changed though when rain arrived in NSW mid-February. A massive dump of water - more than 400mm (15.7in) in some places - caused flooding and transport chaos, but also helped finish off most of the fires.

On 13th February, authorities announced with delight that every single fire in the state had been contained. This means the perimeters of the fires have been "boxed in" and while some areas are still alight, the blaze is under control and won't travel freely. The majority of fire grounds up and down the coastline received the heavy drenching that was much needed - with many getting over 300mm in just one weekend.

The rain has been described by some as a miracle - particularly given the long-term forecast for the summer had predicted an 80% chance of below-average falls. Sydney - the nation's largest city - has been under water restrictions since late last year, when its dams fell below 45% capacity.

Now the city could see an easing of some of these limits as the dam at Warragamba, which supplies 80% of its water, has filled up.

Weather forecasts – on the crest of a wave

Whether you are seeking a surfers' paradise, or a sea as flat as a mill pond for your toddlers, the Met Office hopes to help you find it with a system giving up to five days' notice of where to go for the right waves.

Detailed wave forecasts are usually made by supercomputers and therefore expensive. But Andy Saulter, a Met Office scientist, and Timothy Poate, of Plymouth University, have used data from hundreds of beaches to predict conditions around the UK. The data looks at the steepness and shape of individual beaches, as well as observations of waves, miles out to sea, to form a better picture of surf conditions.

Forecasts can be generated within a few minutes on a basic desk-top computer.

The scientists said: "Such systems can enable the Met Office to generate practical forecasts of surf conditions on beaches nationwide, assisting decision-making for lifeguards, beach-goers and other coastal users."

Blue whales return to old feeding grounds

Scientists have recorded an "unprecedented" number of blue whales around the coastal waters of the sub-Antarctic island of South Georgia.

Just two individuals of the critically endangered species, and largest animal ever to have lived on our planet, were recorded in the area during a survey in 2018. But this year, during a more extensive survey, an extraordinary 36 separate sightings meant a total of 55 blue whales were spotted by the scientists. The research team, led by the British Antarctic Survey, said: "For such a rare species, this is an unprecedented number of sightings and suggests that South Georgia waters remain an important summer feeding ground for this rare and poorly known species."

Project leader Dr Jennifer Jackson, a whale ecologist at the British Antarctic Survey, said that the survey broke new ground, enabling scientists to better understand whale populations' recovery from centuries of hunting. She said the "researchers were thrilled... It suggests blue whales are returning to their old feeding grounds at South Georgia which suggests it's still an area with abundant food for them to eat. Relative to many other oceans on the planet, the Southern Ocean is still relatively pristine, so it still has capacity to support large numbers of whales."

The blue whale population was decimated through the 19th and early 20th centuries, reducing their population by as much as 97 per cent, according to some estimates. South Georgia became a key whaling station, with numerous species hunted to the brink of extinction, including blue, humpback and fin whales.

Export of Shackleton's sledge and flag halted

The government has placed a temporary export ban on the sledge and flag used by Sir Ernest Shackleton on his failed trip to the South Pole following their sale to an undisclosed overseas buyer.

Helen Whately, the Arts Minister, said it would be a "terrible loss" to Britain if the artefacts, valued at £227,500, were ever sent overseas. The decision on the export licence application for the items has been deferred until May 6, with a possible extension to August if a "serious intention" to raise funds to purchase them is made. However, they remain at risk of being lost abroad unless a UK buyer, who wishes to add them to the national collection for public viewing, is found in time.

Ms Whately said: "Shackleton's expeditions to the South Pole are legendary. The sledge and the flag were part of his ground-breaking Nimrod expedition. Together they help to tell the story of one of the most daring moments in the 20th Century. The UK has a proud history of discovery, and it would be a terrible loss for the nation if these unique items did not stay in this country."

In 1907 Ernest Shackleton was one of four explorers, known as the Southern Party, who attempted to be the first to reach the South Pole. They were only 97 miles short of their destination when they famously had to turn back. The expedition paved the way for Roald Amundsen and Robert Falcon Scott, and their 1911 race to reach the Pole.

Wind farms 'killing seabirds' says RSPB

The RSPB has warned that wind farms could be the "final nail in the coffin" for seabirds, this following a fresh study into their eating habits.

The turbines are usually located in shallow sandbanks, for easier construction, but these are target feeding areas for kittiwakes, guillemots, razorbills and shags, which happen to be Britain's four most threatened bird species. The RSPB is calling for a ban on infrastructure, including wind farms in these feeding areas. A spokesman said: "Wind farms need to be built where the sea is shallow. The new data shows where birds go, so we need to not put offshore wind farms in these hot spots. We need environmentally sensible installations."

Wind farms can kill the birds if they collide with the blades of the turbines, as they try to fly to their feeding spots. Even those birds which wisely dodge the structures are forced to take lengthy detours, putting their chicks at risk of starvation as they wait for their parents to return.

The Government has committed to a Seabird Conservation Strategy which adds further Special Protection Areas to the 47 existing sites in English waters.

The World's largest skiing network

Italy has unveiled plans to create what is claimed to be the world's largest, connected ski area, as part of its plans to promote the 2026 Winter Olympics.

The 100 million euro project will see an 800-mile web of interconnecting pistes created in the Dolomites, though environmentalists fear the ski lifts and stations will scar the World Heritage mountain range.

Half the money needed to turn the plans into reality, in Cortina d'Ampezzo, a resort known as the Queen of the Dolomites, is coming from private enterprise and the rest from government funds.

Flow monitoring sensors fail during February floods

The torrential rain in February set a new national all-time record, with roughly twice the February average rainfall. This resulted in record river levels, and the overwhelming of flood defences. One unforeseen effect was the failure of sensors, installed by the Environment Agency to monitor river water levels. Floodwater rose so quickly that the devices' electrical circuits were destroyed.

Sir James Bevan, head of the agency said: "One EA team was anxiously watching the telemetry data from one particular river which was showing an astonishingly rapid rise when the water levels suddenly appeared to stop going up. The team breathed a sigh of relief until they realised that the graph wasn't flat-lining because the river had stopped rising. It was flat-lining because the river had risen above the electronics running the gauge, and overwhelmed the hardware."

18 gauges across 15 rivers recorded their highest water levels during the month, including the Colne, Ribble, Calder, Aire, Trent, Severn, Wye, Lugg and Derwent. Many nearby properties were flooded, some for the second time this year.

Editor. And we continue to build houses on flood plains!

Basking sharks eat out as a group

Basking sharks defy predator stereotypes by taking their families to feeding spots they have eaten at before, scientists have found. A study led by the University of Aberdeen found basking sharks – the world's second-largest fish – prefer to travel with their relatives to familiar feeding sites. It was previously thought the endangered species migrated in unrelated groups but new sampling revealed their tendency to travel as extended family parties through familiar feeding routes.

Study leader Dr Catherine Jones said: "Perhaps relatives hang out together, which could facilitate learning migration routes and encourage other co-operative behaviours. This means there's more going on in basking shark aggregations than first appears, in that they don't fit the shark stereotype of a lonesome independent predator."

The northern European shelf is a rich source of plankton, making the north-east Atlantic Ocean a popular areas for the fish, with hundreds of basking sharks gathering on the west coast of Scotland, Ireland and the Isle of Man in the spring.

Scientists have raised concerns about the species' declining population, with numbers not expected to exceed 10,000 in north east Atlantic waters. Highlighting environmental change and fishing accidents as a threat to basking shark populations, Dr Jones said: "Losing a group of kin together, such as occurs during accidental bycatch, erodes variation rapidly, making these big, and slowly reproducing fish less capable of evolving to cope with environmental change."

Geese change migration route

Migratory geese are changing their behaviour to counter the effects of climate change. Over the past 25 years, barnacle geese have shifted their main migratory route much further north, adapting to changing food availability.

An international team from St. Andrews University found that the birds now miss out on "fuelling up" at their more southerly traditional staging grounds, and don't stop to feed until they reach the north of Norway, far above the Arctic Circle. This is one of the first studies to provide evidence that wild creatures change their habits to cope with climate change. Barnacle geese have been able to make this transition because they have an extensive, varied diet, feasting mainly on leaves, grasses and seeds, and are able to find such food at the right time, albeit much further north.

Calls to replace Royal Yacht Britannia

Boris Johnson has been considering plans to replace Royal Yacht Britannia with two new £150m ships paid for by the foreign aid budget. Mr Johnson has been in talks with former International Development secretary Penny Mordaunt over plans dubbed "Britannia 2.0" for two new ships to be deployed around the world to help with relief efforts.

The new ships - with one called "Britannia" and the other named the "Florence Nightingale" or "Mary Seacole" - would be made available to members of the Royal Family for overseas tours to Commonwealth and other countries. The first ship would cost around £150 million, the second one a little less.

The proposal has attracted interest from private sector firms which have offered to help with running costs, and from organisations which provide training for Commonwealth merchant navies to help man the ships.

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Flow-Accelerated Corrosion in Steam Generating Plants

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Flow-accelerated corrosion (FAC) has been researched for over 50 years at many locations around the world, and scientifically all the major influences are well recognized. However, the application of this science and understanding to fossil, combined-cycle/HRSG and nuclear plants has not been entirely satisfactory. Major failures are still occurring and the locations involved are basically the same as they were in the 1980s and 1990s. This paper reviews the latest theory of the major mechanistic aspects and also provides details on the major locations of FAC in plants, the key identifying surface features of single- and two-phase FAC, the cycle chemistries used in the plants and the key monitoring tools to identify the presence of FAC. The management aspects as well as the inspection, predictive and chemistry approaches to arrest FAC are described, and the different approaches that are needed within fossil, HRSG and nuclear plants are delineated.

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Aqua *free*

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cBlue SC – The new legionella shower filter with replaceable cartridge for hotels, spas and wellness facilities

With its **cBlue SC**, Aqua *free* GmbH has developed a legionella shower filter whose clear and functional design enables it to be harmoniously integrated in modern bathrooms. The shower filter comprises a chrome-plated hand shower with a replacement filter cartridge which provides reliable protection from all water-borne germs such as legionella and pseudomonades while offering an exceedingly pleasant showering experience.

The **cBlue SC** is distinguished by

- a modern design
- a pleasant shower spray thanks to a generously-sized filter area with a good flow rate
- a long service life of 3 or 5 months
- legionella protection plus: maximum safety provided by a filter cartridge with protection from all water-borne germs
- ecological and inexpensive replacement cartridge

These performance characteristics mean that the **cBlue SC** legionella shower filter is eminently suitable for use in hotels, spas, wellness facilities or private bathrooms where discrete protection from water-borne germs is desirable.

The **cBlue SC** is supplied with a replacement cartridge. These replaceable cartridges contain hollow-fibre membranes with a pore size of 0.2 µm which display reliable micro-filtration of 7 log units in the germ retention test, i.e. 99.99999% retention of the smallest water-borne germ *Brevundimonas diminuta*. This complies with the FDA definition of sterile-filtered water and permits carefree showering even in the event of contamination.

The replacement cartridges for the **cBlue SC** are offered as 3-month or 5-month variants to ensure a high degree of flexibility. This saves money as well as conserving the environment as less plastic waste is incurred.

The hand shower can still be used without a cartridge following successful refurbishment after contamination. The “Eco Connect” enables the **cBlue SC** to then be used as a normal hand shower.

cBlue SC

Shower filter for maximum showering pleasure and safe protection from legionella

- 100 % showering comfort thanks to outstanding flow rate
- Optimum safety thanks to reliable retention of all water-born germs
- Perfect for the enviroment and your budget thanks to inexpensive cartridge system
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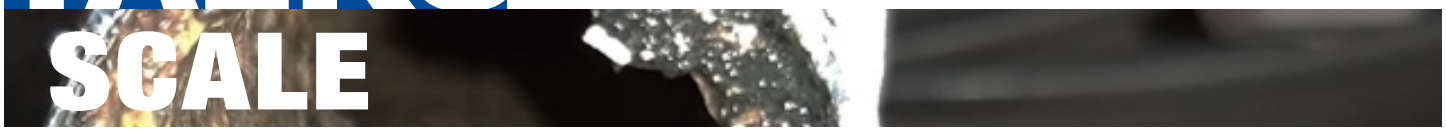
THE WATER MANAGEMENT SOCIETY

TOOLBOX TALKS

Scale an introduction - what is scale?

In the water treatment industry scale is a term used to describe a build-up of mineral deposits on the system. The reasons for the formation of the scale can be complex. Scale can contain various chemical compounds sometimes as a mixture. These compounds are commonly formed from the dissolved inorganic impurities found in the water. A common form of scale is the deposit found in kettles in hard water areas.



Some other types of deposits are referred to as fouling which can be caused by microbiological growth or contamination from process (such as oils). If the fouling results in hard deposits it can be referred to as scale. The exact name used to describe the deposit is not important – what is important is to understand what caused the deposit so that action can be taken to remove it and avoid it reappearing.

Calcium carbonate scale (limescale) deposits can be caused by simply warming or evaporation of water containing high hardness and high alkalinity levels. However, there are several factors that can result in deposits, including:

- mineral impurities (also called dissolved solids) naturally found in water coming out of solution
- corrosion – most commonly rust deposits from the corrosion of iron
- incorrect water treatment (e.g. chemicals being incorrectly applied and used, insufficient bleed or blowdown)
- overheating, low flow or no flow
- contamination of the system water from any source

The appearance of a scale deposit is not a reliable way to find out what it contains. This requires chemical tests often in a specialist laboratory, although some simple site tests can give an idea of some of the components.

Why is this important?

Scale can cause problems in many types of water systems including domestic water, cooling towers, hot and cold closed water systems, steam boilers, cooling towers etc. Examples include:

- inefficient heating or cooling, as scale is a poor conductor of heat. This could mean a building is too hot or cold; a ruined product as it was not heated or cooled correctly; damage to equipment due to overheating or even an explosion. It also adds to running costs significantly
- blockages of pipe work, heat exchangers, lines to instruments and gauges etc.
- damage to valves and other parts of the system
- increase in corrosion even with the best treatment chemicals
- scale can provide protected conditions and surfaces on which microorganisms might grow. Some of these organisms could cause health problems (e.g. legionella) and also cause serious local corrosion

What can be done to control scale?

In order to minimise any scale in a system you need to understand the type of system, how the system operates, the source of water and its quality.

The methods to control scale include:

- reduction in the levels of impurities in the incoming water (by pre-treatment plant such as base exchange water softener, RO etc.)
- addition of acids – great care is needed with this method
- addition of chemicals known as scale inhibitors – these must be chosen with care
- limiting the concentration of dissolved solids by removing some system water to drain and topping up with fresh or treated water
- filtration to remove any deposits before they settle in the system

Usually a combination of methods will be used and expert advice should be sought.

Are there other concerns?

Whatever method of control is selected it is important that its performance is regularly checked. Some methods to control scale can cause other problems such as increased corrosion and some of the chemicals used can be toxic to people or the environment.

ANSWERS TO THE ARTICLE IN OUR WINTER ISSUE

REVIEW OR NOT TO REVIEW? A RISK ASSESSMENT STORY

Q1: Who should decide the frequency of when to review a legionella risk assessment?

Q2: What results might we have to indicate that the control measures are no longer effective?

Q3: How far should the risk assessment go in recommending a review frequency?

1 cpd point

A1: The Risk Assessor (who should have appropriate skills, knowledge, training and experience) should be the one to set a period for the risk assessment. But the site Risk Manager or appropriate Provider would be required to make a decision on the requirement for a review in the interim as they will have knowledge regarding changes to water systems/ use of the building/results from control system monitoring. Hence the need for Managers of buildings to have suitable and sufficient training in Legionella Management.

A2: In a circulating hot water system, poor circulation temperatures on the Principle Sentinel Loops will indicate that controls are no longer effective. The detection of legionella bacteria in the system as part of regular testing will show that current controls are not effective.

A3: The risk assessment should only go so far as to indicate a suitable period of the review dependant on the findings at that time. While making it clear to the reader that any changes to system/use/users/control monitoring results/key personnel/sampling, will require that assessment to be updated at that time.

Answered by John Vince, GradIOSH MWMSoc.

If you would like to get involved with this issue's CPD activity, see page 9.

The Lessons to be learned from Contaminant Leaks into Cooling Water

Bob Wilson, SafeSol Ltd

Abstract

A heavily bio filmed cooling tower is the greatest Legionella risk as far as the general public is concerned. Even the best treated cooling tower can rapidly develop a biofilm, if there is a leak of easily biodegradable process fluid into the circulating water.

This paper looks at some real cases of process leaks into cooling water circuits and the effect of that the contaminants can have on biofilm formation. It also looks at the effects contaminants can have on cooling water chlorination.

The paper concludes that if a cooling system is contaminated with a very biodegradable chemical e.g. an alcohol, a biofilm will develop on the packing very rapidly. The tower should be shut down and the leak isolated before the tower is cleaned, disinfected and returned to service.

Chlorine is very reactive and when mixed with certain contaminants can produce different disinfectants, this paper looks at trichlorophenol and monochloramine.

The reactivity of chlorine means that it is not effective against a well-developed biofilm and suggests that there is a need to investigate other low - cost oxidising biocides for cooling water treatment.

Introduction

While biofilms have been present in nature forever, it is only in the past 30 years that any real science has been carried out on these microbiological ecosystems. In 1990 Montana State University was awarded a grant by the National Science Foundation to investigate biofilms. Under the direction of Bill Charaklis, a biofilm research pioneer at the Centre of Biofilm Engineering identified the importance of biofilms, their cost to industry as well as their advantages in waste treatment. The study of Biofilms is a very young science, but it is extremely important from a legionella control perspective. Legionella like all bacteria prefer the security of a biofilm where they can hide from biocides to swimming around in water (planktonic) where they can be easily killed.

Montana State University Centre for Biofilm Engineering where most of the pioneering work on biofilm was conducted.

Cooling towers present the greatest legionella risk as far as the general public are concerned [1]. While biofilm can develop in the packing of any cooling tower, there is likely to be very little found in cooling towers associated with Air Conditioning systems. There may be slightly more in cooling towers associated with the process industry and there can be serious biofilm formation in towers associated with cooling systems that have a process leak. Biofilms in a cooling tower pack may also trap scale, silt, and corrosion products, a process known as biofouling.

One of the highest risks of an outbreak of legionella as far as the general public is concerned is a cooling tower which develops biofilm in its packing quickly or develops rapid biofouling immediately following cleaning. Both situations normally arise from a process leak into the cooling water.

I want to present some of my experiences of process contamination in cooling towers and draw some conclusions about how they affect tower disinfection and biofilm formation.

Scraping biomass from a cooling tower - typical of a cooling tower with a process leak.

BP Chemicals Grangemouth [2]

The Grangemouth site showing the Hyperbolic Cooling Towers.

I was employed as a water treatment chemist by BP Chemicals from 1969 and 1985 [3] and was responsible for water treatment on the Grangemouth site. The Grangemouth site had 23 different processing plants when I joined and is divided into a North Site and a South Site by the Bo'ness Road (A904). There is a major cooling water system on each side of the road. The North site cooling water system was served by 2 hyperbolic towers and an induced draft tower and had a circulation rate of 6 ,000 tonnes per hour The South site system was served by 3 hyperbolic towers and had a circulation rate of 10,000 tonnes per hour. The only treatment applied to these systems was 2 ppm of chlorine obtained from large cylinders of chlorine gas. There was no corrosion inhibitor – all the heat exchangers were made in admiralty brass. The next section is devoted to my observations of what happened when there were leaks from the process plants into the cooling water system. It should be pointed out that most of these experiences occurred in the 1970s when there was little concern about Legionnaires' Disease and nobody knew very much about biofilm.

Three Categories of Contaminants

On a site where there were 23 different processes and 23 sets of exchangers, condensers, leaks were common. I want to divide the products that could contaminate cooling water into three categories. Easily biodegradable, non- biodegradable, and products that react with chlorine to form a different disinfectant.

Leaks of Easily Biodegradable Chemicals

When I first became involved in the Cooling Systems at BP, I was made aware of an incident that had taken place just before I joined the company. BP Chemicals operated a methanol plant on the south site of the strip and the effluent from its final distillation column was pure condensate with up to 1000 ppm methanol. As part of a site improvement programme it was suggested that this stream could be added to the cooling water circuit. This was a move designed to reduce COD loading of site effluent. Today we know better but in the 1960s, this was a justifiable experiment.

A few days after the stream was introduced other South site plants started to complain about lack of cooling. The problem was addressed by cleaning "snot" from the cooling towers, rodding out some critical exchangers, and of course removing the methanol containing stream from the cooling water. Over the years I have seen many cooling towers in the pharmaceutical industry, in distilleries and in the chemical industry, foul rapidly because of alcohol contamination of the cooling water.

The reason for the fouling is straightforward. A cooling tower pack subjected to a stream containing easily biodegradable material behaves exactly like a packed Bio- tower in a sewage treatment plant. Bio-towers have packing similar to a cooling tower and air is drawn through a counter-current flow of raw sewage which is added at the top of the tower. These towers are generally commissioned by starting with a flow of water containing low concentration of an easily biodegradable substance like sugar or sewage sludge to allow the biofilm to develop. When this film is established the raw sewage can be introduced. Sewage plant operators would not use something as expensive as alcohol to establish a biofilm even though it would work very well. To summarise alcohol or any easily biodegradable substance in water going to a bio-tower is good, alcohol in water going to a cooling tower is bad.

In most cooling systems, where I have witnessed the presence of alcohol, fouling has been extremely rapid. – A clean cooling tower pack can develop a good going biofilm within a few weeks.

In my experience there is little that can be done to prevent this type of biofilm formation, if there is a continuous leak of an easily biodegradable chemical like alcohol. The rate of biofilm development will beat the action of any biocide. Normal chlorination will not help. I have seen percentage concentrations of biocide being added unsuccessfully to reduce/ remove this biofilm formation. [4]

It is probable that any biofilm on a cooling tower pack can harbour legionella. The type of biofilm that develops quickly on a cooling tower will quickly attract a wide range of bacteria, possibly, including legionella.

Cooling towers foul with biofilm which traps, scale, corrosion products in the water, and any solid material in the air flow. This biofouling has an adverse effect on tower performance as well as increasing the risk of *Legionella*.

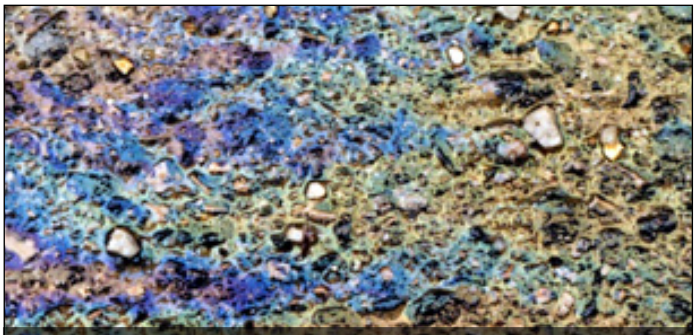
This situation, which is not uncommon in the process industries is described [5] but not really dealt with in HSG 274 Part 1. There is nothing about how to deal with a cooling tower pack that fouls rapidly with biofilm. A cooling tower may be L8 compliant in every respect. It may even have been cleaned in the recent past. Yet within a couple of weeks it has developed a thick biofilm, turning it into a high-risk tower. It is likely that free chlorine levels will have disappeared, and microbiological counts have increased.

In the 1970s my priority when there was a process leak was to try to find the source of the leak and stop it. This was not because of any concern about *Legionella* but simply because lost product meant lost profit.

Today when a heavily bio filmed cooling tower is high risk from a legionella perspective, my advice would be: Shut it down until the source of the leak has been identified and stopped. Only then should the tower be completely cleaned and returned to service. Cleaning the tower or replacing the tower packing before identifying the source of the leak is a very short- term solution as the cooling tower will quickly, foul again.

Leaks of Materials with Low / No Biodegradability

In the 1970s I witnessed a leak of fuel oil [5] into the South Site system in Grangemouth. The result was a real mess as the sumps of the hyperbolic towers were filled with what has been described as chocolate mousse. This is like the brown froth that results when an oil tanker leaks oil into the ocean. Fortunately the leak was located and stopped quickly – Fuel oil from an ethylene plant will have a small quantity of light ends some of which could be easily biodegradable- a prolonged release could result in biofilm formation though this would be a minor concern in a cooling tower severely fouled with thick fuel oil.



Water in a cooling tower sump following a fuel oil leak. The oil weathers very quickly.

It took many weeks to remove the oil residues from the cooling water and the oil deposits from the cooling tower packing.

I was involved in evaporative condensers, part of an ammonia refrigeration system that had become fouled with margarine. The condensers pulled their air from the factory floor where the margarine was produced. The continuous flow of air containing small particles of margarine was stopped by extracting the air to the condensers from outside the factory. Chlorination was introduced and this generally managed to control the microbiological level in the towers.

One of the evaporative condensers, however continued to give intermittent high microbiological results and this occurred when parts of an obdurate deposit on the outside of the condenser tubes broke away. The condensers operated 5 days per week, allowing the rogue tower to be cleaned with a biocide /surfactant mix every weekend. It took a number of weeks and a lot of heavy chemical hits to remove the deposit and restore good microbiological control.

HSG 274 Part 1 does deal with this type of organic contaminant. While some oil and grease deposits could be cleaned if they are spotted quickly, these types of contaminants tend to weather, and in a matter of days, can become difficult to remove by traditional chemical wash techniques. Fuel oil contamination of the packing in an induced draught tower could only be rectified by replacing the packing. The margarine deposits on the evaporative condenser tubes could only be removed by successive high chemical concentration cleans.

The oil /grease type of contaminant, perhaps because it weathers quickly and hardens on to the surfaces in a cooling tower or evaporative condenser, becomes inert and therefore presents a lesser risk than a continuous leak of an easily biodegradable chemical.

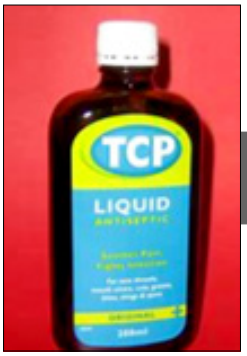
Cooling water Contaminants that react with Chlorine

Chlorine because of its general effectiveness and low cost is widely used as a cooling tower disinfectant. Most treatment today involves the use of sodium hypochlorite solution (14.5% available chlorine) dosed into the cooling system under Redox control.

In the 1970s chlorine came from large yellow compressed chlorine gas bombs (each containing 860 kg of chlorine gas). This was metred into the water leaving each tower to give a free chlorine residual of 2 ppm. The laboratory monitored the free chlorine in the return to the tower each day and this was generally in excess of 1 ppm. When there were no leaks of easily biodegradable materials the tower packing was clean. [6]

Chlorine is very reactive, and this is demonstrated by two different contaminants that entered the BP Chemicals cooling water circuit, reacted with chlorine and produced a different type of disinfectant.

BP Chemicals had a Phenol plant that was served by its South site cooling system and occasionally there was a leak of phenol from this plant into the cooling system. The phenol would react with chlorine to produce chlorinated phenol. Most people will be familiar with the smell of trichlorophenol or TCP and this was the smell that pervaded the atmosphere around the site and even into Grangemouth itself when this leak occurred. Fortunately, this odour was instantly recognised by plant personnel and the offending exchanger shut down immediately. Apart from there being no free chlorine in the cooling water when phenol leaks occurred, these leaks were stopped so quickly that I have no information on the efficacy of chlorinated phenol as a cooling water biocide.



How we normally see trichlorophenol or TCP

An Acrylonitrile Plant was also served by the South Site Cooling System. Acrylonitrile is manufactured by the ammoxidation (addition of ammonia and oxygen) of propylene as indicated in the reaction below:

$$2CH_3{-}CH{=}CH_2 + 2\,NH_3 + 3\,O_2 \rightarrow 2\,CH_2{=}CH{-}C{\equiv}N + 6\,H_2O$$

Propylene + ammonia + oxygen → ACRYLONITRILE + water

During the 1970s there was a leak of ammonia from the Acrylonitrile plant into the cooling water. This resulted in the formation of chloramine (monochloramine as the pH of the cooling water was (7.5-8.5) and a complete loss of free chlorine from the cooling water circuit over the 2-month period when ammonia leaked into the cooling water. In the 1970s no microbiological testing was carried out but there was no "snot formation" on the cooling tower packing. (Nobody really knew about Biofilm in the 1970s) and the cooling system behaved perfectly normally until the leaking exchanger was identified, the Acrylonitrile plant was taken off-line, and the leak fixed.

Chloramines [7] are recognised as water disinfectants and have been used as biocides in potable water. They have never been used intentionally as biocides for cooling water treatment on an industrial cooling system. All indications are that chloramines are effective against legionella and there is some indication that they may be more effective than chlorine itself in dealing with biofilm. [8] They are much slower acting than free chlorine however and could never be regarded as a suitable replacement for cooling water treatment. These are the findings of a study conducted in the University of Istanbul on a model cooling tower where chlorine was compared directly with monochloramine.

A study designed to compare different biocides for legionella control [9]. The tests showed that monochloramine was effective against planktonic and sessile legionella but had no effect on amoeba or biofilm. These failures were attributed to the instability of chloramine and it was suggested that the continuous addition of ammonia and chlorine to the system may have achieved more satisfactory results (This is exactly the conditions that pertained in the South Site cooling system when the leak of ammonia and chlorine being added to the cooling water produced fresh monochloramine).

All the evidence suggests that monochloramine will exert good microbiological control, at least in the short term in a cooling system, providing ammonia is the only contaminant.

If there is a situation where a cooling tower is fouling quickly with biofilm and ammonia is detected in the water there will almost certainly be something else, in the process stream that biodegrades easily.

The Reactivity of Chlorine

Chlorine is very reactive, and this reactivity extends to its reaction with the polysaccharide that glues biofilm together. Chlorine is effective in dealing with bacteria in the outer layers of a biofilm but fails to penetrate far into a biofilm. Chlorine starts to react with the organic materials in the biofilm and there is a rapid fall in chlorine concentration within the biofilm compared with the concentration of chlorine in the bulk fluid. [10] The failure of chlorine to deal with biofilm has been demonstrated in domestic water systems where repeated chlorination has failed to remove legionella. This is the reason that silver stabilised hydrogen peroxide (SSHP) is now used by many water treatment companies for one-off domestic water system disinfections, and why chlorine dioxide and SSHP is used for continuous dosing of domestic water systems.

I have used chlorine dioxide and SSHP on separate chlorine treated cooling water circuits, that had persistent legionella contamination. Persistent legionella or persistent bacterial contamination in any water circuit is usually caused by the presence of a biofilm. Chlorine addition will rarely resolve this.

Conclusions

1. Although the recognition of Legionnaires' Disease has led to a reduction in the number of cooling towers in the UK. Cooling towers and Evaporative condensers remain the largest single risk of Legionnaires' Disease to the General public. Heavy biofouling of the cooling tower pack increases the risk considerably.
2. The greatest risk of rapid and severe biofouling comes from process leaks of easily biodegradable chemicals into the cooling systems. Rapid pack fouling can occur in towers in systems which are fully L8 compliant or towers which have just been cleaned and disinfected.
3. Chlorine and indeed any biocide are completely ineffective in stopping this type of fouling.
4. Chlorine because of its reactivity is not an efficient biofilm removal biocide. Chlorine Dioxide and Silver Stabilised hydrogen peroxide have been used to remove biofilms in cooling water systems. There is a need to investigate other low-cost oxidising biocides for cooling water treatment.

References

1 Legionella Outbreaks and H&SE Investigations, an analysis of contributory factors HAEX 12/07

2 BP Chemicals Ltd in Grangemouth was bought by Ineos. The operating processes will have changed as will the cooling water systems and their treatments which will conform to HSG 282 Part 1

3 In the 1970s most large companies had a chemist or chemical engineer who had responsibility for looking after the boiler systems, cooling systems and effluent treatment. Domestic water systems were not considered as an issue at that time.

4 A Scottish company had a leak of isopropanol into their cooling system. This leak affected a number of their cooling towers, all of which developed a biofilm. Three different companies trialled a number of biocides at different concentrations in an attempt to remove the biofilm. All were unsuccessful.

5 HSG In Table 1.2 there is a description of fouling caused by process contamination which states that the fouling potential will depend on the nature of the contaminants may foul in their own right whereas others may be a nutrient source for microbiological activity, which if not adequately controlled could lead to significant biofouling. This risk factor is likely to be absent in comfort cooling and many light industrial applications.

6 The hyperbolic cooling towers were inspected 2 or 3 times each year by accessing them through a door that allowed access just above the wooden packing. These inspections were to examine packing condition and monitor cooling tower performance. The main fouling observed in this type of cooling tower is algae that grows at the well - lit area at the inside top of the tower. In summer this algal growth could develop to such an extent that large slabs would fall off on to the packing below.

7 Chloramines as a Disinfectant (Source: www.lenntech.com/processes/disinfection/chemical/disinfectants-chloramines.htm)

8 Comparison of the Efficacy of Free Residual Chlorine and Monochloramine against biofilms in model and full- scale cooling towers: Truretgen I Journal of Bio adhesion and Biofilm Research Vol 20 Issue 2 pps 81-85

9 Comparison of disinfectants for biofilm, protozoa and legionella Control Loret J.F, Robert V, Cooper A.J. McCoy W.F. and Levi Y Journal of Water and Health 03.4 ,2005

10 Direct Measurement of Chlorine into Biofilms during Disinfection De Beer D. Srinivasan Rand Stewart PS. Applied and Environmental Microbiology Dec 1994 p4339-4344.

From the Archive: This paper first printed in **Waterline** Autumn/Winter 2005-6

Water our most precious resource

Terry Cummings Ph.D, Loo Si Main (B.Eng. Chemical Engineering) & Chan Oi Yee (MSc. Chemical Engineering)

The need for treatment of water to render it safe for human consumption is a challenging and constantly changing process. As mankind continues to deplete the finite resources of our homeland planet while, at the same time increasing pollution, the water treatment industry finds itself in a two way vice. On the one hand it has to provide a clean and wholesome water supply at an economic cost on the other, to deal with increasingly complex aquatic wastes.

Today, the 'State of the Art' is to use membrane processes to achieve these goals.

Inherent in the use of membranes is the increased efficiencies in terms of treated water usage and steadily reducing power consumption.

This paper addresses these key issues and also of treating wastewater taking the data derived to combine advanced and emerging technology in providing a global fourth water source. It also defines the current and emerging projects that enable the technologies to be available away from infrastructure systems such as sewage, water and power.

Sources of water

Traditionally three sources of water have been identified: -

- Surface Water Run off into lakes and reservoirs, including River Extraction
- Borehole (Artesian Wells)
- Seawater

These follow the water cycle from rain, collection, use, and evaporation to rainfall again.

Wastewater is treated in the use portion of the cycle before discharge to the sewer, river or watercourse. This treatment is not always complete and nature gets the job of finishing off the process.

In many cases this leads to decline of the rivers or watercourses in terms of quality and natural resource such as fish stocks. In arid regions this total water loss is unsustainable.

Wherever biodegradable materials have to be processed in wastewater applications the most common methods of treatment produce sludge, which is dried and taken off site for disposal in landfill sites. This causes problems of its own, landfill sites are rapidly being used up making disposal difficult while the nature of the waste means the biodegradable process continues in the landfill site, which together with rainfall leads to leakage of some pretty obnoxious leachate streams. A major problem is the generation of ammonia in soluble and gaseous forms and methane gas.

PURAL'EAU^R Technology

Pural'eau^R is a biological process wherein biodegradable wastewater can be treated. It is based on the well-proven Fixed Bed Reaction (FBR) process but has been developed to operate with the production of minimal or no sludge.

The past twenty years or so has seen rapid development in submerged bio-film applications largely driven by the need for advanced biological treatment techniques that more effectively treat waste waters yielding little or no sludge residue. This aspect has great environmental impact in eliminating sludge handling, dewatering and disposal. The energy saving in this elimination is also significant. Also eliminated is the long term problem of leachate leakage from landfill sites. These applications have been made possible by the development of reliable polymer media.

As a process it is suitable for treating community, domestic and industrial wastewaters. When compared with Activated Sludge Clarifiers, Bio-Reactors and other types of biological filters Plural'eau^R exceeds conventional performance with odourless operation, minimal sludge production, compactness, low energy and chemical consumption and flexibility.

The method of operation is that given the presence of oxygen, mineral salts and organic compounds are able to colonise microorganisms onto the surface of a solid object to form a bio-film.

Since most wastewaters have oxygen content lower than the amount of organic matter present the amount of dissolved oxygen becomes the limiting factor for aerobic film development.

With the continuing development of the bio-film both aerobic and anaerobic films form in close proximity providing an anoxic-oxic reduction process.

This is the defining factor of the system giving the advantages of anaerobic microbiology, degradation velocities and minimal sludge.

When compared against conventional plant Pural'eau^R uses low volume, low pressure blowers as the only energy consuming equipment.

Water produced by this method is of too good a quality to discharge, it can be returned to the natural cycle by being used for irrigation for example.

Presently being designed for a major Middle East development Pural'eau^R is being used to process the waste from 250,000 People Equivalents (PE). The recovered water is being used for irrigation, toilet flushing, janitorial activities and cooling tower make up, so reducing desalination requirements. **Figure 1(a)** and **1(b)** shows an example of Pural'eau^R plant.

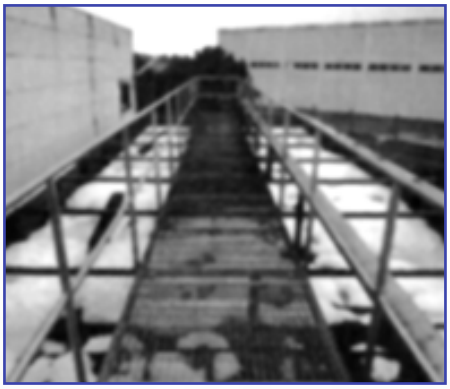


Figure 1(a)

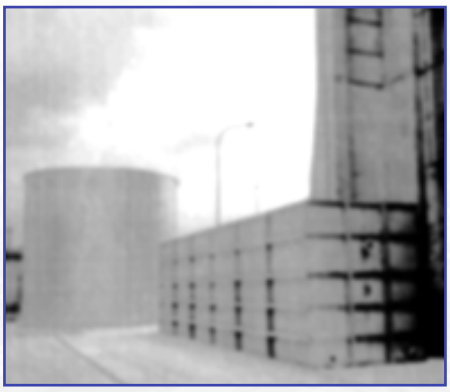


Figure 1(b)

Ultrafiltration

Ultrafiltration (UF) is a member of the continuous separation processes that also includes Reverse Osmosis (RO), Nanofiltration (NF) and Microfiltration (MF). All of these systems utilise membranes that exclude particles based on size. UF membranes generally have smaller pore sizes than microfiltration but larger than nanofiltration and reverse osmosis as shown in **Figure 2**.

UF is primarily a physical, low pressure driven membrane separation process operating typically with differential pressures of 0.5 - 1 barg with a pore size of 0.01 - 0.05 micron. With the large surface area provided by the membrane and the low driving pressure UF can effectively treat large water quantities using significantly less energy than conventional systems.

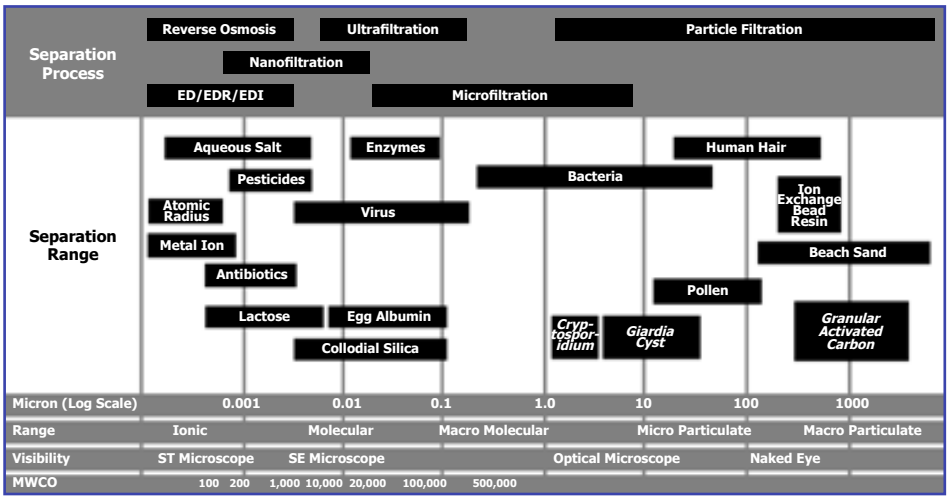


Figure 2

A further benefit, indeed unique benefit of UF is its capability in removing suspended solids, colloids, colour and micro-organisms. Thus, there are many worldwide installations where UF alone is used to treat surface or artesian well waters for potable water supplies.

These plants are very compact with typically a UF occupying a space of only 25% when compared with a conventional system. One of the UF skids built by Enersave is shown in **Figure 3**.

Figure 3: 1000 m³/hr UK Skid in Shanghai Chemical Industrial Park CO-Generation Power Plant

Application of UF membrane technology as a pre-treatment to desalination systems has proven to be advantageous. A significant amount of public domain data indicates consistent RO feedwater can be produced regardless of the changes in seawater quality. This is especially so with beach well applications.

Energy cost indications for UF in desalination applications are 0.1kWhr/m³ of filtrate compared with 0.28kWhr/m³ for conventional plant. Further operational savings are achieved by the reduction of backwash waters. Pilot tests in North Africa for example had conventional clarification and rapid gravity filters requiring 18.75% of treated water for plant operation while UF was 2.36% against a river water turbidity of 170NTU. Typical performance of UF membrane is shown in **Table 1**.

Reverse Osmosis

This is now accepted as the pre-emptive method of desalting water whether seawater for potable and general use or of brackish water for process and industrial use.

Again this is a membrane process but using a membrane having very small pores typically 100 MWCO (Molecular Weight Cut Off) equivalent to 0.00001 micron in size. Because of the small pore size only the water molecule will pass through the membrane, the majority (99.8%) of all salts will not. The force that retains salts in solution in water is known as osmotic pressure. By applying a higher pressure than the natural osmotic pressure against the membrane separation takes place into two water streams one that remains on the membrane surface to carry away the salts, one that crosses the membrane as treated, clean water. From this explanation the name Reverse Osmosis becomes clear.

Almost universally today membranes used in RO application are spiral wound as shown in **Figure 4**.

Parameters	Feed	Permeate	Reduction Rate %
Turbidity, NTU	0 ~ 100	Trace < 0.1	100
Color	2 – 15	1 ~ 3	50 ~ 80
NH4-N, mg/l	0.03 ~ 0.06	0.02 ~ 0.04	33 ~ 56
Total Fe, mg/l	0.1_1.0	0.02 ~ 0.1	80 ~ 90
Total Fe-Mn, mg/l	0.005 ~ 0.6	0.001 ~ 0.008	75 ~ 85
Total Bacteria, CFU/ml	100 ~ 9000	0	100
SDI	UNREADABLE	<1	100

Table 1

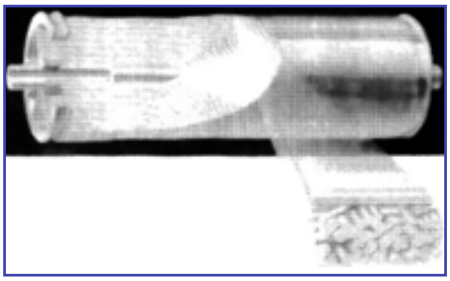


Figure 4: Cross section of spiral wound RO membrane. These are constructed from a semi-permeable membrane sheet, so called because water will pass through (permeate) while ions and salts will not and a non-permeable sheet separated from the membrane by a spacer matrix. As this permeates into the channel so formed it flows from the membrane in a spiral path.

The sheets are sealed on three sides while the fourth is attached to a perforated pipe. Several such sheets are attached to a single pipe, which are then rolled together to form a cylinder. As they are rolled a further spacer is inserted between the sheets so forming the concentrate flow path. Outer protection is provided by a layer of fibreglass. This complete membrane assembly is known as an 'element'. Example of RO skids fabricated by Enersave is shown in **Figure 5**.

Figure 5

Osmotic pressure of a solution can be measured, in the laboratory across a membrane by the level difference caused as clean water passes into the concentrated solution, the greater the level difference the higher the concentration. Thus, seawater has a much greater salinity and corresponding osmotic pressure than a brackish water system. For example, Thin Film Composite (TFC) membranes require a feed pressure of approximately 60 barg for seawater and approximately 10 barg for brackish water.

Historically, much higher pressures have been required for seawater desalination purposes but developments over the past two decades have steadily improved on this. **Figure 6** shows that circa 1980 the electrical power per cubic metre of permeate produced was more than 8. Today it is less than 2.

Why is this?

There are three principle reasons: -

Pumps have been improved for high pressure application with steadily improving efficiencies now consistently >85%.

Energy recovery by the use of turbines and other devices used to extract the high pressure energy of the concentrate stream now allow energy recovery of >80% giving significant reduction in pump power.

Low energy membranes have been developed that require significantly less power to drive the reverse osmosis process.

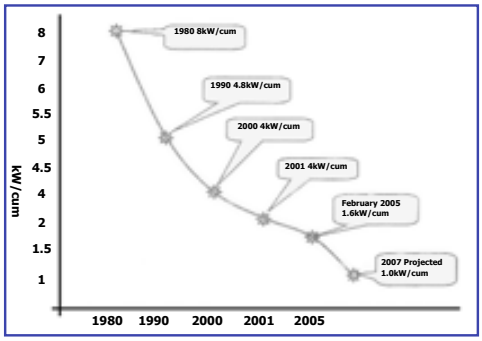


Figure 6: Electrical consumption comparison chart

Pumps

Traditionally centrifugal pumps have been used for larger desalination systems. Due to 'slip' the efficiency of these pumps was usually in the 60-68% range.

In the past five years or so great strides have been made particularly in the field of positive displacement pumps where overall efficiencies of around 90% are being reported.

Energy Recovery

From the earliest recovery systems, typically Pelton Wheel reaction turbines energy recovery systems have evolved. Today recovery efficiencies of >95% are being routinely achieved. Since this is generally configured as a side stream the High Pressure Boost pumps are much reduced in size with a consequent power decrease as much as 50%. A typical arrangement is shown in **Figure 7**.

Expressing flow rates as a % and typical pressures as barg:-		
Position	%	barg
Seawater Inlet	100	2.0
Energy Recovery Inlet	55	2.0
Energy Recovery Outlet	55	48
HP Pump Outlet	45	50
Boost Pump Outlet	55	50
Membrane Bank Feed	100	50
Permeate	40	0.5
Membrane Concentrate	60	48
Concentrate to drain	60	1

Thus it can be seen that the High Pressure Pumps are approximately half the size as in the past and the boost pump required for offsetting mechanical losses has a nominal 2 barg hydraulic boost.

Membranes

The significant breakthrough is in the minimisation of the boundary of flow layers.

Resistance of the separation barrier (the semi permeable membrane) is of a secondary nature when considered against the total resistance of the feed side boundary layer and the permeate side boundary layer. Since this barrier presents a discontinuity to flow there are always stagnant layers of fluid on the surfaces. Thickness of these stagnant layers are a direct relationship to the hydraulics of the system. Outside of these layers the water can be considered in a homogeneous state.

Thus, it is important to design the membranes to minimise these stagnant layers.

Membrane manufacturers have studied the hydrodynamics and modified their products to maximise the turbulence, measured by Reynolds number so decreasing the film thickness and so reducing the resistance to mass transfer.

The Reynolds Number is dimensionless and is derived from: -

$$R_e - \frac{v\,l\,p}{u}$$

where v = velocity of flow, I is the linear dimension of the gap through which the fluid is flowing, p is the density of the fluid and u its viscosity.

By formulating new co-polymers membrane manufactures have concentrated on modifying the dimension and also paid very close attention to variations in viscosity due to temperature. Several desalination projects in China for example use waste heat to maintain the RO operating conditions at a stable 25°C with a significant saving in membrane surface area >50% in some cases.

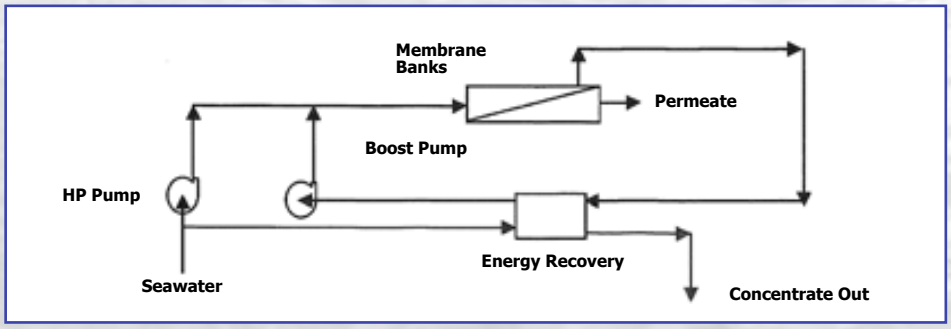


Figure 7: Typical Schematic Energy Recovery

In practical terms what does this mean?

Figure 6 shows the decline in electrical power consumed by seawater desalination systems since the 1980s when typically around 8kW/cum was the power requirement. This has been steadily eroded to the point where, around 2000 the cost of desalinated water at 4kW/cum was broadly the same as thermal plants. Further improvement in power consumption now has systems operating at 2kW/cum and pilot operations at 1.7kW/cum. Membrane manufacturers have research programmes showing great promise of achieving an electrical consumption of 1kW/cum by 2007.

Figure 8 shows how these reductions have been achieved when plotted against a 34,000mg/l salinity seawater with desalination RO operating at 40%.

The steady improvement in membrane performance has also benefited in higher recoveries as well as lower energy requirements. For the sake of clarity these have not been considered in the energy reduction calculations.

Fourth source of water

Desalinated water is expensive to produce by whatever method, when compared with water extracted from brackish supplies. The majority of systems comprise once through only. That is to say that the water is used once and discharged to waste.

Combining Pural'eau[R] technology with Ultrafiltration, Grey Water is produced that has little or no solid waste and no losses except for evaporation. This water can be used for all applications except potable supplies. Because bacteria, odour and other objectionable side effects of conventional sewage treatment are absent it can be safely used for toilet flushing, laundry, irrigation, janitorial and even for feed to cooling towers.

Adding Reverse Osmosis to the system gives a safe, potable water supply. This is blended with potable supplies as make up from the RO systems, much reducing the amount of desalinated water required having great cost and energy saving impact.

Currently being designed for a Middle East situation is a 90,000 cum/day desalination system with sewage and wastewater treatment using Pural'eau[R] concepts followed by UF. The resultant Grey Water is blended with seawater for treatment by the RO system.

To further enhance water and power efficiency the whole site is being engineered for rainwater harvesting. While it is appreciated that rainfall is scarce in the region it is 42mm per annum. With a covered area approaching 1million sq. metres this is an annual water supply of 42,000 cu. metres or 11,088,000 gallons almost sufficient to run the air conditioning cooling towers.

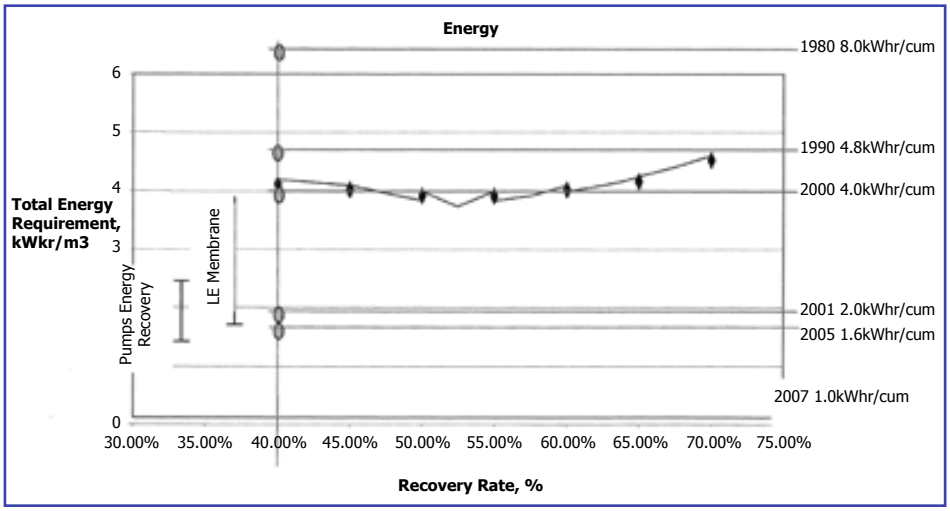


Figure 8: Total Energy Requirement against 34,000mg/l salinity seawater with desalination RO operating at 40%

Thus, by providing an integrated water and wastewater system significant operational and energy savings can be achieved.

Systems away from Infrastructure

There are operating pilot plants both for Pural'eau[R] technology and ultrafiltration that utilise solar and wind power. By definition these are small generally sufficient to handle 250 or so People Equivalents a day.

The Tsunami tragedy of late December 2004 caused a fundamental change in consideration for this type of system. **Figure 9** shows a portable, self-contained Ultrafiltration system designed, built, shipped to Bandar Aceh and put into service in 10 days. It is sufficient to provide basic potable water needs for 8,000 people per day.

ENERSAVE MISSION STATEMENT

Water is a fixed resource under constant pressure from rising demand.

Figure 9

To provide the very best in water solutions to offset shortages and to provide for increasing consumption.

To use all techniques in water provision, desalination, reclaim, recovery and reuse to enable expansion, growth and to enhance quality of life within the constraints of total global water supply.

The Authors wish to express their appreciation of the assistance of Dow Chemicals, Liquid Separations and of their Mr. Ravi Subramanian in the preparation of this paper.

CONTRACTS, PRODUCTS & PUBLICATIONS

Loch Ness to deliver improved water supply

Ross-shire Engineering, in partnership with Scottish Water, has assembled and pre-commissioned a new Water Treatment Plant (WWT) which will be the central element of a £21m investment by the water authority. The innovative modular approach to construction was developed by the Highland firm.

The project also utilises another alliance partner, Efficient Service Delivery, which will provide a single, improved water supply from Loch Ness to around 1,250 customers in Fort Augustus and Glenmoriston. It will also help to meet the needs of the area's world-renowned tourism sector, which sees significant seasonal increases in demand for water.

The WWT has now arrived at its long term home on the banks of the Loch, in forestry just south of Invermoriston. It took three weeks to transport each of 16 modules on a 41 mile journey from the manufacturing site in Mur or Ord.

Editor: Seems like a monster project. (Sorry)

WTP gain new approval for corrosion inhibitor

Water Treatment Products' best-selling Closed System Inhibitor, CW55M has gained important new approval.

In 2017 BuildCert (now called NSF International) changed its closed system inhibitor test, under the Chemical Inhibitor Approval Scheme. The new test is considerably more challenging and introduces a step change in performance requirements under corrosive conditions. The test also requires all current products with an existing approval under the old test to be retested every 5 years.

This gives CW55M a unique benefit in that building operators with multi user occupancy such as residential, offices and retail space with multiple heating and chilled systems will be able to use one product across the whole estate, thus eliminating any cross-contamination issues caused where in the past multiple products would have been needed.

For further information visit: www.watertreatmentproducts.co.uk

Heating scheme to use mine water energy

Construction to create a ground-breaking heating scheme, using mine water energy, is set to start in the spring. The Seaham Garden Village development, in the North East of England will consist of 1,500 homes, a school, shops, and medical and innovation centres. The new development will be supplied with geothermal heat from the Coal Authority's nearby Dawdon mine water treatment scheme, which treats water abstracted from an extensive network of flooded abandoned coal mines in the area.

Mine heat can be an energy source that is unaffected by external factors, meaning it has a stable price and is not subject to future variations or rises in energy prices. It is a renewable energy source that also has the potential to have a zero carbon footprint.

Jeremy Crooks, Head of Innovation at the Coal Authority, said: "Heat from abandoned coal mines is an innovative and practical solution to one of the big challenges facing our economy, de-carbonising our heating supplies. There would be wider benefits to this sustainable energy source too, as it would also attract new investment, create employment and deliver lower fuel bills to Seaham Garden Village and to other district heating schemes to be built on the coalfields."

The scheme, the result of a collaboration between the Coal Authority, Tolent Construction, and Durham County Council, is also unusual in that it does not use metal pipes, due to the lower temperatures involved.

Mr Crooks said: "Mine water energy has the potential to be an important, sustainable source of energy for the UK, whilst also providing many commercial benefits." Mr Crooks said new technology could make coalfield areas more attractive to investors and businesses, reviving some areas of the UK where it is most needed.

General Binding Rules 2020

If you own, live in, or are building a property off the mains sewage network you should have replaced or upgraded your septic tank system by 1st January 2020, in accordance with the Environment Agency General Binding Rules.

The General Binding Rules for small sewage discharges (SSDs) have been put in place to protect England's surface water resources (e.g. rivers, streams etc.) from pollution caused by septic tanks and other small-scale sewage treatment plants.

Under the new regulations, you can no longer discharge low quality effluent from septic tanks directly into ditches, streams or other watercourses. Instead, you have the option of replacing your system or upgrading it to incorporate a drainage field. This is also known as an infiltration system and means the effluent can seep into the ground instead for further treatment by soil bacteria.

Under the new General Binding Rules, a septic tank or treatment plant must meet British Standards BS EN 12566. In addition, the drainage field must meet BS EN 6297:2007 standards.

Note that if you live in Wales, Scotland, or near a groundwater source protection zone, different rules may apply. Owners should check with their local environmental agency.

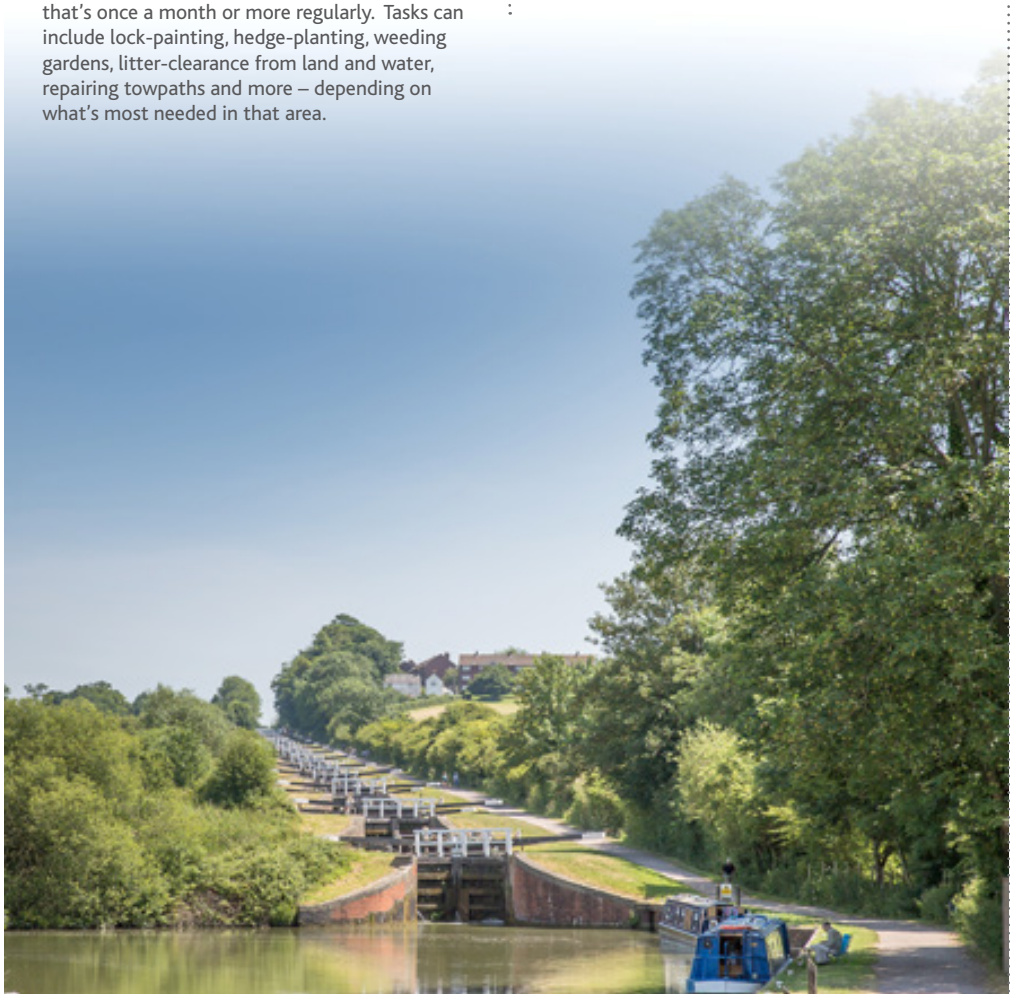
Canal and River Trust appeal for volunteers

The Canal and River Trust are expanding the number and range of volunteering roles that they offer.

Richard Parry, chief executive at Canal & River Trust, said: "On the waterways, community spirit is very much alive and well, with our canals and river navigations at the heart of such a diverse variety of villages, towns and cities across England & Wales. And, with so many ways to get involved, 2020 can be a year when more people take positive action for their local canal, for their community, and – because we know that volunteering and spending time outdoors, by water, is good for wellbeing – for themselves. In 2019 we saw record numbers of people volunteer 671,000 hours of their time to the waterways. There was a 27% increase in the number of volunteer lock keepers across the network, to 1,130, and the first volunteer to record a staggering 10,000 hours of volunteering time since the charity's formation in 2012."

Volunteer lock keepers and towpath rangers offer a friendly welcome to visitors and boaters and help people get to know their local canal. Education volunteers work with schools to teach pupils about water safety and anything and everything canal-related. They can also take part in running activities on the towpath, at canal festivals, and local fairs. Volunteers for the Trust's Let's Fish programme help host hundreds of free learn-to-fish events for all the family.

Also the Trust's three museums as well as iconic attractions such as the World Heritage Site at Pontcysyllte Aqueduct or Standedge Tunnel all offer volunteer opportunities, whilst Towpath Taskforces are flexible opportunities for volunteers to come along whenever they're free, whether that's once a month or more regularly. Tasks can include lock-painting, hedge-planting, weeding gardens, litter-clearance from land and water, repairing towpaths and more – depending on what's most needed in that area.



AI discovers antibiotics effective against drug resistant bacteria

Scientists have used artificial intelligence to uncover new types of antibiotics in the face of growing concerns about resistance to the drugs.

A group of researchers from Massachusetts Institute of Technology (MIT) say their machine-learning algorithm was able to identify a powerful new antibiotic compound, capable of killing some of the world's most problematic disease-causing bacteria.

They claim the technology is able to work more quickly and efficiently than existing systems, because it checks more than a hundred million chemical compounds in a matter of days to pick out potential antibiotics that kill bacteria.

The AI was trained specifically to track down possible antibiotic molecules known for being effective against E.coli growth.

"We're facing a growing crisis around antibiotic resistance, and this situation is being generated by both an increasing number of pathogens becoming resistant to existing antibiotics, and an anaemic pipeline in the biotech and pharmaceutical industries for new antibiotics," said MIT's Professor James Collins. "We wanted to develop a platform that would allow us to harness the power of artificial intelligence to usher in a new age of antibiotic drug discovery. Our approach revealed this amazing molecule which is arguably one of the more powerful antibiotics that has been discovered."

The molecule, named halicin, (after the 2001 film's AI computer Hal) proved effective against E.coli, which did not develop any resistance to it during a 30-day treatment period on mice.

Researchers, who published their paper in the Cell journal, say they want to study halicin further in the hope of developing it for use in humans.

Fernox has launched its new TF1 Sigma Filter Installer's Pack

The pack comprises the TF1 Sigma Filter with slip socket connection and the reformulated Cleaner F3 and Protector F1 500ml product. This 3-in-1 handy pack ensures installers have everything they need to clean and protect a domestic heating system.

The Fernox TF1 Sigma Filter has been engineered from a composite polymer for improved strength and reliability compared to conventional, lidded filters. The filter combines Hydronic Particle Separation (HPS) technology with a powerful magnet to ensure both magnetic and non-magnetic debris is captured and prevented from depositing within the boiler to cause premature breakdown or failure. The filter also benefits from a sealed design. Having no lid reduces ongoing servicing and labour costs as there is no 'O' ring to replace each year. A compressed 'O' ring, which needs changing, may compromise the watertight reliability of a lidded filter whereas the integrity of sealed filter design eliminates that risk. The Fernox filter saves time on-site during cleaning and maintenance of the system.

Also included in the pack is the Fernox Cleaner F3, a non-foaming chemical cleaner reformulated to clean larger volume systems up to 130 litres, 16 radiators or 250sqm of underfloor so for 97% of all UK housing stock only one bottle is required to clean the system. The product starts to work after only one hour and can be left circulating in the system for up to seven days prior to flushing, which is especially useful for heavily contaminated systems. Time spent on-site for a thorough clean is much less due to the improved formulation. Effective against dirt and sludge, this universal cleaner removes debris that would otherwise block pipes or become trapped within the boiler, damaging vital components.

Once clean, the system is ready for dosing with Protector F1. This reformulated chemical inhibitor offers even greater pH buffering and combines three different types of active inhibitors to form a protective barrier between the system metals and water – preventing electrolytic corrosion from taking place and stopping the build-up of sludge and limescale long-term.

The new Fernox TF1 Sigma Filter Installer's Pack is available from all leading merchants.

For more information about Fernox, please visit: www.fernox.com

A cluster of Legionnaires' disease in Belgium linked to a cooling tower, August-September 2016: practical approach and challenges

Epidemiol Infect. 2019 Dec 20;147:e326.
doi: 10.1017/S0950268819001821.
Hammami N1, Laisnez V1, Wybo I2, Uvijn D3, Broucke C1, Van Damme A1, Van Zandweghe L4, Bultynck W4, Temmerman W4, Van De Ginste L4, Moens T3, Robesyn E5,6.

Abstract
A cluster of Legionnaires' disease (LD) with 10 confirmed, three probable and four possible cases occurred in August and September 2016 in Dendermonde, Belgium. The incidence in the district was 7 cases/100 000 population, exceeding the maximum annual incidence in the previous 5 years of 1.5/100 000. Epidemiological, environmental and geographical investigations identified a cooling tower (CT) as the most likely source. The case risk around the tower decreased with increasing distance and was highest within 5 km. Legionella pneumophila serogroup 1, ST48, was identified in a human respiratory sample but could not be matched with the environmental results. Public health authorities imposed measures to control the contamination of the CT and organised follow-up sampling. We identified obstacles encountered during the cluster investigation and formulated recommendations for improved LD cluster management, including faster coordination of teams through the outbreak control team, improved communication about clinical and environmental sample analysis, more detailed documentation of potential exposures obtained through the case questionnaire and earlier use of a geographical information tool to compare potential sources and for hypothesis generation.

To Access the Paper visit:
https://www.cambridge.org/core/journals/epidemiology-and-infection/article/cluster-of-legionnaires-disease-in-belgium-linked-to-a-cooling-tower-augustseptember-2016-practical-approach-and-challenges/21ABA6C10D490D5E5D49F3C5601CC81A

CSS select Qdos pumps for polymer dosing

Chemical Support Systems Ltd, which has designed, manufactured, installed and commissioned over 2,000 chemical dosing systems worldwide, has selected Qdos pumps from Watson-Marlow Fluid Technology Group for polymer dosing in wastewater treatment applications.
This usage is likely to increase as more effort is made to reduce the presence of phosphorus in wastewater. Currently, in the UK, over half of water bodies and three quarters of lakes exceed the phosphorous discharge consent level of 0.1 mgP/l, for 'good environmental status.' The amount of dosing depends on the amount of phosphorus present, with potential fines for those found guilty of discharges over the limit.
Ian Bishop, one of the three co-owners at CSS, says: "Companies with wastewater streams are trying to achieve increasingly stringent discharge consent limits, but also want to reduce operational wastewater treatment costs. Our chemical dosing systems, many of which rely on Qdos pumps, help to achieve both these things."
Qdos pumps cut chemical costs through higher accuracy metering. In addition these pumps offer linear and repeatable low-pulse flow rates from 0.1 to 2,000 ml/min (up to 7 bar), under varying process conditions.
Mr Bishop said: "When supplying a chemical dosing system to a customer, there are certain qualities we look for in a dosing pump. We use Qdos pumps predominantly for their reliability, intuitive operation, accurate dosing and ease of maintenance. If chemicals are particularly viscous, such as polymers, we find Qdos pumps even more useful. In our experience using conventional diaphragm pumps for dosing high-viscosity polymers can be problematic due to blockages within the suction and discharge valves. With Qdos pumps there is a reduction in the level of maintenance required by not having to clean and flush the associated pump head and valves on a periodic basis."
Further information: www.chemicalsupport.co.uk and www.watson-marlow.com

20th Anniversary

On 19th December 2019 Water Treatment Products celebrated the 20th Anniversary of the formation of the Company.
Tim Carter, MD and Founder of Water Treatment Products said "People often ask me how we have become the No. 1 own label manufacturer of water treatment chemicals? Not always an easy question to answer as there are so many reasons but the main ones being continued investment of time, energy and of course money into infrastructure, equipment and our people.
From those small beginnings, starting from a single industrial unit on the Gilchrist Thomas Industrial Estate, Blaenavon on 19th December 1999, WTP is today a 3-acre manufacturing, 70,000 sq. ft. facility based around its original location employing 60 staff; and providing over 500 customers with water treatment products and expertise."
The 20th Anniversary was celebrated at the Company's headquarters with a showcase of photos and materials of the past 20 years to view the development and success of the Company, and the personnel involved.
Initially, the company manufactured industrial water treatment chemicals only but soon expanded into the leisure market for pool chemistries and, in due course, equipment and test kits for testing water quality.
For further information visit:
www.watertreatmentproducts.co.uk

Impact of temperature on Legionella pneumophila, its protozoan host cells, and the microbial diversity of the biofilm community of a pilot cooling tower

Sci Total Environ. 2019 Dec 28;712:136131.
doi: 10.1016/j.scitotenv.2019.136131.
[Epub ahead of print]
Paniagua AT1, Paranjape K1, Hu M1, Bédard E2, Faucher SP3.

Abstract
Legionella pneumophila is a waterborne bacterium known for causing Legionnaires' Disease, a severe pneumonia. Cooling towers are a major source of outbreaks, since they provide ideal conditions for L. pneumophila growth and produce aerosols. In such systems, L. pneumophila typically grow inside protozoan hosts. Several abiotic factors such as water temperature, pipe material and disinfection regime affect the colonization of cooling towers by L. pneumophila. The local physical and biological factors promoting the growth of L. pneumophila in water systems and its spatial distribution are not well understood. Therefore, we built a lab-scale cooling tower to study the dynamics of L. pneumophila colonization in relationship to the resident microbiota and spatial distribution. The pilot was filled with water from an operating cooling tower harboring low levels of L. pneumophila. It was seeded with Vermamoeba vermiformis, a natural host of L. pneumophila, and then inoculated with L. pneumophila. After 92 days of operation, the pilot was disassembled, the water was collected, and biofilm was extracted from the pipes. The microbiome was studied using 16S rRNA and 18S rRNA genes amplicon sequencing. The communities of the water and of the biofilm were highly dissimilar. The relative abundance of Legionella in water samples reached up to 11% whereas abundance in the biofilm was extremely low (≤0.5%). In contrast, the host cells were mainly present in the biofilm. This suggests that L. pneumophila grows in host cells associated with biofilm and is then released back into the water following host cell lysis. In addition, water temperature shaped the bacterial and eukaryotic community of the biofilm, indicating that different parts of the systems may have different effects on Legionella growth.
To Access the Paper visit:
www.sciencedirect.com/science/article/pii/S0048969719361273

What is the risk of missing legionellosis relying on urinary antigen testing solely? A retrospective Belgian multicenter study

Eur J Clin Microbiol Infect Dis. 2019 Dec 14. doi: 10.1007/s10096-019-03785-8.
[Epub ahead of print]
Muyldermans A1, Descheemaeker P1, Boel A2, Desmet S3, Van Gasse N4, Reynders M5; National Expert Committee on Infectious Serology.

Abstract
Currently, diagnosis of legionellosis relies mainly on urinary antigen testing (UAT) for Legionella pneumophila serogroup 1 (Lp1). However, this test has several limitations, particularly missing non-Lp1 infections. The purpose of this large multicenter study was to investigate the risk of missing legionellosis relying on UAT solely. Molecular results of Legionella detection as part of a first-line (syndromic) testing algorithm for severe respiratory tract infections were investigated retrospectively and compared with UAT results in 14 Belgian laboratories. Overall, 44.4% (20/45) UAT results appeared false negative and were reclassified as legionellosis based on PCR findings [Legionnaires' disease, 37.5% (15/40); Pontiac fever, 100% (5/5)]. A total of 39.4% (26/66) diagnosis probably would have been missed or delayed without a syndromic approach, as UAT or specific molecular testing for Legionella was not requested by the clinician. Furthermore, we confirmed the higher sensitivity of molecular Legionella detection in lower respiratory tract compared with upper respiratory tract specimens ($p = 0.010$).
To Access the Paper visit:
www.ncbi.nlm.nih.gov/pubmed/31838606

Management of Legionella in Water Systems (2020)

This is a US document which can be downloaded for free as a PDF. It is a Consensus Study Report of the National Academies of Sciences, Engineering and Medicine 2019 *Management of Legionella in Water Systems. Washington, DC: The National Academies Press.*
doi.org/10.17226/25474.
The report was produced by the Committee on Management of Legionella in Water Systems, which consisted of representatives from the Water Science and Technology Board, the Board on Life Sciences, Board on Population Health and Public Health Practice, Division on Earth and Life Studies, and the Health and Medicine Division.
Legionnaires' disease, a pneumonia caused by the Legionella bacterium, is the leading cause of reported waterborne disease outbreaks in the United States. Legionella occur naturally in water from many different environmental sources, but grow rapidly in the warm, stagnant conditions that can be found in engineered water systems such as cooling towers, building plumbing, and hot tubs. Humans are primarily exposed to Legionella through inhalation of contaminated aerosols into the respiratory system. Legionnaires' disease can be fatal, with between 3 and 33 percent of Legionella infections leading to death, and studies show the incidence of Legionnaires' disease in the United States increased five-fold from 2000 to 2017.
The document can be purchased as a hard-back for $75.00.
Further information:
www.nap.edu/catalog/25474/management-of-legionella-in-water-systems

Nijhuis Industries to acquire Deba UK Ltd.

Nijhuis Industries, the Dutch based Water and Wastewater company, represented in the UK by Nijhuis Industries UK & Ireland, has agreed to acquire Deba UK Ltd. to complement its existing portfolio of services.
The acquisition of Deba UK Ltd. is effective immediately and is part of the Nijhuis Industries group strategy of increasing its portfolio of water and wastewater services and also growing its presence in the UK and Ireland, delivering solid and adaptive solutions for a sustainable and resilient future. The Company will be renamed Nijhuis DEBA Ltd. and its offices in Wokingham will be added to its existing presence in Truro and Bristol.
Since 1972, DEBA UK Ltd. has provided engineering services, products and technologies that enable organisations to meet their health, safety and environmental obligations in the areas of Legionella compliance as well as water and ventilation hygiene. It is a proven provider of mechanical and chemical solutions for cooling towers and also provides wastewater bio-organic catalyst applications. Menno M. Holterman, Nijhuis Industries CEO, commented that 'The DEBA suite of services is an excellent fit with our global vision of providing water and wastewater services that recognise the increasing scarcity of water resources and that contribute to the circular economy.'
Nijhuis Industries UK & Ireland has a long-established history in the UK and the current operation was formed following the acquisition of H2OK Water and Energy by Nijhuis Industries in 2013. The two companies had previously worked together for over 15 years. The company currently provides consultancy, design & build, maintenance and operational services for industrial and municipal wastewater, commercial and residential sewage treatment, floodwater and infrastructure projects.
Further information visit:
www.nijhuisindustries.com/news/press-release-nijhuis-industries-to-acquire-deba-uk-ltd/

Prince William launches Earthshot Prize – Royalfoundation website statement

Over the last ten years, the evidence that we face urgent challenges to protect the environment has become indisputable, and it's clear that the time to act is now. Drawing inspiration from the concept of moonshots, which since the moon landing in 1969 has become shorthand to talk about the most ambitious and ground-breaking goals, Prince William announces the Earthshot Prize: an ambitious set of challenges to inspire a decade of action to repair the planet.
With plans to formally launch the project later this year, intense work is already underway on this multimillion pound project. The Earthshot challenges will be announced in special events around the globe and an annual awards ceremony will take place in different cities across the world each year between 2021 and 2030.
In what is set to be a 'super year' for the environment with crucial summits including the Convention on Biodiversity in China and the COP26 Climate Change Conference in the UK, Prince William will team up with global partners on a decade-long project that reaches every corner of the earth. The new initiative, which has been under development for over a year, will refocus global attention on finding answers to the biggest issues currently facing the planet including: climate and energy, nature and biodiversity, oceans, air pollution and fresh water. Crucially, the Earthshots aim to reward progress across all sectors of industry and society, not just technology. The Prize could be awarded to a wide range of individuals, teams or collaborations – scientists, activists, economists, leaders, governments, banks, businesses, cities, and countries – anyone who is making a substantial development or outstanding contribution to solving these environmental challenges. In addition to a significant financial award, winners will receive large-scale public recognition for their work that will aim to inspire business and government collaboration and scaling.
For further information visit:
www.royalfoundation.com/programme/the-earthshot-prize/

HSE health & safety during the Brexit transition

From the HSE website: The UK has now left the EU. The transition period is in place while the EU and UK negotiate new arrangements for a trade deal. It will end on 31 December 2020. Your responsibility to protect the health and safety of people affected by your work activities remain the same during the transition period.

The guidance: health and safety made simple, basics for your business, will help you to comply with the law. You should continue to manage risk in your business in a proportionate way.

The basics for your business:-

Appoint a competent person.
Choose who will help you manage health and safety in your business

Prepare a health and safety policy.
What a policy is and how it helps you manage health and safety

Risk assessment.
How to identify hazards and assess risks at work

Consult your workers.
Involve your workers and inform them about health and safety

Provide information and training.
Tell your workers what their health and safety duties are

Have the right workplace facilities.
Have toilets, washbasins & other welfare facilities workers need

First aid in work.
Advice on your first aid kit, training workers and appointing first aiders

Display the law poster.
You must display the poster or give workers the equivalent leaflet

Get insurance for your business.
Find out why you may need employers' liability insurance

The law.
The Health and Safety at Work Act, criminal and civil law

Report accidents and illness.
You must report certain injuries, near-misses and work-related illnesses to HSE

HSE website:
www.hse.gov.uk/brexit/

The UK has now left the EU

No prosecutions after 2012 Edinburgh LD outbreak

No one will be prosecuted over the deaths of four people in the 2012 outbreak of Legionnaire's disease in Edinburgh, according to the Scottish prosecution service. The Crown Office and Procurator Fiscal Service (COPFS) said it has proved impossible to identify the source and there is insufficient evidence to prosecute any person or organisation for the outbreak in the Gorgie area of the city.

"Following a complex and thorough investigation which involved detailed genetic analysis we can only conclude that there is no scientific basis for any prosecution related to the deaths and as a result no criminal proceedings are instructed by crown counsel," said Gary Aitken, head of COPFS's specialist health and safety division.

During the outbreak, 92 cases were identified and 45 people had to be treated in hospital. Between 5 June and 15 July, four people died. A multi-agency incident management team, led by NHS Lothian and including HSE and City of Edinburgh Council, was launched to try to minimise the impact.

Bert Air, 56, was the first person to die as a result of the outbreak on 5 June. His partner, Catherine McDonald, said: "I am hurt, angry and disappointed at the outcome. I simply cannot express the frustration that I feel. We have waited so long to reach this point but I don't feel we have been provided with any answers as to what happened. I still want to know why Bert died."

HSE's head of operations in Scotland, Alistair McNab, said the long incubation period of Legionnaire's disease hampered their efforts to find the source. "Legionnaires' disease can have a long incubation period of up to 19 days, so by the time an outbreak is notified to HSE and other regulatory bodies and sampling carried out on water systems, the bacteria levels may have changed or the source producing bacteria may have ceased operation. In addition, as a precautionary measure to prevent further ill health when an outbreak is declared, companies are encouraged to shock-dose their cooling towers with chemicals, which again can prevent positively identifying the source."

COPFS said that following the investigation by HSE and Lothian and Borders Police, it received a number of reports of health and safety breaches unrelated to the deaths. Crown counsel have instructed that "a number" of companies be prosecuted.

Groundwater shortages for US food industry

American agriculture is a giant, world-leading industry that, while meeting extensive domestic demands, still exports around $140 billion in farm products each year. Soybeans go to China. Cherries to Japan. Baskets of goods to Canada.

Some of that production rests on a risky and unstable foundation, a new study finds. It takes water to grow those crops, and an increasing portion of the country's irrigation water is unsustainably mined from groundwater sources that are being depleted. Groundwater use is unsustainable in the long term when the amount of water that is extracted from an aquifer is greater than the amount that enters, via rainfall or artificial means.

A research team led by the University of Illinois at Urbana-Champaign sought to quantify that deficit as it relates to farm irrigation. They wanted to know how much of this unsustainable groundwater is used to grow corn, wheat, cotton, and dozens of other crops, said Megan Konar, a lead author for the study. They also wanted to know how much unsustainable groundwater is embedded in the domestic food trade and how much is exported.

Konar and her colleagues combined groundwater depletion data with county-level food trade data. They found that, between 2002 and 2012, unsustainable groundwater use increased by 32 percent in products traded domestically. The increase was 38 percent for exported goods.

"Agricultural production that depends on unsustainable groundwater use will eventually become infeasible, once groundwater pumping reaches the physical or economic pumping constraints," the researchers write. "It is therefore essential to understand the risks posed to domestic and international agricultural supply chains by the eventual declines in agricultural production from these locations."

The study was published online in the journal *Water Resources Research*.

The dishwasher rubber seal acts as a reservoir of bacteria in the home environment

A paper published in: BMC Microbiol. 2019 Dec 19;19(1):300. doi: 10.1186/s12866-019-1674-5.
Zupančič J1, Turk M2, Črnigoj M2, Ambrožič Avguštin J2, Gunde-Cimerman N2,3.

Abstract

In modern lifestyles, people make their everyday tasks easier by using household appliances, for example dishwashers. Previous studies showed massive contamination of dishwasher rubber seals with fungi, thus bacterial community, able to survive under harsh conditions, remain undetermined.

Bacteria that colonise the extreme environment of household dishwasher rubber seals were investigated using cultivation-dependent and metagenomic approaches. All bacterial isolates were tested for resistance to seven selected antibiotics. Same time bacterial diversity of tap water, connected to the dishwashers was investigated.

All 30 dishwashers investigated were colonised by various bacteria. Cultivation approaches resulted in 632 bacterial isolates in total, belonging to four phyla, eight classes, 40 genera and 74 species. The majority were Gram-positive, as solely Firmicutes (dominated by the Bacillus cereus group) and Actinobacteria. Gammaproteobacteria were primarily represented by Stenotrophomonas maltophilia, Pseudomonas aeruginosa and Escherichia coli.

These data indicate that colonisation of dishwasher rubber seals probably depends primarily on the bacterial input from the dirty vessels, and much less on the bacteria in the tap water. Based on the antibiotic resistance data, the dishwasher rubber seal bacterial isolates do not represent a serious threat for the spread of antibiotic resistance into the household environment. Nevertheless dishwashers cannot be ignored as potential sources of human infections, in particular for immuno-compromised individuals.

To Access the Paper visit: bmcmicrobiol.biomedcentral.com/articles/10.1186/s12866-019-1674-5

Europe experiences exceptionally warm winter

The 2019/2020 winter has been the warmest on record for Europe, with average temperatures 1.4C above the previous high of 2015/2016. Winter is defined as the months of December, January, and February.

The Copernicus Climate Change Service (C3S) says the warmth was very evident in the north and east of the continent where a number of local temperature records were being broken. Globally, February was the second hottest on record. It was cooler by only 0.1C compared with the previous high of 2016.

The C3S reports the numbers in its latest climate bulletins. It said the mild conditions this winter led to a number of impacts across Europe, including "difficulties for reindeer herding in northern Sweden, failure of the ice-wine harvest in Germany, and having to import snow for sporting events in Sweden and Russia".

The December-February average was 3.4C above the 1981-2010 norm. This made 2019/20 by far the warmest European winter in the data records from 1979 on which the service's climate bulletins are based.

New type of membrane developed

Imperial College London and University of Edinburgh scientists have created a new type of membrane that could improve water purification and battery energy storage efforts.

The new approach to ion exchange membrane design, which is published in *Nature Materials*, uses low-cost plastic membranes with many tiny hydrophilic ('water attracting') pores.

Current ion exchange membranes, known as Nafion, are used to purify water and store renewable energy output in fuel cells and batteries. However, the ion transport channels in Nafion membranes are not well defined and the membranes are very expensive.

In contrast, low-cost polymer membranes have been widely used in the membrane industry in various contexts, from removal of salt and pollutants from water, to natural gas purification—but these membranes are usually not conductive or selective enough for ion transport.

The scientists developed the new membranes using computer simulations to build a class of microporous polymers, known as polymers of intrinsic microporosity (PIMs), and alter their building blocks for varying properties. Their invention could contribute to the use and storage of renewable energy, and boost the availability of clean drinking water in developing nations.

The polymers are made of rigid and twisted backbones, and contain micropores that provide ordered channels through which molecules and ions travel selectively based on their physical sizes. The team demonstrated that their membranes were highly selective when filtering small salt ions from water, and when removing organic molecules and organic micropollutants for municipal water treatment.

Further Information: Imperial College London

Managing legionella in care homes' hot water systems

With outbreaks of Legionnaires' disease still being reported in the UK, and indeed further afield, one risk likely to be at the forefront of the industry's mind is the spread of the bacteria behind the disease. Found commonly in water, legionella bacteria multiply where nutrients are available and temperatures are between 20-45°C. Warm, standing water is the ideal growing environment. Legionnaires' disease is a potentially fatal type of pneumonia, contracted by inhaling airborne water droplets containing viable legionella bacteria. Such droplets can be created, for example, by hot water systems, atomisers or hydrotherapy baths.

While anyone can develop Legionnaires' disease, the elderly, smokers, alcoholics and those with cancer, diabetes, or chronic respiratory or kidney disease are at a higher risk. As such, it's vitally important that water delivery systems used in public buildings such as care homes or healthcare centres avoid using standing water, which once circulated through the building can spread contamination.

The UK regulator for workplace health and safety, HSE, published document L8 in 2013: 'Legionnaires' disease. The control of legionella bacteria in water systems'. The Approved Code of Practice and guidance document states that a low risk solution to Legionnaires' disease-causing bacteria is to have hot water fed from an instantaneous water heater.

Zip's InLine product, an instantaneous electric hot water product (IEHW), offers the ideal solution. IEHW is a highly effective means of delivering instant and continuous hot water within residential and commercial projects. Heated at the point of use and only utilised when needed, the InLine is perfect for a range of applications. Whether it's for single or multiple units, the system can supply both sinks and showers, and ensures peace of mind for those responsible for water heating systems within large institutions.

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

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INDUSTRY UPDATES

Legionella Control Association

During the COVID-19 outbreak, the LCA have been writing informative Q&A's and valuable articles for LCA members and their clients. Topics include safe management of water systems in buildings during COVID-19 outbreak and taking samples. The information is freely available to all on the News page of the LCA website:
www.legionellacontrol.org.uk

The LCA currently have 377 Full members, 24 applicants and there are 5 LCA members suspended and not listed on the LCA website. The LCA Standards Sub Committee are continuing the review and drafting of all LCA documents, which will be presented at the postponed LCA conference on the 14th October 2020 at Drayton Manor. Tickets for the conference, titled 'Times They Are Changing' are on sale and the event is proving to be one of the most popular the LCA have organised including a networking dinner at the hotel on 13th October 2020.

admin@legionellacontrol.org.uk

BSRIA

Since 1955 the Building Services Research and Information Association, in short BSRIA, has been leading the construction and building services industry in publishing best practice guidance documents, training professionals, and providing independent compliance and consultancy services. BSRIA is currently updating two major guides: BG 1/2008 on renewable technologies to capture the latest trends and innovations on sustainable energy sources, and BG 29/2012 on pre-commission cleaning of pipework for closed-loop water systems that provide heating or cooling in most buildings. This latter is updated in collaboration with the Closed Systems Control Association (CSCA) and a steering group made of professionals from the industry. Major advocate of better collaboration in projects and delivery of efficient buildings, BSRIA is regularly investigating failures in new and refurbished buildings and is encouraging the adoption of the Soft Landings approach on every project to prevent these. BSRIA will be hosting the annual Soft Landings conference on 25th June 2020 at the London South Bank University.

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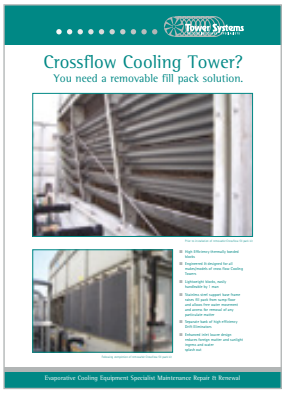
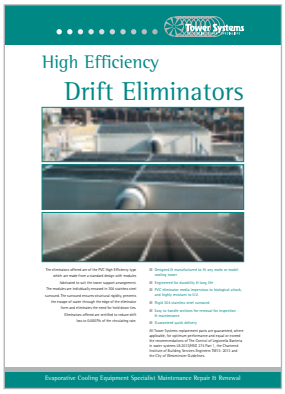
New Equipment/Turnkey Installation Solution

Removable Crossflow Fill Pack Solution



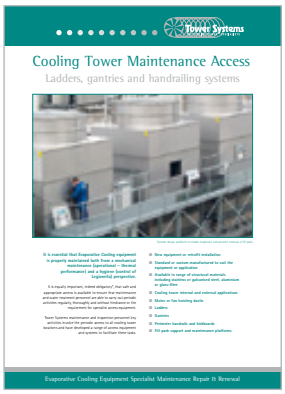
High Efficiency Drift Eliminators



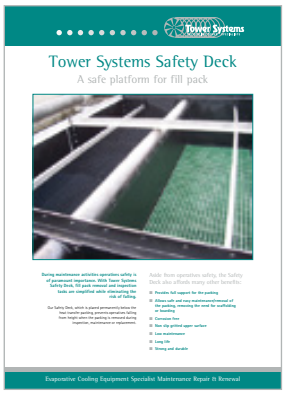
Routine Maintenance Visits

Replacement Parts

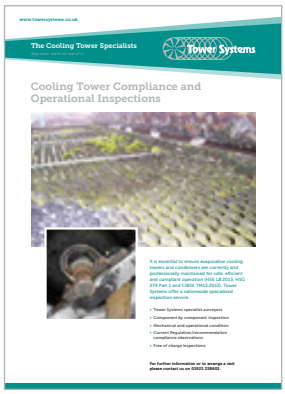
Maintenance Access



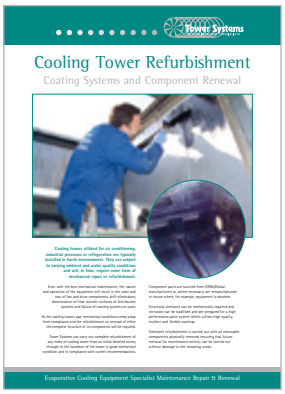
Safety Deck



Condition Surveys



Refurbishment



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A Day in the Life of a Legionella Consultant

Caroline Summers, Myriad Compliance Ltd

My day usually starts off relaxed but often doesn't remain that way! After my cats have their breakfast, they are off to start their day - mine is just starting. People often discuss earworms and their effect on the mind. Well hopefully my earworms are constructive most of the time!

So, reminding myself of my daily responsibilities, my mind kicks in and I am fully awake. After years of being a worker bee, I have finally taken the steps towards independent working and opened myself up to the flexibility this can offer. With two appointments for the day, I set off to a packed commuter train headed for Charing Cross (with ladder often in hand). Noticing all the fashionable people going to the city, it occurs to me why I do the job. With everything being so expensive, it's not the bundles of money that's been promised or the image. In fact, it seems most would say water consultants have a geeky and uninteresting image. Therefore, the most rewarding aspect to my job is preventing disease through ensuring there is clean water available.

I meet new people each day and although I have seen plenty of water systems during my time, new developing technology keeps me interested in the job. There is a learning curve with changes to regulations or assets themselves which makes me ask more about them and the technology being applied.

Without sounding too negative the only part to this job I dislike is going into the male toilets to test. It's usually a knock with dash process and trying not to look around!

Completing a risk assessment according to how I have been trained involves the logical flow of water into the building from the mains and that's where the risk can become raised. As the population increases (with the prediction that in 2050 there will be 77 million in the UK) the only way is up. I feel that providing enough clean and safe drinking and bathing water will be a big challenge for the water industry.

Recently I spoke to a client about Legionella sampling from the mains supply and their response was "We don't envisage any negative results." I thought, OK fair enough, but within the first month of a new contract starting I detected 2 Legionella positive results from 2 mains supplied buildings where water had been left within pipework to stagnate. I might add this was within a sheltered accommodation site. There is social responsibility attached to the role especially where vulnerable people live.

There is no shortage of water in the UK but it's a question of how we manage the resource. If I had to pass on any advice to someone starting in the industry it is that the role offers plenty of job security. Once you get the skills and knowledge behind you there are plenty of opportunities to develop and grow. It's a steady job and being part of the Water Management Society has helped broaden my mind towards what others do in the industry. Most people have niche roles so there is a great sea of knowledge to tap in to. As members give their free time to a not for profit organisation it's touching to know the water industry isn't all about the money. I have been a member for about 5 years, and I thought initially the Society was a formal group, but this has changed after being involved and seeing others' commitment.

Another challenge to the water industry is attracting younger people to be interested and retaining them long term. Other industries have mentioned the same issue, as modern life is very IT driven. What I would say is that scientific skills like problem solving and attention to detail which are used in computer-based roles are also used in the water industry or as an independent consultant.

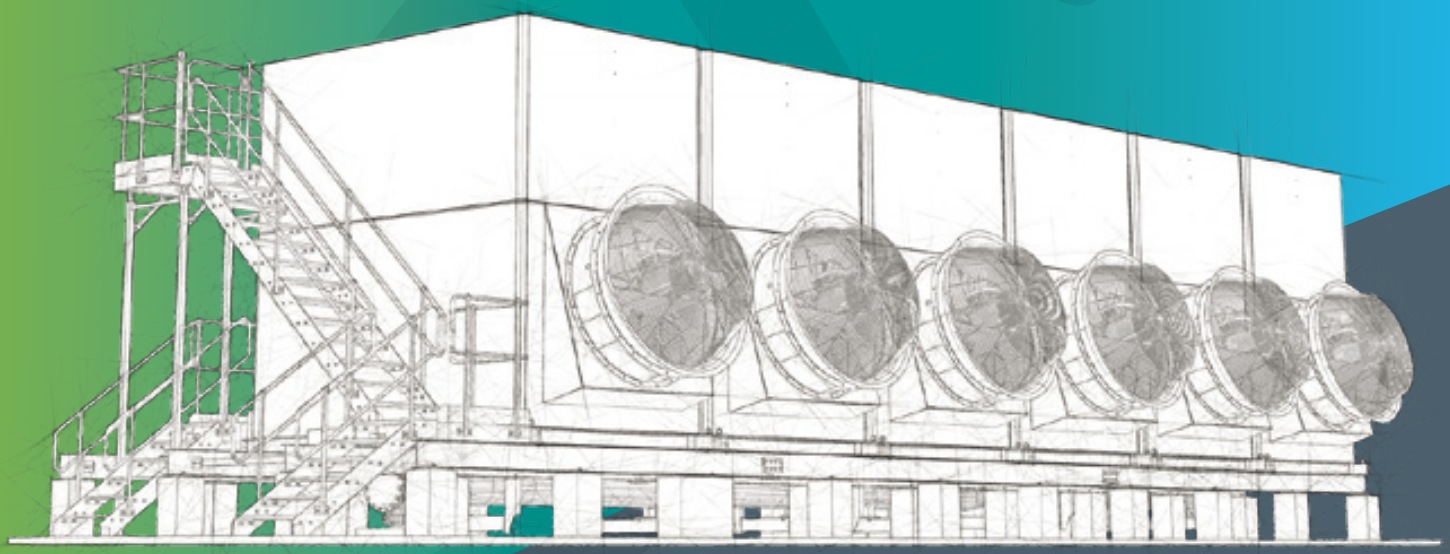
So back to my daily routine - on the job I meet my contact who shows me the building and I soon start to examine the water system for possible sources of risk and non-compliances. Taking careful note to record all detail and give general guidance on site to the client. I discuss the legal roles and responsibilities to them and any practical procedures that should be followed. After finalising the on-site work, I decide to head home so I can consider the entire system and risks associated.

I hear so much about work-life balance, it's like a new busy word. Some of my interests include being part of a local community gardening group and collecting and studying art. Creativity can be part of any process I find useful in my daily life.

A student once said to me that her mathematics teacher made the subject fun by making her lessons creative. Well that's for another day....

Watermiser
water cooling solutions

DESIGN
MANUFACTURE
INSTALL



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We are innovative leaders in the UK cooler tower and industrial water-cooling market, placing sustainability at the heart of everything we do. We've designed, manufactured, supplied and installed evaporative cooling towers, dry blast and adiabatic coolers, chillers and associated equipment for many years now from our base in Scotland and we're proud to be viewed as something of niche experts in this field.

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Legionella Control Association

A partner of Dustacco Engineering

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THE WATER MANAGEMENT SOCIETY

TRAINING COURSE PROGRAMME 2020

SPRING & SUMMER PROGRAMME 2020

Tuesday 19th May	Management and Control of Closed Systems ●
Wednesday 20th May	Practical Legionella Risk Assessment ** ●
Thursday 21st May	Cleaning & Disinfection ●
Tuesday 16th June	Legionella Training for Duty Holders & Responsible Persons incorporating L8
Tuesday 23rd June	Cleaning & Disinfection ●
Wednesday 24th June	Foundation Course in Water Treatment Chemistry
Thursday 25th June	Landlords & Letting Agents Legionella Risk Assessment Training ●
Tuesday 7th July	Legionella Risk Assessment of Water Systems – Basic
Wednesday 8th July	Temperature Monitoring, Sampling & Inspection of Water Systems for Technicians ●
Tuesday 14th July	Cooling & Boiler Water Chemistry Part 1
Wednesday 15th July	Boiler Water Chemistry (Follow on) *
Tnursday 16th July	Cooling Water Chemistry (Follow on) *

AUTUMN PROGRAMME 2020

Tuesday 15th September	HTM 04-01 Water Hygiene Training: Managing & Controlling Risk of Waterborne Pathogens in Healthcare Water Systems ●
Wednesday 16th September	Monitoring the Risk of Waterborne Pathogens ●
Tuesday 22nd September	Practical Legionella Risk Assessment ** ●
Wednesday 23rd September	Legionella Risk Assessment in Cooling Systems **
Tuesday 6th October	Cleaning & Disinfection ●
Wednesday 7th October	Foundation Course in Water Treatment Chemistry
Tuesday 13th October	Legionella Training for Duty Holders & Responsible Persons incorporating L8
Wednesday 14th October	Legionella Risk Assessment of Water Systems – Basic
Tuesday 10th November	Temperature Monitoring, Sampling & Inspection of Water Systems for Technicians ●
Wednesday 11th November	Spas and Swimming Pool Chemical Control and Management
Tuesday 17th November	Managing the Risk of Legionella in Cooling Towers Systems
Wednesday 18th November	Management and Control of Closed Systems ●
Tuesday 24th November	Practical Legionella Risk Assessment ** ●
Wednesday 25th November	Cleaning & Disinfection ●
Tuesday 1st December	Legionella Risk Assessment of Water Systems – Basic
Wednesday 2nd December	Legionella Training for Duty Holders & Responsible Persons incorporating L8

WHERE INDICATED ● COURSE WILL USE THE WMSOC PRACTICAL TRAINING AREA

PTA PRACTICAL TRAINING AREA

* Delegates attending these courses should first attend the Cooling & Boiler Water Chemistry Part 1 course or have a good working knowledge of basic terminology.

** Delegates attending the Practical or Cooling Systems course will be asked to prove that they have previously attended the Legionella Risk Assessment of Water Systems – Basic course or equivalent.

It is generally agreed that training should be refreshed on a regular basis; the recommended interval is 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.

ALL OF OUR COURSES ARE

City & Guilds ACCREDITED PROGRAMME

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