

Welcome to the summer issue of the FWR Newsletter



A few years ago Britain's biggest ever 'fatberg' was removed from a sewer under Kingston upon Thames. This was a single, congealed lump of fat mixed with wet wipes which weighed over 15 tonnes! As Thames Water said at the time 'Homes and businesses need to change their ways when it comes to fat and wipes: *Bin It – Don't Block It!*' Rachel Dyson from Anglian Water has written our lead article on FOG (fats, oils and grease). Pipe blockages cost UK water companies an estimated £88m in 2012–13. A further surprising fact is that around 80% of pipe blockages are avoidable, simply because they are caused by the build-up of FOG and non-flushable items. In her article, Rachel argues that putting a price on FOG for reuse is one of the key ways to ease the situation.

In his *Wastewater Matters* piece, Steve Bungay also refers to recycling in terms of innovation being central to making a 'circular economy' work successfully.

Reports from various recent conferences are also included in this issue.

For information on events and news highlights please go to our website www.fwr.org. You can also contact us via email (office@fwr.org.uk) or telephone (01628 891589).

Maxine Forshaw - Editor



A manhole full of Fats, Oils and Grease



Rachel Dyson
Programme Manager, Anglian Water

FOG

AN INCREASING PROBLEM AND OPPORTUNITY

TO MOST PEOPLE, fog means changeable nasty weather but for water companies the issue of FOG (used fats, oils and grease) is totally different, though just as difficult to predict and just as challenging.

Every day, householders and businesses wash thousands of litres of used cooking oil and FOG (fats, oils and grease) down sinks. In its liquid form it may look harmless, but as hot fat cools it solidifies quickly and becomes hard and sticks to the inner lining of pipes. In addition, it binds with everyday items like wipes, cotton buds and sanitary waste which are flushed down toilets. Over time, the FOG and the non-flushable items can build up and stop water flowing freely, causing blocked pipes and pumps, sewer flooding and pollution.

It is estimated that 80% of all pipe blockages are avoidable as they are caused by this accumulation of non-flushable products and

FOG. According to data shared by all UK water and wastewater companies, there were 366,000 blockages in 2012–13, at an estimated cost of £88m, 80% of which were avoidable costs.

However, those are only the incidents dealt with by water companies and a tiny fraction of the overall extent of the problem. In addition, around one in five of us are likely to have called a plumber to unblock a drain in the past year, costing on average £66 but in some areas the cost can be as high as £240 or more. Plus, further downstream there is the problem of blocked pumps at the pumping station as well as the costs of internal and external flooding and pollution incidents caused by FOG blockages.

THIS ISSUE

FATS, OILS AND GREASE

– An increasing problem and opportunity

by Rachel Dyson,
Programme Manager, Anglian Water

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Fatberg pulled from a burst 6 inch sewer in Cambridgeshire

The sewer network plays one of the most important roles in the protection of public health. Yet it is in need of some protection itself. Proactive policing of what goes into every toilet and sink is, of course, an impossible task. Water companies have little control over what is discharged into the sewer network, yet are responsible for its performance.

The challenge is to change attitudes and persuade householders and businesses that it is beneficial for us all to make sure FOG does not escape into the sewerage system. In a world of dwindling resources and promotion of a circular economy, universal recycling of used cooking oil as a source of renewable energy should be encouraged.

For householders, the message is simple: 'never put used cooking oil and fat down the sink, recycle it'. With an estimated 130 million tonnes of used cooking oil available from UK homes, the potential is huge. However, the pitiful amounts available from individual homes make it unviable to provide convenient door-to-door collection services amongst all but a few pioneering local councils, such as Oadby and Wigston in Leicestershire. The more common approach of relying on people to take used cooking oil to a household waste recycling centre has limited appeal unless the site is nearby. Meanwhile, South Norfolk Council, and a handful of others, have established local collection points but low yield attracts little enthusiasm among waste collectors targeting greater profits elsewhere.

Sainsbury's has realised the importance of helping its customers prevent FOG blockages and, by working closely with water companies, it has run a national Christmas FOG awareness campaign for the last two years. The retailer has also trialled a used cooking oil collection scheme at stores in Scotland and Blackpool. Following success in these areas, and again working in partnership with regional water companies, Sainsbury's is looking to extend this scheme to further stores across the UK where it will sit alongside existing recycling facilities.

For recycling to be a success it must be incorporated into everyday life and made easy for people to action. Without doubt, clear messaging such as the Waste & Resources Action Programme's *Love Food Hate Waste* campaign wins support. In comparison, the more complex information for used cooking oil disposal means that an efficient route for household FOG recycling remains an unsolved dilemma.

By far the biggest challenge is the large quantities of FOG produced in the commercial sector. We now eat out more often, with greater reliance on fast food. The number of restaurants, cafes, takeaways, supermarket rotisseries and work canteens is estimated to be around 575,734 nationally, according to data from Caterlyst (January 2016), and rising.

Food premises lack clear advice about what to do with waste FOG. There is still too much confusion about the use and maintenance of effective grease management systems, the

sizing and siting of grease separators and the frequency and effectiveness of bacteriological dosing. Food serving establishments have a high turnover of staff, and grease management training, although essential, is not consistent and is often overlooked. Simple measures, however, can minimise discharges of FOG. Staff training should encourage good kitchen practice, including scraping and dry wiping grease and food waste from plates and pans into waste bins before they are washed.

Caterers are now reminded to manage food waste legally and safely to help prevent fats, oils and grease from blocking sinks, pipes and drains as part of the Food Standards Agency's *Safer Food Better Business* updated food hygiene regulations.

Many food premises pride themselves on their FOG retrieval techniques used in the cooking process. Whilst it is a legal requirement for food businesses to produce a Waste Transfer Note, indicating that waste oil has been taken away by a

section 111 of the Water Industry Act 1991, it is a criminal offence to discharge 'any matter likely to injure the sewer or drain, to interfere with the free flow of its contents or to affect prejudicially the treatment and disposal of its contents'. Yet it can be extremely difficult to attribute the presence of FOG in a sewer to specific premises which makes it hard to get sufficient evidence for a successful prosecution.

Water companies have powers of entry to inspect premises known or believed to be discharging trade effluent. However, sewerage undertakers have collectively decided not to classify waste from food premises as trade effluent, which inhibits their legislative powers. The UK water industry has been working with Defra under the 'Red Tape' challenge to introduce a 'light consent' for food serving establishments that repeatedly abuse the sewer by letting FOG enter the sewer network with no grease management in place. Work around this has, however, currently been put on hold.



Wash sink at food premise, St Ives, Cambs

registered waste carrier, this does not provide proof that all FOG is being properly managed. During recent inspections, an Indian restaurant produced paperwork indicating that 10 litres of waste oil had been collected – but records showed around 10 times that amount should have been expected, to match what was bought in.

More often than not, it is the prep sinks, pre-rinse sinks, dishwashers, washing machines, wok cookers, chip storage bins and disposal of FOG to floor drains which are left unprotected.

What is not in dispute is the fact that deliberate disposal of waste FOG into the sewerage system is not permitted. Under

Nationally, water and sewerage companies are working collectively to learn from each other with regard to utilisation of third party organisations to assist with FOG management; they are also looking at internal enforcement processes that can be applied based on the relevant laws. A number of water companies have recovered the costs from food serving establishments associated with repeat FOG blockages and related incidents, and one prosecution of a food premise has been successfully made with other water companies looking to follow suit.

Under this collaboration, water companies are working



Food premise manhole with evidence of FOG

with big name chains at Head Office level in connection with FOG management within the limitations of the law – currently there is no legal requirement to fit any grease removal or trapping devices. Nevertheless, there are laws to prosecute where it can be proved a premise has blocked the sewer and there is the new building regulations law to consider grease management at the time when a new kitchen is built, ie the installation of a large underfloor interceptor. Unfortunately there is no law which specifies the sort of trap/device that must be retrofitted in a working kitchen. Add to this the issue that there are no UK standards for such devices or biological dosing and it becomes a real headache for both food premise owner and water company. These big name chains, however, realise the economic sense, as well as reputational importance, of acting responsibly when it comes to reducing FOG entering the sewer network.

The protection of the sewer network will continue to be a focus of water companies' wholesale function, despite the backdrop of market reform in the water industry in April 2017. From this date, all food premises will be able to choose who provides their water and sewerage services although the incumbent sewerage undertaker (part of the wholesale operation) will still be responsible for the sewer network and for dealing with blockages and incidents as well as paying the fines related to flooding and pollution incidents from blockages. It is essential therefore that all water and sewerage companies take a united approach on FOG blockage prevention so that food premises hear the message nationally that action will be taken on repeat offenders blocking the network with FOG.

The recently formed Grease Contractor's Association (GCA) is a welcome organisation into the FOG world, whereby food premises can have a one-stop shop to help them through the confusing maze of FOG management processes and systems, from initial FOG audit to installation and maintenance of the management systems. This is underpinned by British Water's *Food Serving Industry FOG Code of Practice*. <http://www.britishwater.co.uk/article/fog-20.aspx>.

Water companies such as Thames Water have invested in processes and technolo-

gies to 'harvest' the FOG from the network to turn into biodiesel, while other water companies are looking to retrieve the FOG from the network to use in their anaerobic digestion (AD) plants to increase their renewable energy generation. It can be argued that FOG in the network is already producing energy for AD plants through the normal treatment process without any further intervention required, given the difficulty in retrieving the FOG and separating out the 'rag'. However, the cost of dealing with sewer blockages and related incidents outweighs the argument to do nothing.

The opportunity to help contribute to the circular economy through FOG management with domestic customers and businesses, and the increasing investment by the water industry in technologies and processes to harvest FOG from the network can only be positive steps forward, while also contributing to water companies' bottom line and ultimately contributing to lower costs on water customers' bills.

The key is to put a value on FOG – so that it is viewed by all as a valued commodity not to be washed down the sink!

Numbers at a glance

- 366,000 blockages in a year for water companies alone
- Cost to water companies £88m +
- More than 80% of blockages are avoidable, caused by 'non-flushable' products (eg wipes, sanpro waste) and FOG
- Majority of pumping station failures are the result of blocked pumps – not included in the above total costs
- Pollution incident clean-up costs and prosecution fines not included in the above costs
- 80% of sewer flooding and pollution incidents are as a result of a sewer blockage.

Rachel Dyson is a Programme Manager at Anglian Water and Chair of Water UK Sewer Network Abuse Prevention Group and 21st Century Drainage Sewer Misuse workstream. ❖

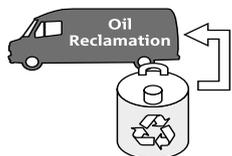
All photographs are courtesy of Anglian Water

Safe method

DISPOSING OF FOOD WASTE, FATS, OILS AND GREASE

Avoid pipe blockages, flooding and potential pollution of the environment from your premises. By following these safe methods you will also **save money**.



SAFETY POINT	WHY?	HOW DO YOU DO THIS?
Scrape plates, pans and utensils into the bin. It is recommended that you should have a dedicated bin for the collection of food waste. Before washing pots and pans, wipe them with a paper towel and put the paper towel in the bin.	This will help to prevent fats, oils and grease, as well as food bits, building up in the pipes and potentially causing blockages. Plus you could be prosecuted and fined for allowing oil and food scraps to cause a blockage under Section 111 of the Water Industry Act.	As part of your staff training ensure that all are aware of the need to do this before washing up. Add this to your list of training items: <ul style="list-style-type: none"> • Are all staff trained? Y/N 
Use strainers to stop food going down the plughole (and empty contents into the bin or container for your food waste collection).	This will help to prevent food building up in the pipes and potentially causing a blockage. If toilets won't flush or your drains back up and cause internal flooding, you could be legally forced to close while the problem is sorted.	Ensure a strainer is always placed in the sink over the plughole. Do not sweep waste into floor drains - place food waste in the bin. <ul style="list-style-type: none"> • Do you have strainers in place? Y/N
Collect used fat, oil and grease in a sealed, secure container.	Fats, oil and grease can build up in pipes creating a blockage leading to bad smells, costs, loss of reputation and potential business. Legally, you could be forced to close until the problem is sorted out.	Ensure all staff know what to do with used fat, oil and grease as part of their training. Add the following to your list of training items: <ul style="list-style-type: none"> • Where is the fat, oil, grease storage area? • How often is the area cleaned? • Is this on your cleaning schedule? Y/N 
Contact a registered waste carrier for the collection of your used fats, oil and grease. Ensure that you keep records of how much fat, oil and grease has been collected by the registered waste carrier. The Waste Transfer Note they give you in return must be kept on your premises for two years for possible inspection.	The registered waste carrier will give you a legal document, known as a Waste Transfer Note, in return for the used fats, oil and grease. They may even pay you, as it can be used to convert into biodiesel. Disposing of this waste correctly prevents it getting into the sewer system and also helps the environment. This will avoid the risk of giving waste to someone who's not registered and up to a £5,000 fine for prosecution under the Environmental Protection Act 1990.	Add the below to your list of training items: <ul style="list-style-type: none"> • Who is your registered waste carrier? • Where are your waste transfer notes kept? 

Excerpt from Food premise FOG management factsheet, created by Anglian Water in partnership with Essex Food Liaison Group

SLUDGETECH CONFERENCE

27–29 June 2016

Steve Bungay, FWR Wastewater Section Co-ordinator

SLUDGETECH AIMS TO BRIDGE THE GAP between academia and industry, bringing together leading experts to share knowledge and insight into the challenges and opportunities surrounding sewage sludge.

This year's conference showcased the latest research and innovation that is taking place across the world with the aim of inspiring the next generation to seek a career in sludge. Supported by CIWEM and a steering committee of experts, the three-day event built on the success of the 2015 conference, with two days of presentations of peer reviewed papers, concluding with a site visit to Reading Wastewater Treatment Works.

The conference was opened by Professor Matt Higgins of Bucknell University, Pennsylvania and included a mix of domestic and international speakers from academia, the UK Water Companies, and industry. The speakers ranged from research students presenting their current research, to long-standing industry experts discussing the challenges facing the industry.

Day 1 of the conference included sessions on *Upgrading and optimising existing assets*, *How to best support agriculture*, and *Combining energy and nutrient recovery*.

The day included reviews of existing technologies, new emerging technologies, and how real-time control can be used to optimise processes. With an eye firmly on the future, Julian Sandino, Vice President CH2MHill gave a thought-provoking presentation on *Embracing disruptive technologies to manage risk in wastewater planning*. In the *How do we best support agriculture* session we saw how advanced technologies such as pyrolysis can be integrated with the recycling of treated biosolids to agriculture. Sarah Fane, a



Steve Bungay chairing at Sludgetech 2016

PhD postgraduate researcher at Cranfield University presented a paper on nutrient release from damaged cells which may contribute to elevated *E.coli* levels in biosolids: a subject that may have a significant impact on the water companies' approach to complying with the Biosolids Assurance Scheme.

Day 2 included sessions on *The influence of policy*, *International experience of upgrading and optimising assets*, and *Developments in material recovery*. Professor Rex Thorpe (University of Surrey) presented a paper on *advanced thermal*

treatment – the basics and the current state of the art. His paper drew from the engineering doctorate of Sludgetech's organiser Dr Nick Mills, illustrating how we can take energy recovery from sludge to the next level.

The Royal Society sponsored Sludgetech's inaugural conference in 2015, the 2016 conference following on from its success. Building on this year, *Sludgetech 2017* will be an IWA Specialist conference on 'Sludge Management' and will take place on 9–13 July 2017 at Imperial College London. ♦

UK AD and BIOGAS Conference and Exhibition

6–7 JULY 2016

Steve Bungay, FWR Wastewater Section Co-ordinator



Photo credit James Brocket WWT.

UK AD and Biogas 2016 brings the world's leading international technology and product suppliers under one roof, along with some of the most engaging and knowledgeable minds in the industry. This year there were over 300 international exhibitors and 24 free seminar and conference sessions.

In December 2015, Ofwat Published *Water 2020: Regulatory framework for wholesale markets and the 2019 price review*. This framework set out Ofwat's preferred options in relation to the design of the future regulatory framework for the industry, addressing both the role of markets and the role of regulation. In response to this consultation CIWEM organised a technical seminar – *Towards a Market for Sludge: Challenges and Opportunities* – which sought views from each of the Water and Sewerage companies, consultants, the Environment Agency and the Consumer Council for Water, in particular looking at the environmental impact of the proposed reforms.

The Sludgetech 2016 conference included a session on *The Influence of Policy*, where Ofwat presented their consultation results: *Creating a competitive sludge market in England and Wales*. This opened Ofwat's results to a wider audience, including both the municipal and commercial arms of the AD (Anaerobic Digestion) sector.

As Ofwat continues work on its *Water 2020* vision, the municipal and commercial AD industry needs to quickly understand the opportunities in order to capitalise on this growing international market. The most recent proposals include further competition within the sewage sludge market and more use of innovative technology.

One of the conference sessions asked *What Challenges and Opportunities does the De-regulation of Water hold for AD?* and included speakers Richard Laikin (PricewaterhouseCoopers), Steve Bungay (CIWEM), and Alison Fergusson (Ofwat); Dr Piers Clark (Isle Utilities) chaired the session. From the initial consultation, Ofwat have identified that there is real potential for markets in sludge activity. They believe that there could be better ways of handling sludge across company boundaries. They also think there could be synergies with the wider waste market. Alison Fergusson said that Ofwat's research had shown that 13% of the sludge in

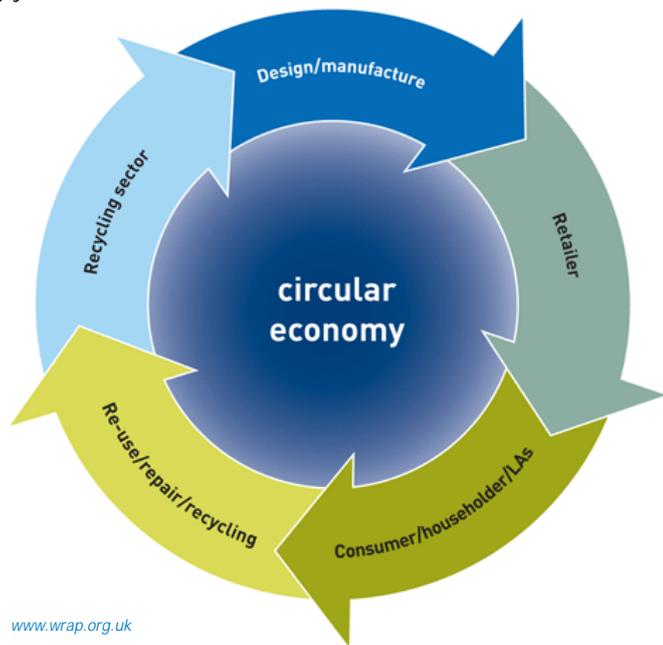
WASTEWATER MATTERS

Water – Innovation and the Circular Economy

Steve Bungay, FWR Wastewater Section Co-ordinator

INNOVATION IN THE WATER SECTOR IS CHANGING. Although the water companies recognize that innovation should be a part of everyday life in the water industry, the implementation of innovation, especially technical innovation, is changing.

In media and management circles there is an increasing focus on the **circular economy** and supply chain management. The principles of the circular economy are simple. The organization WRAP (Waste & Resources Action Programme) has defined a circular economy as *an alternative to a traditional linear economy (make, use, dispose) in which we keep resources in use for as long as possible, extract the maximum value from them whilst in use, then recover and regenerate products and materials at the end of each service life.* See <http://www.wrap.org.uk/about-us/about/wrap-and-circular-economy>. By the very nature of water and the water cycle, the water industry has inherently operated as a circular economy to some extent for many years.



Credit www.wrap.org.uk

The water cycle is one of the simplest circular concepts to understand, and our exposure to it has roots in our school education. So, to the water industry, the circular economy is not, or should not be, a new concept.

Long gone are the days when a sewage treatment works' (STW) design flow sheet had an arrow entitled 'sludge' that disappeared off the page into the ether. STWs generally produce high quality effluents and now regularly employ nutrient removal. Sludge treatment centres (STC) regularly practise the treatment and conversion of raw sewage sludge to treated biosolids; biogas is produced and is typically used on-site in combined heat and power (CHP) engines, or the biogas is upgraded and biomethane is injected into the natural gas grid. Where CHPs are used, heat generated by the engines is typically used at that location, and any electricity produced can be used either on-site or exported into the electricity grid. The water industry is still very dependent on agriculture in its circular economy, with the majority of the treated biosolids being recycled to agriculture. STWs have become wastewater treatment works (WwTW). However, due to the current approach of treating and not recovering nutrients, these WwTWs are still a long way from being the water recycling centres that some water companies portray them to be.

All ten water and sewerage companies (WaSCs) are actively involved with innovation to some degree. Anglian Water operates an online *Water Innovation Network (WIN)*, Dŵr Cymru Welsh Water runs an online *Innovation Process* portal, and Northumbrian Water operate an online portal *Market Innovation and Technologies (MINT)*. Severn Trent Water held an Innovation Day earlier in the year. Southern Water has been exploring innovative ways in which to meet the challenge of balancing its share of the water supply in the environment. South West Water runs another online system – *Pure Innovation*. Thames Water operates a number of innovation centres including the *Thames Water Innovation and Smart Technology Centre (TWIST)*, and the *Thames Water Sludge & Energy Innovation Centre*. Like Severn Trent, United Utilities have hosted an innovation event. Wessex Water has an *Innovation and Technology Forum* to bring experts together from across their business, and have a joint research programme with the University of Bath. Finally, Yorkshire Water in their *Blueprint for Yorkshire* have identified a number of key areas of focus for innovation over the next five years, and operate a system for procurement and contract management innovation.

Innovation is critical to the circular economy. However, in an increasingly media-driven society, the water industry must not lose sight that **innovation** and **Research and Development** are not the same thing. Innovation is the successful exploitation of new ideas, and is a much broader subject for the water companies than R&D alone. Innovation will extend into the supply chain, partners, suppliers, and customers. It is technical innovation that encompasses R&D. But it is R&D that underpins technical innovation and not vice versa. Regulatory, economic and customer trends now mean that it is more important than ever that water companies should innovate. However, it is critical that R&D is not a casualty in the drive towards innovation and the circular economy.

WwTWs and STCs are approaching successful operation within a circular economy. However, we are still a long way from extracting the maximum value from resources in both the water and sludge line.

England and Wales could be profitably transferred to other facilities across water company boundaries.

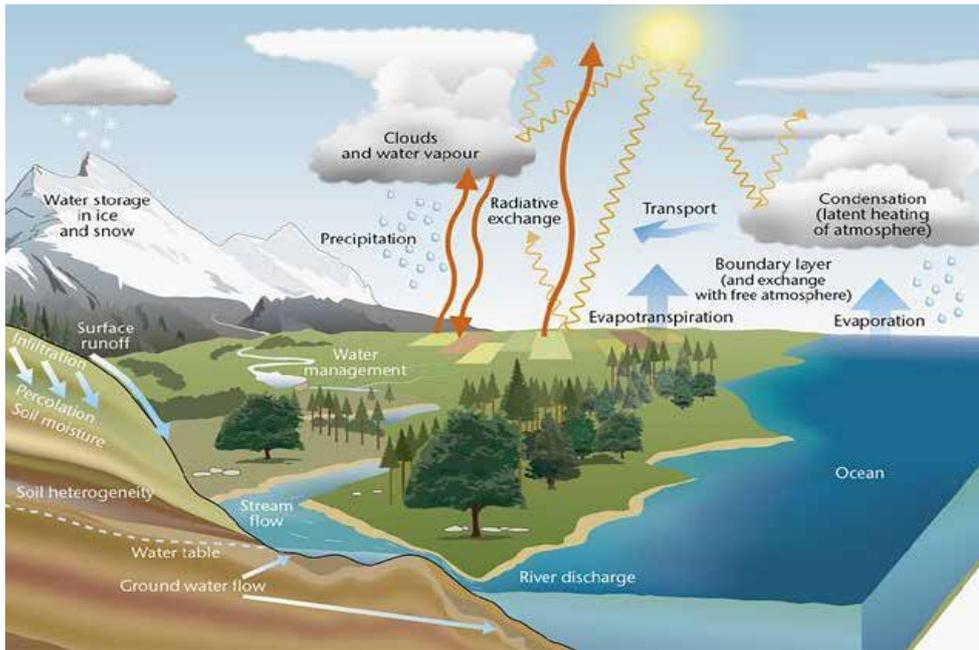
However, Richard Laikin, UK Water Sector Leader at PwC, warned: 'Most water companies have no idea about the unit costs of their sewage sludge operations – how much it costs to treat and transport the sludge, and the cost of generating energy from it. There's a lot of work to do to work out what the costs are in this part of the value chain, and a lot that has to happen before informed choices can be made'.

Steve Bungay (Chair of the Wastewater Management Panel at CIWEM) cautioned that the new

market would need to follow clear standards on the quality of sludge treatment so that the final stakeholder – farmers – have confidence regarding the quality of digestate and treated biosolids, whatever company ends up supplying them.

If the sewage sludge market is deregulated, it is critical that the quality of the final product is not compromised. Currently, the Water and Sewerage Companies convert raw sewage sludge into high quality treated biosolids. In a deregulated market, it is essential that all operators in the AD market produce high quality digestate and biosolids. Glass, eggshells and plastics are not

acceptable components of biosolids which are recycled to agriculture. In addition to this, currently there is a disparity between geographical and regulatory standards and codes of practice for sewage sludge, biosolids, and other organic wastes. This is something that Ofwat have recognized in their consultation. A potential solution to this disparity is the new Biosolids Assurance Scheme (BAS). If, in order to operate in the deregulated market, operators have to work within BAS, this could be a mechanism of ensuring that both consistent regulation and a high quality product is recycled to farmers' fields. ♦



The water cycle – credit www.metoffice.gov.uk

R&D and risk management are critical components of achieving a successful circular economy. Currently, however, the water companies are very risk adverse. This aversion to risk, combined with operating frameworks and procurement strategies, serves to stifle both R&D and innovation. For successful R&D there has to be an acceptance of failure. If R&D and technical

innovation were that easy, we wouldn't need to do it. For every successful R&D project, there will be failed projects. However, in a risk adverse culture, there is no understanding that in order to achieve a successful outcome, failure may play an important role. Cascading risk onto the supply chain under the banner of innovation does not solve this problem; it simply moves the ownership of the

problem elsewhere. Frameworks and procurement strategies also act as barriers for small innovative companies to engage with the water companies. There is a desire to improve the management of the supply chain, and to stimulate the supply chain into undertaking R&D. However, currently the door is firmly closed to the exploitation of this desire.

Deregulation of the sludge market will also have an effect on innovation. At present, only time will tell if this effect is positive or negative. Ofwat's proposed changes are more in line with a traditional linear economy and not a circular economy. One of the concepts of sludge deregulation is that competition should drive innovation. However, will this innovation support or hinder the circular economy?

A circular economy requires a **holistic** approach. Nutrient recovery from sewage is currently almost non-existent, limited to almost a handful of struvite harvesting plants. Producing biopolymers and enzymes could potentially offer significant opportunities for the recovery of high value industrial resources from activated sludge. The recovery of energy from sewage sludge has improved remarkably over the last two AMP (Asset Management Plan) periods. However, the overall per cent of energy recovered still remains relatively low. Advanced digestion and thermal hydrolysis technologies are now well developed, and biogas upgrading to biomethane is developing quickly.

To make the next technology step, and a move towards a circular economy, innovation, R&D, and risk management will all have a part



Advances in Disinfection of Potable Water

14 July 2016

Mike Waite, FWR Water Supply Co-ordinator

WAS ONE OF AROUND 60 DELEGATES ATTENDING THIS MEETING in the impressive Victorian surroundings of The Leeds Club in Yorkshire. The meeting was clearly aimed at industry professionals well versed in the legislation and practical aspects of disinfection. Here is a flavour of the day – for my full account please go to <http://www.fwr.org/drnkwatr/disinfection2016.htm>

Mike Newberry (MWH) reminded the meeting of **the DWI approach to UV disinfection**, setting out why validation of UV equipment is necessary and the various different systems in use for validating. For any installation it is important to consider the potential pathogen challenge.

Richard Lake described Affinity Water's long experience of, and heavy **reliance on UV**. It had a UV unit as long ago as 1990 and by 1996 already had around 10 sites with high quality chalk groundwater where medium pressure UV and marginal chlorination was the only treatment. Depending on the source, the company used super and dechlorination, UV and mar-

ginal chlorination, or for some high quality sources, just marginal chlorination. With the recognition of aquifer changes due to extreme weather and the *Cryptosporidium* risk, the company realised that disinfection had to be an absolute barrier. Early advice was that only physical removal of *Cryptosporidium* was effective and the company installed a number of ultrafiltration plants. In 2007 the regulations changed to allow *Cryptosporidium* to be 'rendered harmless' following recognition that it was sensitive to UV. Since UV offers economic benefits compared to ultrafiltration, the company is moving to replacing ultrafiltration by UV plants.

Robert Pitchers (WRc) referred to **the latest WHO Guidelines which promote the application of health targets**, these being applied as DALYs (Disability-Adjusted Life Years) (Australia, Canada) or Infection Risk levels (USA, Netherlands). The UK requires water suppliers to have Water Safety Plans which necessitate having site-specific pathogen-focussed disinfection policies. To assist water companies WRc has developed a toolbox which relies on published data and, where necessary, extrapolation and allows companies to optimise chlorination.

After lunch, Andrew Elphinston (Black and Veatch) talked about **experiences in the design, installation, and operation of UV plants in Wales**. Following experiences with *Cryptosporidium* at a hitherto good quality upland source in 2005, Welsh Water reviewed all its sources and concluded that over 25 were at risk and UV would be the preferred solution. Comparing low pressure with high pressure UV plants led the company to adopt both types depending on location and power availability.

Ludwig Dinkloh (XYLEM) spoke about **the application of Advanced Oxidation Processes (AOP) to seasonally occurring micropollutants**. He explained that AOP rely on the production of highly reactive OH radicals which can be generated by ozone + hydrogen peroxide, UV plus hydrogen

to play. Ian McAulay, Viridor's Chief Executive, has clearly stated that Viridor would not invest in new waste and recycling infrastructure for the UK if austerity is allowed to 'kill off' education and innovation in the industry. The water companies are facing similar challenges to the waste companies and they are both key players in the UK's adoption of the circular economy package.

For success in developing a circular economy, it is critical that innovation is not simply a sound bite. If the water companies are to extract the maximum value from sewage and sewage sludge, they need to promote R&D; they need to engage with the supply chain; they need to engage with academia; and they need to be prepared to take a risk. ♦



Credit: Rafal Olechowski/shutterstock.com

peroxide, or UV plus chlorine. The main seasonal micropollutants are geosmin and methyl iso-borneol (MIB) and they tend to only occur for 2–3 months per year. AOP can also be used for removal of some pesticides, in particular metaldehyde which can be a problem for some water companies.

Richard Joshi (atg UV Technology) finished the meeting with an interesting forward-looking presentation on **the future of UV**. He talked about the way in which new ideas progress through inflated optimism via disappointment before stabilising in their application. Any new product must meet a market need, and technically possible does not necessarily mean practically viable. One interesting development could be UV LEDs. These would have many advantages, being small, wavelength-tunable, solid state, instantly switching, mercury-free and low voltage. Unfortunately at present their efficiency is low. He surmised that UV LEDs are at least 10 years away for large volume water treatment but some small volume applications could happen sooner. UV could have a role in water re-use where resources are scarce and could be used in small package plants for small communities. Finally, he suggested that AOPs were likely to be a key element in developments of advanced water treatment. ♦

WRC INNOVATION DAY 2016

Mike Waite, FWR Water Supply Co-ordinator

THE THEME OF WRC'S ANNUAL INNOVATION DAY IN APRIL

was *Sharing Knowledge for a Changing World*. This event has been steadily growing since its inception and I think 2016 was its most successful to date. The event had a limit of 300 delegates and was oversubscribed, showing how much the occasion is now valued. I was fortunately able to attend and found the day of great interest.



Courtesy WRC plc

The first innovation encountered was the use of *Blendology*, a system whereby delegates registered their details online before the meeting and on arrival were issued with identity cards which, when tapped against any other card, recorded the link. Once tapped, the details of contacts could be retrieved online at a later time. This was a useful replacement for the traditional exchanging of cards.

The day began with four keynote addresses, beginning with Simon Walker (Candover Consulting Ltd) talking about **'Future Proofing your Organisation – the Future of Work and Leadership'**. He gave a lively presentation in which he stressed that organisations need to be flexible in time, location and processes and should recognise that times and technologies are changing. Organisations should be a network, not a hierarchy, accepting inputs and ideas from anyone. He quoted the saying 'Beware of Hippos' (Highest Paid Person's Opinions) as a criterion for the value of ideas. His key message was that organisation leaders should lead but also listen and show humility over ego.

Next came **'The Circular Economy as a Driving Force for Change'** by Ian McAulay, Chief Executive of Viridor. One of his key points was that there should be no such thing as waste, but rather it should be considered a resource. Organisations should aim for zero waste. He advocated resource networks and gave as an example Greater Manchester where several local authorities handle waste together at an energy recovery facility (ERF) which burns waste to generate heat and power. There are proposals to encourage actual and potential users of ERF heat to locate near to facilities and develop brownfield sites close to ERFs with this as a driver.

Jon Brigg, Innovation Manager Yorkshire Water, described **'An Integrated Approach to Innovation'** being developed by Yorkshire Water, as part of the Kelda Group. At the start it is important to define needs and be willing to change, carry out R&D, and aggregate issues

holistically. The company has set up a long term 'Integrated Water, Waste, and Resource Recovery Concept and Action programme' which (refreshingly) is virtually acronym proof; this looks at existing power production and the possible development of new wholesale products such as heat, CO₂, and sub-potable water. These initiatives will produce benefits for both customers and the environment. The company is looking at the use of redundant land, especially around sewage works, with the development of industries to use heat and power from ERFs, and is piloting this at Esholt near Bradford.

The final informative presentation was given by Eileen Linklater of the European Marine Energy Centre on **'Innovate, Collaborate, Generate – a Pathway to Commercialisation for New Technologies'**. She described how the seas around the Orkneys were being used to try out a range of systems for capturing energy from waves or tides without the use of barrages. She said that the UK could get 20% of its energy needs from waves and tidal activity, and the drivers for the development of this energy source are both climate change and economics. At present, Orkney produces 104% of its energy needs from wave and tide. There are problems with feeding the surplus into the national grid and the power production is not steady, being influenced by the state of the tides. They are developing energy storage using production of hydrogen by electrolysis and its subsequent use in fuel cells.

Over 60 exhibitors were in attendance, providing an impressive selection of innovative techniques and equipment.

The afternoon was devoted to a session bringing delegates together in small groups to consider a number of innovation issues. Once again pupils from Isambard Community School were present throughout the meeting, producing and showing an excellent video record of the day. The day supported the charity BLISS (for babies born premature or sick). ♦



An update on the activities of the FWR

Caryll Stephen

Chief Executive of the Foundation for Water Research



AS YOU CAN SEE IN THIS NEWSLETTER FWR HAS

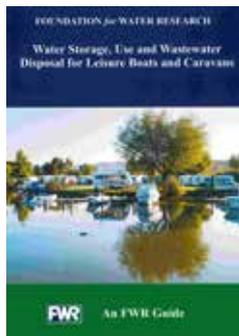
focussed on wastewater and has been out and about throughout the summer months at various events concerning both waste and clean water. We also attended the recent New Forest Show at Brockenhurst which had many visitors and our stand was very popular. A lot of interest was shown in one of our new Reviews of Current Knowledge (ROCKs) concerning *Water Storage, Use and Wastewater Disposal for Leisure Boats and Caravans*.

The Chinese delegations due this summer have been delayed due to visa problems, but we are now optimistic that a visit from one of the groups will take place in September. We are planning a few more events this autumn and further ROCKs are already in production. On the catchment based approach front, we are pleased to say that we have received a further year of funding (2016–2017) for our hosting role of the South Chilterns catchment partnership.

In the meantime, I do hope our readers are enjoying the current summery weather and, as usual, a big thank you to everybody who has contributed to this issue of our newsletter. ❖

New FWR Publications

Copies of these reports are available from the Foundation for £15 each, less 20% for FWR members.



Water Storage, Use and Wastewater Disposal for Leisure Boats and Caravans

FR/G0010, July 2016

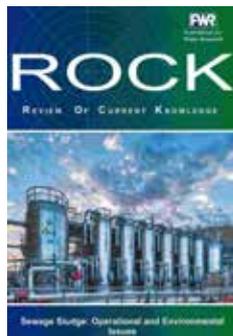
This Guide provides a comprehensive overview of the safe storage and use of drinking water, and disposal of wastewater, for owners of leisure boats and caravans. With reference to the latest guidelines and regulations, this publication aims to bring all the relevant information together in one easily accessible document.

Wherever water is stored or wastewater created there is a risk of infection that needs to be managed. Good hygiene is therefore essential when treating, distributing and using drinking water, and when handling and disposing of wastewater. Contaminated water can transmit infection not only when drunk but also when used for cleaning teeth or washing food such as salad which is eaten without cooking. Recreational use of water can also lead to infections although this is outside the scope of this guide; for further reading on this topic see FWR Guide FR/G0005 *Standards for Recreational Water Quality*. ([http://www.fwr.org/ environw/frg0005.pdf](http://www.fwr.org/environw/frg0005.pdf)).

Clean and safe water therefore remains a keystone for public health protection. Following the guidance in this report will help ensure that leisure boat and caravan users meet their obligations to preserve clean water for everyone.

The advice is based around the use of leisure boats and caravans in the UK for personal use and does not cover the use of commercial vehicles. Much of the content may nevertheless be relevant further afield. The term 'caravans' also includes motorhomes when appropriate.

The first section of the guide addresses the collection, storage and use of potable water. The second section covers the collection, storage and disposal of wastewater. ❖



Sewage Sludge: Operational and Environmental Issues (4th edition)

FR/R0001, Revised June 2016

This updated Review of Current Knowledge is concerned primarily with 'sludge' from urban and domestic wastewater treatment works. Many of the principles, however, will also apply to sludges from wastewaters from industrial processes, and to digestates from biogas plants.

The main objective of treating these wastewaters has been to separate water from the other constituents so that the water is fit for release either back to the environment or for reuse. The second objective is to recover resources from the other constituents; this is being given increasing priority as we strive to move from a disposal society to a recycling society. It is important to keep in context the risks and benefits compared with both 'ambient' activities and with the do-nothing option of not recycling.

The publication looks at how sludge is produced (after being treated, sludge is also now referred to as 'wastewater biosolids'). Sludge as a resource, in terms of water, energy, chemical, metals, etc, is then considered. Sludge treatments are covered (dewatering, biological and chemical treatment, drying, plus incineration and other thermal processes). The risks of using sludge on land is examined, encompassing metals and inorganic chemicals, organic chemicals, risks from pathogens, odour, and both unknown and emerging risks. And finally, the author looks at the benefits of using sludge on land. ❖

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Foundation for Water Research

Allen House, The Listons, Liston Road, Marlow, Bucks SL7 1FD.

T : +44 (0) 1628 891589

F : +44 (0) 1628 472711

E : office@fwr.org.uk

W : www.fwr.org

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