

Spring/ Summer 2019; Volume 20 Issue 1

“Promoting the professional and scientific interests of members to safeguard the public interest in the application of chemical sciences in water-related industries.”

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The Agriculture - Water Interface

Globally, agriculture is reported to account for 34% of land area usage, contributes circa 24% of global greenhouse gas emissions and accounts for 70 % of freshwater usage. Agriculture also plays a major role in water pollution and especially the degradation of inland and coastal waters. These interesting facts were only some of those presented and discussed at a 1-day meeting in the Royal Society of Chemistry (RSC) on 1st November 2018 in London titled “The agriculture water interface – Current topics”. The conference was jointly organised by the RSC Agriculture Sector and Water Science Forum interest groups and the day was split into 3 perspectives:- firstly from the agricultural industry, then from the regulatory perspective and finally from those involved in monitoring and mitigating the fate of pollutants in water. The full programme and pdf copies of the individual presentations can be found on the RSC Water Science Forum website at <http://www.rsc.org/Membership/Networking/InterestGroups/WaterScience/Agriculture-2018.asp>

The **Industry Perspective** session (Chair: Murray Smedley, Barkwith Associates Limited) featured presentations from a range of activities in agriculture-based industries and was opened by Steve Cann, from Future Food Solutions, who gave a farming perspective and described the “Sustainable Futures” programme which is looking at ways of locking sustainability actions into the supply chain. The producers of crop protection solutions followed with a presentation titled “Stewardship approaches for water protection” by Dr Alison Hall from Adama Agricultural Solutions UK. Dr Hall introduced the Voluntary Initiative which is an industry-led partnership <https://voluntaryinitiative.org.uk/> with a mission to promote the responsible use of pesticides in order to protect water and the wider environment and ensure the availability of professional pesticides in agriculture and horticulture while avoiding unnecessary regulation on the sector. The final presentation in this session was “Working with Nature – Creating Business Value from Healthy Landscapes” by Andrew Griffiths (pictured), Head of Sustainability for Nestle UK. Andrew explained that since 2007 as a result of their Reduce, Reuse, and Recycle management they have reduced water withdrawals per tonne of product by 60% in the UK and Ireland and 38% globally.



Water Factoid— Water is the only substance on earth that occurs naturally in solid, liquid, and gas forms.



The Agriculture - Water Interface (continued)

The **Regulatory Perspective** (Chair: Richard Maycock, Corteva, European Regulation) covered by Dr Robin Blake (Compliance Services International) with a talk titled "Importance of chemical legislation to water quality in agriculture" and Dr Robin Price (Anglian Water Services Limited) with a talk entitled "Achieving 100% compliance for metaldehyde – is treatment the answer?" Dr Blake described the EU Water Framework Directive (WFD) and how this and a number of other EU directives are of relevance to the agriculture sector. Dr Price spoke about the metaldehyde issue and how Anglian Water had developed a new treatment works to remove this problematic molluscicide (***see 'In the news' for an update on metaldehyde use**).

The **Monitoring and Fate of Pollutants** session (Chair: Graham Mills, University of Portsmouth) kicked off with a presentation from Professor Adie Collins (Rothamstead Research) on "The agriculture – water quality interface: mitigating the multiple unintended consequences". He stated that in 2016 only 14% of surface water bodies in UK were classified as good/high status under the WFD and that agriculture has been directly attributed to 31% of failures. The next talk saw Dr Nick Paling (photo below) from the Westcountry Rivers Trust gave a presentation on the Upstream Thinking partnership which is working to improve water quality in the South West of England by changing land management to protect rivers (www.upstreamthinking.org). The programme looks to provide advice and grants for farmers and the restoration of peatland in partnership with landowners. Professor Fred Worrall (Durham University) presented "Learning from experience – pesticide monitoring in English groundwater" which described an approach to predict the occurrence of pesticides in groundwater. To finish the day off Dr Joanna Clint (Catchment Projects Manager for Thames Water) gave a water companies view with her presentation "Monitoring and mitigating pesticides in water: a collaborative approach - Why, what and how". This was a fascinating conference which clearly highlighted that the agriculture and water industries were inextricably linked. It was clear that pesticides were a major problem for water companies and that raw water treatment was not the way forward to deal with the increasing risks of agricultural related pollution.

Many thanks to Murray Smedley, Richard Maycock (Agriculture Sector) and Graham Mills (WSF) for helping with the meeting organisation. Many thanks to Tilele Stevens (WSF) for helping on the day (and photos). Many thanks to Tom Lynch for providing the initial text. **Gary Fones (meeting organiser)**.



RSC and WSF in India

In November 2018 (12th to 15th) The James Hutton Institute (**Dr Richard Allan, WSF**) in partnership with the Ashoka Trust for Research in Ecology and the Environment (ATREE) and the University of Portsmouth (**Prof Gary Fones, WSF**); funded by the Newton Bhabha fund (with contributions from the British Council and the Royal Society of Chemistry); delivered a workshop focused on developing Early Career Researchers (ECRs), which explored real-world opportunities for research collaborations focused on water source protection and monitoring in India.

The four-day event hosted at the Royal Orchid Hotel, Bangalore, India was attended by more than 30 academics in water science research and policy from India and the UK, including 18 ECRs from the UK and India. The links and themes developed through the workshop have crystallised thinking around a range of strategically important research areas.

Common themes included:

- Development of low-cost analytical tools;
- Development of GIS-based modelling of the systems;
- Use and deployment of decentralised wastewater treatment systems;
- Modelling of groundwater flows;
- Development of management strategies that take account of local preferences;
- Establishment of an integrated monitoring framework for the region and national scales;
- Wider studies on the impact of water pollution on the ecosystem and biodiversity.

Three project areas were identified for immediate support:

- Development of a fund to support future activities;
- Training and further interdisciplinary workshops to take account of a broader need for social science inclusion;
- Development of an integrated monitoring framework and strategy, which considers a system approach.



Rajesh Parishwad from the Royal Society of Chemistry discussing funding and publishing opportunities

RSC and WSF in India (continued)

The workshop was both timely and important, as it shone a spotlight on sampling and analysis of waters for water quality monitoring in India. In Europe there is a coordinated approach to environmental monitoring of surface waters (Water Framework Directive) and drinking water (EU Drinking Water Directive). In India there are regulations, however, there is no real consensus on a standard approach to water quality monitoring in terms of sampling protocols, transport of samples and analytical methods (plus associated quality control/assurance procedures). The UK organisers (Richard Allan and Gary Fones) wish to thank all the ECRs, key note speakers and rapporteurs for their support and engagement. Special thanks to Dr Priyanka Jamwal and her team at ATREE for making the event happen and to the RSC (Newton Bhabha) for their financial support. - **by Richard Allan and Gary Fones**



Indo/UK water science discussion at the workshop



Early career researchers, key note speakers and workshop organisers on a site visit to Jakkur Lake, Bangalore, India

Alan Tetlow Bursary Report

In October 2018, the Alan Tetlow Memorial Bursary was awarded to Angela Pinzon-Espinosa to attend the 16th Annual Meeting on Environmental Toxicology and Biological Systems held in London, where she presented her doctoral research in an oral presentation. Angela completed her PhD in Environmental Sciences at Brunel University London. Her research focused on the detection and identification of toxic chemicals in industrial effluents using luminescent bacteria, and the development of low-cost clean-up technologies targeting refining chemicals. In particular, her doctoral project studied the gap between chemistry and toxicity in oil refining effluents, showing that naphthenic acids are important contributors to the biological effects exerted by refining effluents. Furthermore, she found that their chemical stability makes them highly resistant to remediation using bacteria and advanced oxidation processes. Angela anticipates her results to be a starting point for better environmental regulations relevant to refining wastewater resulting from the processing of heavy crude oil, as naphthenic acids are not currently considered in the effluent guidelines for the refining sector.

Early Careers Workshop

Fiona Campbell, the Water Science Forum committee's early career representative, organised an Early Careers Workshop on 19th February 2019 in collaboration with Scottish Water and the Royal Society of Chemistry. Around 25 young people, at different stages of education and career, attended the event. It included talks on Royal Society of Chemistry, the Water Science Forum and Scottish Water, with a focus on careers advice. There was also a practical element to the event, where small groups were taken around the Inorganics, Organics, Microbiology and Cryptosporidium laboratories at Scottish Water, bringing to life water science through hands on activities. The feedback received was extremely positive, and the attendees found it invaluable being able to ask questions about careers in science and water, to both experienced and early career scientists, including apprentices from Scottish Water.



WSF Committee—Appreciating Helen



It's a big Thank You to Helen Keenan for the commitment and effort she has put into her time as Chair and the WSF generally.

Helen will be remembered by her distinctive dulcet tones tinged with a dose of Glaswegian. It was not without good reason that at one international conference I attended with her, that the organisers arranged sub-titles as she spoke (and that was in Edinburgh so how the English coped is still to be determined never mind the non-English speakers what did they make of it). Helen will be remembered for the ways she could make the most academic and dry subjects interesting: who else would have The Red Hot Chilli Pipers (think heavy rock music with bagpipes) as the interval entertainment at a conference discussing Mercury pollution.

Helen's professional achievements are equally impressive: from her role as Laboratory Manager

through to Director of the MRes Programme at the University of Strathclyde. She was especially keen to support students taking alternative routes to gain their qualifications, whether it was via part time or open access arrangements rather than a conventional route straight from school to full time university. Her work has global impact through her interaction and participation with UN agencies. This is particularly seen when she was invited to join the United Nations GESAMP (Group of Experts on the Scientific Aspects of Marine Environmental Protection). She served as Chair of Working Group 37, dealing with mercury and its compounds



In the News

Wet wipes to get 'Fine to flush' logo to tackle fatbergs— BBC News

<https://www.bbc.co.uk/news/business-46835573>

Pharmaceutical residues in fresh water pose a growing environmental risk — IOP

<https://iopublishing.org/news/pharmaceutical-residues-in-fresh-water-pose-a-growing-environmental-risk/>

Outdoor use of metaldehyde banned from 2020— WWT online

<https://wwtonline.co.uk/news/outdoor-use-of-metaldehyde-banned-from-spring-2020>

River Thames— polluted by single use items —Marine Conservation Society

https://www.mcsuk.org/news/river_clean_report

Papers of Interest (RSC Journals and Open Access)

Long-term performance evaluation of an anoxic sulfur oxidizing moving bed biofilm reactor under nitrate limited conditions

<https://pubs.rsc.org/en/content/articlehtml/2019/ew/c9ew00220k>

Comparison of different monitoring methods for the measurement of metaldehyde in surface waters

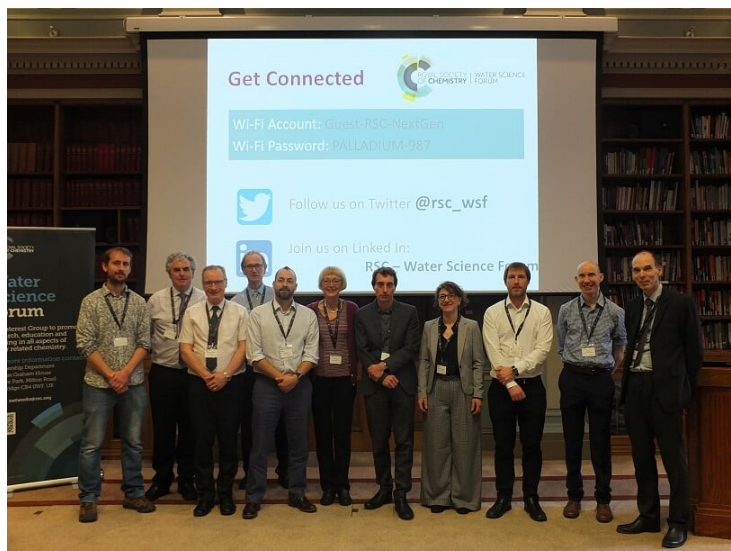
<https://link.springer.com/article/10.1007%2Fs10661-019-7221-x>

WSF Newsletter— If you have any items of interest or stories for the newsletter please email us at—rscwsf@gmail.com

Groundwater Conference

The Water Science Forum organised a very successful meeting in March at Burlington House entitled Groundwater Quality: Public and private water supplies. There were 64 attendees, with EA and the water industry well represented, and 9 expert speakers.

The first presentation was given by Tim Besien who coordinates groundwater aspects of the Water Framework Directive and Groundwater Directive for the Environment Agency. He described the latest policy and regulatory changes to improve management of groundwater resources. Marianne Stuart, Senior Hydrogeochemist for Groundwater Protection at the British Geological Survey presented the latest data on emerging organic contaminants collated by the EA. She illustrated examples of spatial analysis of groundwater quality mapped across England and Wales for representative contaminants in relation to geology and land use. An increasing number of



chemicals are being detected with new GC-MS and LC-MS detection techniques, a large proportion of which are unregulated. Some of these, together with their breakdown products, could pose a possible risk to health. Pharmaceuticals and hormones are of increased concern, including those recently added to the EU Watch List. Tim and Marianne emphasised the need to protect groundwater from contaminants with high water solubility and long persistent lifetimes. There is a need to prioritise which substances require monitoring and adopt a more risk-based approach.

Dr Aidan Foley, a hydrogeologist and expert in karst hydrology, explained in detail the value of understanding flow in chalk aquifers. He made a strong case for wider adoption of a well-established methodology in groundwater mapping in karst in order to more accurately delineate safeguard zones and in undertaking evidence-based risk assessments during planning applications. Ben Ellis, EPO for Stratford-upon-Avon District Council, highlighted difficulties in applying current EU regulations to private water supplies and emphasised the shortage of available expertise and resources within Local Authorities. He was also concerned that installers of boreholes are currently unregulated and recommended accreditation. Richard Philips, Drinking Water Inspectorate, gave an overview of how both public and private supplies are regulated (including the implications for the owners and operators of the 2018 amendment to regulations), describing the differences in water quality between the two types before focusing more specifically on the private supplies and the challenges they face.

After lunch Dr Joanna Akoumianaki from the James Hutton Institute, Scotland, described a methodology to facilitate risk-based monitoring of small (private) water supplies. Bacterial contamination normally poses the more serious health issue and James Sorensen of BGS described use of fluorescence spectroscopy as a rapid field test for detection of microbially contaminated drinking water. The impact of local factors and the wide variability in borehole construction, treatment systems and monitoring regimes were ongoing themes. In the case of private water supplies, the competency in operation and maintenance of treatment equipment is often a significant issue, as was well-illustrated by Neil Grant of Kennet Water who presented a comprehensive overview of available treatment options. The final presentation was given by Professor David Blackwood, Abertay University, who described the application of multi criteria analysis to rural private water supply treatment options in deciding the best treatment for a specific location. His case study demonstrated the value of involving community representatives as well as experts in the scoring panels. The day brought out some good discussions on a number of significant issues, and we have received excellent feedback on the success of the day. - by Adrian Clark

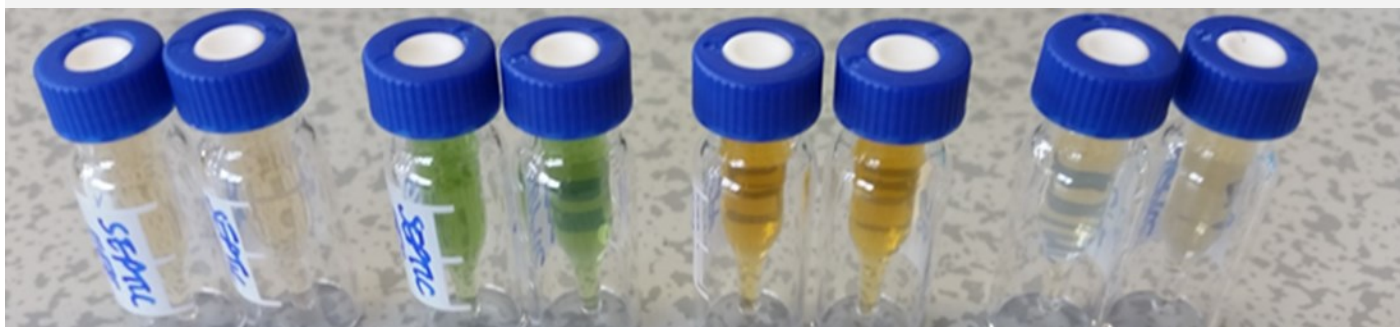


WSF Events—Keep up to date with our future events on the RSC event website

<http://www.rsc.org/Membership/Networking/InterestGroups/WaterScience/ForthcomingEvents.asp>

Water Science Bursary Report: Trace organic contaminants in rural catchments impacted by septic tanks

Bruce Petrie from Robert Gordon University, Aberdeen is very grateful to the RSC's Water Science Forum for the award of a Water Science Bursary. The bursary was used to establish a new analytical methodology for the determination of chiral and achiral trace organic contaminants in septic tank effluents and surrounding surface waters. The optimised method utilised solid phase extraction and enantioselective liquid chromatography-tandem mass spectrometry. This enabled the simultaneous analysis of 16 contaminants including pharmaceutical drugs at ng/L concentrations. The new methodology was applied to help establish the role septic tanks can play in the dissemination of trace organic contaminants in the aquatic environment. Surface waters were collected from two sub-catchments of the River Don, Aberdeenshire. The sub-catchments studied are in rural locations with households utilising septic tanks within their catchment and no communal wastewater treatment systems. At one surface water sampling location some of the contaminants (paracetamol, caffeine and cotinine) were present at concentrations comparable to studied septic tank effluents. It is planned that the developed method will be used to support further studies on trace organic contaminants in surface waters impacted by septic tanks. To read more about the research please click [here](#).



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Water Science Forum bursaries

Water Science Forum bursaries have helped support research across a number of subjects. If you are interested in applying for our Water Science Forum Bursaries, up to £2000 is available per applicant for both the Alan Tetlow and Water Science Bursary. They are open to all WSF members from any country and the money available can be used for a wide range of activities including conferences, research, lab visits and research projects across a range of topics including water quality.

Contact: Hon Sec, RSC Water Science Forum, Thomas Graham House, Science Park, Milton Road, Cambridge, CB4 0WF, UK

See our website for more information: <http://www.rsc.org/Membership/Networking/InterestGroups/WaterScience/bursaries.asp>

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