

# Water Science

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“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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## Conference special: Emerging contaminants in waters and soils, practical considerations: Sampling, analysis and consequences

**The Emerging contaminants in waters and soils, practical considerations: - Sampling, analysis and consequences conference was held at The Source Skills Centre, Meadowhall, Sheffield on the 4th March 2015.**

There were 75 attendees. This was a joint WSF, ECG & INEF event. There was also support from ESED, Sensor in the Water Industry Group (SWIG) and RSC Journals.

The organising committees are grateful to the speakers below for giving up their valuable time to speak on their respective subjects.

The aim of the meeting was to present a number of perspectives on the chemistry of emerging contaminants in soil and water environments.

The event concluded that many of these newly recognized contaminants are produced industrially yet are dispersed to the environment from domestic, commercial, and industrial use including:

- Pesticide distribution to land
- Wastewater treatment effluent discharges
- Landfill sites
- Sewage sludge spreading to land

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## Chairman's Report 2014

*Kevin Prior*

2014 has proved to be an exciting year for the Water Science Forum. Our membership is growing in leaps and bounds and now stands at over 800.

I am told that WSF is one of the larger and more active interest groups at the present time.

Our members, and thus expertise, come from many sectors within the water community: environmental consultancies, utility companies, industrial treatment companies, academia and regulatory bodies.

Members may also noticed that WSF has benefited from the RSC's rebranding with WSF gaining a new logo and valuable assistance from the Design and Networks Teams in refreshing our own material.

Our two bursary schemes, the Alan Tetlow Bursary, and the Developing Water Scientists Awards, have attracted their usual interest from post graduate students. I am also pleased to say the Developing Water Scientists is proving attractive to members following vocational and non-conventional university studies. The bursaries have been used to part fund specialist training, and to support academic and technical development projects. Science teachers have also used the scheme to assist students in less favoured areas.

Special bursaries were awarded to enable up to four delegates to attend the Disinfection By-Products conference in Mulheim.

A special mention must go to Bexhill Collage for the innovative way they have used the scheme to enable visiting speakers and enable student field trips.

WSF also runs ad-hoc poster prizes and offers concession rates at events for students and low income individuals. This article is continued on page 4...



**This edition's water factoid:**

“There are more molecules in a pint of water than there are pints of water in all of the Earth's oceans.”

**Water Science Forum bursaries**

Please consider applying for the Alan Tetlow and WSF bursaries. They are open to all WSF members from any country and the money available can be used for a wide range of activities from conference and research lab visits for example to research projects in a range of topics including the water quality area. Up to £2000 is available per applicant. If you are unsure of eligibility please still apply and your application will be given full consideration.

## Emerging contaminants in waters and soils, practical considerations: Sampling, analysis and consequences continued...

Some emerging contaminants are recalcitrant to conventional sewage treatment or drinking water treatment and many are small and/or very polar molecules which are difficult to remove by granular activated carbon filtration methods.

Key receptors to these contaminants are humans who consume drinking water sourced from contaminated water and aquatic ecology.

Presenters included Rakesh Kanda (Brunel University - *Emerging and Priority Pollutants – the Need for Ultra-Low Trace Level Monitoring*), Graham Mills (University of Portsmouth) and Anthony Gravell (Natural Resources Wales - *Comparison of Active and Passive Sampling in Relation to Contaminants of Emerging Concern*), Maria Romero-Gonzalez (University of Sheffield - *Measuring Continuous Concentration of Mass Pollutants in the Aquatic Environment*), Marianne Stuart (British Geological Survey - *Emerging Contaminants in Groundwater in Urban Environments*), Barbara Kasprzyk-Hordern (University of Bath - *Stereochemistry of Pharmacologically Active Compounds: a New Paradigm in Environmental Analysis and Risk Assessment*), Zulin Zhang (James Hutton Institute - *Short- and Long-term Temporal Trend of Organic Contaminants in Soils Following Single or Multiple Applications of Sewage Sludge to Pastures*) and Christine Switzer (University of Strathclyde - *Emerging Contaminants in Soils: Challenges and Opportunities from Quantification to Remediation*).



Conference presenters L-R: Rakesh Kanda, Graham Mills and Barbara Kasprzyk-Hordern

The event was brought to a close by Simon Parsons (Scottish Water) with his lecture Sustainable Water Treatment. Simon received the RSC's Sustainable Water Award in 2014. His presentation centred on the priorities for improving drinking water and in particular he talked about lead removal, reducing disinfection by-products and removal of colour. He also drew attention to a number of internationally significant drinking water quality incidents where there had been (in retrospect) an overreaction to public pressure to “remove chemicals” from potable water supplies.



Conference presenters L-R: Zulin Zhang, Maria Romero-Gonzalez and Christine Switzer

Some further information on the presentations is available from WSF ([www.rsc.org/wsf](http://www.rsc.org/wsf)) and ECG ([www.rsc.org/ecg](http://www.rsc.org/ecg)) web pages in the downloadable files at the bottom of the page.

## Emerging organic contaminants in groundwater in urban areas

Marianne Stuart, Debbie White, Kat Manamsa, Dan Lapworth, Peter Williams, James Sorensen

The British Geological Survey (BGS) have been investigating the occurrence of microorganic compounds (MOs) in groundwater beneath cities. As analytical techniques improve MOs are being found in the groundwater environment worldwide. Emerging contaminants (ECs) include pharmaceuticals, personal care products, such as DEET and the parabens, lifestyle compounds, such as caffeine and nicotine, and food additives and their metabolites. Few of these are at present regulated under the WFDF.

The Environment Agency have collected samples for microorganics (MOs) in groundwater on a wide scale since 2007 and these show that some ECs as well as established MOs have been frequently detected in England and Wales. Transformation products can be more toxic, polar or persistent in the aqueous environment than their parents. Whilst some ECs are probably no threat to drinking water at such  $\mu\text{g/L}$  concentrations, there is little information on their impact on other groundwater receptors in the environment.

Sources in the urban environment could include wastewater, industrial effluent leakage and landfills. Collecting good samples for MOs is challenging due to potential sources of contamination, including sampling equipment and plastic borehole casing.

We have results from contrasting urban areas:

- Samples from multi-level piezometers in Nottingham and Doncaster, both on the Sherwood Sandstone aquifer, showed that MOs, including ECs can be found at depths of over 50 metres in groundwater. We detected industrial compounds, plasticisers and UV stabilisers, personal care products, pesticides and petroleum compounds. The number of compounds detected in each sample appears to be a useful tool for interpreting these data and was consistent with chloride concentrations and earlier work on pathogens, suggesting a sewage source.
- For the Thames floodplain at Oxford, the urban impact can be distinguished from a landfill plume using MOs. Plasticisers, octyl phenol and pharmaceuticals dominated in the urban area whereas the leachate plume contained chlorinated solvents, 1,4-dioxane and metaldehyde.
- For the developing town of Kawbe in Zambia, the pressures on the shallow groundwater system are from unsewered sanitation. ECs were detected mainly in prosperous areas. However, we may see increasing personal care products and industrial chemicals as low income countries develop.



## Poster prize winner: Debbie White

On the 4<sup>th</sup> March I was lucky enough to be able to attend the Sheffield RSC's meeting 'Emerging contaminants in waters and soils, practical considerations: -Sampling, analysis and consequences' in Sheffield. The venue and meeting were excellent and it was a good opportunity to communicate our science and network.

The poster I presented used the Doncaster multi-level piezometer case study to show the robust protocols required to minimise the introduction of contamination during the sampling process and introduce the use of multi-level sampler as a tool to investigate EOCs.

As a great deal of the micro-organic contaminants are anthropogenic in origin and include personal care products and plastics sampling can produce samples contaminated by the sampler, sampling process or their equipment. Knowing your contaminants and their contaminant pathways allows the sampler to reduce the possible introduced contaminants and incorporate equipment blanks to check for background levels in the sampling equipment.

The multi-level used were bundled narrow piezometers of differing lengths with short screened sections. They are the best method of obtaining a detailed snap-shot of the vertical changes in piezometric head and water quality; their low volumes make them ideal for rapidly obtaining a representative groundwater sample

After a very good meeting I was surprised to be called to the podium as I had won the best poster prize. A very good end to the day.



## Sustainable Water Lecture: Prof. Simon Parsons

So what would you like to see in the Water Science Museum of the Future - what are the things we do today that we you would like to stop doing by 2020? This has been the topic of the series of Lectures given at Cranfield, Herriot Watt and Sheffield as part of the Sustainable Water Award and has covered colour measurement, coagulation, lead pipes, membranes and chlorination. So when will we see an end to laboratory methods that take days to give a result or to the use of chlorine as a disinfectant. What is clear is that when looking forward at what to stop we cannot ignore the lessons of history, whilst the Dutch have delivered chlorine free water supply there are plenty of example of where when poorly managed this can end up in a disaster.

It's been a real pleasure delivering the three lectures and following on from the two previous winners, David Stuckey and William Davison in showing the critical role the chemical sciences play in delivering a safe and sustainable water supply. Thank you to the Water Science Forum and the Royal Society of Chemistry for allowing this to happen.



## Forthcoming WSF events in 2015

WSF are organizing a number of events for 2015 and 2016. Please check out the website for further details:

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

## Science Jokes!

**What did the Atlantic ocean say to the Pacific ocean?**

Nothing, oceans don't talk...they just wave!

**Why did the weatherman bring a bar of soap to work?**

He was predicting showers!

**If H<sub>2</sub>O is the formula for water, what is the formula for ice?**

H<sub>2</sub>O cubed!

**Want to hear a joke about Nitrogen Oxide?**

NO!  
**Sixteen sodium atoms walked into a bar...followed by Batman!**

### The Newsletter of the Royal Society of Chemistry Water Science Forum

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The views expressed in the newsletter are those of the authors and do not necessarily represent the views of the RSC, the Water Science Forum or the author's organisation

### Alan Tetlow Bursary

In memory of Alan Tetlow the Water Science Forum bursary will help post graduate students, young (under 35) or professional water scientists during the first 10 years of their career.

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

### Join the committee

We are always keen to recruit new personnel to the Committee, especially if your field of interest is concerned with new and emerging technologies e.g. effluents as a resource, heat recovery, or membrane technology. All Water Science Forum members are eligible. Vacancies usually arise at the end of each year and elections are held if necessary.

If you wish to be considered for election to membership of the WSF Committee please contact the Hon. Secretary who will advise you accordingly.

## Chairman's Report 2014 continued...

A Developing Water Scientist Award has been made to a sixth form college to enable the chemistry department to introduce a number of practical activities, visits and fund visiting scientists. This college has also offered to open the visiting speaker events to surrounding schools and colleges.

Our events programme has once again been popular with the following successful events in 2014:

- ◇ Member Engagement meetings in Belfast and Cardiff
- ◇ CPD Best Practice Workshop and seminar
- ◇ Flow Cytometry Training in conjunction with Cranfield University
- ◇ "Can we afford NOT to monitor priority pollutants?" A conference on the topic of priority substances in the field of water policy held in conjunction with the RSC Environment Health and Safety Committee and the Society of Chemistry and Industry Environment Group
- ◇ Disinfection By-products conference. A 3-day event in Mulheim in conjunction with IWW (Germany) and the Society of Chemistry and Industry Environment Group

Reports and presentations where available can be found at <http://www.rsc.org/Membership/Networking/InterestGroups/WaterScience/past-events.asp>

A number of events were also badged by WSF as a way of supporting those events whose objectives were aligned with WSF, without entering into any financial liability.

More recently WSF held an event entitled Contaminants of Emerging Concern on the 4<sup>th</sup> March 2015 at the Skills Centre, Meadowhall, Sheffield in conjunction with the RSC Environmental Chemistry Group and the International Network of Environmental Forensics. This attracted a total of 74 attendees plus exhibitors. Two poster prizes were awarded, £100 cash and an on-line subscription to *Environmental Science: Processes & Impacts*.

We have to thank the Environment, Sustainability and Energy Division for financial support for this event and Environmental Science: Water Research & Technology journal for sponsoring the journal subscription prize.

WSF is active in the field of policy science interface, sometimes referred to as external influencing. In addition to our scientific programme, members represent the RSC and, in some case the UK, on international bodies.

WSF were pleased to see:

Mr Richard Allan was appointed as chairman of the CEN European Committee for Standardisation Strategic Advisory Body on Environment (SABE): a body that advises the European Standards Technical Board on issues related to environment.

Dr Ian Barnabas, our Vice Secretary, is an active member of BSI committee EH3/2 Water Quality. He also attended, representing the UK, at a meeting of CEN TC230/WG1 (Water Analysis - Physical and biochemical methods) in Oslo in May 2014, which is engaged on standards to support the Water Framework Directive.

Dr Roger Wellings, Secretary, represents the WSF on BSI committee concerned with sampling of rivers and streams. He attended a meeting of ISO TC147 - Water quality which took place in Berlin in October 2013 and chaired a meeting of SC6 WG4 on sampling of rivers and streams in his capacity as convener of the Working Group.

There are also a number of members of the committee who are actively involved in influencing national, European and international standards in the water quality field as well as at the expert level for the Standing Committee of Analysts.

WSF produce a newsletter twice a year, support the group's web page, MyRSC page, and create messages for dissemination via the RSC grapevine system and bulk e-mail processes. The Chairman especially appreciates the efforts of Bruce Petrie (newsletter editor) and Jonathan Mace (web master).

A number of topical briefing papers have been produced through efforts lead by Dr John Andresen. These were published in Environmental Science: Water Research & Technology journal.

WSF hopes to have active and collaborative relationship with the other interest groups such as the Environmental Chemistry Group, International Network of Environmental Forensics plus the Toxicology Group along with our existing collaborative efforts with the SCI and SWIG.

Members who would like to contribute skills in organising events, in running meetings, in editing and publishing, in managing finances or in marketing are encouraged to contact the Chairman or the Hon Secretary, who will be pleased to discuss work of the WSF Committee and the forthcoming opportunities in 2015.

### Thanks

The Chairman would like to thank all members of the WSF for their continued support and it is, therefore, a particular pleasure to welcome the 5 new members who joined us in 2014, raising our current full committee membership to a total of 16.