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ECG *Bulletin*

Environmental outreach.

Into the blue

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Environmental Briefs.

ECG *Bulletin*

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What inspired you to become a scientist? During my A-levels studies, I attended a talk at the Cavendish Physics Laboratory in Cambridge by Joe Farnham about ozone hole chemistry. I was the youngest there by at least ten years and what felt like thirty years. The talk was a bit dry for a seventeen year old. But three truths suddenly came clear to me: a few simple chemical reactions could have an enormous effect on the planet, science could be my ticket to some interesting places in the world – including Antarctica – and chemistry was not all about making new compounds, but could be used to explain the natural world.

How did you come to specialise in atmospheric and cryospheric chemistry? I wanted to go to Antarctica. My 4th year degree supervisor Professor Richard Wayne studied atmospheric chemistry and ozone. I wondered if this was my ticket, and it was: by applying my love of physical chemistry to the real world. I enjoyed my 4th year research so much that I stayed on to complete a DPhil in Atmospheric/Physical Chemistry, and gave up my other desire to be a fast jet pilot. I carried out post-

Into the blue

The Natural Environment Research Council (NERC) organised a large outreach event this year. This followed the success of allowing visitors on board the NERC's *Discovery* research vessel last year, whilst it was anchored in the Thames in London. This year, members of the public were allowed to inspect the NERC's dedicated aeroplane for atmospheric and oceanic research at Manchester airport. In an adjacent hangar, a host of environmental science outreach activities and stalls were on display. The whole event attracted much media interest (BBC Newsround, Sky News and BBC evening and regional news programmes). Just over five thousand members of the public visited over five days, and two hundred stakeholders and VIPs attended the evening events.

Each of the five NERC research centres had been encouraged to come up with an idea for a stall for the exhibition. Our team decided on a general environmental chemistry theme, which included some of the successful activities we had used for previous RSC-sponsored outreach activities:

1. Ocean acidification (adding dry ice to an alkaline solution and seeing the indicator change the pH to acid).
2. Soil testing (picking out microplastics in the soil and investigating them with a smart phone microscope and then testing the soil for pH, nitrates and phosphates).
3. Introducing zeolites to extract Fe- or Co-contaminated solutions.
4. Atmospheric chemistry (small sensors measuring air pollution).

The volunteers were recruited through ECG social media plus friends and colleagues, and ranged from teachers, science communicators, environmental consultants, an undergraduate, a PhD student, an early career RSC committee member, and post-doctoral researchers. The RSC NW region education officer, Charlotte Still, also joined in. We all shared a flat locally, so enjoyed the rare downtime we had at the end of the long days. We will keep in touch for future outreach opportunities as the team worked well together, and each individual brought their own perspective to the demonstrations.

Volunteers' impressions

Callum Taylor

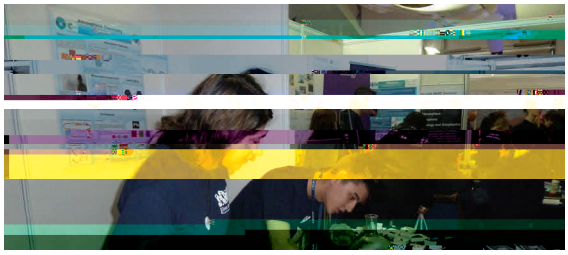
I am currently on my placement year of my degree in Forensic and Analytical Science at the University of

Rowena Fletcher Wood, Zoë Fleming, Beth Dowler, Matthew Savage and Marios Panagiwlemy,

Huddersfield. I have been a member of the RSC for over a year now, and I jumped at this opportunity to volunteer for a few days.

In some areas of science, keeping the public involved and updated with developments in specialised research is perhaps not too important. However, in the environmental sciences, it is crucial because everyone, from a child in primary school to the CEO of a FTSE 100 company, contributes to the environmental challenges faced by society. Outreach events such as "*Into the blue*" stimulate interest and awareness among the public and even among other scientists about this topic. This event opened my eyes to the scale of environmental research in the UK, particularly the monitoring programmes in oceanic and atmospheric research. I also found the British Antarctic Survey stall very stimulating.

Volunteering for the ECG at this event has shown me the variety of career paths available to the younger scientist. For example, monitoring pollution or finding innovative solutions to handling disposal. I learnt that communicating your scientific discoveries to the public can be difficult due to varying levels of education and interest. To engage younger generations with science and the environment with demonstrations and fun hands



on experiments, such as our dry ice experiment, will surely spark interest for some of them to continue with science later in life. In terms of my own career, this event has shown me that there are many paths available, and so being bound to a rigid plan for the future is not necessarily more beneficial than a flexible one. To adapt John Donne, it is no one person's duty to look after the earth, it is all of ours.

Eloise de Spretter

I graduated in July with integrated Masters Degree in Environmental Science, and am now working in the agriculture sector as a scientific data administrator.

I too jumped at this chance to help with the Environmental Chemistry Group's stand at the "*Into the blue*" event. It was an exciting opportunity to talk to the public about something I care about, and to meet those conducting research in the environmental sciences. Communicating science to the public is extremely important and also challenging. This is particularly true of environmental science, which incorporates so many different concepts. "*Into the blue*" succeeded in communicating these ideas to the public, through fun, games and hands-on exhibits. At the ECG stand, I found children were excited to dig in the soil to see what they could find and were asking, "How did plastic get there?" Parents asked what they personally could do to help make a difference and reduce the amount of plastics that end up in our oceans. Many people commented that the event had opened their eyes to a whole world of environmental challenges that they had not considered before.

It wasn't just visitors who had the chance to see the research presented at this event; I had an amazing time meeting and speaking to the other exhibitors. I particularly enjoyed the tour of the NERC research aeroplane and visiting the British Antarctic Survey stall, where you could see the amount of preparation, work, time and effort that takes place before an expedition. Sometimes studying the environment can feel all doom and gloom. However, this event has inspired me and I believe it inspired many of the visitors too.

Further information

NERC research aircraft in Manchester in the News: http://www.bbc.co.uk/news/video_and_audio/headlines/37770945

NERC's "Into the blue" website: http://intotheblue.nerc.ac.uk/manchester/

Imagine yourself a hundred years in the future. No further changes have been made to mitigate climate change and we are now in an energy crisis, places like Oxford are ﬂooded continuously, and food scarcity is a global problem. What can we do to address and prioritise these issues? At the start of the event, each speaker gave a 5-10 minute talk or “pitch,” followed by an audience vote using Turning Point handsets – an interactive technology that allows live vote collection and data display in Powerpoint presentations. Following the revelation of the votes, the speakers responded, and the story of the future’s crisis unfolded.

Speaking at the event were F ¾ ll ű the ḍ
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or intravenous administration of the contrast agent results in urinary excretion of the absorbed Gd, where it enters wastewater treatment plants see below . Several applications of REEs are a direct result of legislation to improve air quality e.g. Ce in catalytic converters or the transition to a low carbon economy. For example, Nd, Dy and Sm are used in the manufacture of magnetic alloys for hybrid engines and in permanent magnets for wind turbines as well as a whole host of consumer electric goods such as headphones, computer hard drives, and electric motors . Nickel-metal hydride rechargeable batteries fo a

are usually present in the 3ش oxidation state so they can form soluble complexes with nitrates, chlorides, and sulphates. In highly complexing media, REEs form insoluble species with carbonates, phosphates and hydroxides, which means their toxicity could be underestimated in these solutions. REE complexes become less soluble with decreasing temperature and increasing pH or redox potential. Thus, chemical speciation modelling is required to estimate the free ion concentration in solutions and to predict toxicity.

Most toxicological data relate to Ce and La, with a little information on Gd and Nd, but virtually nothing for the other REEs. REEs have a similar ionic radius to calcium and so can replace Ca in cell functions or block Ca channels. However, the most widely reported mechanism of toxicity is a redox imbalance in cells that leads to oxidative stress. Several studies have used reactive oxygen species ROS or antioxidant acti

with phosphorus pentoxide P_2O_5 and indicates that the source of REE anomalies in the ash are likely from REE phosphors present in fluorescent materials *15* . REEs were found to be present at several orders of magnitude higher in acid mine drainage water than natural water *16* presenting an opportunity to provide a modest but continuous supply of potentially valuable resources as a by-product of otherwise costly remediation activities. Sewage sludge only seems to be a promising source of Gd though presumably due to its use as a MRI contrasting agent , since other REEs show enrichment factors near unity indicating geogenic origin *17* .

The maturation of technologies for recovering REEs from waste streams and recycling them in 'end-of-life' products may result in lower concentrations released into environmental media. However, this must be contrasted against an anticipated exponential growth in their use in consumable products. It is unlikely that the environmental impact of REEs, which seems to be lower than many other metallic elements, will drive increases in recycling and recovery. Therefore, the adoption of technologies to exploit "second-hand" REE resources will likely be dependent on the price of REEs on the global market.

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About 88% of nutritionally important food crops such as fruits, vegetables, nuts and seed crops are pollinated by animals *2*. Neonicotinoid impacts on pollination services will thus have widespread consequences for ecosystems and species biodiversity, and also affect human food security. Animal-pollinated plants contribute most of the vitamins and minerals in our diet. Thus, although calorie-containing foods such as wheat and rice are mostly wind pollinated, the nutritional core of our diet could be threatened by falling bee numbers if bees, which pollinate three quarters of the world's food crops, are representative of other pollinator species .

In his interview, Dr Ben Woodcock explained that he was part of the CEH cohort involved in a large-scale, independent study of neonicotinoid impacts commissioned by pesticide giants Syngenta and Bayer *3*. The study took place over one growing season at

pesticide led to fewer visits to the apple ll lowers. This not only meant less ef ficient pollen collection, but also impacted the apple trees, producing fewer seeds. Seeds are considered a key indicator of quality for most apple varieties. The study suggested effects were likely to be on the level of the bee colony, rather than individual ¾ es †

Forthcoming meeting

What's new in the analysis of complex environmental matrices?

When: Friday 3 March 2017
Where: Science Suite, Royal Society of Chemistry, Burlington House, Piccadilly, London W1J 0BA

A joint meeəng organized by the RSC's Environmental Chemistry Group, Water Science Forum, and Separaəon Science Group.

Programme
9.00-9.40 am Registration and coffee

9.40-9.45 am **Graham Mills University of Portsmouth, UK : Opening and welcome to meeting**
9.45-10.15 am **Leon Barron King's College London, UK : Screening of complex forensic and environmental samples using high resolution analysis and *in silico* data mining tools**
10.15-10.45 am **Andrew Sweetman Lancaster University, UK : Use of passive samplers as a potential compliance tool within the EU Water Framework Directive**

10.45-11.15 am Coffee break

11.15-11.45 am **Colin Cr oSw À s 5 Ŏ η**

conceptual model, which assumes a groundwater or unsaturated zone source of vapours that diffuse through unsaturated soils toward the surface and into buildings, the occupiers of which are the receptors. It is assumed that sub-surface conditions will reduce or attenuate vapour concentrations as vapours migrate toward the building, and that dilution of vapours will occur as they mix with air in the building.

The screening levels are used to assist in determining whether volatile substances in the subsurface pose a risk to human health via the vapour intrusion pathway. They are not intended to be used as clean-up levels or remediation targets. The tool allows for the derivation of site speciﬁc values.

Site measurements

Typically in the UK, soil and groundwater samples are analysed for VOCs during routine intrusive site investigation works. An initial vapour intrusion assessment can then be carried out by comparing these concentrations with generic assessment criteria GAC . This approach is focussed on characterising the VOC source area and is limited by the use of generic screening tools, with no site-speciﬁc conditions such as inclusn ♣ ‘ arr ony Ų⅜ ‘ s iv ʊ e,

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into contact. This contact point is in reality a contact line when viewed in three-dimensional space.

The second pressure term is the entry or displacement pressure, P_e, and