

Ask an expert – Q&A session with Dr Stephen Mudge

INEF committee
Chairman Dr.
Stephen Mudge is
an independent
environmental
science

consultant based
in the United
Kingdom. He

took time out of his busy schedule to answer some questions about INEF, his career, and environmental forensics with INEF Social Media person Sri Chaudhuri. To find out more about his environmental consulting activities you can visit his website: www.environmental-investigations.co.uk.



How would you define Environmental Forensics?

In its simplest form, I guess I would say - who did what, when, and where? There are all sorts of aspects and extensions to this but the basic premise is identifying what is out there, how long ago did it enter the environment, and where did it all go?

My own experience and expertise is focused on identification of the contaminating matter, usually through its chemical signature (I prefer signature to fingerprint since the concept of a fingerprint implies it does not change with time and yet we rely on changes with time to determine age etc.). It is important to recognise that several contaminants may pre-exist in the environment either through entirely natural processes or through previous human activity; separating the new from the old can be a challenge, but I do enjoy a challenge. Apportioning responsibility between sources is my bread and butter activity and some of the multivariate statistical methods we have access to now can be very helpful and instructive.

How did the International Network of Environmental Forensics (INEF) come about?

This goes back to a meeting held in Qingdao, China back in 2008 hosted by Zhenhui Gao. This meeting was hosted under a different banner but it was thought that there should be a charitable, not-for-profit group that brought practitioners of environmental forensics together for the purpose of sharing experience and knowledge and, critically, conducting outreach to widen the number of people aware of environmental forensics. A few well-known die-hards in this area (including Bob Morrison, Zhendi Wang, Paul Philp) and I came up with a plan that I took to the Royal Society of Chemistry (RSC) to see if they would adopt us as a special interest group so we could take advantage of their infrastructure. It took a bit of time but we were accepted, even though we do not exactly fit their model of a special interest group - we are a mixture of all disciplines and that is relatively rare.

Getting the officers together was another challenge and getting our first bank account seemed to take forever due to the anti-money laundering regulations; Gwen was in Canada by that stage and one bank required her to go into one of its branches to sign the paperwork to open the account. Of course, there are no branches of that bank in Canada and so we switched to another bank altogether!

What did you study in university and how did it relate to Environmental Forensics?

My original undergraduate course was a joint honours degree in Marine Biology and Chemical Oceanography at Bangor University. As you may gather, this had a strong marine focus but it did cover all the different scientific disciplines. I

specialised in the chemical side of science for my Ph.D. which involved developing new anti-fouling paints to replace the TBT based ones that had become "unpopular"! My post-doctoral work was on the environmental geochemistry of plutonium and subsequently polonium. This took me away from just the marine sector and by the time I was teaching in a university, I was working in all different compartments of the environment. Having a breadth of knowledge certainly helps and as one gets older, you also get to be able to say "I remember working on a similar case...". Experience certainly helps.

What first sparked your interest in science?

I have always been interested in science from way back in primary school - I used to collect magazines that built into collections - I loved these and would read them avidly. I do remember saying as I left primary school (at age 11) that I wanted to be either a marine biologist or a nuclear physicist. Rather precocious in retrospect. Having said that, I have sort of done both even though the radiochemistry was in the environment rather than in a reactor. I was able to take a couple of my O-levels a year early and this enabled me to spend a year getting an astronomy O-level: this was great since it allowed us to conduct our own research projects as part of the assessment and I distinctly remember lunchtimes spent in the physics laboratory observing the Fraunhofer lines in the sun's spectrum. It felt like real research and discovering things for the first time. Great stuff.

Can you tell us a little bit about your career and what you currently do?

After my environmental radiochemistry post-doc work at Lancaster University, I joined Bangor University's School of Ocean Sciences as a marine chemist. My principal tool of investigation was GC-MS and finding all sorts of

interesting compounds in samples. For several years I investigated the source of organic matter in samples through the use of lipid biomarkers. I started the world's first degree in environmental forensics in the early 2000's and INEF's Bulletin and Proceedings Editor David Megson was one of the first students to do this degree - it is great to see he is still doing it now! Changes to the funding for UK universities made me think that higher education was losing its purpose and so I started working for *Exponent Inc.*, initially part time, but then full time as the cases and work came in. This gave me the opportunity to be part of the Deepwater Horizon Response and I worked with a fantastic group of dedicated scientists on this. Last year I left *Exponent Inc.* and now work independently doing similar investigations - I love handling data and getting to the underlying truth in it.

What advice do you have for those interested in studying Environmental Forensics?

Go for it! If the opportunity is there, you can have a great education since to cover the subject properly, you need some physics, chemistry and biology (and all the ancillary stuff too). You also get to go outside and get muddy and wet while doing it. Even if you change path later on in life, this should give you a good grounding in many aspects of the environment and science and qualify you for many jobs. Choosing a course can be hard as there are relatively few out there and you may need to travel. Your skills will certainly be needed in the future and also at many diverse global locations.

If you are asking what qualities I need to have to do this, I would suggest an open and inquiring mind and a desire to prove something rather than simply accepting it.

What do you think are some of the challenges that face the field of Environmental Forensics in the near future?

I think we have finally recognised that a contaminated environment can adversely impact the human race - the population is also going up and so the land and resources available for various tasks are becoming scarcer. Since most activities are driven for economic benefit, the environment will remain at risk. Our challenges will centre on the ability to identify the potential hazards before they have an adverse effect...not an easy task.

On a day-to-day basis, one of the big issues is the funds available to do investigations; everyone has to work to a budget but analyses can be expensive especially if we need to use the modern, less common, approaches that will always carry a higher price tag. Having these resources can also pose a problem: can you

identify the source and who was responsible from this single sample? Possibly not.

The other issue might be the design of sampling and analytical programmes. You need to develop an approach that answers the question you have in mind and this will determine what should happen; too often the wrong samples are taken and analysed for the wrong thing. There is a need to educate people who have responsibility for this.

Is there anything else you would like to share?

Being part of the INEF family is great - there are many very good scientists out there and being able to share information between ourselves has been very helpful. So, get involved and be part of INEF.