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## Notes from the Chair

I am sometimes asked what lay behind the decision to set up the Nuclear Industry Group. My answer is that it is because we are proud to be physicists. We want our professional development to be through the Institute of Physics and to encourage others to do the same.

The Nuclear Industry Group has created an environment for physicists to meet other physicists from within the nuclear industry. We are pleased to have had Dr. Brian J. McParland, Prof. John Collier and Dr. Ron Cameron speak to us over the past 12 months and to have arranged a visit to the National Physical Laboratory. We are said to have been the fastest growing Group in IOP history and membership stands at 364.

This coming February, the current committee will have been in role for two years, with a further year to run before re-election. My own involvement goes back a further eighteen months as we came to set the Group up and then run it on an informal basis before we got full Council approval and held the first formal AGM. With matters in good health, this seems to be a good time for me to stand down as Chairman. This will allow the incoming Chair a year to work with the existing committee before elections in 2014.

I have hugely enjoyed my time with the Nuclear Industry Group. It has been a great pleasure to work with the officers of IOP on setting something new up. I am particularly grateful to Jenny Richards and Becca Holyhead for all their early enthusiasm; and to all the current committee for their contributions and for working well as a team.

The search is on for a new Chairman. If you are interested in the role, please speak to me (or to the Honorary Secretary, Andy Quinn). It is a very satisfying and worthwhile thing to take on.

**John Priestland**  
**Chairman**  
**IOP Nuclear Industry Group**

## Nuclear Industry Group Prizes 2011

The Nuclear Industry Group was pleased to award two prizes this year at the AGM. Selecting the prize winner this year was again a difficult decision as the calibre of the entrants was very high.

We were pleased to award the first Career Contribution Prize to Dr Alan Copestake of Rolls Royce's Submarines business. Dr Copestake has been involved in Reactor Physics methods' developments for many years being instrumental in developing new computational methods (including acceleration techniques) to solve the physics problems in computationally acceptable timescales. He has also led the development of a full suite of codes for reactor physics core design including a 2D lattice physics code, a 3D coarse mesh whole core modelling code, a model of the thermal hydraulic feedback within the core, and links to plant modelling codes. During his long career he has demonstrated his expertise as a general physicist as well as in specialist areas. His work is highly praised by his supporters.



This year's Early Career Prize was awarded to Dr Craig Shearer of NNL. Dr Shearer has been involved in the Muon Tomography Research Programme as part of an NDA (Nuclear Decommissioning Authority) initiative to characterise civil nuclear material that is stored within a variety of waste containers for both ILW (Intermediate Level Waste) and HLW (High Level Waste) at the NDA's various site license companies around the UK. Craig's work has received high praise, both inside and outside his organisation.



In addition to Dr Shearer, two other Early Career candidates deserved special mention. Thomas Morris of Sellafield and Mike Roberts of Atkins were also extremely strong candidates for this prize.

The calling notice for the 2013 Nuclear Industry Group prizes will be released in early December 2012. The deadline for submissions will be January 18th, 2013.

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## Getting Chartered – Some Guidance Hints and Tips

**Heather Beaumont**

One of the aims of the Nuclear Industry Group is to encourage the professional development of physicists working in the nuclear industry through the Institute of Physics. This includes encouraging and assisting our members towards gaining Chartership. The IOP website provides a wealth of information on becoming Chartered

together with guidance for applicants. In this newsletter the NIG aims to highlight some of this information as well as providing some insights from the experience of the Committee members, gained both in their own routes to Chartership and from participation in the Chartership Panel.

There are a number of benefits of being Chartered. For example:

- It can help to demonstrate your commitment to your career to others.
- It can help you in applying for jobs.
- It encourages networking with senior colleagues which can be beneficial to advancing your career.
- It represents the quality of your work and can help you obtain indemnity insurance.
- Your status is peer reviewed and thus provides additional status beyond qualifications and is a demonstration of your professionalism.
- It can help you in your career planning and in some instances can lead to promotion.

### **Getting Chartered – a few tips for your application form:**

In becoming chartered your application form, and how you present yourself on it, is very important. Don't forget that the Chartership Panel will not know you and may not be familiar with your employer. It's highly likely that not all the panel members will be from the nuclear industry and hence may not be familiar with the everyday terms and acronyms that we take for granted, so make sure you define all the acronyms you use and define terms where necessary. Many of the tips below have been drawn from the IOP literature and website so please make sure you read all the available information that's there to help you fill in your form. Some of these tips may seem obvious but they are common weaknesses in applications:

- Choose your supporters carefully and don't forget to ask their permission before submitting your application. This is part of the application and the IOP really do ask them to comment on your work and experience so it's not just a formality. The minimum requirement is for two supporters, ideally CPhys themselves, but did you know that if you are unable to find two Chartered Physicists, then provided you provide a letter of explanation you can ask another suitably qualified person instead e.g. a Chartered Engineer. You can also include a third supporter if you can't find two who cover the whole of your application. Make sure that your supporters are familiar with the IOP competences and what you have done to achieve them as they will be asked to

confirm this on the supporter forms that they will be sent.

- Explicitly address the competences provided on the application form - this is what your application will be evaluated against.
- Don't make the panel work too hard or expect them to read between the lines - the ability to articulate your experience is part of the process.
- Stick to the word limits provided: don't test the panel's patience.
- Focus on the outcomes - YOUR contribution to an activity, what YOU gained from it. Don't make your application sound like a standard job description.
- Be specific: the panel often have to request further information because applicants generalise - be specific in every detail.
- Do follow all the instructions and complete every form/section asked of you - failure to do so will not impress the panel and may delay your assessment. Use the flowchart at the beginning of the form to see what you need to complete.
- If your application is deferred or rejected, and you re-apply, make sure you specifically address the feedback given by the panel.
- Take care with your grammar and spelling and make sure the information you provide is consistent across every form and on your CV.
- Be aware that the panel will focus on both your technical and your managerial skills to see what level you are working at - the organisational chart is not considered in isolation. Make sure that your name appears on the organisation chart as the panel will check.
- Do take the CPD section seriously - it should be future focused, tailored to your own needs and those of your business and include measurable outcomes. Try and include some activities which are outward facing and not all inwardly focussed on your employer. A separate article below gives some more information on CPD.

- Do ask colleagues who have been through the process for advice, particularly if yours is not a straightforward case (perhaps if you are having trouble finding supporters, or your work is classified).
- Get yourself a mentor - they can help you to develop your skills and articulate your experience, as well as casting an objective eye over your application. See the Institute's mentor information pages for details of how they can help with this.
- The IOP's guide on responsible experience provides some further useful additional help with your application. This can easily be found on the Website.
- Most of all, remember: YOU need to make the case as to why you should be awarded Chartered Status.

### Did you know?

There is a route to become a Chartered

Engineer via the IOP for candidates without an engineering degree. There are a number of advantages to pursuing this route via the IOP, for instance there is no need to register in advance as is the case with other institutes. In addition, the panel that assesses these applications and conducts the interviews have gone through this route themselves so understand the issues facing a physicist in engineering discipline.

### Acknowledgements

Much of the material in this article has been drawn from the IOP website and other IOP material and has been reproduced here with the permission of the IOP Chartership office.

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Heather Beaumont is Head of Profession for Physics and Team Leader for Physics and Licensing in AMEC's Existing Nuclear Business based in Knutsford, Cheshire. Heather has been in the nuclear industry with AMEC and its predecessor organisation NNC for over 20 years. She currently sits on the IOP Chartership Panel.

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## Continuous Professional Development – CPD

**Heather Beaumont**

### What is CPD?

The IOP's CPD policy defines CPD as "the systematic maintenance, improvement and broadening of knowledge and skill, and the development of personal qualities necessary for the execution of professional and technical duties throughout working life. Put more simply, it is a life-long learning approach to planning, managing and benefiting from development activities."

CPD doesn't have to be formal training courses or lectures, in fact simply turning up and sitting in a lecture or training course is not in itself CPD. The key element is what you get out of participating that matters more, for example how have you benefitted from it and how it might help you in the future. The IOP takes a broad view of what activities constitute CPD. These include formal training courses, on-the-job training and mentoring, attendance at evening talks such as those organised by the NIG, to sitting on committees, panels or networking. The key is really that the activity needs to result in some kind of learning. Reflection on your learning is thus a significant part of your CPD.

Above all CPD is your responsibility, not something that your employer does for you, it is your commitment to your career development.

### The role of CPD in obtaining and maintaining Chartership status

CPD forms an important part of becoming Chartered and for applicants achieving Chartership from 2012 onwards it will be necessary to retain suitable records to formally reinstate your Chartership status every 3 years. The IOP website provides a useful document with guidance on what you will need to submit to reinstate your Chartered Physicist status ([http://www.iop.org/membership/prof-des/policy/file\\_50377.pdf](http://www.iop.org/membership/prof-des/policy/file_50377.pdf)). Remember this submission is not something that can simply be prepared a few days before you need to send it off. As the IOP document indicates, one of the key aspects of any CPD is reflecting on what you have gained from your activities and to capture this close to the time of your activity and not months or even years after the event.

## Where can I find support and more information?

The IOP provide networking opportunities, via various other forms of support (e.g. via the Chartered Physicists' LinkedIn group). Support is offered by the IOP and can be accessed via their website and can be found in the "Careers" section and the "Join the IOP" section and includes:

**Professional development workshops** where you can find out about getting chartered or mentoring at short evening workshops.

**Professional helpsheets**, this is a free resource to members helping you manage your own professional development and include many useful topics such as "What is CPD?"; "How to produce a personal development plan"; "Identifying your personal development needs"; "Networking for professional development"; and "Reflecting on professional development experiences".

**Online learning** to help equip you with soft skills, designed for physicists. You can take these courses anytime and anywhere as long as you have access to a computer.

**MyPath**, this is a unique online physics career planner tailored around you and enables you to work towards any CPD goal, including Chartership.

**Outreach workshops** which can help to boost your skills as a science communicator.

**Professional development articles** that you might find useful.

Further help and assistance can be obtained directly from the IOP by emailing [CPD@iop.org](mailto:CPD@iop.org)

## Acknowledgements

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## Certificate of Nuclear Professionalism

**Geoff Vaughan**



### What is the Certificate of Nuclear Professionalism?

The certificate is a higher educational programme designed to equip individuals with the necessary skills required for today's professional working within the nuclear industry. It has been developed by the National Skills Academy for Nuclear, The Open University with involvement from industry and Higher Education such as the University of Central Lancashire.

It has been designed in partnership with nuclear employers to ensure that the content and structure of the framework that supports the Certificate is specified by them and delivered by a mix of employer and higher education partners.

IT supports progression to chartered status and national recognition by the Nuclear Institute.

The Certificate incorporates 7 training modules.

1. Safety and Environmental Management
2. Technical Leadership
3. Communications
4. Commercial Awareness

5. Project Management
6. Nuclear Principles Protections & Frameworks
7. Safety Case Production & Evaluation

### Who will it be suitable for?

All Employer Members of the National Skills Academy for Nuclear.

New graduate entrants to the nuclear sector both from full and foundation degree level.

Existing members of the nuclear workforce wanting to develop their career.

Individuals wishing to enter the nuclear sector.

All people who want to develop the appropriate behaviours for working in the nuclear industry.

### Registration

All students wishing to complete the Certificate of Nuclear Professionalism are required to be formally registered on the CoNP programme.

This is done via the OU's Virtual Learning Environment and provides students with access to OU support services. Using the VLE, students will record a portfolio of evidence of their achievement, synthesis, and application of the learning outcomes of the teaching from the seven CoNP modules forming the core of the CoNP award. Further Info. Registrations onto the VLE is via theSkills Academy website.

The assessment and award of the Certificate for Nuclear Professionalism process is conducted by The Open University (OU) and identified by the OU module title, T894 *Professional practice portfolio*, which runs for

12 months and is available twice a year (May start and November start).

Full details can be found at: <http://www.nuclear.nsacademy.co.uk/products-services/certificate-nuclear-professionalism>.

For details of UCLAN's one-week course covering Modules 1, 3 and 7, contact Dr John Inkester at [jinkester1@uclan.ac.uk](mailto:jinkester1@uclan.ac.uk)

Geoff Vaughan is a senior lecturer in Nuclear Safety and Regulation at the University of Central Lancashire, one of the universities providing training for the CONP.

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## Ensuring Safety, Security and Safeguards in Nuclear Power

**Geoff Vaughan**

### Opportunities and Challenges of a coordinated approach

Nuclear Power is an emotive subject and people hold a wide range of views on the use of the technology. However, it is recognised that if nuclear energy is to be used to generate electricity, it must be safe and nuclear materials must be secure.

The global expansion of nuclear power will require the consent of the public and this will only be obtained when they have confidence in the technology, its operators and regulators. The protection that society demands requires the successful delivery of nuclear safety, nuclear security and non-proliferation safeguards. Designers, operators and regulators need to understand the interfaces between nuclear safety, security and safeguards and the potential synergies if society is to have confidence in this technology.

Coordination and management of the three "S's" is increasingly being recognised by the nuclear community as an important enabler for the successful use of nuclear power. Previously, the **safety** of facilities, the **security** of both nuclear facilities and materials and the need to prevent proliferation through **safeguards** have been treated as essentially separate issues. The advantages and necessity of ensuring the separate requirements are not in conflict has

become apparent, and interest in the relationship between them and their interfaces has been gathering pace globally.

The University of Central Lancashire is promoting a conference to stimulate thinking about the interfaces between safety, security and safeguards in design, operation and regulation and how the requirements can be better coordinated in current and in future programmes.

Invited speakers will be senior members of UK regulatory bodies, the EU, IAEA and the nuclear industry and there will be a panel session to discuss wider issues. The venue will be the University's conference centre at Westleigh near Preston (link to Westleigh facilities:.

<http://www.uclan.ac.uk/information/services/fm/services/conferences/westleigh.php>)

The conference will take place on Wednesday 12<sup>th</sup> June 2013. The cost of the conference is £250 +VAT and will include morning and afternoon refreshments and lunch.

[www.uclan.ac.uk/triplesconf](http://www.uclan.ac.uk/triplesconf)

Contact for further information: [triplesconf@uclan.ac.uk](mailto:triplesconf@uclan.ac.uk)

## The Physics of Diagnostic Nuclear Medicine

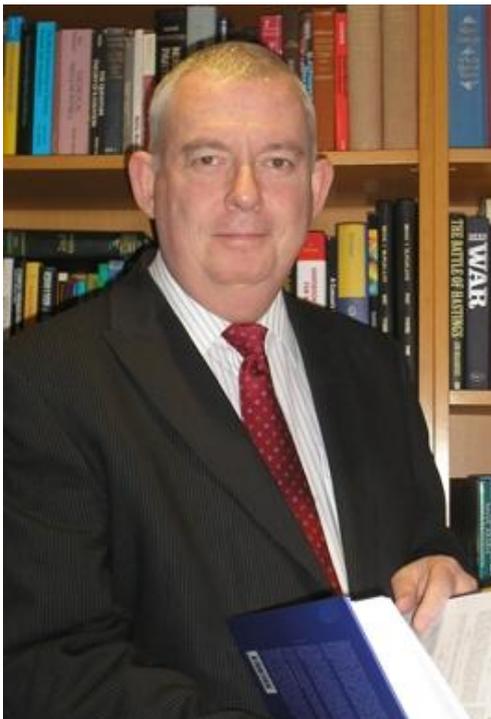
A report on the talk given by Dr Brian J McParland, Head of Medical Physics at GE Healthcare Medical Diagnostics

**David Tattam**

On the 19<sup>th</sup> October 2011 the Nuclear Industry Group was pleased to welcome Dr Brian J McParland to give a talk on the subject of The Physics of Diagnostic Nuclear Medicine with the theme of connections.

The talk was very well attended and gave a great insight into the healthcare aspects of the Nuclear Industry and the development of the technologies that are taken for granted today.

The talk started from the first Nuclear Medicine examination at Beth Israel Hospital New York, which could only have happened with the invention by CTR Wilson of one of the first radiation detection devices, the cloud chamber.



Carl Anderson first proved the existence of positrons for which he won the Nobel prize in 1937. PAM Dirac's theories explained that the annihilation of matter and antimatter would create radiation. Many years later the combination of these two pieces of work lead to the use of positron emitting radionuclides in Positron Emission Tomography (PET). Dr McParland explained the operation of these detector systems and the valuable functional imaging information that they can give.

The gamma cameras of today owe their existence to the work of Robert Hofstadter who discovered sodium iodide as a detector medium. These detectors are put in grid formation, along with collimators and sometimes multiple detector head to make the gamma cameras we are familiar with today.

Dr McParland explained that the optimum photon energy for a nuclear medicine scan is a compromise between the transmission (how much of the information gets out of the body) and the absorption (how much energy is deposited in the detector), with an optimal energy of around 100keV. Glenn Seaborg and Emilio Segrè discovered Mo99 / Tc99m, now the workhorse in nuclear medicine departments. The metastable Tc99m is "milked" from the Mo99 containing column using saline solution.

The Tc99m has a photon at 140keV, and with a relatively short half-life of around 6 hours makes it suitable for nuclear medicine scans. Dr McParland explained the design by Tucker and Richard of the Tc99m generator. There are 50 million doses of Tc99m used worldwide each year.

The work of Hounsfield and Cormac was pivotal in the development of X-ray from a 2D image to a 3D image. The use of tomography allowed the images to be presented in the third dimension.

The talk finished with Dr McParland underlining the connections between different, apparently unrelated, disciplines (physics, chemistry, physiology) leading to technology which could not have been envisaged at the time of doing the research.

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David Tattam is the Physics Group Manager at GE Healthcare. David's group looks after the Dosimetry services, Environmental assessment services, and all things radiation measurement for the company.

## Nuclear Industry Group visits the National Physical Laboratory

**Chris Holland**

On the 26th March 2012 the Nuclear Industry Group was privileged to be invited to take a tour of the National Physical Laboratory.

After coffee and group introductions the morning sessions began with a series of talks given by NPL staff. Martyn Sene, the NPL deputy director kicked off proceedings by welcoming the group to the NPL and giving an amusing and insightful introduction to the work that the NPL conducts. He showed how the need for accurate measurement dated back to the Magna Carta and that almost every industry including engineering, travel and financial sectors were reliant on high precision measures of length, time, mass and a multitude of other parameters. He explained that the NPL is a world leader in precision measurement and outlined the interaction between the NPL and other world leaders in metrology from the US and Germany. The NPL's role is governed by the mission to provide excellent science and from this it maintains its international status, it can have a real impact on the economy and provides a platform for sustainable business growth.

Following Martyn's introduction a series of the NPL's experts gave enlightening presentations about some of the specific projects that the NPL has undertaken. Alan Turnbull spoke on materials challenges facing the nuclear industry including some of the AGR life limiting graphite issues and corrosion in the Davis Besse PWR in the US. Jerry Lord's presentation outlined novel techniques developed by the NPL to monitor graphite degradation, using high precision cameras. Steven Judge from the radioactivity division gave a presentation which highlighted the need for very accurate measurement in order to comply with radioactive discharge regulations in an economic manner and also how the NPL

contributed to the world's nuclear data libraries. Lena Johansson covered radioactive waste management in next generation nuclear power plants and the collaborations the NPL is involved in across Europe. Finally Tim Jones gave an interesting presentation on knowledge transfer for the nuclear industry, including an introduction to the measurement network and the ionising radiation special interest group. I would encourage readers to check out the measurement network for more information <http://www.npl.co.uk/measurement-network> the special interest group on ionising radiation may be of particular relevance.

After lunch the group was taken on a tour of the labs including the high temperature laboratory which measure the oxidation of different materials, the 3D microscope lab that enables the NPL to reconstruct to very high accuracy things like the indentation caused by the Vickers hardness test. Next on the tour were the radioactive labs which measure activity of radionuclides to the highest precision in the world. From there the group was taken to see the team which are working on novel temperature measurements using the speed of sound in gas, using both a resonance chamber and a time of flight principle.

Finally, the group was taken to the accelerator which is used to create neutrons at exact energies required for precision measurements. The day was very well attended and a great experience. In addition, the IoP nuclear industry group would like to extend its gratitude to all those at NPL who made the day possible.

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Chris Holland is a Chartered Physicist working in AMEC's Existing Nuclear Business based in Knutsford in Cheshire.

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## HiPER – the other way to fusion energy

A report on the talk given by Professor John Collier, the director of the HiPER project

**Chris Holland**

On the 26th March the Nuclear Industry Group was privileged to listen to the lecture by Professor John Collier on Inertial Confinement Fusion (ICF) and the HiPER project.

ICF is the process of using powerful lasers focused on pellets of tritium and deuterium to heat and compresses them in order to create nuclear fusion. ICF is an alternative to magnetic confinement fusion which is the process of

generating fusion inside an extremely hot plasma confined by magnetic fields.

Professor Collier spoke of the key physics involved in ICF including its birth in the 1960's and the work of the Lawrence Livermore labs in the US. He gave an outline of the current projects both operational such as the National Ignition Facility (NIF) in the US and under construction such as the laser megajoule facility being built in France.



The configuration of NIF was explained in some detail giving some idea of the scale of the facilities and challenges. The facility covers the area of three American football fields and uses 192 beamlines focused onto a 2 mm diameter pellet to "ignite" the DT pellet indirectly using x-rays generated in the hohlraum. It seemed clear that the physics was well understood and that the technology is scalable to a power plant. The principle challenge being the realisation of an economic and technically achievable pellet throughput of 10 ignitions per second that

would be needed for a typical 1GW electrical power plant.

Professor Collier went on to describe the High Power Laser Energy Research facility (HiPER) project which will be part of the next generation of ICF devices. HiPER is still in the design stage, but its goal is to demonstrate that the pellet throughput is achievable and the important principles of tritium breeding, essential for a sustainable fuel cycle is feasible. These devices will provide the key stepping stone to a commercial ICF power station.

The talk was expertly delivered and a lively Q and A session followed. ICF is certainly going to be a significant player in the search to meet the world's growing energy demands and the IoP nuclear industry group would like to extend its gratitude to Professor Collier for his excellent presentation.



## Global Energy Outlook and Role of Nuclear Power

A report on the talk given by Dr Ron Cameron, Head of Nuclear Development at the OECD NEA

### Andrew Quinn

On the 18th September we were proud to have Dr Ron Cameron, the Head of Nuclear Development at the Organisation for Economic Co-Operation and Development (OECD) Nuclear Energy Agency, who came to talk about how the global demands for energy have changed over time and projected into the future, decarbonisation and how nuclear power can play a part in this in light of incidents such as Fukushima.

Energy demands have constantly been rising since 1945, however the first decline since

World War II was just recently in 2009 when the economic crisis hit. This was only a temporary lull in the increasing energy demands as they start to increase in 2010 and 2011.

With this initial observation, Dr Cameron described that despite this increasing demand for energy, there is still over a billion people worldwide without access to energy, and double this without access to clean cook facilities – it is apparent that energy use is disproportionate in developed countries.

From the World Energy Outlook held in 2011, it was estimated that 50% of the predicted growth in energy demand would be from China and India in the next 25 years, with uncertainties around nuclear power following Fukushima, CO<sub>2</sub> has risen to a new high and oil imports also reaching a new high all having impacts.

One of the challenges is decarbonisation – currently 60% of the CO<sub>2</sub> emissions are from the energy sector, rising to 75% by 2050. It is here where governmental energy policies have the biggest impact, are essential to limit global temperature increases. Dr Cameron highlighted that there was a big reliance on Carbon Capture technology, and that approximately 50% reduction in CO<sub>2</sub> emissions can be done simply through efficiency gains.

Dr Cameron then went on to talk about the role of nuclear power in the global energy mix, highlighting the amount of new build plants

worldwide that have already begun construction from initial concrete pour and that already a significant number of existing plants have plant life extensions. He went on to detail the advantages of nuclear power, and said the biggest issues surrounding nuclear power were down to policy issues from both governments and investors; and following the Fukushima accident regaining public confidence in the reliability of nuclear power is essential.

The talk was followed by a comprehensive questions session ranging on topics from fusion, Small Modular Reactors and use of thorium as fuel also. The lecture was very well attended and the Nuclear Industry Group would like to thank Dr Ron Collier for his excellent talk and presentation.

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Andrew Quinn is a Thermo-Fluids engineer working for Rolls – Royce Nuclear Business in Derby.

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## Items for the next newsletter – Submit an Article

We'd like to hear what you're doing, what you think of the Nuclear Industry Group, any ideas you may have for networking opportunities or anything else you think would be of interest to the rest of the group. We plan to publish our next Newsletter in summer of 2013.

Please submit any articles and accompanying photographs or pictures to either Heather Beaumont (mailto:[heather.beaumont@amec.com](mailto:heather.beaumont@amec.com)) or Geoff Vaughan (mailto:[gvaughan@uclan.ac.uk](mailto:gvaughan@uclan.ac.uk)) .

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This newsletter is also available on the web and in larger print sizes.

The contents of this newsletter do not necessarily represent the views or policies of the Institute of Physics, except where explicitly stated.

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