The Nuclear Industry

Opportunities for physicists

IOP Institute of Physics | Careers

The Institute of Physics is a scientific charity devoted to increasing the practice, understanding and application of physics. It has a worldwide membership of around 40 000 and is a leading communicator of physics-related science to all audiences, from specialists through to government and the general public. Its publishing company, IOP Publishing, is a world leader in scientific publishing and the electronic dissemination of physics.

Picture credits
p2: iStockphoto.com/Damir Cudic
p14: iStockphoto.com/Björn Kindler
p16: iStockphoto.com/Prill Mediendesign & Fotografie
p18: iStockphoto.com/Ivan Cholakov
p20: iStockphoto.com/zilli
p22: iStockphoto.com/zilli
Case study profile images were supplied courtesy of the individuals

Institute of Physics
76 Portland Place
London
W1B 1NT

Tel +44 (0)20 7470 4800
Fax +44 (0)20 7470 4848
www.iop.org/careers

E-mail members.careers@iop.org
www.facebook.com/instituteofphysics
www.twitter.com/physicsnews

Registered charity number: 293851
Charity registered in Scotland: SC040092

Contents

Introduction

The nuclear renaissance 3
Who this booklet is for 4
What this booklet includes 4

An overview of the industry

Opportunities in nuclear power

Power generation 5
Reprocessing 6
New build 6
Map of licensed nuclear power sites in the UK 8
Current generating reactors operating in the UK 9
Decommissioning and waste management 9

Opportunities outside nuclear power

Defence 10
Healthcare 11
The academic sector 11

Careers information

Skills and qualifications 12
Nuclear Graduates scheme 12
Tips on getting into the nuclear industry 12
The Institute of Physics Nuclear Industry Group 13

Case studies 15

Company details 24

Acknowledgements 27

Introduction

The nuclear renaissance

The nuclear industry has been a major part of Britain's economy for more than half a century. It is also a sector with a strong future.

Globally, Britain is the tenth biggest generator of nuclear power, and nuclear currently provides around a sixth of our electricity requirements. With demand for energy increasing and the need to reduce carbon emissions firmly on the political agenda, nuclear looks set to play an ever bigger part in meeting Britain's future energy needs.

With the prospect of a new wave of nuclear power stations to be built in this country, there is a huge need for dynamic and talented people to take part in this programme. There has never been a better time for physicists to think about a career in this industry. Little wonder then, that a recent survey showed 70% of members of the Institute of Physics were interested in finding out more about the challenges and opportunities that the sector holds.[1]

Working in nuclear power is not the only avenue to consider. Nuclear technology plays a big role in defence and healthcare, and there are opportunities for physicists in both areas. Many physicists find their niche in research and development in academia, supporting these sectors. This guide will give you a starting point to begin exploring each of these areas.

I am delighted to endorse this booklet and to urge any physicist looking for a challenging career to read on and find out what the nuclear industry can offer them.

Jennifer Richards CPhys FInstP
Vice-president, membership and qualifications, Institute of Physics

1. *Institute of Physics Industry Survey*, March 2010

Introduction

Who this booklet is for

Although primarily aimed at graduates, this guide can help any physicist interested in making a move into the nuclear industry. Whether you are looking to work on the construction of new power stations, in defence or decommissioning, this guide will give you an overview of the industry, tell you who the major employers are, how to apply, and the sort of challenges that you can expect your career to hold.

It will also give you an idea of the skills and qualifications that you will need, pay and conditions, and the opportunities for advancement. Plus, there is information on the Nuclear Decommissioning Authority's Nuclear Graduate scheme.

What this booklet includes

We have included a general overview of the nuclear power industry, covering:

- power generation;
- reprocessing;
- new build;
- decommissioning;
- waste management;
- healthcare;
- defence;
- R&D in academia.

There are also listings for some of the major employers in the nuclear industry – companies like EDF, Babcock International and AMEC. Also, to give you more of a personal taste of what working in the nuclear industry might be like and how you might progress, we have included profiles of five physics graduates currently working in this field.

We hope that you find this booklet interesting, informative and accurate. If you have any comments or suggestions, please contact Vishanti Fox, careers manager at the Institute of Physics, on 020 7470 4800 or e-mail members.careers@iop.org.

An overview of the industry

It is worth beginning by noting that there are four key stakeholders associated with each nuclear site. These are:

- The owners of the site. These are usually also the operator of the site, but this is not always the case (e.g. the Nuclear Decommissioning Authority owns a number of legacy sites and competes for the right to operate them).
- The operators of the site – these will be the licence holders for the site.
- Supporting contractors to the owners or the operators.
- The regulators of the licensed site. They also employ contractors to assist them in their assessment of the sites.

There will be career opportunities in each of these areas, but the nature of the work is different. The responsibility for safe operation of the sites is that of the licensee, and they have to convince the regulator that they are in control and have the necessary arrangements in place for this. The nuclear industry is a highly regulated industry, with the key regulators being the Nuclear Directorate within the HSE, which is currently in transition to an independent regulatory body outside the HSE, and the Environment Agency (or in Scotland, SEPA).

Owners and operators are also interested in value for money and finding ways to deliver more for less. Such considerations are well suited to physicists who have a broad understanding of many technical areas and can fit well into multi-disciplinary teams.

Supporting contractor roles tend to be much more technical with analysis undertaken in a whole range of specialist areas.

In the following sections we consider the opportunities in each of the main areas of the industry.

Opportunities in nuclear power

Power generation

The UK has 10 nuclear power stations currently in operation:

- Two Magnox stations – the UK's first generation of nuclear power stations.
- Seven Advanced Gas-cooled Reactors (AGRs) – the second generation of power stations.
- One Pressurised Water Reactor at Sizewell. This is one of Western Europe's newest operational reactors.

The Magnox stations are owned by the Nuclear Decommissioning Authority (NDA), the body responsible for overseeing the decommissioning and clean up of the UK's civil nuclear sites. These stations are operated under contract by Energy Solutions and have a combined capacity of nearly 1.5 GW. The AGRs and Sizewell B are owned and operated by British Energy, the largest nuclear power generator in the UK and now part of EDF Energy. These eight nuclear power stations have a combined installed capacity of nearly 9 GW. Plant-life extension (and maximisation) for the AGRs (or at least predicting more accurately when they should close) provides significant opportunities for scientists and engineers.

British Energy employs physicists in its Central Support Function and at the power stations. The Central Support Function is mainly located at Barnwood in Gloucester and is made up of several departments in which a physicist could work. The Design Authority, for example, is one such department with a central role in maintaining, developing and reviewing nuclear safety cases for the power stations.

Working in power generation
Physicists frequently find roles as:

- Safety case engineers – providing design solutions to manage nuclear safety risks over the lifetimes of the power stations.
- Engineering technologists – providing specialist technical support to help assess plant performance integrity and safety margins. Technologists also provide advice on the operating limits and operating margins of plants.
- System engineers – responsible for providing advice to the stations on various systems.
- System health engineers – ensuring equipment and system reliability in designated plant areas.
- Health physicists – responsible for controlling radiation hazards and for keeping exposure to the workforce and the public to a minimum.

Reprocessing

Reprocessing is the sector of the nuclear industry dedicated to recycling the re-usable materials from used nuclear fuel so that they can be used again in new fuel. The process separates these valuable assets from waste materials, which are then processed and managed prior to their disposal.

Reprocessing also involves transporting radioactive materials both within the UK and worldwide and storing radioactive materials safely over the long term.

Reprocessing is one of the options available to the nuclear industry to manage nuclear fuel once it has been irradiated in a nuclear reactor. The other option is direct disposal, but the big advantage of reprocessing is that the separated materials can be recycled and re-used.

Working in reprocessing
Reprocessing, which takes place at Sellafield, Cumbria, is a vital part of the UK nuclear industry, and work in the sector varies greatly, from meeting the business challenges of operating commercially in a global marketplace to making new advances in chemical engineering.

However, reprocessing is currently not government policy for those reactors being considered for new nuclear build. Instead, there is an emphasis on storing the irradiated fuel safely on site for many years to allow the cooling of the material prior to direct disposal. Development of plant and processes to enable long-term storage of spent fuel on site is therefore a growth area.

Working in fuel production
Urenco provides the AGR fuel in terms of the uranium, and it has significant growth plans, including abroad. Westinghouse (Springfields) manufacture the fuel as used in the AGRs (plus some PWR fuel), and is similarly expecting to expand with new build developments. Sellafield Ltd also produces MOX fuel from the reprocessed material.

The future
Around 20% of the current UK civil nuclear industry workforce is engaged in reprocessing, but the sector looks set to decline over the long term. Unless new options are taken up, it is estimated that reprocessing will shrink to 7% of the workforce by 2025 as existing contracts expire.

But that still leaves almost 2000 jobs in the sector, and with the expansion of the nuclear industry worldwide and the ever-increasing demand on fuel resources that entails, the recycling of materials will be extremely important. Reprocessing continues to be developed and researched, and ever-more efficient and proliferation-resistant options are being explored.

New build

A new wave of nuclear power stations looks set for construction in the UK to help meet the need for safe, reliable low-carbon energy.

In the consultation on its National Policy Statements in October 2010, the government identified eight sites as potentially suitable for new nuclear power stations. All are adjacent to existing nuclear sites. EDF, Horizon Nuclear Power (a

consortium of E.ON and RWE) and Nu Generation (a further consortium consisting of GDF, Scottish and Southern Energy and Iberdrola), have all announced their interest in building new nuclear plants.

EDF is leading the way with plans to build four 1.6 GWe European Pressurised Reactors (EPRs) – two each at Hinkley Point in Somerset and Sizewell in Suffolk. EDF hope that the first unit at Hinkley Point can begin operation from 2018.

Horizon Nuclear Power has announced plans to build new plants at Wylfa in Anglesey and Oldbury in Gloucestershire, and Nu Generation plan to develop land adjacent to Sellafield.

The opportunities presented by new build will be undeniably impressive, with thousands of new jobs created. Recruitment by EDF and Horizon is already under way.

Working in new build

Nuclear new build combines the demands of a large civil infrastructure project with complex, safety-regulated engineering.

The new generation of power stations will require the highest calibre workforce, with skills ranging from project management and business development to hard-science technical capabilities, as well as engineering and consultancy skills.

Opportunities exist for physicists in a number of areas:

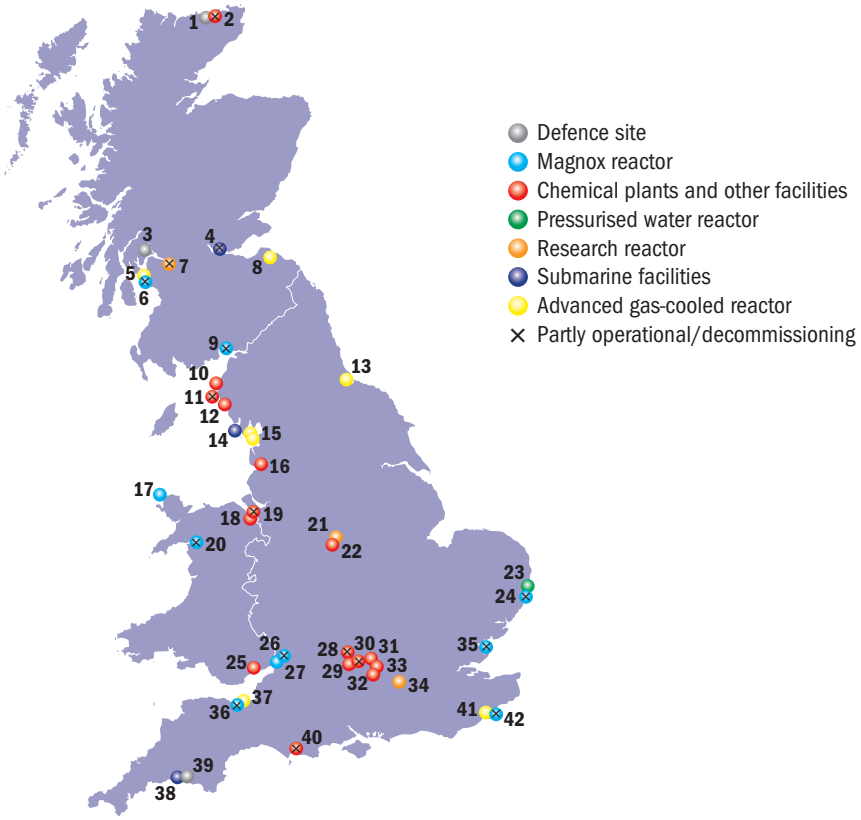
- **Design** – there will be a limited number of UK jobs working on the actual reactors of new build plants as these are mainly covered abroad (France and the US). However, there are numerous aspects of the current new build plant designs where work is incomplete or needs modification for UK-specific requirements and physicists will be heavily involved – from details of modular construction techniques to modification of control and safety instrumentation.
- **Construction** – physicists would not normally expect to be involved in construction, but they often take project management roles.
- **Operation** – on a power station, physicists commonly take responsibility for operating the reactor. In operational support, physicists are commonly found filling roles in fuel management teams overseeing fuel cycle management and fuel development. There are also roles in safety case development/project management and planning, and health physics.
- **Manufacture** – physicists will be in demand from manufacturers of specialist equipment such as radiation detectors and monitors. However, the majority of new build prospects are for construction and project-management personnel.
- **Safety** – the nuclear industry takes safety as its prime consideration and physicists are key to the analysis of safety studies. Interests cover a wide range, including radiation exposure, accident consequence analysis, fracture mechanics, materials properties, reliability and human factors. Safety case authors need the ability to work across a wide range of disciplines, including physics, engineering, chemistry, mathematics and materials science.

The future

New build offers a wealth of opportunities for physicists, ranging from the highly technical to applied engineering. A career in nuclear really is a job for life (if required) with a construction phase lasting several years and a typical operational phase of around 60 years.

Furthermore, the plants currently being considered are typically referred to as Generation III, but already consideration is being put into the development of Generation IV reactors, which will be safer, more efficient, will produce less waste and will have reduced the risks for proliferation.

Map of licensed nuclear power sites in the UK



1. **Ministry of Defence** Vulcan Shore Test Facility
2. **Dounreay Site Restoration Ltd** Dounreay
3. **Ministry of Defence** Clyde Naval Base
4. **Rosyth Royal Dockyard Ltd** Rosyth
5. **British Energy Generation** Hunterston B
6. **Magnox North** Hunterston A
7. **University of Glasgow** Glasgow
8. **British Energy Generation** Torness
9. **Magnox North** Chapelcross
10. **Studsvik UK Ltd** Lillyhall
11. **Sellafield Ltd**
12. **LLW Repository** Drigg
13. **British Energy Generation** Hartlepool
14. **BAE Systems** Barrow
15. **British Energy Generation** Heysham I and II
16. **Springfields Fuels** Preston
17. **Magnox North** Wylfa
18. **URENCO** Capenhurst
19. **Sellafield Ltd** Capenhurst
20. **Magnox North** Trawsfynydd
21. **Rolls Royce** Derby
22. **Rolls Royce** Derby
23. **British Energy Generation** Sizewell B
24. **Magnox South** Sizewell A
25. **GE Healthcare** Cardiff
26. **Magnox South** Berkeley
27. **Magnox North** Oldbury
28. **UKAEA** Harwell
29. **GE Healthcare** Harwell Building 443.26
30. **GE Healthcare** Harwell Building 10.23
31. **GE Healthcare** Amersham
32. **AWE** Aldermaston
33. **AWE** Burghfield
34. **Imperial College Consort reactor** Ascot
35. **Magnox South** Bradwell
36. **Magnox South** Hinkley Point A
37. **British Energy Generation** Hinkley Point B
38. **Devonport Royal Dockyard Ltd** Devonport
39. **Ministry of Defence** Devonpoint Navel Base
40. **UKAEA** Winfrith
41. **British Energy Generation** Dungeness B
42. **Magnox South** Dungeness A

Current generating reactors operating in the UK				
Reactor	**Type**	**Net capacity each**	**Start operation**	**Expected shutdown**
Oldbury R1 and R2	Magnox	217 MWe	1968	June 2011
Wylfa R1 and R2	Magnox	490 MWe	1971/2	December 2010
Dungeness B R21 and R22	AGR	545 MWe	1985/6	2018
Hartlepool R1 and R2	AGR	595 MWe	1984/5	2014/2019?
Haysham 1 R1 and R2	AGR	615 MWe	1985/6	2014/2019?
Heysham 2 R3 and R4	AGR	615 MWe	1988/9	2023
Hinkley Point B R3 and R4	AGR	600 MWe	1976/8	2016
Hunterston B R3 and R4	AGR	605 MWe	1976/7	2016
Torness R1 and R2	AGR	625 MWe	1988/9	2023
Sizewell B	PWR	1196 MWe	1995	2035

Decommissioning and waste management

Decommissioning is the process whereby a nuclear power station or facility is taken out of active service, dismantled and demolished. The safe management of radioactive materials and waste plays a major role.

There have been nuclear power stations in the UK since the 1950s. Many of the earliest were built without clear plans for when they would go out of service and later ones were designed for a lifespan of around 30 years. Like all industries, nuclear power generation produces waste, which needs to be managed in a way that is safe – for people and the environment.

Other nuclear facilities were constructed for military, fuel reprocessing and industrial purposes, and pose challenges in decommissioning and radioactive waste management.

Decommissioning and waste management are therefore absolutely crucial to meeting the commercial and environmental challenges of the nuclear sector, and anyone with a job in the sector plays a vital role in Britain's nuclear industry.

Working in decommissioning and waste management

A physicist who goes into this sector will be confronted with a stimulating range of technical and knowledge-based challenges. Having a technical background and logical thinking skills are very important, as are strong communication skills. At Sellafield, for example, physicists are widely employed across the business, engaged in tasks that range from traditional technical work such as modelling and calculations to safety assessment and project management.

For many people, job satisfaction comes from problem solving and working within a team to come up with a technical solution. Indeed, decommissioning work provides some of the most interesting work in the whole nuclear sector. Physicists work with a wide range of other technical specialists to engineer solutions to problems that may be unique in the world, and on some of the highest risk plants in the industry.

The future

The decommissioning and waste management sector currently employs around half of the civil nuclear operating workforce. Even assuming that there was no new build in future years, Britain's

legacy of nuclear power stations and other nuclear sites means that decommissioning will continue for at least the next 100 years in the UK.

On the waste management side, there will be opportunities to get involved in the planned new underground storage facilities for intermediate and high-level waste. These will be constructed by the Nuclear Decommissioning Authority's Radioactive Waste Management Directorate (RWMD) based at Harwell, which employs many. Challenges include assessment of waste currently being generated, safety studies and design work on the proposed repository.

Consultancy (UK and international)
The UK provides significant support to the nuclear industry worldwide, from ongoing work with the Chernobyl overbuilding and the modernisation of Eastern European power and process/storage facilities, to having input on the design and development of the next generation of reactors, including fusion and ITER. There are large technical consultancies such as Atkins and Serco Assurance that provide general support to the industry, but there are also hundreds of smaller specialist suppliers, for example materials and magnetic systems technology for ITER, instrumentation in all its varieties, computing (e.g. modelling and predictive capability), fire, seismic assessment, criticality, shielding and safety cases development. Such roles can often give the opportunity for international travel or to work overseas.

Opportunities outside nuclear power

Defence

A nuclear deterrent continues to play an important role in Britain's national defences.

The defence sector of the nuclear industry covers two linked areas: the UK nuclear deterrent and nuclear powered submarines. Both of these are widely viewed as important national assets.

The Atomic Weapons Establishment (AWE)

The AWE provides and maintains the warheads for the UK's Trident missile-based nuclear weapons programme. It also provides fundamental research and development support.

AWE's work covers the entire life cycle of nuclear warheads, from the initial concept to manufacture and assembly, and in-service support for decommissioning and disposal.

AWE has two main sites: Aldermaston and Burghfield. Plasma physics and design physics are a key part of AWE's work. There are also opportunities for physicists working on the new lasers to simulate the conditions in the heart of a nuclear explosion.

The sector consists of the Ministry of Defence (MoD) and key contractors such as BAE Systems, Babcock and Rolls-Royce, that all design and build for defence applications and the Atomic Weapons Establishment, which provides and maintains the warheads and submarine capability.

Working in the defence sector
Physicists are involved in a range of activities in the nuclear defence sector, including radiation protection and monitoring, reactor and nuclear systems modelling and design, consequence and environmental impact analysis and materials testing. Physicists also have roles to play in project management, where technical knowledge backs up other, softer, skills.

The MoD also delivers its own nuclear education, training and research up to postgraduate level. This is carried out through the Nuclear Department, part of the Defence Academy.

Physicists in the defence nuclear sector are based in London, south-west England, central southern England and both southern and northern Scotland. There are also a number of defence contractors working in the Midlands and north-west England.

You will work with a wide range of people too, such as contractor agency staff, MoD civil servants and uniformed service personnel.

As in the civil nuclear power industry, there is a growing field in decommissioning/waste management of old plant and sites, such as the nuclear submarine fleet and its associated maintenance facilities.

Experienced nuclear personnel within the MoD are seen as key national assets and can expect to benefit from a managed career progression, a recruitment and retention allowance as well as the usual Civil Service pay and benefits.

The MoD also operates a Defence Engineering and Science Group scheme that provides early training and career management for graduate entrants, some of whom enter the nuclear field.

The future

The nuclear defence sector has a sound future with new challenges emerging in the provision of the nuclear deterrent in the post-Trident era. The decommissioning of nuclear submarines and facilities is also now under way.

Healthcare

Nuclear technology has medical applications both in diagnostics of disease and radiation treatment of conditions such as cancer.

Radioactive tracers are used to image the function of organs in the body. This is key to giving clinicians vital information to make confident decisions on patient treatment.

Physicists are vital to the safe and reliable production and use of these tracers as well as the detectors used to gather the images that the clinicians use. The GE Healthcare site, the Grove Centre in Amersham, is a production site of these radioactive tracers. Physicists also have an important role to play in hospitals.

The work of a physicist in healthcare can vary widely, from plant design to producing the tracers safely, to ensuring that the workers and the local environment are safe. In hospitals, medical physicists are key to ensuring that the tracers are used in the correct quantity, handled and administered safely to ensure a good image for the clinicians. Physicists are also heavily involved in the design and safe operation of diagnostic equipment (X-rays, CAT, MRI) and radiotherapy equipment.

The academic sector

The academic sector plays a key role in supporting the nuclear industry with research into new technologies and techniques, and there are numerous opportunities for physicists.

The universities of Birmingham, Brighton, Edinburgh, Glasgow, Liverpool, Manchester, Surrey, West of Scotland and York all have nuclear physics groups. Working within these groups offers opportunities to support the nuclear energy industry with research into new technologies and techniques, as well as the chance to work internationally in laboratories such as Jyväskylä in Finland and Argonne in the US.

Nuclear physicists can also be found in engineering and materials departments in UK universities. These departments offer applied research opportunities in areas such as instrumentation and materials performance, especially in high radiation fields.

There will be increased opportunities for nuclear physics research as plans for new nuclear builds in the UK are developed.

You can find out more about the research undertaken in the academic sector, with a breakdown of work in various universities, at **www.nuclearliaison.com**.

Careers information

Skills and qualifications

Qualifications

The minimum qualification that you will need to enter the nuclear industry as a physicist will be a degree, foundation degree or a BTEC/HNC/HND in a relevant subject.

If you are looking for a first job, you might typically expect to join a graduate training scheme run by one of the big companies. For these schemes, you will typically need a good degree (2:2 or above) in a science or engineering-related discipline to take part. A relevant postgraduate degree could also give you a definite advantage.

Skills

To flourish as a physicist in the nuclear industry you will need to be able to demonstrate:

- a strong interest in science and technology;
- an ability to develop skills in other disciplines and to work with experts in mathematics, chemistry, engineering and materials science;
- problem solving and analytical skills;
- planning and organisational skills, including project management;
- a high level of proficiency in maths and computing;
- team work, people management and other "soft" skills;
- a strong appreciation for health and safety.

Salary and conditions

Graduate starting salaries tend to be £20 000 to £28 000, while a well-qualified manager or specialist could expect to earn £60 000 or more.

If you are involved in running a power station you could work according to a seven-day shift system, including nights and weekends. If you're working in the industry more generally or in research and development, standard office hours are the norm.

You might need to consider relocating to work in the nuclear industry, with key sites situated across the country from Dounreay (near John O'Groates) to Plymouth. See the map on p8 for more details.

Training and professional development are taken seriously by all major employers, including in-house or external training courses, mentoring schemes and opportunities for chartership or membership of professional bodies.

With the nuclear industry looking to expand substantially in future years, there are excellent prospects for job security and advancement.

Nuclear Graduates scheme

Nuclear Graduates is a two-year graduate programme created by the Nuclear Decommissioning Authority with the backing of 20 major employers, ranging from Westinghouse to AMEC. It's open to graduates from all disciplines and backgrounds, but physicists are obviously on the agenda.

The Nuclear Graduates scheme is designed to give participants an insight into the industry, built around a series of three secondments, each lasting eight months, spent with different employers. Around half of the graduates taking part will get the opportunity to do a three-month placement abroad with a partner organisation. Go to **www.nucleargraduates.com** to find out more.

Tips on getting into the nuclear industry

- Get operational experience on site, working on practical projects. Get as much varied experience as you can through all the technical aspects. That puts you on a good footing to get to the front of the queue when people are recruiting – *David Tatton, GE Healthcare*.
- Think about the area of the nuclear industry that you would like to go into. There is a lot of documentation and paperwork that goes with everything for safety purposes. If you are more practical and problem-solving orientated you

need to make sure that you get yourself into the appropriate area – *Craig Waters, AMEC*.

- A year-long or summer placement in the industry looks very good on a CV and offers an excellent opportunity to sell yourself, establish contacts and perhaps most importantly, allows an insight into what areas inspire you – *Rhodri Morgan, Hyder Consulting*.
- Enter the industry with no preconceptions and an open mind. The nuclear industry is unique in so many ways and is a fantastic career for those who want something a bit different – *Thomas Morris, Sellafield Ltd*.
- Try to obtain a placement at a company before graduating to ensure that you enjoy it and that it provides useful experience for when it comes to applying for a job – *Tom Horsley, AMEC*.
- Take as many nuclear-related modules as possible, stay in touch with current developments in the industry and check what contacts your university may have with the industry – *Rhodri Morgan, Hyder Consulting*.
- Go for it! There are countless roles out there and, whether you use your degree directly or not, the same logical and creative approaches to problem solving required at degree level will serve you in good stead in the nuclear industry – *James Rendell, Sellafield Ltd*.

The Institute of Physics Nuclear Industry Group

Formed in 2010, the Nuclear Industry Group is a thriving special-interest group for physicists involved or interested in the nuclear industry.

The group is concerned with all aspects of the industry – civil, defence and healthcare – and reflects the diversity of roles that physicists have within it. Meetings are held at least once a quarter, each featuring speakers relevant to the industry and take place outside regular working hours in locations that reflect the geographical spread of members.

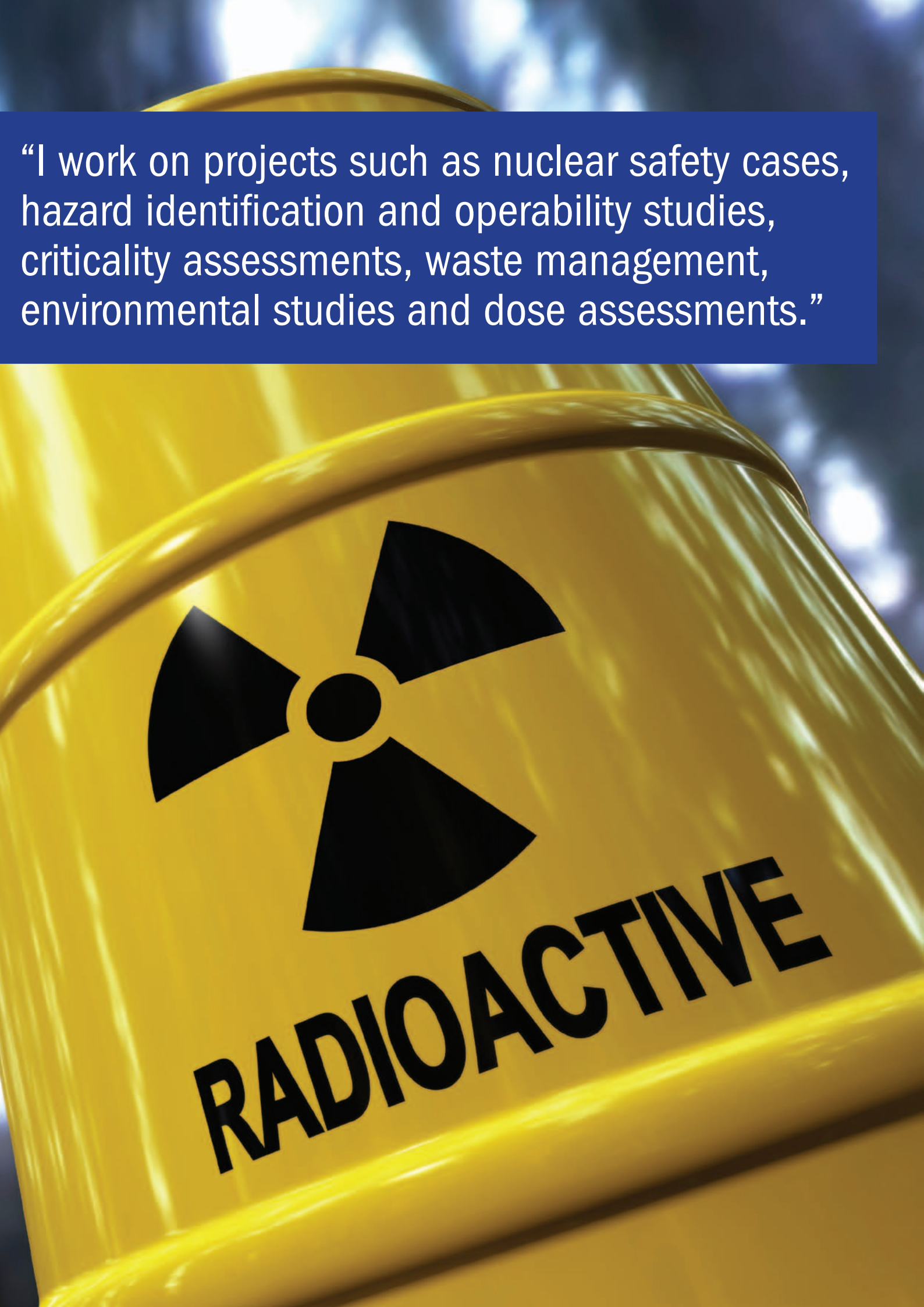
The group takes a particular interest in professional development and networking opportunities. They encourage members to achieve formal Chartered Physicist or Fellowship status with the Institute of Physics, and to continue to develop themselves throughout their careers.

The networking opportunities offered by the group help support this as well as fostering contact between physicists from a wide range of backgrounds.

They also seek to engage and include those who are not directly involved in the nuclear industry.

So whether you have been in the industry for 30 years, are a student considering their career options, or someone with a general interest in the sector, they look forward to welcoming you as a member and seeing you at a meeting soon.

For more information about the IOP's Nuclear Industry Group, please go to **www.iop.org/activity/groups/subject/nig/index.html**.



“I work on projects such as nuclear safety cases, hazard identification and operability studies, criticality assessments, waste management, environmental studies and dose assessments.”

Case study: Ash Matadeen

Age: 28
Job: Consultant
Company: AREVA RMC, Abingdon, Oxfordshire
Studied: MSc in the physics and technology of nuclear reactors, University of Birmingham

As a consultant at AREVA RMC, the core of my work relates to managing risk in high-hazard industries. I work on projects such as nuclear safety cases, hazard identification and operability studies, criticality assessments, waste management, environmental studies and dose assessments.

Being a consultant means that my work can vary greatly. Some weeks I might find myself working on a single project while at other times I might be working on two or three different projects as well as attending seminars and training courses.

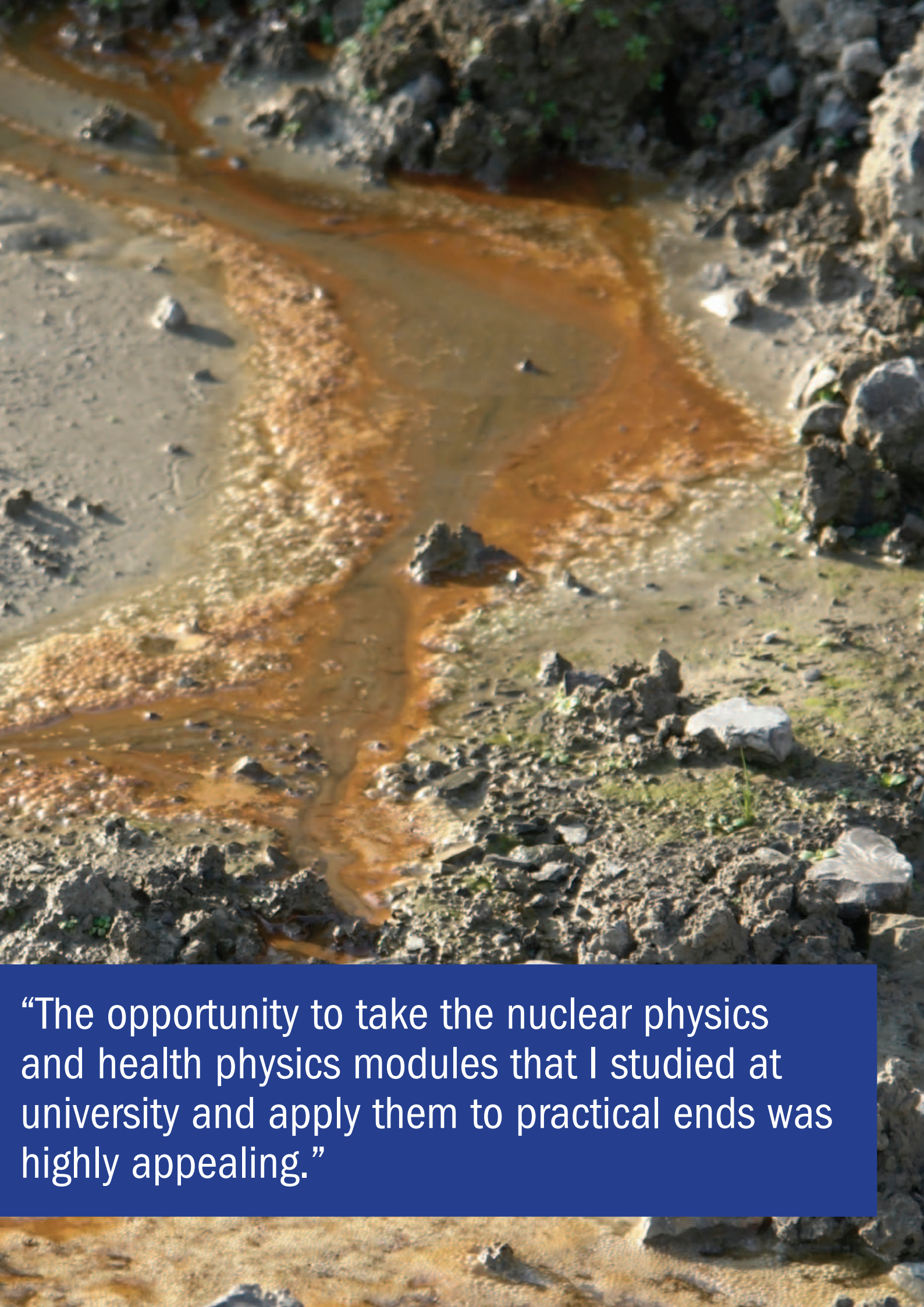
I am currently based at the AREVA RMC office in Abingdon, where I work on addressing regulator queries on the preparations for the approval of new build for the UK EPR(TM), AREVA's Generation III+ reactor. The team that I work with on this project includes two other consultants from AREVA RMC and colleagues from AREVA NP and EDF in France.

After completing my physics degree at the University of Birmingham, I did an MSc in the physics and technology of nuclear reactors. This provided me with the skills and knowledge that I needed to begin my career in the nuclear industry.

This is not a typical career path, however. In fact, there is no typical career path. My colleagues come from various backgrounds, including physics, chemical engineering, mechanical engineering, chemistry, geology and environmental science. It is the variety of skills within the company that allows us to work successfully on a wide range of projects.

The challenges of my job depend on the projects that I am working on. That could mean anything from regularly commuting to a client's office to modelling a difficult nuclear criticality problem. I enjoy the technical challenges the most as they change as I move on to different projects. Plus there's usually someone within the company with more experience who is able to help. This allows me to improve my knowledge and skills in the different subject areas.

With the UK looking into new reactor builds, future prospects in nuclear consultancy are very good. In addition, there is also the need to decommission our existing nuclear sites and build a geological disposal facility for managing radioactive waste safely.



“The opportunity to take the nuclear physics and health physics modules that I studied at university and apply them to practical ends was highly appealing.”

Case study: Rhodri Morgan

Age: 29
Job: Nuclear consultant
Company: Hyder Consulting Ltd, Bristol
Studied: MPhys physics and astronomy, University of Leicester

I am a nuclear consultant working for Hyder Consulting in their Utilities Sector in Bristol. Currently my role involves a part-time secondment at Oldbury Power Station in Gloucestershire, working within their decommissioning team.

When I am not doing this, I work on an array of projects, ranging from dealing with radioactive contaminated land to researching emerging techniques applicable to nuclear decommissioning.

I studied physics and astronomy at university. I wasn't thinking of a career in that area per se; it was a field that fascinated me and still does. Upon leaving university, I saved money working in mundane temping roles and travelled for six months. On my return I was offered a graduate role with Hyder, within their geo-environmental department.

I started off working in the contaminated land industry, but this soon led to nuclear work. The opportunity to take the nuclear physics and health physics modules that I studied at university and apply them to practical ends was highly appealing. The nuclear sector wasn't a field that I had considered in depth while studying, but since entering the industry I have been very excited by the projects that I have been involved in.

I am continually surprised by the variation in opportunities available within the nuclear industry, ideally suited to a physics-based background. The industry is ideal for ambitious graduates with a desire for new challenges and variation. I enjoy the freedom and responsibility that I have in my role. The opportunity to follow my own direction on projects is exciting. Similarly, working within a team of focused experts, both at Oldbury and Hyder is very enjoyable and provides a great opportunity to develop and ask questions.

The main challenges of the job are picking up as much technical understanding and experience as possible while being fully engaged in ongoing projects. To provide adequate technical support I often need to brush up on background knowledge. It's also sometimes difficult overcoming some of the preconceptions surrounding the industry's safety record among friends and family. The environmental impact of nuclear is negligible, yet its reputation is severely tarnished by past events, from which the industry has learned and applied valuable lessons.


“Sometimes a solution
is very difficult to find
and carry out, but
never impossible.”

Case study: Craig Waters

Age: 25
Job: Nuclear physicist (graduate trainee)
Company: AMEC, Warrington, Cheshire
Studied: BSc physics, Warwick University

My job involves designing, testing and deploying remote operations methods and equipment aimed at inspecting and testing parts of nuclear reactors that are otherwise not accessible.

My everyday work consists of designing, developing and experimenting with methods and equipment (some state of the art) to find suitable ways to carry out inspections and testing. My average week usually consists of a bit of experimental rig work, designing and producing inspection equipment, and trips to nuclear sites where the work is going to be carried out.

I always like to work in a team as many heads are better than one. I'm based at AMEC's offices in Warrington, Cheshire and the site includes engineering laboratories where I carry out all the equipment and methods development. I carry out the final work on nuclear sites.

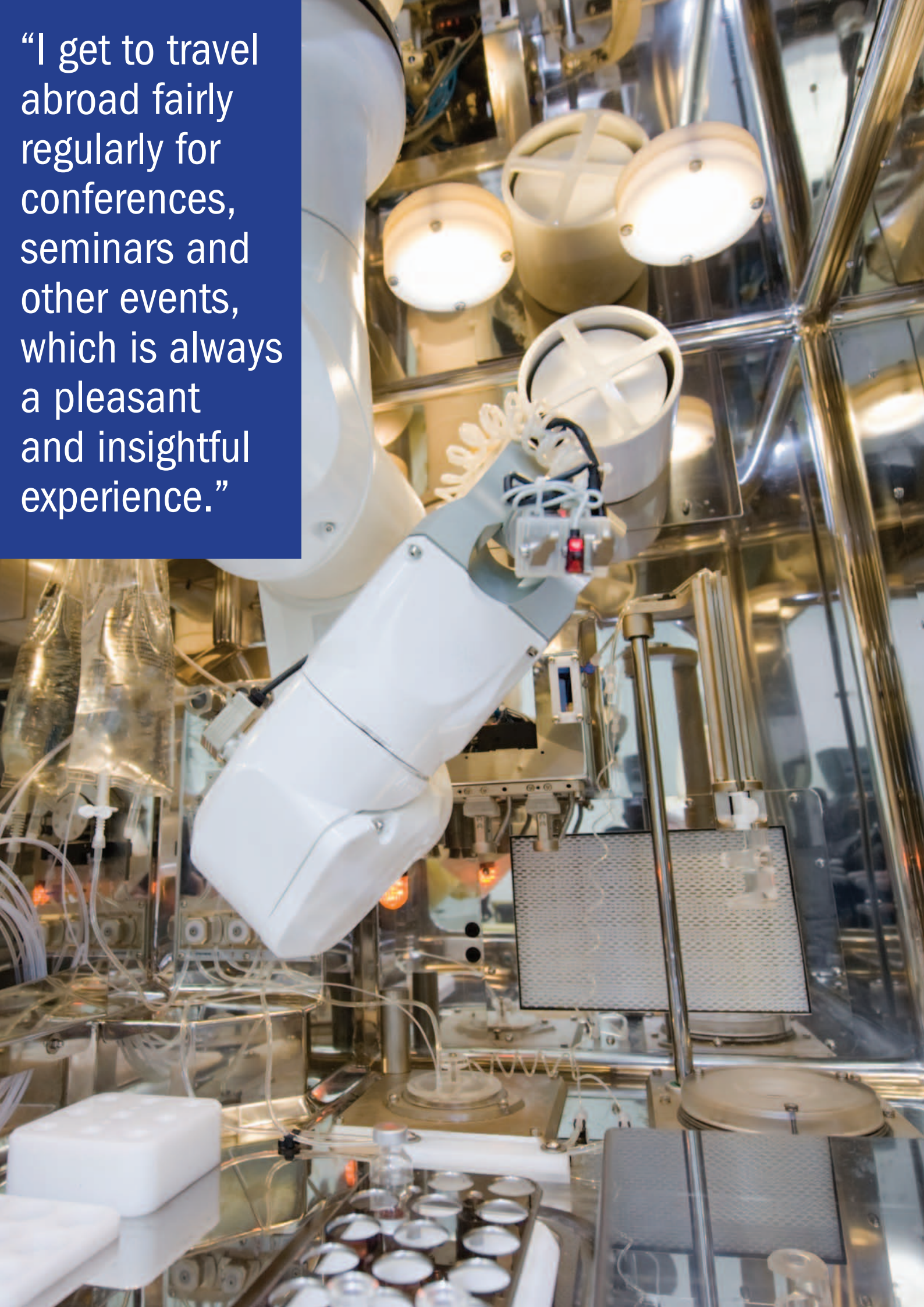
I joined the AMEC graduate training scheme and that gave me the opportunity to join the development and remote engineering department – the very same team that I currently work in. I wanted something a bit more practical than an office-based job, and this team is ideal for hands-on work. I have a desk in an office but I spend most of my time in the engineering laboratories or on site.

I studied physics at Warwick University and my ultimate qualification was a 2:1 BSc (Hons). After university I worked on a farm (which I had been doing for five years on and off during my university studies). This gave me a lot of practical skills relating to complex machinery and operating equipment. I decided to apply my degree and move into the nuclear industry.

I decided to get into this industry because I wanted something that would satisfy my practical background and use what I had learnt while studying for my physics degree.

The main challenge of my job is solving complex problems. I enjoy the fact that sometimes an inspection requirement in the reactor at first may seem impossible, but after a bit of careful thinking and equipment development a solution can normally be found. Sometimes a solution is very difficult to find and carry out, but never impossible.

“I get to travel abroad fairly regularly for conferences, seminars and other events, which is always a pleasant and insightful experience.”



Case study: Thomas Morris

Age: 26
Job: Team leader, analytical services
Company: Sellafield Ltd, Cumbria
Studied: BSc physics, University of Leeds

I am based in the analytical services department on the Sellafield site. My time is split between three roles: I'm the team leader in a fast-paced production environment; liaison officer for a group of laboratories; and involved in setting and maintaining international standards associated with the Nuclear Fuel Cycle.

Every day at Sellafield is different and poses unique challenges. If I take this week as an example, I have been involved in organising and planning a technical project for an instrument upgrade. I have also been in liaison with one of our regulators and many other personnel across the site to help co-ordinate the installation of a new machine. Finally, I've been conducting operations to ensure that the members of my team are happy, motivated and working to their full potential.

I work in a laboratory environment (think of your stereotypical sci-fi set) with numerous colleagues. However, I get to travel abroad fairly regularly for conferences, seminars and other events, which is always a pleasant and insightful experience.

I studied a straight BSc (Hons) in physics at university. I don't have the brains to be an academic, but I wanted to utilise my knowledge and enthusiasm for science in a business where science contributes to its success. The nuclear industry is one of those rare industries where scientific knowledge can be directly applied – it's all subatomic physics after all.

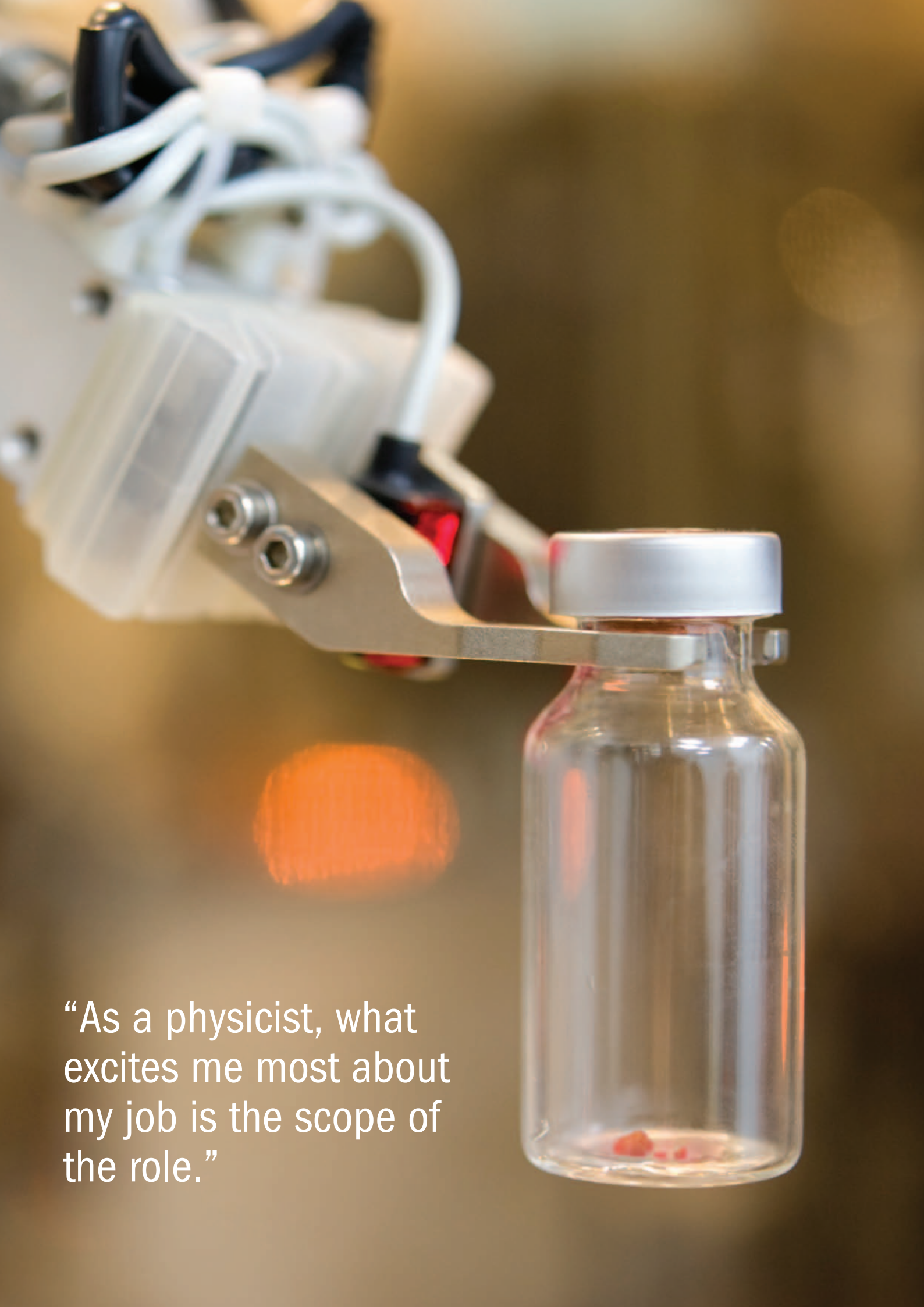
I have worked in my department since I joined the graduate training scheme at Sellafield in 2006. I showed enthusiasm towards the more technical aspects of the department and so I was asked to lead the mass spectrometry team.

I have been very lucky that I have experienced many aspects of the Sellafield site in a short period of time. In addition, I spent most of 2008 in Germany as part of a secondment gaining experience that was impossible to find in the UK.

The variation of my job is challenging, there is no "comfort zone", but I wouldn't want it any other way. Safety is of utmost priority in an establishment such as this and so it's sometimes difficult to grasp the long timescales that are required for jobs that would be relatively simple in other industries.

I would like to progress in my career, keeping within the nuclear industry, until I reach the top. My managers have outlined a career plan for me that identifies me as a manufacturing manager in the foreseeable future.

From there on in, it's a case of working hard, keeping my team safe and always staying positive and optimistic about the future of the nuclear industry and my impact within it.



“As a physicist, what excites me most about my job is the scope of the role.”

Case study: David Tattam

Age: 38
Job: Physics group manager
Company: GE Healthcare, Buckinghamshire
Studied: PhD, physics, University of Birmingham

My primary area of work is medical diagnostics. We manufacture radioactive pharmaceuticals to help clinicians diagnose disease. My job as a physicist covers all aspects of radiation safety and measurement. This covers the safety of our workers by measuring radiation using dosimetry and other specialist measurement devices. My group also makes measurements in the local environment to demonstrate that the site has insignificant impact.

I did my first degree at Imperial College, London. I then went on to do an MSc in applied radiation physics at the University of Birmingham. I enjoyed that and they offered me a PhD in boron neutron capture therapy, which is a form of radiotherapy.

After completing my PhD, a measurement physicist role came up at Amersham (which subsequently became part of GE Healthcare). Since taking on the role, I've gradually gained more responsibility. I now head up a team of 15 that comprises the dosimetry and environmental service, the radiation and radioactivity calibration laboratory, the waste measurement group and the radiation protection instrumentation function. I am a qualified expert for the UK sites advising on compliance with Environmental Agency requirements.

My role is key to ensuring that the workers are in a safe environment, and that the public and wider environment are protected. My team ensures that the dosimetry systems used to monitor the radiological exposure of the workers are right for the job and provide the managers with good data, demonstrating that doses are as low as reasonably achievable.

As a physicist, what excites me most about my job is the scope of the role. I can be dealing with a dosimetry issue in the morning, looking after an environmental improvement project in the afternoon and rounding the day off helping answer customer queries about a product. It is very satisfying to think that my role ensures the protection standards on the sites are consistent with best practice in the industry.

Company details

Abbot Risk Consulting (ARC)

Abbott Risk Consulting
Trident One
Styal Road
Manchester
M22 5XB

E-mail **jo.york@consultarc.com**

AMEC

You can e-mail your CV or obtain further information about opportunities for graduates by contacting Barbara Smith, graduate programme manager, **barbara.smith@amec.com.**

AREVA

Contact Helen Higgs,
e-mail **helen.higgs@arevarmc.com**

Babcock

Contact Patricia Downes,
e-mail **graduates@babcock.co.uk**

BAE Systems

Contact Martin Pulford,
e-mail **martin.pulford@baesystems.com**

www.baesystems.com/Careers

EDF

EDF Energy
Barnett Way
Barnwood
Gloucester
GL4 3RS

For further information on the career opportunities available within EDF Energy please visit **www.edfenergy.com/careers**.

E.ON and Horizon Nuclear Power

Visit our website for up to date contact and graduate scheme details. There is a link to where you can apply speculatively online (equivalent to sending in a CV).

www.horizonnuclearpower.com

Frazer-Nash Consultancy

Up to date information on opportunities and the recruitment process within Frazer-Nash can be found on our website. Prospective candidates are then invited to e-mail their CVs (and ideally a completed application form).

E-mail **cv@fnc.co.uk**
www.horizonnuclearpower.com

Fluor

Fluor Limited
140 Pinehurst Road
Farnborough
GU14 7BE

E-mail **steve.benton@fluor.com**

Galson Sciences

Dr Matt White
Galson Sciences Limited
5 Grosvenor House
Melton Road
Oakham
Rutland
LE15 6AX

E-mail **mjw@galson-sciences.co.uk**
www.galson-sciences.co.uk

We only consider applications from post-graduates, not graduates.

Hyder Consulting

Susan Hewish
Business development director – nuclear
Hyder Consulting (UK) Ltd
5th Floor
The Pithay
All Saints Street
Bristol
BS1 2NL

E-mail **susan.hewish@hyderconsulting.com**

Company details

Ministry of Defence

Ken Kempthorne
DES SM S-NSQEP-PM
Birch 3b, #3326
Abbeywood
Bristol
BS34 8JH

Applications are welcomed as part of the nuclear component of the MoD Defence Engineering and Science Graduate Scheme.

Nuclear Graduates

Contact Anna Byrne,
e-mail **anna.byrne@nucleargraduates.com**

nucleargraduates

Rolls-Royce

For direct entry recruitment enquiries please contact Craig Ruff,
e-mail **craig.ruff@rolls-royce.com**

Details of our graduate programmes are available at **www.rolls-royce.com/careers**

Rolls-Royce

Springfields

Contact Paul Sutton,
e-mail **paul.c.sutton@springfieldsfuels.com**

Studsvik UK Ltd

Colin Myers
Human resources manager
Studsvik UK Ltd
Unit 14, Princes Park
4th Avenue
Team Valley Trading Estate
Gateshead
Tyne & Wear
NE11 0NF

E-mail **colin.myers@studsvik.co.uk**

Studsvik

Westinghouse

There is a UK recruitment e-mail address specifically set up for people wishing to contact us about prospective employment or to send in speculative CV applications.

E-mail **ukrecruitment@westinghouse.com**

Westinghouse

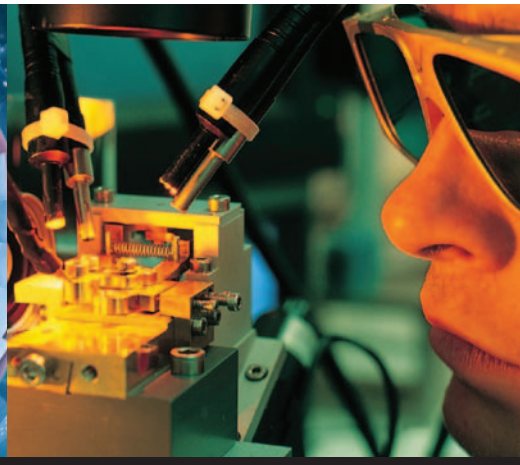
Acknowledgements

The Institute of Physics would like to thank the following for their assistance in the preparation of this guide: Tamara Baldwin, Frank Francis, Bob Hawkrigg, Ian Holloway, Rebecca Holyhead, Emily Meese and Martin Phillips for commenting on the text, and John Priestland, chairman of the IOP's Nuclear Industry Group, for his comments and support.

brightrecruits

energy and utilities

aerospace



manufacturing

telecommunications

engineering

defence

Jobs for physicists, physicists for jobs

brightrecruits offers jobs from around the world, in energy and a wide range of other sectors. Whatever stage you are at in your career, your background in physics or engineering could open up a world of opportunities.

Visit **brightrecruits.com** today to browse jobs, register and upload your CV.

brightrecruits.com

About the Institute of Physics

The Institute of Physics is a scientific charity devoted to increasing the practice, understanding and application of physics. It has a worldwide membership of around 40 000 and is a leading communicator of physics-related science to all audiences, from specialists through to government and the general public. Its publishing company, IOP Publishing, is a world leader in scientific publishing and the electronic dissemination of physics.

To find out more, go to **www.iop.org** or contact us on 020 7470 4800.

Institute of Physics
76 Portland Place
London
W1B 1NT

Tel +44 (0)20 7470 4800
Fax +44 (0)20 7470 4848
E-mail **members.careers@iop.org**