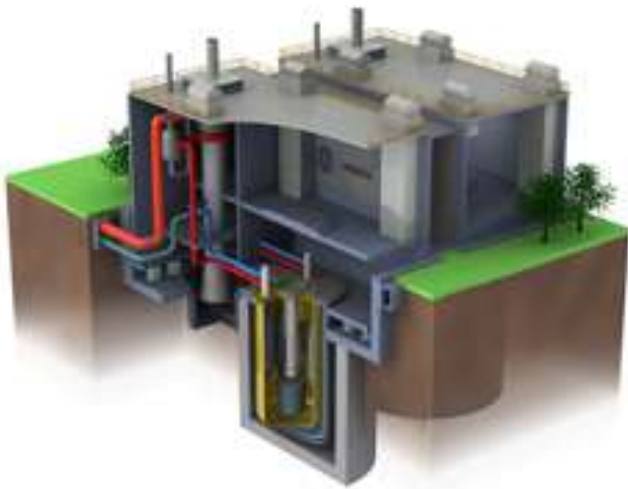
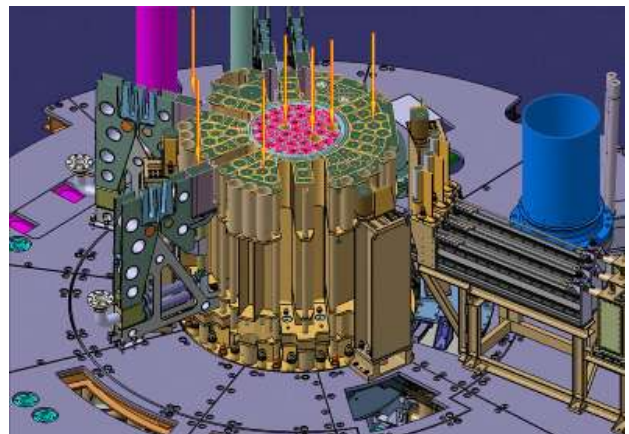


Issue no. 3



*GE-Hitachi's PRISM Reactor
(Image courtesy of GE-Hitachi)*



*The Jules Horowitz Reactor
(Image courtesy of CEA)*



*Shimane 3, The Chugoku Electric Power Co., Inc.
(Image courtesy of Hitachi-GE Nuclear Energy, Ltd.)*

Contents

Notes from the chair	2
Geoff Vaughan	
Nuclear Industry Group Prizes 2013.....	3
Elections for Committee: Would you like to Join the NIG Committee?	3
Are your thinking of applying for Chartership?.....	4
Experiences in progressing towards CPhys.....	4
Andrew Quinn	
A journey through Chartered Engineer territory.....	6
Sarah Abel	
The Jules Horowitz Reactor	7
David Farrant	
Nuclear Waste Disposal in the States has hope	8
Robert Hayes	
Hitachi's Advanced Boiling Water Reactor (ABWR) Seminar.....	9
Heather Beaumont	
Geological Disposal of Radioactive Waste in the UK Geological Disposal of Radioactive Waste in the UK.....	11
Michael Gifford	
GE-Hitachi's PRISM Reactor	11
David Tattam	
Next Generation Nuclear Energy – the UK's role.....	13
Geoff Vaughan	
Ensuring Safety, Security and Safeguards in Nuclear Power: Opportunities and challenges of a coordinated approach	14
Geoff Vaughan	
Future Events.....	15
Items for the next newsletter – submit an article.....	16

Notes from the Chair

Let me begin my first Chairman's letter by saying welcome to all new members of the Nuclear Industry Group of the Institute of Physics. You are joining one of the fastest growing groups which currently has over 330 members. This is a fantastic achievement for a group which has only existed for about 2 ½ years and the success of the group is largely due to the drive and determination of my predecessor, John Priestland.

John got together a number of us about four years ago and we developed the remit for the group with a name that clearly distinguishes us from the Nuclear Physics Group to emphasise that not all physicists working in the nuclear industry are involved in the behaviour of nuclei. The group recognises that the nuclear industry is of interest to a broad audience and so seeks to engage and include those who are not directly involved in it. Therefore there is a warm welcome to members from a wide range of backgrounds and interests.

The group was formerly founded in 2010 and many of the current Committee were part of the originating members. John decided to resign late last year and I took over from him at the AGM in February this year. We owe John a great deal of thanks for his efforts and I hope that I, with the support of the Committee, will be able to build on the foundations he laid. I am sure I speaking for all the members of the NIG when I say "Thank you John". At the



AGM in February, I made a presentation to John: this was from personal contributions from all of the Committee, showing the regard we have for his efforts.

In mentioning the Committee, I should point you to the call for nominations for the vacancies caused by resignations, later in this Newsletter. One Officer nomination is also called for, as Michael Gifford has suggested he stands aside from the post of Treasurer, though he will stay on the Committee. Michael has done a sterling job, for which much thanks, and has indicated that he will help a new Treasurer take over from him.

The Newsletter gives us a chance to interact with members on matters such as Chartership and to report on meetings and seminars, both sponsored by the NIG and by other organisations, that might be of interest to members. The Committee tries to find topics for Newsletter articles, visits and lectures that will attract members and in future I intend to try to have the latter in different parts of the country, recognising that travel for such events may be difficult. If members show interest (we will be sending out a questionnaire) we will consider web streaming or filming the talks.

Finally, I would encourage you all to try to attend NIG events – the nuclear industry is, if slowly, growing again and networking with others will help to develop careers, understanding of the different aspects that comprise the nuclear industry and hopefully be enjoyable!

Geoff Vaughan
Chairman
IOP Nuclear Industry Group

Nuclear Industry Group Prizes 2013

The Nuclear Industry Group was pleased to award an early career prize 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.

The prize went to Rhodri Morgan of Hyder Consulting for his leadership of the development of Laser Induced Breakdown Spectroscopy as a tool for the monitoring of nuclear waste packets. Within this project his efforts in bringing together diverse areas of research to develop a viable solution to a difficult problem were particularly noted by his supporters.

The calling notice for the 2014 Nuclear Industry Group prizes will be released later this year. The deadline for submissions will be January 31st, 2014.



Elections for Committee: Would you like to join the NIG Committee

We need you! There are currently some vacant places on the Committee so we will be inviting nominations for these places later in the year. Also we will be requesting nominations for the post of Treasurer, as the present post-holder is willing to stand aside. Look out for the email

requesting nominations.

Officers and members must stand down after a maximum of three years (though it is proposed to increase to four years), but can be re-elected, but the maximum period on the Committee (as Officer and/or member) is nine

years (12 years if the longer period is adopted). If you want to contribute to the development of the NIG, joining the Committee is a good way (see the request for nominations elsewhere in this Newsletter) – and it will also raise your profile in the industry. Even if you don't want to commit to joining the Committee we are always looking for new ideas for lectures, events etc and suggestions for venues so we can reach as a wide a part of the NIG as possible – so if you have ideas send them to the Chairman or the Secretary.

What the Committee does.

As we are asking for nominations for the Committee, it was felt useful to give a brief overview of what the role of Committee members is and what the Committee does.

There are three Officers, Chairman Secretary and Treasurer and 10 Members, one of whom is co-opted from the Nuclear Physics Group and we will also be offering a place to the Energy Group. The roles of the officers is fairly obvious, but includes liaising with IoP through the Groups Forum. Some of the Committee

members take on specific roles such as being members of the prize committee, Newsletter editor etc., others may do one-off tasks such as organising an event or lecture.

The Committee organises the events and lectures that currently are held about four or five times a year. Possible joint events with other IoP Groups, or sponsoring events outside IoP, are discussed and promoted. One of the more hidden activities of the Committee is commenting on IoP documents and responding to requests for views on Government Consultations to inform the IoP response. The NIG also arranged a one-day seminar on whether the UK should develop a research Reactor capability: it is pleasing to note that whilst the seminar concluded that the financial case was not strong enough for a go-it-alone UK system, the UK is now part of the Jules Horowitz Reactor (see article by David Farrant). As the type of event and subject of lectures is determined by the Committee, a strong, knowledgeable membership is necessary to maintain the successful start to the life of the NIG.

Are you thinking of applying for Chartership?

Two of members of the NIG are currently going through the process of becoming Chartered. Andrew Quinn is currently progressing his application for Chartered Physicist status. Andrew works at Rolls-Royce as a Thermo-Fluids Engineer and has been in post for just over five years now. Sarah Abel is working as an engineer at Atkins Sarah Abel is an Engineer at Atkins with 5 years experience primarily in Systems Engineering, Nuclear Engineering, Safety Case Development and Engineering Project Management in the Nuclear and Defence industries. Sarah is progressing towards CEng via the IoP. The following two articles provide some insights into the the journey to Chartership from their perspective.

Experiences in progressing towards CPhys

Andrew Quinn

I started the process of progressing towards Chartered Physicist just over five years ago, shortly after starting full-time employment after completing my Masters degree in the Physics and Technology of Nuclear Reactors at the University of Birmingham. At the time there was a minimum requirement of professional development before being able to apply for Chartered Physicist; however this is no longer the case as long as the candidate is able to fulfil and demonstrate the requisite competencies. I look at each of these in turn, along with some things I have learned whilst going through the process that may help in completing your own CPhys application forms.



The first section is the Core of Physics, this is only required if your undergraduate degree is not accredited by the Institute of Physics. A list of accredited degrees from various institutions can be found in the following document on the IoP website:

http://www.iop.org/education/higher_education/accreditation/file_43311.pdf. In my case I had to complete this section, and only brief statements are required against each section. These can be covered by a variety of means, such as relevant lectures on the topic, private study, any appropriate university modules (any academic reference in this section needs to be at higher education level), conferences or any courses undertaken as part of your job.

Following this section is the CPhys Master's Project Equivalence Report. This is not required for those who have an accredited integrated Master's (MPhys or MSci) degree already. However, if you do not hold an accredited Master's degree, but did do a project or thesis as part of your Master's degree, then you can send a copy of the abstract of your work to the membership team at the IoP (membership@iop.org) who will review the abstract. The key aspects need to be that it is clear that it is your own work, and that it is a detailed area of Physics. If the membership approves the abstract as a suitable replacement for this section, then retain a copy of the confirmation to include with your submission. Otherwise you will need to complete this section, with the guidelines detailed in the application form. Make sure you emphasise your own involvement in the project, especially if it was a piece of work that you collaborated on; and the technical aspects of it also.

The next section is the CPhys Professional Review Report, and covers several subsections: career history, organisation chart, competencies and responsible experience. In each of these sections it is important to emphasise personal involvement and responsibilities. The introduction is a summary that covers your career to date, highlighting personal responsibilities and description of your role, up to your current position. This is then followed by a copy of your current organisation chart, which should highlight your position within the company, who you report to and any staff that you would be responsible for.

The next section is the initial professional development – if you are following a training scheme that is accredited by the Institute of Physics, the rest of this section does not need to be completed and you just need to get the scheme leader. For those who do need to complete this section, it is split into two parts – the five competencies (A to E) and examples of responsible experience. The competencies A to E are described in section 3.2 at the front of the application form, and as always focus on your own involvement and responsibilities when detailing how you meet these competencies. It is recognised that candidates will be stronger in some areas than others, so if you feel that you are weaker in one area compared to another then that shouldn't be a problem. The responsible experience section should cover three or four examples of different tasks you have undertaken at a professionally responsible level. Examples of what this may constitute can be found at the start of the section under "Guidance on Responsible Experience" and there are two key points to remember:

1. The list in the application form is not exhaustive and other examples of responsible experience may be appropriate,
2. There is no expectation that a candidate meets every criteria listed either.

The three or four examples should be sequential chronologically, and follow on from each other. In addition they should illustrate how you, as a candidate, have developed over this time in becoming more experienced and taking on greater responsibilities. The final part of this section is a short statement relating to CPD following on from achieving chartership – how are you going to continue to develop yourself professionally. This could be by becoming a mentor to those starting towards Chartership, look to becoming a Fellow, or other ways of developing yourself in a professional manner.

Finally, a note about supporters – the documentation says that you should have two supporters who are chartered with the Institute of Physics. This is not always applicable because the supporters will need to be individuals who are familiar with your work (since they will be asked to verify this) that you have described in the responsible experience section. You are allowed to have more than two supporters, and only one of these need to be chartered with the Institute of Physics. If this turns out to be the case, all you need to do is to explain the justification for your choice of supporters in a

covering letter detailing the reasons why; although your supporters should still be chartered with another institute however.

If you have any further queries then I strongly suggest contacting the IoP membership team, they are very helpful and can clarify a lot of points that might not be explicit in the application form. In addition, if there is a "getting chartered" workshop being held in your area (see the IoP website for details), then

these are very useful since it gives you the opportunity to ask questions directly on the process also.

Andrew Quinn is the Honorary Secretary for the Nuclear Industry Group and is a Thermo-Fluids Engineer at Rolls-Royce for just over five years now and is about to submit his Chartered Physicist application.

A journey through Chartered Engineer territory

Sarah Abel

While studying Physics and Astrophysics at the University of Birmingham, I took part in a project to design a satellite along with 18 other students. I thoroughly enjoyed applying my physics skills to solve a complex design problem and the experience fostered an existing interest I had in engineering. After graduating I decided to look for jobs in the engineering sector and was interested in consultancy because of the variety of work. The wide range of opportunities offered by Atkins, across different engineering sectors, immediately appealed to me and I started on the Atkins graduate scheme in 2008. I have since worked on a range of interesting and challenging projects in both the Defence and Nuclear Power sectors.

I have been able to apply the skills I developed as a physicist to a range of engineering disciplines including systems engineering, mechanical engineering, control and instrumentation and safety case development. I have a particular interest in technical project management and enjoy multi-disciplinary projects which require me to develop a broad knowledge and skills set across a range of technical areas. Chartered status represents an internationally recognised level of competence which is both useful to my company and helpful for guiding breadth and depth of experience. As someone that transitioned into engineering, I believe that achieving Chartered Engineer (CEng) status is important to demonstrate the skills and experience I have gained.

I reviewed my Chartership progress against the CEng competencies every 6 months with a mentor. This helped me to identify gaps in my experience to focus on in the next period. The output of these meetings then fed directly into development reviews with my line



management who supported me in identifying and securing relevant opportunities to close those gaps. It is easy to get bogged down in capturing the detail of each piece of work so I learnt to focus on the skills that I had gained, whilst drawing out competency areas I was less confident about. I would then pursue opportunities to challenge myself and develop them.

Identifying a suitable mentor at the beginning of your career is essential to the process. I would strongly recommend having someone separate to your day to day work, if possible. I have been lucky enough to keep the same mentor for most of my professional development. This has meant they could independently observe my development over a number of years and help me to appreciate (and remember!) what I had learnt. I would also recommend producing short summaries of project work on completion of every placement or task as this makes your life much easier when it comes to filling out the forms.

The CEng UK Competency Specification is

the same for any engineering institute and there a number of options available. For me, the benefit of being able to achieve this status through the IoP is that the institute has guided many others with physics degrees successfully towards CEng. The IoP membership team and Nuclear Industry group have also been very supportive, with the IoP 'Getting Chartered' workshops being particularly helpful. I hope to be able to act as

a mentor to others following the CEng route with the IoP in future.

Sarah Abel is an Engineer at Atkins with 5 years experience primarily in Systems Engineering, Nuclear Engineering, Safety Case Development and Engineering Project Management in the Nuclear and Defence industries. Sarah is in the process of applying for Chartered Engineer

The Jules Horowitz Reactor

A report on the NNL's involvement in the project and a recent seminar

David Farrant

Access to facilities that will provide fuel and materials test data under irradiation is an essential part of any country's nuclear reactor programme. It is acknowledged, however, that most current materials test reactors (MTRs) around the world are ageing and many are scheduled to close over the coming years. With that in mind, a new materials test facility, the Jules Horowitz Reactor (JHR), is currently under construction at the CEA's Cadarache site in the south of France with the aim of underpinning the international community's test reactor requirements well into the future. This is being built, and will be operated, within the context of an international consortium.



On 12th March 2013 the UK Government announced a significant funding commitment to the JHR. This commitment will allow UK-based academics, national laboratories and the nuclear industry guaranteed access to the reactor, and enable collaboration on safety and innovation. At the same time, the Government announced that UK participation in the JHR programme would be led by the UK's National Nuclear Laboratory (NNL). NNL currently leads the UK involvement in the existing international fuel and materials experimental programme at

the Halden test reactor in Norway and NNL, the Government's Department of Energy and Climate Change (DECC) and CEA believe that a similar approach should be adopted regarding the UK's interactions with JHR.

JHR will be a 100 MWth light water MTR optimised for fuel and material testing. In summary, the capabilities of the JHR will include the following:

- Fuel testing under nominal, off-normal and accident (eg loss of coolant accident) conditions
- Material testing under high dpa and controlled thermal gradients
- Pressure vessel steel testing
- Corrosion and stress corrosion cracking testing
- High temperature materials testing
- Gen II, III, III+ and IV fuel and material types
- Supply of medical isotopes

NNL will set up a UK consortium of interested parties who, together, could make use of JHR's capabilities and realise the benefits of UK membership. The first step in this process was the organisation of a day's seminar (22nd May) when a wide cross-section of organisations in the UK who could potentially have an interest in the project (including Government, industry, national labs, academia etc) were invited to hear about the project. At this seminar, an overview was provided of the UK R&D infrastructure and Government drivers for JHR membership, in addition to background on the Halden project for comparison purposes. The main part of the meeting was a presentation by CEA on JHR's capabilities, the potential for sending secondees now to work at the reactor

site, plus a question and answer session with the audience.



The current expectation is that first criticality of JHR will happen at the end of 2016, with the first tests starting in 2018. The initial experimental capability will focus on normal and off-normal LWR tests. In due course this will be expanded to cover accident conditions and other high temperature materials testing

capability, and eventually testing under Generation IV reactor type conditions.

If anyone would like any further information about the JHR project and the UK's involvement in it, please contact the author.

Acknowledgements

The images in this article are courtesy of CEA.

David Farrant has been involved in the nuclear fuel industry for over 30 years starting with BNFL through to his current role in NNL. His main focus has been on fuel design and licensing, from involvement in the design and licensing aspects of the initial UO₂ fuel supply to Sizewell B and the supply of MOX fuel overseas through to involvement in a number of EU Framework advanced fuel and reactor projects. He is the Chairman of the IAEA's Technical Working Group on Fuel Performance and Technology and the UK member of the Halden Board of Management; he is also now leading the UK's involvement in the JHR.

Nuclear waste disposal in the States has hope

Robert Hayes

The Waste Isolation Pilot Plant (WIPP) (<http://www.wipp.energy.gov/>) is the world first geological disposal facility for transuranic waste. Transuranic waste is largely plutonium contaminated items generated from weapons manufacture such as gloves, cleaning items and tools. It is located in the south east corner of a salt deposit having a larger cross sectional area than the state of Florida.



The exact location is almost in the middle of the layer where the salt is approximately 610 m thick. The shipment of the waste to the WIPP from the generator sites has taken place over more than 13.7 million loaded miles (which is equivalent to over 28 trips to the moon and back) all without a single detectable release. The WIPP is a fully operational salt mine having received the states safe mine of the year award for over 2 decades with a production record

boasting over 2 million curies permanently removed from the biosphere. This has allowed 14 separate generator sites to have been completely cleaned up of transuranic waste through over 11,000 shipments comprising almost 90,000 cubic meters of waste. It is a matter of pride that all this is done while being under budget and ahead of schedule with a very impressive safety record (challenging that of your neighborhood public library).

It is here at the WIPP where I do ALARA, dosimetry support (internal and external), consequence assessment, free release, shielding, nuclear criticality safety, statistical analysis, testing, nuclear emergency response, research and all radiation safety technical support. In addition to these, I also support MIT as a research affiliate with their dark matter detector (<http://dmtpc.mit.edu/>) with on site operational needs in the WIPP underground. Recently I have also taken on the role of the radiochemistry laboratory director for CLIA compliance applications (CLIA #32D2040667) at the WIPP labs as well (there is never a lack of work to do at the WIPP).

In what began as an altruistic attempt to give back to society, I started writing a weekly science column for my local newspaper (<http://www.hobbsnews.com/>). These articles

eventually found their way to the Oklahoman newspapers website as a blog (<http://newsok.com/blogs/science-and-technology>) with the oldest of the articles having already been edited into an e-book (<http://www.amazon.com/dp/B00CC2KB5S>).

Having worked at both the WIPP and the Nevada Test Site, I have been afforded many opportunities to contribute to the nuclear field which have rewarded me back by being made a fellow of the American Physical Society and chairing the American Nuclear Society's

Radiation Protection and Shielding Division in 2009-2010.

I believe the WIPP paradigm shows great promise for the nuclear industry and am encouraged that its progress both continues and is being maintained with high standards.

Robert Hayes is a Principal Engineer at Nuclear Waste Partnership LLC based in Carlsbad, New Mexico, USA. He is a Fellow of the American Physical Society with whom the IoP has a number of links.

Hitachi-GE's Advanced Boiling Water Reactor (ABWR) Seminar

A report on the seminar held by Hitachi hosted by Imperial College, London.

Heather Beaumont

In January 2013 John Hayes (the then-UK Energy Minister) made a formal request for the Office for Nuclear Regulation (ONR) and the Environment Agency to conduct the GDA process for Hitachi-GE's Advanced Boiling Water Reactor (ABWR) design. Horizon Nuclear Power (a wholly owned subsidiary of Hitachi) is proposing to build either two or three reactors at each of Horizon's two sites at Wylfa in Anglesey and at Oldbury in South Gloucestershire.



*Shimane 3, The Chugoku Electric Power Co., Inc.
Source: Hitachi-GE Nuclear Energy, Ltd.*

Earlier this year, Hitachi-GE held an invitation-only seminar, hosted by Imperial College in London, to present their ABWR concept to industry, academia and other interested parties. The objective of the seminar was to give the audience a broader understanding of the technology. This event was attended by over 80 delegates and there was a great deal of interest throughout from the audience.

After introductions from Professor Robin Grimes of Imperial College, the seminar was opened formally by Mr Naoki Ito, the Minister of the Japanese Embassy. Mr Ito's opening address made reference to the successes of 2012 within the UK, such as the Olympics and the Queen's Diamond Jubilee. He went on to make a number of positive statements highlighting the significance of the step into the UK nuclear market by Hitachi.

The European Chairman of Hitachi, Sir Stephen Gomersall, completed the opening addresses. He expressed his delight that Hitachi-GE were entering the UK new nuclear build programme, stressing the business advantages within the UK where it is hoped that successful relationships and partnerships can be built to work towards a common enterprise and with common objectives. He informed the audience that Hitachi-GE are confident in their ABWR technology, which is the only advanced (generation 3+) reactor already constructed and operating in the world. They are also confident in being able to licence the ABWR within the UK, and noted that it had already been licensed in three other countries. It was recognised that it was early days with a lot of work to implement ABWR in the UK but Hitachi-GE are confident that the design will be able to successfully deliver enablers such as pass through the GDA process, and attract international investors.

The seminar was split into four sessions chaired by Mr John Baker, Horizon Nuclear Power's licensing director and Professor Grimes.

The first session opened with an overview of Hitachi Ltd and Hitachi-GE Nuclear Energy, presented by Mr Shunsuke Utena, Hitachi Ltd's General Manager of the Europe Nuclear Energy Development Division. He talked about the history of the Hitachi company from its roots as a machine repair shop in the early 1900's to its status today as one of the world's largest electronics companies with over 323,000 employees world-wide in a range of different business sectors, with the nuclear sector comprising about 20% of their Power Business portfolio. He went on to discuss the evolution of the ABWR design. There are currently four ABWR operating units in Japan, with a further three under construction in Japan and two in Taiwan. The company are also looking at other European markets for their technology including Finland and Poland. Mr Baker went on to say that Hitachi-GE have a proven track record of delivering on time and on budget, a record that is based on experience and continuous R&D.



*Shimane 3, The Chugoku Electric Power Co., Inc.
Source: Hitachi-GE Nuclear Energy, Ltd.*

The remainder of the day was broken up into three technical sessions at which senior Hitachi-GE engineers and managers presented various aspects of the ABWR design, construction, and operation and maintenance.

Session 1 included three further presentations on the ABWR concept, reactor system design and core and fuel design. The ABWR concept was cited as being a simple configuration, small in size and having strong safety features, high performance in terms of high fuel economy and flexibility in core design and high reliability. Its construction time is relatively short, proven by their experience on existing plants.

Session 2 focussed on the safety design of the ABWR and on lessons learned from the Fukushima

accident. The audience was informed that the UK ABWR would include Fukushima counter measure features including strengthening the plant facility by, for example, introducing greater physical separation, redundancy and diversity. In addition the introduction of mobile countermeasures located separate from the plant is also planned.

Session 3 provided details of instrumentation and control design, plant layout and arrangement design and construction technologies and experiences. Hitachi's construction strategies all revolve around detailed and in-depth planning before beginning construction and a philosophy of "just do it as planned".

The final session of the day was a lively question and answer session, clearly demonstrating the interest of the audience in the design and plans for the UK-ABWRs.

The seminar concluded with some key highlights from Hitachi:

- Hitachi-GE have constructed 4 ABWRs in Japan, on-budget and on-schedule
- ABWR is the only proven generation 3+ technology in operation, but in-line with the lessons learned from Fukushima further enhancements to safety in relation to external hazards will be implemented
- Hitachi will proceed with a UK-ABWR supported by Horizon and the UK supply chain. They expect a robust and rigorous review and will learn from previous experience with the GDA process.
- Hitachi are planning on building 2 or 3 UK-ABWRs at each of the Wylfa and Oldbury sites, starting operation in the early 2020's
- They anticipate strong support from both the UK and Japanese governments and good long-term relationships with UK academia and industry.

Acknowledgements

The author wishes to thank Horizon Nuclear Power Limited and Hitachi-GE for the opportunity to attend this event on behalf of the NIG. The images in this article are courtesy of Hitachi-GE Nuclear Energy, Ltd.

Heather Beaumont is Head of Profession for Physics and Business Manager for Physics and Licensing in AMEC's Clean Energy Europe Business based in Knutsford, Cheshire. Heather has been in the nuclear industry with AMEC and its predecessor organisation NNC for over 22 years.

Geological Disposal of Radioactive Waste in the UK Geological Disposal of Radioactive Waste in the UK

A report on the talk given by Adam Dawson

Michael Gifford

The subject of radioactive waste disposal is an emotive one and many would think it is one of the toughest problems that the UK has to solve. The good news is that the NDA has found somebody for whom it is only the second hardest problem he has been asked to tackle. Adam Dawson has had a varied career and in his most recent post prior to joining the NDA he was at DECC grappling with the issues around carbon capture and storage – the hardest problem he has faced!

Adam's talk took us through the fundamentals of the nuclear waste issue and how the process for dealing with the half million or so m³ of varied materials was progressing. As any good story-teller should, Adam started at the beginning with the history of the waste inventory and what was in it. For those in the audience not directly involved with this issue this was a sobering reminder of the price our descendants will be paying for the cheap energy and global security that the UK has enjoyed since the 1950s. Sobering or not, it became clear that Adam was genuinely optimistic about the possibility of finding a solution.



After a quick canter through the options that were put forward by CoRWM in 2004 (and I am sorry that we didn't have time to consider disposal in ice sheets further!) we moved on to the crux of the issue. Assuming a geological disposal facility is the best solution, where do you put it? Once again Adam lifted the spirits of the audience with his convincing argument that the technology and geology was challenging but manageable. In simple terms, you can build a disposal facility in a variety of different geological environments, and adapt the waste packaging system and containment to fit the characteristics of the rock. In that way, safety can be assured. While the assembled group were basking in the comfort of this knowledge Adam chose to once more cast us on the emotional roller-coaster with the sad truth that the social and political issues are far from as easy to counter.

Adam gave a very clear picture of the ways in which the Kentish and Cumbrian proposals had foundered on the rocks of public opinion and told us how the NDA plans to reinvigorate the search for a host community, and the important role that community benefits will play in that process.. Sadly I came away feeling that even his seemingly boundless energy will be sorely tested in the slow process of convincing people that having such an essential facility nearby will help secure prosperity for the area. On a more positive note, if anybody can crack the problem then it is probably Adam Dawson.

Michael Gifford is the founder of Mountain Hare Consulting, a Cambridge based business consultancy specialising in helping individuals and companies develop new opportunities. Michael previously worked for Atkins in a number of roles in and around the Nuclear Industry. He has been Hon. Treasurer of the IoP Nuclear Industry Group since its formation in 2010.

GE-Hitachi's PRISM Reactor

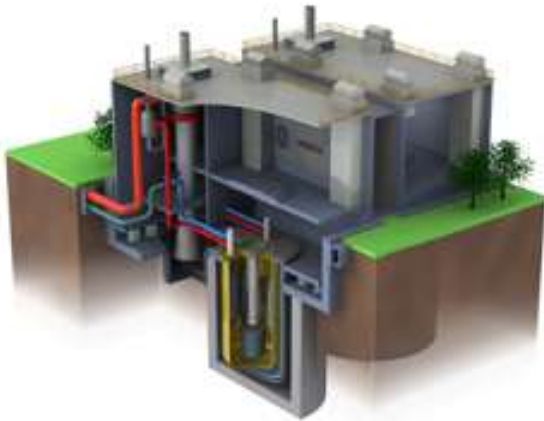
A report on the talk given by Dr David Powell, GE Hitachi

David Tattam

On the evening of 1st May 2013 the Nuclear Industry Group was pleased to welcome Dr David Powell from GE Hitachi to the IoP

Headquarters. The talk was very well attended with over 50 people in the audience. David presented GE Hitachi's solution for dealing with

the UK's stockpile of plutonium using the PRISM (Power Reactor Innovative Small Module) reactor.



David joined GE Hitachi as Vice President for nuclear power plant sales in Europe in January 2011. David has over 28 years of experience in the nuclear industry, holding a number of senior positions involved in developing and running nuclear businesses, including responsibility for Westinghouse's European fuel business and a period living and working in Tokyo, as President of BNFL/Westinghouse Japan. David holds a Doctor of Philosophy in metallurgy from the University of Manchester.

David outlined the background of the Company and the joint venture between GE (General Electric) and Hitachi which formed GE Hitachi. Between them the two parent companies employ around 21,000 people in the UK!

David also discussed the Hitachi purchase of Horizon Nuclear Power. The Generic Design Assessment (GDA) of the ABWR (Advanced Boiling Water Reactor) is now proceeding with the potential to build 2 or 3 units at Horizon's two sites at Wylfa and Oldbury.

GE Hitachi's portfolio of reactors includes: ABWR, ESBWR (Economic Simplified Boiling Water Reactor) and the PRISM reactor. The ABWR is a Generation III reactor with extensive operational experience. The ESBWR is a Generation III+ reactor with passive cooling which would enable the reactor to cool itself for more than seven days without any operator intervention in the event of power failure. PRISM is a fast reactor with passive air cooling. A PRISM power block comprises of 2 reactors each supplying 311MWe of electricity. The reactor could use fuel fabricated from plutonium making it ideal for managing the UK's plutonium. In this way the reactor would

generate electricity as well as dealing with the plutonium in a manner consistent with the non-proliferation agreement.

David reviewed all the options that the UK Government had considered for the long term management of the plutonium stock pile, and the potential costs to the tax payer. Long term storage, immobilisation, and production of MOX fuel to burn in reactors distant from the storage location all resulted in net costs of several billion pounds to the tax payer. GE Hitachi's PRISM solution provided an integrated approach for dealing with the plutonium and generation of low carbon electricity offering potential value for the UK tax payer.



David discussed the Government review process and their approach of being open to alternative ideas to deal with the plutonium legacy. The Nuclear Decommissioning Authority had invited expressions of interest and GE Hitachi has subsequently submitted its detailed feasibility study report to the NDA and awaits a response.

The session finished with a number of questions about the PRISM reactor technology and an interesting debate on the approach to managing the UK's plutonium.

Following the interest of the London talk, David Powel subsequently repeated his talk at the Birchwood Centre, Warrington. This talk was also well received and attracted an audience of over 50 people

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.

Next Generation Nuclear Energy – the UK's role

A report on a half-day seminar at the Royal Academy of Engineering on the prospects for the UK to be involved in future nuclear research and reactor systems.

Geoff Vaughan

The House of Lords Select Committee on Science and Technology had recognised that in recent years the UK has ceased to participate actively in advanced nuclear fission research activities - a field in which we were a world-leader in the latter half of the 20th century. The Government has responded with a Nuclear Industrial Strategy and the Royal Academy of Engineering organised a half-day event on 6th June 2013 to discuss the current situation in the UK and how we could re-engage in this field.

The first speaker was the Chief scientific Advisor to the Department of Energy and Climate Change, Professor David Mackay. He gave an overview of the energy situation and, taking account of pressures such as carbon reduction, security of supply and the cost to users, the affect this might have on future nuclear reactor developments such as generation IV. He outlined the measures that the Government were putting into place to enhance the UK's role. The following presentation by Professor Martin Freer, Birmingham University, discussed the report produced by the Birmingham Policy Commission into the future of nuclear energy in the UK. Both these presentations were hopeful that the future would see more nuclear energy and research in the UK.

Dr Richard Stainsby, NNL, considered Generation IV designs mainly in the context of breeding through fast reactor cycles as he noted that virtually all Generation IV designs were now moving in this direction. Fast Breeder Reactors are, of course, not new and there is a wealth of information from UK and elsewhere on the specific requirements involved in closed cycle attempts to extract more energy from a given amount of uranium. Dr Stainsby noted that using MoX in thermal fission reactors had a small effect on increasing the energy from uranium.

A particular issue is the apparent conflict between the attempts to destroy the plutonium

that is in store rather than use it as the necessary seeding for the first generation breeder reactors. One of these is the PRISM reactor, which can use a mixed metal fuel of plutonium and uranium. This reactor was described by Dr David Powell of GE-Hitachi, the designer of the system.

An alternative fuel in the form of Thorium was promoted by Baroness Worthington, Shadow Minister of Energy and Climate Change. She identified some of the advantages of thorium, such as low proliferation risk and increased safety if an accelerator driven system were used but noted there are several barriers in current understanding and research is still at a relatively low level. She suggested that it would be a long time before thorium was a viable fuel in the UK.

Finally, an international perspective was given by Dr Harold MacFarlane of the US Idaho National Laboratory who discussed the issues related to introducing Generation IV reactors, noting that the concept was introduced around 22000 to release money for research! The high level goals, in his view, were sustainability, safety and reliability, economics, proliferation resistance and physical protection. Dr MacFarlane did not see Generation IV reactors coming into commercial use before 2050, with LWRs (Generation III/III+) largely filling the gap till then.

It is clear that there are many areas for research into fuel and reactor types, materials that can survive at higher temperatures, reprocessing technologies and improving safety and security of reactors. How much of this the UK will actually get involved in is still a question that is open, but it does seem that, after many years of stagnation, research in fission reactors is potentially about to blossom again.

Geoff Vaughan is a Senior Lecturer in Nuclear Safety and Regulation at the University of Central Lancashire.

Ensuring Safety, Security and Safeguards in Nuclear Power: Opportunities and challenges of a coordinated approach

Nuclear Safety, Security and Safeguards are all important in ensuring that nuclear power does not pose unacceptable risks to the public but, for various reasons, they have tended to be developed independently. This has led to conflicts in requirements and in recent years there has been a growing feeling that a more integrated approach would bring advantages. The University of Central Lancashire held a one-day international meeting to discuss the current position and future possibilities.

Geoff Vaughan

On the 12th June the University of Central Lancashire (UCLan) hosted a one day conference at its Westleigh Conference Centre which looked at the development, current situation and benefits of greater integration in the three areas of Safety, Security and Safeguards (the 3Ss).

Professor Laurence Williams (UCLAN) opened proceedings by presenting a strong argument for a change from the historic approach, where the 3Ss were considered as separate issues, to one where the synergies are recognised at all organisational levels and the three areas are coordinated within all life-cycle stages, from design to decommissioning, in the transport of nuclear materials and in the management of radioactive sources and waste. Professor Williams explored the challenges of such a change in respect of licensee responsibilities and organisation, the separate cultures, beliefs and values of the safety and security communities and the approach to risk evaluation. He suggested four levels of integration – government (possible impact on legislation), regulation (explored in the next paper), licensees (where security would need a voice at Board level) and the supply chain.



Andy Spurr, Mike Griffiths, Roger Howsley, Dave Cliff, Zdenka Polovja, Mark Bassett, Vice Chancellor Malcolm McVicar, Mel Draper and Prof Laurence Williams

Deputy Chief Inspector **Mark Bassett** from the Office of Nuclear Regulation (ONR) explored some of the challenges to regulatory integration arising from differences in the underpinning

legislation and regulatory frameworks for safety and security. The established goal setting approach to safety risk, under the control of the licensee, was contrasted with the Secretary of State setting the “risk appetite” for security. From 2007, ONR has had civil nuclear security and the UK safeguards added to its traditional safety responsibilities and work is progressing towards an integrated approach. A new operating model for regulatory programmes was being established but combined safety and security cases were still far in the distance. He concluded the real issue is cultural, not legal.

International perspectives were provided by **Zdenka Polovja** from the EU’s Joint Research Centre who explored the use of common technology to address both safety and security as desirable approach Gen IV design goals, and **Dr Roger Howsley**, the Director of the World Institute for Nuclear Security (WINS), who outlined the work of WINS. Dr Howsley noted that whereas most nuclear company Boards have sub committees and representation on Finance, Environment and Safety, very few do on Security: he felt there should be a shift in the culture of security from being an issue for the state to one that is a prime responsibility of the duty holder.

Mel Draper, the ex-Head of Non-Proliferation Policy at DECC gave an informative outline of the structure and history of the Non-Proliferation Treaty, with a focus on the Article that encourages the “fullest possible” peaceful use of nuclear energy. This is the vehicle through which, at the related international review conferences, the synergies of the 3Ss are being increasingly emphasised with IAEA in the lead role.

Chief Constable **Mike Griffiths** of the Civil Nuclear Constabulary, whose mission is to deter, defend, deny and recover, suggested considering overlapping safety and security emergency exercises.

Contributions from the industry were focussed on different facets. **Dave Cliff**, Licensing Manager for the Westinghouse UK's AP1000 highlighted procedures in the GDA process: he identified that safety and security integration was a challenge as maintaining the standard design was a priority and the two issues had been treated in isolation. **Dr Andy Spurr**, Managing Director of Nuclear Generation for EDF Energy, gave a challenging presentation on the 3S interfaces in operation. He noted EDF Nuclear Generation Board did have both safety and security represented and Dr Spurr took exception with anyone who suggested that safety and security was achieved by low risk number crunching as the key to safety was a cultural ethos where the most senior manager gave time to a visible challenge role where management accountability, sound processes and good training were at the centre. The multi-layers of defence surrounding these were then functional oversight within the organisation,

independent oversight from within and external oversight from third party audit.

The subsequent panel discussion reflected on the challenge in safety and security is to allow courage and judgement which is only achieved if there is openness and transparency. Secrecy must never be a cover for incompetence and ways need to be found that allow operational experience feedback to address security as well as safety.

All the speaker presentations can be obtained from the UCLAN Conference Office at COffice@uclan.ac.uk: for further information contact Geoff Vaughan at gvaughan@uclan.ac.uk

Geoff Vaughan is a Senior Lecturer in Nuclear Safety and Regulation at the University of Central Lancashire.

Future Events

The NIG is pleased to announce the next few events in our calendar.

26th September 2013: Nuclear Physics Technology Showcase - IoP HQ London

The STFC Innovations Club, the Nuclear Industry Group, the Nuclear Physics Group and the National Nuclear Laboratory are jointly hosting a workshop on developments and applications of nuclear physics in the key areas of healthcare, security, energy and the environment. This event is intended for people from industry looking for academic partners for development projects or for opportunities for new products/services, and for researchers in nuclear physics wanting to get more involved in knowledge exchange and learn about good practice in this area and the funding available.

For further details or to register for the event, please see <https://eventbooking.stfc.ac.uk/news-events/nuclear-physics-technology-showcase>

30th September 2013: Alan McGoff of the Environment Agency will give a lecture on Regulating New Nuclear Build – Progress and Lessons at Horizon Nuclear Power, Gloucester, UK

The lecture is scheduled for 6.30pm with a 7.00pm start. Pre-Registration for this event is mandatory and registration will need to be closed one week before the lecture (23rd September). Registrar at <https://www.eventsforce.net/iop/446/home>

Synopsis: Significant progress is being made on proposals for new nuclear power stations in the UK. The regulators' have a key role in new build to ensure that any new stations would meet the high standards of safety, security, waste management and environmental protection that they expect. This talk will cover the approach that the nuclear regulators are taking, the progress made and the lessons learned so far.

29th October 2013: visit to the Culham Centre for Future Energy, including a tour of JET

This event is an opportunity to see the Joint European Torus (JET)- the world's largest and most powerful tokamak and the focal point of the European fusion research programme. The visit will also include MAST (Mega Amp Spherical Tokamak) - the UK's fusion energy experiment which may lead to a compact Component Test Facility to accelerate the development of commercial fusion power. The visit starts with a presentation on fusion energy at 11:30 at the Culham Centre for Fusion Energy (www.ccf.ac.uk). (Lunch may be purchased at the Culham canteen.) Invitations to register for this event will be sent shortly.

6th March 2014: AGM, followed by David Farrant on the Jules Horowitz Reactor and its role the future R&D in the UK - IoP HQ, London

After the AGM, David Farrant will give a presentation on the Jules Horowitz Reactor and its role in the future R and D in the UK (see article on page 7). The Government has set out future plans for R and D in the UK to support the development of so-called Gen IV systems and participating in the multi-national Jules Horowitz reactor is one aspect of this plan.

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 early of 2014.

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

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.

The Institute of Physics, 76 Portland Place, W1B 1NT, UK.

Tel: 020 7470 4800
Fax: 020 7470 4848