See www.iop.nig.org for further details
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Notes from the Chair

Once again it is my pleasure as Chair to introduce this, our 9th Newsletter, to all members of the Nuclear Industry Group (NIG). This newsletter is one of our main vehicles of communication with you and so we must again thank Alfie O’Neill for his hard work in producing it. My thanks also go to all those who have contributed articles and given up their free time to support the group. It has been a pleasure to work with our committee without whom the group would not be so successful and smooth running.

Over the past year the group have held four events at a range of locations. These included a two day Topical Research Meeting on Physics.Innovation.Nuclear in Manchester, a one day event on Women in Nuclear at The Harwell Campus and evening talks in Bristol and in Warrington. You can read more about these events later in the newsletter. It is worth recognising the efforts of the committee members who all gave up their time to organise the events. Special thanks go to Dale McQueen and his team for their sterling efforts in organising our Physics.Innovation.Nuclear event in November 2017. Our Women Physicists in the Nuclear Industry event received positive feedback from the delegates and thanks are due to Claire Elliott and Lucy Bailey from our committee together with a number of the committee of the Women in Physics Group (Joanne Cole, Kathleen Stevenson, Josie Coltman). My thanks go to David Weaver and Jamie Townes for their hard work in organising a very interesting talk by Jim Gulliford, Head of the OECD NEA Databank in March. As this talk was hosted by the South West Nuclear Hub it is available on YouTube and you can access it here: https://www.youtube.com/fjMrTBNPtXc?t=4m24s

Our second evening event this year was on Accident Tolerant Fuels by Kerr Fitzgerald of NNL and my thanks go to Alfie O’Neill for organising this event.

This year we have welcomed some new committee members, Jamie Townes and Andy Hicks. Andy has taken over the role of Honorary Group Treasurer from Chris O’Leary who stepped down from the committee. My thanks once again to Chris for his input during his term as Honorary Treasurer.
As many of you will have seen we have recently issued an election notice for new committee members. If you haven’t already done so please vote for your preferred candidates. I, along with the other committee members look forward to welcoming new members. Speaking from experience, I have found that being involved on an IOP Group committee opens the door to a range of interesting activities and networking. It also provides the opportunity to help influence issues that affect our industry at a national level via engagement in IOP and input to IOP submissions to government consultations.

I hope that you find this newsletter interesting, as always we value the comments and suggestions of you, our members, and any suggestions of event topics that you would find interesting or would like to participate or see us explore further would be welcomed so do please get in touch. You will see we have sent out a survey to our membership to help us canvas your views. On that note wishing you all a successful year.

Heather Beaumont
Chair - IOP Nuclear Industry Group
Nuclear Industry Group Career Contribution Prize 2018

Article by: Alfie O'Neill
This year the Nuclear Industry Group awarded a Career Contribution Prize at an evening seminar held in June. The Career Contribution Prize is for a physicist who has spent a substantial portion of their career in the nuclear industry. It is to be awarded to the nominee who the judging panel feel has most fully displayed outstanding levels of innovation and contributed to the progress of the industry over a sustained period. The nominee must have displayed outstanding commitment to the promotion of the nuclear industry throughout their career.

Once again the calibre of entrants was high and selecting a worthy winner was a difficult process, but we are pleased to announce that this year’s Career Contribution Prize was awarded to Colin Zimmerman of NNL.

Following completion of his doctorate at the University of Edinburgh, Colin started his career as a radiometric physicist at BNFL in 1981. This launched a varied technical career where Colin has worked in nuclear data, radiation transport calculations, and the development of a code on the quantitative analysis of the environmental impact of advanced fuel cycles. Until recently Colin was also the UK representative at the NEA/OECD Working Party on the Scientific Issues of the Fuel Cycle. He also ventured into IAEA safeguarding work, supporting UK activities on non-proliferation. As well as a distinguished technical career Colin has worked hard to support the development of physicists within BNFL and as the Discipline Chair for Physics in NNL.

The calling notice for the 2019 Nuclear Industry Group prizes will be released later this year where we will be looking for nominations for both an Early Career prize and a Career Contribution prize. So please get your thinking caps on now and seek out those colleagues and friends worthy of recognition!
Brexatom and the Nuclear Sector Deal

Article by: Heather Beaumont

It is not possible to write an annual newsletter without commenting on the matters affecting our industry over recent months, such as the withdrawal from the Euratom Treaty and the Nuclear Sector Deal.

In a year where headlines across the UK have been dominated by Brexit issues the potential impact of the withdrawal of the UK from the Euratom Treaty dubbed “Brexatom” by Dame Sue Ion cannot pass without comment. It is clear that the industry, spearheaded by the NIA, has made its voice heard and government is taking steps to address the issues. IOP also have a Policy Group on this topic that I have had the privilege to be part of. Below is a summary of the current position on the four key consequences for our industry of Brexatom:

• Nuclear Safeguarding which is currently covered by the EU system which is agreed with the IAEA. Arrangements for nuclear safeguarding are being put in place, this required a new Act of Parliament which received Royal Ascent in June (see the article on Establishing a post-Brexit domestic UK Nuclear Safeguards Regime, page 22)

• Nuclear Cooperation Agreements (NCA’s). Without NCA’s in place the UK would not be able to continue to trade in the nuclear materials or information with other countries. In many of these countries NCA’s are a legal requirement to enable trade. At the time of writing the process of putting in place Nuclear Cooperation Agreements (NCA’s) with a number of countries is underway. I understand that the UK remains on track to have all the bilateral NCAs in place for when Euratom arrangements cease to apply.

• Relationship between UK and the remaining EU member states for nuclear skills, knowledge and materials. The UK’s future relationship with the EU is being negotiated in a separate Agreement to be entered into once the UK has left the EU with an aspiration to reflect the positions set out in the government White Paper dubbed “Chequers Paper”.

• Nuclear Research and Development Programmes. This has been recognized and the UK and EU, led by the BEIS Science and
Innovation Team are handling this, and are seeking close association with Euratom and the EU R&T programmes.

At the time of writing this newsletter there is still uncertainty on whether there will be a “no-deal” with respect to Brexit. The Brexit Withdrawal Agreement covering all aspects of the UK’s withdrawal from the EU (including everything from the headline grabbing aspects such as the Northern Ireland border to Brexatom) is constructed as an “all-or-nothing” deal so a “no-deal” has the potential to impact on the industry. The government are issuing “Technical Notices” to UK organisations advising them of steps to consider in the event of a “no-deal”.

The Nuclear Sector deal was announced on 27th June and speaks positively about the industry and the contribution it makes to the UK economy, with a strong focus on how this can be maximised in the near future. It also identifies the importance of Nuclear in meeting the needs of our changing economy and new technology such as electric cars. The deal has been developed in close collaboration with the industry through the Nuclear Industry Council. It also underlines many of the current challenges: the need to cut costs on new build (so that it is economically competitive) and decommissioning and the industry is already making good progress against these targets. It also underlines the importance of investable new reactor designs and attracting new skills into the sector. The deal is too long to summarise here but suffice to say it has been positively received by the industry. You can find a summary here [https://www.gov.uk/government/publications/nuclear-sector-deal/nuclear-sector-deal](https://www.gov.uk/government/publications/nuclear-sector-deal/nuclear-sector-deal) and the full text here [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/720405/Final_Version_BEIS_Nuclear_SD.PDF](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/720405/Final_Version_BEIS_Nuclear_SD.PDF).
Event – From Magnox to Chernobyl: A report on clearing up problematic nuclear wastes

Article by: Alfie O’Neill

Sean Barlow, from the University of Sheffield gave a talk in September 2017 covering looking a history of the clear-up of Nuclear Waste and some of it’s surprising uses. A copy of Sean’s slides are available on the IOP NIG webstite, under Recent Events:

http://www.iop.org/activity/groups/subject/nig/recent-events/page_63207.html
Event – IOP Topical Research Meeting
Physics.Innovate.Nuclear

Article by: Dale McQueen

The past few years have been pivotal for the nuclear industry both in the UK and internationally: a final investment decision has been made on Hinkley Point C; decarbonisation ambitions have been set by the 2015 United Nations Climate Change Conference (COP21); and demonstrable progress in cleaning up some of Europe’s highest hazard nuclear facilities (from Chernobyl to Sellafield).

With these developments and the UK HMG Industrial Strategy and Nuclear Sector Deal being developed, the Institute of Physics Nuclear Industry Group (IOP NIG) decided it was the opportune moment to celebrate how physics contributes to this important sector – from fuel manufacture, reactor design, spent fuel management, waste management and decommissioning. The IOP NIG made a bid for the IOP’s Topical Research Grant and was successful!

The event was organised on the principle of celebrating how ‘physics’ (in the broadest sense) contributes to and is leading the development of innovations across the nuclear sector; celebrating developments in industry, academia and within the supply chain. We believe that this was one of the first events aimed solely at physicists in the nuclear industry and are proud to have put into motion this event.

The line-up for this event was impressive – a collection of industry stalwarts, technical experts and international suppliers. The event was sponsored by Rolls Royce, Sellafield Ltd, Wood and NTEC and supported by the Nuclear Institute, the Nuclear Industry Association and the International Atomic Energy Agency (IAEA).

Day one was opened by Professor Sarah Thompson, Vice President of the Institute of Physics, and welcomed the event as a welcome addition to the IOP’s agenda. Neil Smart, Chief Scientist at Sellafield Ltd, was the keynote speaker who set the context for the day and highlighted the importance of physics and innovation in driving the decommissioning mission forward at Sellafield.
Chris Goddard and Bill Westall gave an overview of some of the assay technologies being utilised in the decommissioning of the Magnox reactor fleet in order to minimise the impact on waste management and disposal of the wastes.

The delegates were given the opportunity to sample some of the technologies on display over lunch (including a Virtual Reality headset from Radioactive Waste Management Ltd) as well as a wide array of poster presentations. Over 20 posters were being presented covering topics across the spectrum of the sector and lifecycle; from innovations in pond-water chemistry; through to the UK nuclear data network and robotics.

The afternoon gave an overview of some of the more strategic elements of decommissioning and waste management; James McKinney gave the NDA’s strategic approach to Integrated Waste Management and Paul Skelton and Ed Matthews following up with a summary of how this strategy plays out at Sellafield Ltd and Radioactive Waste Management Ltd in reality, with Ed providing a great video summary of some of the key milestones reached over the last few years.

The day was closed with a presentation from Neil Owen at Createc, a firm that have commercialised technology associated with the radiation mapping of contaminated areas. They gave us a summary of some of the challenges in operating in such an environment, and shared their experiences of deploying their technology both at Sellafield and Fukushima dai-ichi.

Keeping the theme of innovation in industry, the delegates were provided with an evening dinner in the Museum of Science and Industry in Manchester. Dame Sue Ion provided a passionate speech about the need for the industry to be proud of its achievements and celebrate our success and be prepared to share them (and to get in front of the camera!)
Day two moved the focus from the past to the future; Paul Nevitt from the Nuclear Innovation and Research Office (NIRO), was the keynote speaker and gave an overview of the opportunities and challenges facing the UK civil nuclear sector.

The most prominent (potential) opportunity facing the UK nuclear sector at present is Small Modular Reactors, and Simon de Haas gave us an overview of Rolls-Royce experience in developing the proposition so far. John Lillington, Wood, then gave an a broader perspectives on the types of SMRs on offer.

We were excited to be able to host Mikhail Veshchunov from the IAEA as he gave a truly international perspective; giving the audience an overview of some of the work being undertaken by IAEA in the sphere of nuclear fuel engineering.

The final slots in the day sought to explore some of the key challenges facing our industry – digital, diversity and skills and development. Ben Lindley of Wood gave a sample of some of the innovations and progress made on digital reactor design; Dawn Watson, Sellafield Ltd gave a perspective on how diversity is the key to innovation in the sector and Jon Billowes gave a summary of how skills and development is critical to pulling some of the skills gaps facing the industry.
Chris Savage from the Nuclear Industry Association closed the session with a hot-off-the-press update on latest situation on the Industry Strategy and emerging Nuclear Sector Deal. It was a fitting close to an event that celebrated how we are managing the legacy of the industry, but using this as a platform to make the most of our futures.

The best poster presentation awards were awarded to Miss Hajir Al Hamrashdi of Lancaster University and Mr Henry Preston of NNL.
This event wouldn’t have happened if it wasn’t for the resilience and drive of our committed working group; Claire Garland, Adam Dugdale, Thomas Dowd, Rebecca Sparkes, Douglas Cragg & Ben Chapman. Many thanks for your patience and tenacity in pulling this together! Many thanks to our sponsors, Rolls Royce, Sellafield Ltd, Wood and NTEC and supporters; the Nuclear Institute, the Nuclear Industry Association and the International Atomic Energy Agency (IAEA).

In the words of Dame Sue Ion, we need to be “proud of our achievements” and I hope that this success has helped highlight some of these achievements driven forward by physics and left the delegates proud; of the great talent we have within the industry and the innovation being sought to help enhance the nuclear industry for future generations.

I left in awe of some of those who presented, and look forward to celebrating the success of physicists in the nuclear industry again at some point in the near future.
Event – Nuclear Education and Skills Capability: The Role of International Collaboration

Article by: David Weaver

This talk was presented by Jim Gulliford, Head of the NEA Data Bank and was held in association with the SW Region Nuclear Hub, University of Bristol in March 2018.

The talk covered two areas: (i) an overview of OECD’s Nuclear Energy Agency (NEA) for which 2018 marks the 60th Anniversary and (ii) the NEA Nuclear Education Skills and Technology (NEST) Framework. For those who were unable to attend the talk, it can be accessed online at:

https://www.youtube.com/watch?v=fjMrTBNPtXc&t=4m24s

In addition, as a result of introductions fostered by NIG, Jim Gulliford was interviewed by Physics World during his visit to Bristol and an article about the NEA NEST Framework appeared in Physics World, July 2018, pp39-40. Consequently, this review will be kept brief as information is already available elsewhere.

NEA is an intergovernmental agency under the OECD framework; 32 countries are members of both OECD and NEA, 4 countries are OECD members but not part of NEA, while Russia is a member of NEA but not OECD. NEA has 7 standing technical committees ranging from Safety of Nuclear Installation, Nuclear Law, Radioactive Waste Management and Nuclear Science. It has 75 working parties and expert groups and 21 international joint projects. In addition, the NEA’s Data Bank provides access to Evaluated Nuclear Data (e.g. JEFF - the Joint Evaluated Fission and Fusion Nuclear Data Library), Computer Codes, and Verification & Validation activities.

See: https://www.oecd-nea.org/databank/

The Nuclear Data work is linked to the network of Nuclear Reaction Data Centres which include NNDC at Brookhaven and the IAEA-NDS in Vienna.
NEA has always been involved in international collaboration on Nuclear Knowledge Management, Skills and Education and this led to the publication in 2000 of a review “Nuclear Education and Training: Cause for Concern?” This was followed in 2012 by “Nuclear Education and Training: From Concern to Capability”. The NEST Framework has been newly launched with the aim of creating a global network of universities, research institutes and businesses to help build and maintain the skills of the next generation of nuclear researchers and subject matter experts. The focus on Subject Matter Expertise arises because of the aging workforce, a growing demand and the predicted loss of up to 1/3 of the Subject Matter Experts over the coming 5 years - expertise that currently take decades to develop.

NEST Project Proposals under Development are:
- Hydrogen mitigation research project (HYMERES II) - led by Switzerland
- Decommissioning of Graphite Facilities - led by Russia
- SMRs – led by Canada
- MSR – led by USA
- Advanced Remote Technology with AI – led by Japan

The aim is to have the final version of the NEST Agreement signed this year together with the first meeting of NEST Management Board. It is hoped to have 2-3 NEST Projects ready to start before end of 2018 with the first cohort of NEST Fellows actively engaged in project research tasks this year, followed by hands-on work at managing institutions. Additional education events should start in 2019 with an aim to ramp-up NEST to 100+ new Fellows per year and then the facilitation of continued involvement in international activities. The key is involvement of established experts working alongside the next generation of young nuclear professionals.
Event - Women Physicists in the Nuclear Industry

Article by: Claire Elliott & Heather Beaumont

On Wednesday 25th April, the IOP Nuclear Industry Group and the Women in Physics Group, held their first joint meeting. It was a great success, celebrating and showcasing the work of women in the nuclear industry and discussing some of the issues that women in this sector face. The event was open to all, regardless of gender, and welcomed people at all career stages.

The day began with an invited key note talk on ‘Your Authentic Self’ from Adriënne Kelbie, Chief Executive of ONR. She spoke passionately about how events in her childhood helped to shape her drive and ambition. She went on to describe the start of her career, how she has found herself at ONR and some interesting moments along the way, including relating to some surprise when the woman in a meeting, discounted by colleagues as a likely secretary, took the lead.

Panel sessions were then held, either side of the crucial lunch-break networking time. The audience – 46 in number, and mixed in terms of their
level of professional experience and gender – were treated to a dynamic conversation in both sessions. ‘Awkward’ questions were raised, and answered reflecting on personal experience. The first panel session focussed on women’s careers; how they reached where they are, and how the support of colleagues was crucial was highlighted. This included a range of career paths including civil nuclear reactors, medical physics and fusion.

The second panel session focussed on the impact of career breaks, and some advice on invaluable preparation that can be done before departing and before return. The breaks discussed were not limited to maternity leave, but also covered the impact of breaks for other reasons such as health related absences. There was a great level of support in the room, for those sharing their stories. General advice arising from this session included having confidence in your own ability; knowing what you want to do and going for it; keeping conversations with your employer going whilst away; using the time to learn new skills; not undervaluing what having a break can do for you and knowing your rights. Dr Katie Perry (Chief Executive of the Daphne Jackson Trust) and Kristina Smith (HR Consultant at AWE) who were able to answer more general questions on career break policies.

Finally, the day closed with two technical talks, from women in medical physics and engineering consultancy. Talks were given by Dr Heather Williams (Senior Medical Physicist at the Christie NHS Foundation Trust in Manchester, Ordinary Member of the IOP WIPG and founder/director of ScienceGrrl) on ‘Physics meets Chemistry meets Biology: Nuclear Medicine’ and Jenny Richards (Director of Hydrock nmcl) on ‘Nuclear and Me’, which were both fascinating talks in their own right. Jenny’s included how she progressed from starting as a Health Physicist at Harwell to setting up her own consultancy firm, which is now part of Hydrock.

It was fantastic atmosphere to celebrate the diversity of the roles women hold now, and we are very grateful to all the speakers, panellists, session chairs and the supporters (AWE and Cavendish Nuclear) for enabling the event to happen – and for everyone in attendance for being open and supportive!
We hope all involved were able to go away with a renewed spirit for supporting their colleagues, and enabling a diverse workforce to be treated equally. Inspired by this event, we have heard of at least one organisation which is making plans to set up a buddy scheme for people taking career breaks – which is great to hear. If you missed the event or would like to discuss the issues covered further, contact IOP.

After the main event, Dr David Price (Public Engagement Officer for the Diamond Light Source) gave an overview of the Diamond Light Source facility before giving an optional tour of the facility for those who had registered for it. Dr Josie Coltman (physicist in the Design Physics Group at AWE, Ordinary Member of the IOP WIPG and one of the organisers of the event) said “it was fascinating to see the vast size of the synchrotron and all the different beamlines used for studying pretty much anything from ancient paintings to unknown virus structures.”
Following our successful Women Physicist in the Nuclear Industry event (see article above) I asked IOP for some gender balance statistics for our Nuclear Industry Group which are worth sharing with our membership. Our group currently stands at 965 members of which just over 21% are women. With such a large group membership, it is likely that this is reflective of the percentage of women physicists within the industry, although there is no currently data available to substantiate this assumption. This is reflective of the proportion of girls studying physics post-16 (c.20%) according to an IOP Gender Balance study [1]. It is worth noting that IOP have a number of resources [2] available to support gender balance activities in schools and for any group members carrying out outreach activities this is a useful resource. It is also interesting to compare this to the percentage of women in the STEM workforce in a STEM industry in the UK of 24% (2017 data [3] from WISE – Women in Science and Engineering).

The proportion of women members within the NIG who are chartered is lower than the overall group membership around 18% and the proportion of women fellows is higher at around 24.5 %. Speaking from the perspective of a Chartered Member and Fellow of the IOP I would encourage all our members to work actively towards Chartership and subsequently Fellowship. You can find some hints and tips on applying in previous versions of our newsletters, downloadable from our group area [4] on the IOP website.

Event - What Happens to Nuclear Fuel in a Reactor?

Article by: Alfie O'Neill

In June the IOP NIG hosted an evening seminar by Kerr Fitzgerald, a Fuel Performance Scientist at the National Nuclear Laboratory. The talk covered five broad areas, as detailed below.

The Purpose of Nuclear Fuel?
The purpose of nuclear fuel is to generate heat which can be used for electricity production. Nuclear reactors follow roughly the same method as fossil fuel power plants (i.e. energy from fuel heats a coolant which is used to generate steam to spin turbines). Inside a nuclear reactor, fuel is subjected to harsh conditions, for example in a Pressurised Water Reactor (PWR) it sees pressures of 155 atm, coolant temperatures of $330^\circ$C and radiation doses of $1 \times 10^{18} \text{n/m}^2/\text{s}$. Typically fuel survival is achieved by using fuel ‘rods’ – these utilize a cladding material to help maintain geometry for fission, maintain structure for coolant flow, prevent coolant-fuel interaction and to contain radioactive atoms.

Nuclear Fission: Energy Generation
Splitting uranium-235 atoms releases approximately 200 MeV (~32 pJ), the majority of which is kinetic energy of the fission fragments. But over the course of the fuel’s lifetime, a single PWR pellet typically releases $26,000,000,000$ J of energy. This equates to 7 trillion fissions per second inside each pellet, which has a significant impact on the microscopic and macroscopic behaviour of the fuel rod.

Nuclear Fuel Phenomena
The heat generated from fission events is transferred to the coolant. The high temperature can cause significant thermal expansion of fuel pellets, this imposes shear stresses which can cause cracking in brittle $\text{UO}_2$ pellets. Densification can occur whereby the porosity of the pellets decreases, resulting in a ~1% reduction in the pellet volume. In addition the composition of the fuel changes as fission products are generated. The
accumulation of these fission products and fission gases can cause fuel pins to swell, and bubbles in the fuel grains can grow and coalesce, this causes more gasses to escape the pellets. These are just a small fraction of the effects occurring in nuclear fuel, yet incredibly the fuel survives!

**Fuel Failure Rates**

On average, only 50-80 fuel rods fail per million each year, the reasons for fuel failure are complex and interlinked. However, as our understanding and technologies increase, the fuel rod leak rates are decreasing.

![PWR fuel leak rate in 1987-2010.](image)

**Fuel Research in the International Community**

Advanced modelling of fuel systems is improving our fuel performance understanding. Recent advances allow thermal hydraulics and fuel neutronics codes to be linked. A lot of work is currently ongoing into enhanced-Accident Tolerant Fuels (e-ATF). These are fuels defined as being able to:

“\textit{Withstand severe reactor accident events (e.g. loss of active cooling) for significantly longer time periods than conventional nuclear fuel systems, while still maintaining or improving current standards of fuel performance during normal reactor operation.}”

e-ATF systems can focus on changes to cladding of fuel design, or a combination of both, though all solutions have advances and drawbacks and a balance must be found.
Establishing a post-Brexit domestic UK Nuclear Safeguards Regime

Article by: Zahid Riaz & Jo deBank, Communications Manager, Office of Nuclear Regulation (ONR)

As part of its preparations for Brexit, the UK Government announced its commitment to leave Euratom, the European nuclear safety and research community that was set up in 1957 at the beginning of the European Economic Community (EEC).

The Euratom treaty includes the provision of nuclear safeguards arrangements for non-proliferation of nuclear materials. Safeguards are measures to verify that countries comply with international treaty obligations not to use nuclear materials from civil nuclear programmes to manufacture nuclear weapons.

Currently, nuclear safeguards arrangements in the UK are regulated by Euratom and the International Atomic Energy Authority (IAEA); with ONR providing a monitoring role, together with a supporting and intervening role as necessary with UK nuclear duty holders to ensure that UK safeguards obligations are met.

The UK Voluntary Offer Safeguards (VOA) agreement with the IAEA and Euratom came into force in 1978 and specifies the UK’s acceptance of the application of IAEA safeguards "On all source or special fissionable material in facilities or parts thereof within the UK, subject to exclusions for national security reasons only."

Post-Brexit, ONR will become the UK’s nuclear safeguards regulator alongside its role as the UK’s nuclear safety and security regulator. In June, the Nuclear Safeguards Bill became the Nuclear Safeguards Act, giving
ONR legal powers to set up a domestic safeguards regime. This work is being led by ONR Deputy Chief Inspector (DCI), Dr Mina Golshan.

Asked about this issue, Dr Mina Golshan stated:

“It is the IAEA obligations that the UK needs to meet, and the terms of that are stated and agreed in the VOA and Additional Protocol (AP). Under that we have to report on material and operations in certain eligible facilities as identified in the VOA; we need to facilitate independent verifications by the IAEA inspectors and meet the requirements of nuclear cooperation agreements - That is what the UK needs to deliver in order to meet its international obligations."

She added: "Euratom is a regional regulator. They have their own arrangements, scope and coverage for the work that they do. The safeguards regulation aims to deliver a regime in the UK that is broadly equivalent in scope and coverage to that currently delivered by Euratom. And I stress that it is equivalent rather than to replicate. There are good reasons for that. As a regulator for safety and security, we have additional means of getting the intelligence and information that we need to draw up safeguards conclusions and we will do so; it's important to note that Euratom doesn't have access to this information and intelligence and that is why it is appropriate for us to meet outcomes rather than simply replicate. The scope and coverage in the Euratom treaty is broader than currently stated in the VOA and we, as intended by the government, aim to cover that scope and coverage. So the number of facilities involved is simply larger."

The Office for Nuclear Regulation (ONR) is currently working to establish a UK State System of Accountancy for and Control of Nuclear Material (SSAC), which will provide a domestic safeguards regime after the UK exits Euratom. With regard to progress on how this will be achieved:

- ONR is working closely with the department of Business, Energy and Industrial Strategy (BEIS) on the development of safeguards regulations. The government consulted publicly on the draft regulations over the summer seeking views on their operability and effectiveness. Both ONR and BEIS are also currently developing the future regulatory framework i.e. reporting, assessment and inspection processes, together with relevant guidance documents,
• Earlier this year, ONR signed a contract for the delivery of the IT system for the UK Nuclear Safeguards Information and Management Reporting System (SIMRS), a vital part of setting up the UK SSAC: the contract was awarded to Axis 12 Ltd a UK based IT consultancy, partnered with NAC International Inc. an experienced US company specialising in the development and operation of nuclear material control and accounting systems. There has been good progress to ensure it is ready by 29 March 2019, when the UK will leave the EU.

• Another key part of ensuring the UK meets its international obligations is ensuring that ONR recruit and train safeguards inspectors. ONR already have the necessary number of safeguards inspectors in post to meet those obligations and will continue to recruit as necessary.

Although the ONR is confident that it will be ready to meet international obligations after exiting Euratom; it does not intend to be complacent. ONR will continue building its capability and embedding regulatory processes in the months afterwards.

Setting up an independent UK safeguards capability is a demanding piece of work for ONR, and it remains a huge priority for ONR to ensure it gets it right.
The 9th International Conference on Modern Practice in Stress and Vibration

This event was organised by the IOP Applied Mechanics Group, and was co-sponsored by the IOP NIG.

This conference happens every three years and is organised by the Applied Mechanics Group of the Institute of Physics in the UK, this year it was held at Clare College in the University of Cambridge between 2\textsuperscript{nd} and 4\textsuperscript{th} July.

The conference is well-established for the presentation of research findings in stress analysis and vibration dynamics with the intention of providing directed focus on the state-of-the-art in theoretical and experimental methodology.

The aim of the conference is to bring together physicists, mathematicians, materials scientists and engineers from academia and industry, and to provide a platform for the presentation of creative and novel research findings facilitating an interchange of ideas and providing guidance for future research direction.

The scope of the Conference is broad and covers the following full range of fundamental, experimental and applied research in stress and vibration analysis:

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<td>Computational techniques</td>
<td>Damping materials</td>
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<td>Contact mechanics</td>
<td>Full/Multi field techniques</td>
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<td>Measuring and modelling residual stresses</td>
<td>Vibration based structural testing</td>
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<td>Damage assessment</td>
<td>Finite and boundary elements</td>
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<td>Fatigue and fracture mechanics</td>
<td>rotating systems</td>
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<td>Identification and control</td>
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<td>Multi-functional and smart structures</td>
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<td>Mechanics of advanced materials under vibroimpact loading</td>
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The Keynote speakers included:
  • Professor Janice Barton, University of Southampton
  • Professor Steve Beeby, University of Southampton
  • Professor Nick Petrinic, University of Oxford
  • Professor Keith Worden, University of Sheffield

Further details can be found here:  
http://mpsva2018.iopconfs.org/home

IOP Travel Bursaries – Scientific Basis for Nuclear Waste Management Symposium XLI, Sydney 2017

The Institute of Physics provides financial support to research students and early career physicists to attend international conferences, major national meetings, and to visit international facilities. This year the IOP NIG supported Sean Barlow’s attendance at an international conference in Sydney Australia. Sean kindly provided a travel report to the group which is included below, in addition to presenting a talk to the IOP NIG, an article on which can be found in the 2017 newsletter.

For more information on IOP bursaries and information on how to apply in future, see the link below:

http://www.iop.org/about/grants/travel-bursaries/page_69141.html

Article by: Sean Barlow, Postgraduate Research Student Department of Materials Science and Engineering at the University of Sheffield.

The 41st annual meeting of the Scientific Basis for Nuclear Waste Management Symposium, a Materials Research Society (MRS) endorsed meeting, was held at the Pullman Hotel conference venue in Sydney, Australia, between the 29/10/17 and 03/11/17.
Invited speakers representing national and international waste management programs gave talks on the first day of the conference and included distinguished guests such as Michael Ojovan from the IAEA, Hef Griffiths from Australian Nuclear Science and Technology Organisation (Australia), Michael Slater from the Nuclear Decommissioning Authority (UK) and Evaristo Bonano from Sandia National Labs (USA) among others.

Subsequent sessions focused on technical issues being dealt with and being researched including radiation damage on materials, glass wasteforms, ceramic and glass-ceramic wasteforms, partitioning and transmutation as well as a session on repositories and the design and various geological disposal facilities. Stand out presentations include Claire Corkhill, from the University of Sheffield, on understanding the dissolution of vitrified nuclear waste in a cement based geological disposal facility and Oleksandr Novikov, from SSE Chernobyl, on the decommissioning of the Chernobyl nuclear power reactors in Ukraine.

A gala dinner was held on the Thursday 02/11/17 aboard a catamaran which toured Sydney harbour at night providing spectacular views of the harbour bridge and opera house. During this dinner prizes were given out
to the two scholarship winning students of the conference, Amber Mason and Sean Barlow.

The last day of the conference comprised a tour of the Australian national nuclear facilities at the ANSTO site including the Opal reactor where medical isotopes such as Tc-99 are created and the beamline hall where materials science experiments take place using the neutron flux from the reactor. The waste management facilities were also visited which included standing next to a TN-81 cask containing vitrified nuclear waste.

I networked well with other delegates and obtained several new contacts from those interested in my work presented at the conference. I also benefited from the attending the conference by increasing my communication skills through presenting two very distinct topics clearly and concisely and answering questions confidently. The tour of the ANSTO facility provided me with an insight to the actual practices of a nuclear licenced site. I was awarded the scholarship for the conference by writing the best abstract and hence attendance has been a great benefit for my future career in the nuclear industry.

The conference was an obvious success and the continuation of this symposium will remain with the next meeting XLII taking organised for next year in Boston, USA.
InstMC Festival of Measurement

The Institute of Measurement and Control (InstMC) are hosting a Festival of Measurement. The Festival was launched in September 2018 at the IMEKO World Congress and will run until World Metrology day 2019. On 20th of May 2019, all the SI units will finally be based on measurable physical constants and the last remaining measurement artefact (the kilogram) will no longer be needed.

To celebrate this change, InstMC wants to spend the time leading up to the SI redefinition highlighting the importance of measurement in all areas of life.

For events and to get involved speak to Steff.Smith@instmc.org or visit:

www.festivalofmeasurement.org/

NIG Members Survey

We’d like to hear from you! In order to help everyone in the NIG get the most from their membership we would like to know what it is you’d like to see the committee and group doing. This will help us align the groups focus and events with the needs and expectations of our members. We’re also open to feedback on how to increase attendance at meetings and events.

The survey is currently open online at:

https://www.surveymonkey.co.uk/r/55WJVMC

Please complete the survey if you’ve not already done so and let us know what works, what could be better and what you enjoy about being a member of the group.
Future Nuclear Industry Group Newsletters

In order to reduce the printing and distribution costs of delivering our annual newsletter the IOP NIG committee have decided to move to a opt-in approach for receiving paper copies of our newsletter in future. As such, if you wish to continue receiving paper copies of the NIG Newsletter from 2018 onwards please contact Alfie O'Neill at alfie.oneill@physics.org, or writing to Alfie O'Neill, National Nuclear Laboratory, Preston Laboratory, Salwick, Preston, PR4 0XY. Please remember to include your postal address so we know where to send the newsletter!

All other members will in future receive electronic copies of our newsletter to their IOP registered email address.

Following changes in UK Data Protection law, you need to opt-in to receiving IOP Group communications, in order to do so, please sign into your IOP account online.

Letters to the Group

The NIG welcomes letters from its members, so please get in touch with us if you attended one of our events and it sparked an idea, you have been involved in a particularly interesting project or have any other thoughts which might be of interest to the rest of the group!

Please submit any articles and accompanying photographs or pictures to alfie.oneill@physics.org.

Future Events

Keep an eye out for more details as they are confirmed at: http://www.iop.org/activity/groups/subject/nig/calendar/index.html
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 the next Newsletter in autumn 2019.

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. In addition the views and opinions stated in this Newsletter do not represent those of the organisations employing the article authors.

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