Hazards forum

The Hazards Forum Newsletter

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Edited by Dr Neil Carhart

Views expressed are those of the authors, not necessarily of the Hazards Forum

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December 2016

Call for Contributions: Safety and Reliability Society relaunch their Journal with Taylor & Francis

The Safety and Reliability Society (SaRS) has provided a journal to its members and to a wider audience since 1980. SaRS are pleased to announce that their journal, Safety and Reliability, has now been upgraded. From 2016 it will be published by Taylor & Francis and indexed in Thomson Reuters databases. The full archive of journal articles and papers is also available online to its members and subscribers.

The scope of the new journal covers, but is not restricted to the following methodological areas:

- Reliability analysis, assessment, prediction, testing, modelling and techniques
- Safety analysis, assessment, prediction, testing, modelling and techniques
- Risk analysis assessment, prediction, testing, modelling and techniques
- Reliability, risk and safety management
- Reliability, risk and safety methodology
- Safety culture
- Human factors and errors
- Industry case studies

SaRS welcomes papers and articles from academia and industry which can be submitted via http://www.tandfonline.com/toc/tsar20/current. The society is also interested in curated special editions – if you have a relevant collection of papers in mind, please contact Jacqueline Christodoulou in the SaRS office to discuss on 0161 393 8411 or info@sars.org.uk.

Dr Jacqueline Christodoulou MBE CPsychol CSci AFBPsS
Chief Executive, The Safety and Reliability Society

The Hazards Forum Executive Committee

The members of the current Hazards Forum Executive Committee are given below, where the first five named people are the current trustees:

The Nuclear Legacy: Progress with Hazard Reduction at Chernobyl & Fukushima and Regulation of the Legacy in the UK

Neil Carhart

On **Tuesday 20th September 2016** the Hazards Forum hosted an **evening event** at the Institution of Mechanical Engineers, 1 Birdcage Walk, Westminster, London.

The safe and effective management of radioactive material arising from normal operation and incidents in the nuclear industry is vital to building and maintaining the trust of the general public. **This event focused on** the progress with decommissioning the damaged reactors at Chernobyl and Fukushima Daiichi, and how the Office for Nuclear Regulation (ONR) regulates the UK nuclear industry's legacy.

The **chair** for the evening was **Dr Mike Weightman CB, FREng**. He retired in 2013 from the post of HM Chief Inspector of Nuclear Installations and Chief Executive of ONR. Currently, he is Visiting Professor, Engineering Department, Cambridge University; Non-executive Director, National Nuclear Laboratory; Independent Advisor to the Japanese NDF and NRA; independent consultant to UK NDA, Finish Government; OECD's NEA, IAEA and international companies. He was the author of the report, commissioned by the Secretary of State for Energy & Climate Change, 'Japanese earthquake and tsunami: Implications for the UK nuclear industry' and he led the IAEA's Fukushima Fact Finding Mission to Japan in May/June 2011. As well as chairing the event, he gave a **presentation on the '***Progress with decommissioning at Fukushima Daiichi'.*

The evening's first speaker was Dr Ing Fulcieri Maltini. Fulcieri graduated in Electrical Engineering, has a Doctorate in Electronics Engineering and a Masters degree in Nuclear Engineering. In 1994 he joined EBRD - the European Bank for Reconstruction and Development in London where he was responsible for the Nuclear Safety Account, the Fund created for the closure and decommissioning of several Soviet Nuclear Power Plants (Chernobyl in Ukraine and others in Bulgaria, Lithuania, Slovakia and Russia). Dr Maltini has been in charge of the conception of the Chernobyl programme including the establishment of a safety strategy for the entire site remediation and the planning for plant decommissioning. His presentation was **titled** '*The Accident and the decommissioning of Chernobyl nuclear power plant'.*

The third speaker at the evening's event was Dr Mina Golshan, Deputy Chief Inspector and Programme Director for Sellafield, Decommissioning, Fuel and Waste (SDFW) Programme at the Office for Nuclear Regulation (ONR). ONR's SDFW Programme covers the regulation of 21 licensed nuclear sites including all sites owned by the Nuclear Decommissioning Authority (NDA). In addition, her team has developed ONR's strategy for regulation of a future Geological Disposal Facility. In 2012 as part of ONR's Regulatory Assurance Directorate, she established ONR's Strategy and Oversight function which provides independent assurance to the Chief Inspector and the ONR Board on the effectiveness of ONR's regulatory functions. Dr Golshan has a wide regulatory experience and for the past two years represented the UK at the IAEA Nuclear Safety Standards Committee, NUSSC. Her earlier career involved a period of time with HSE's Hazardous Installations Directorate and before that a number of positions in research and consultancy within the public and private sectors. Mina presented on '*Regulating the legacy of UK nuclear industry; past, present and future'.*

The event was opened by the **Hazards Forum Chairman** Rear Admiral (retd.) Paul Thomas CB greeted all those in attendance. He thanked Costain for sponsoring the event, along with the Institution of Mechanical Engineers, the hosts for the evening. He welcomed Dr Maltini on becoming a member of the Hazards Forum, and encouraged any non-members present to consider joining. He then handed over to **Dr Mike Weightman, the chair for the evening.**

Dr Weightman introduced the topic of decommissioning and regulation. He put this in context by emphasising the scale of the decommissioning efforts in the UK, projected to cost in excess of £70bn and the important of public confidence and trust. Dealing with waste is an important part of a vibrant nuclear industry. There are lessons that can be learnt from global approaches to decommissioning. There are 440 nuclear reactors operating worldwide at the present time, and around 60 being built, so decommissioning is an important ongoing activity.

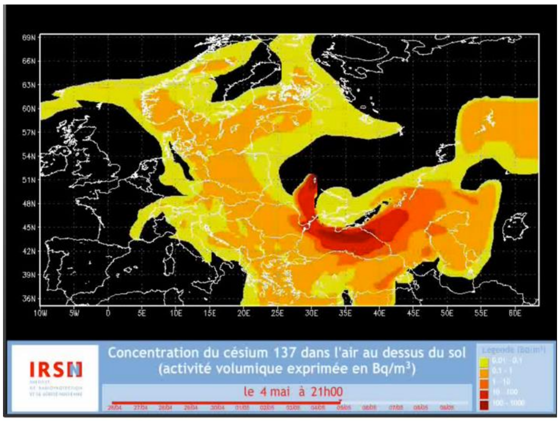
Dr Maltini began his talk by thanking the Hazards Forum for the opportunity and expressing his respect for the organisation. He acknowledged the timely nature of the event, on the 30th anniversary of the Chernobyl disaster, and the 5th anniversary of the events on Fukushima.

There were 5 nuclear power plants in Ukraine in 1986. Chernobyl, in the north, was the first with four reactors of the RMBK design. This design features a water-cooled and graphite-moderated reactor. Such a design has not been replicated since Chernobyl. The reactor design is interesting as the fuel is included in boxes surrounded by graphite to moderates the reaction. The whole plant is made up of 500 of these boxes. There is no containment of the kind found in a modern reactor. Water is piped through the reactor, converting it to steam that is then used to power a turbine and generate electricity.

On the 26th April 1986 the operators were conducting a test on Reactor 4 to see whether the 'runout' of the steam turbines could be used to generate sufficient electrical power to support cooling water flow in the event of a coincident shut-down and power cut. While the plant had back-up generators there could be a small delay in bringing them on line for which residual power from the turbines could have compensated. During this experiment the reactor became unstable, resulting in two explosions. The graphite burned for 15 days.

The effects of the radiation were enormous. The estimated levels in the areas of the reactor building were 0.056 sieverts per second (Sv/s), i.e. 200 sieverts per hour. To put this in context the lethal dose is thought to be around 5 sieverts over 5 hours. The town of Pripyat was abandoned by its 45,000 inhabitants following the accident.

Dr Maltini showed the audience a video illustrating the movement of a significant radioactive cloud resulting from the explosion and burning graphite. Over the following eight days the cloud spread across Ukraine, norther Europe, eastern Europe and southern Europe. By the 4th of May 1986 it had reached parts of France. The French government initially denied that the cloud had reached France, however it later admitted that Cesium-137 contamination associated with the explosion had been found in the east and south of the country. A lot of southern Switzerland was affected, and still today the Swiss authorities forbid the hunting of wild boars that dig into the ground to feed. The figure reproduced below shows the radioactive cloud over Europe 9 days after the accident (source IRSN)



Data shows large areas of land in Belarus (29,900km^2), Ukraine (37,200km^2) and Russia (49,800km^2) contaminated with Cesium-137 to a degree of 37-185 kBq/m^2. Elsewhere, in Europe, countries such as Sweden (12,000 km^2), Norway (5,200 km^2) and Italy (300 km^2) exhibit similar levels of contamination. Some 2,200 km^2 of Belarus were contaminated to levels above 1,480 kBq/m^2. 6.4 million people inhabited the high contamination areas of Belarus, Russia and Ukraine, with a further 98 million in the low contaminated areas within those countries.

While the I-131 that affects the Thyroid has a relatively short lifespan, the Cs-134 and Cs-137 have a much longer life, and traces can still be found today in contaminated areas. Estimates of fatal cancers related to the event across the whole of Europe vary, as shown in the table on the following page.

Authors	Year	Deaths
IAEA/WHO	2005	9,000
TORCH	2006	30,000 – 60,000
Cardis et al.	2015	16,000 (6,700 – 38,000)
TORCH	2016	40,000

Initially around 150,000 people were involved in trying to stop the fire, rising to over 500,000 in the clean-up process. This involved depositing sand and other materials into the ruins. Workers were only permitted to work for short periods, resulting in a total collective dose of 60,000 person Sieverts between them. Around 131,000 people were evacuated. Dramatic pictures show a type of mechanical cemetery for all of the abandoned trucks and helicopters involved in the process that are now contaminated.

In summary, 5 million people still live in highly contaminated areas, 500 million in less contaminated areas. Half of Chernobyl's fallout was deposited on Western Europe. 6,000 thyroid cancer cases have been reported and more are expected. There is a possible linked increase in thyroid cancers in countries in western Europe. Increased radiogenic leukaemia, cardio-vascular disease and breast cancers have all been confirmed, as well as radiogenic birth defects, mental health issues and other radiogenic illnesses.

In June 1986 construction began on the steel and concrete sarcophagus that was to enclose the reactor building and intended to protect the environment. This was completed by the end of the year. The final dismantling will not be completed however until 2064.

The process of decommissioning is funded through grants from over 40 different countries. In 1993 the G7 took an initiative to prevent further nuclear accidents in Russian built Nuclear Power Plants. They asked the European Bank for Reconstruction and Development (EBRD) to establish and administrate a fund for the decommissioning of RBMK and VVER-230 type reactors. The initial funding of around €285 million came from the G7 countries, the EU, Belgium, Denmark, Finland, Netherlands, Norway, Sweden and Switzerland.

In 1997 the Chernobyl Shelter Fund (CSF) was established to construct a long-term shelter for Unit 4. As of 2014 the CSF has received €1.14 billion.

In total the EBRD manages six nuclear safety funds on behalf of the EU and 29 donor countries. €2.5 billion has been contributed to these since 1993. The EBRD has a team of engineers to design and manage procurement and follow up implementation of related contracts.

The Chernobyl safety programme began by undertaking a plant safety assessment. This concluded that the first thing required was interim dry spent fuel storage. The spent fuel was at the time contained in large water tanks for a number of years as it cools down. There was also liquid and solid waste that required treatment facilities. The solid waste treatment plant was funded by the EC and Ukraine. A new safe confinement project was initiated along with an industrial complex for the long term storage of radioactive waste (VEKTOR).

The interim spent fuel processing and storage facility will house 22,000 assemblies from Units 1, 2, 3 and 4 as well as 2,000 spent rod absorbers. What are known as 'Nuholm casks' have been constructed to house the spent fuel after processing for 100 years. While there have been decisions elsewhere to bury nuclear waste, at Chernobyl the decision was made to store the waste in Nuholm casks above ground, with appropriate monitoring and seismic protection. This is made somewhat possible by the exclusion zone in place at the site and avoids risks associated with underground storage such as those presented by the water table. The fuel assemblies and fuel racks are transported from the old spent fuel storage facility to the new one via railway carriages. The fuel is placed into a basket which is then placed within a double-walled canister designed to hold 186 fuel tubes. The canisters are then placed into the concrete casks, shown below (source chnpp.gov.au).

The second plant constructed was the liquid radioactive treatment plant. A solid waste processing facility was also constructed along with a facility to incinerate some waste. Following processing, the material is taken to the VEKTOR complex for final storage. This has capacity for 55,000m2 of nuclear waste above ground.

Dr Maltini postulated that the most important decision was probably what to do with the actual reactor. An assessment was carried out into the original sarcophagus containing unit 4. It was concluded that this should be replaced. The original structure was built quickly under difficult circumstances and was found to be inadequate at preventing radioactive material leaking to the environment. The original structure would need to be demolished once a new structure had been built.

He concluded his talk by describing the construction of the replacement sarcophagus. It was assembled on site, 200m from the reactor building, in an area that was first covered with uncontaminated sand. The structure has a length of 165m, a width of 257m and a height of 109m. In its final form it will weigh more than 30,000 tons and has a minimum lifetime of 100 years. Work began in 2010 and is expected to be completed by 2017 at a cost of around €1billion. A recent image of the structure is shown below (source chnpp.gov.au).

The evening's chair **Dr Mike Weightman** then gave a talk describing the progress with decommissioning the Fukushima Daiichi plant. The tsunami and earthquake was devastating. Over 20,000 were killed or missing as a direct result. Despite this the resilience and fortitude of the people affected was impressive. The main lessons from this process can be grouped into issues around learning, being observant of what is happening and looking forward. The transition from a time of crisis to a calm, sustained, determined and harmonious progress is important.

The fundamental lessons, when you analyse the root causes, relate to control and institutional failures. These are common to incidents across all nuclear facilities. There is a need for a strong, robust institutional nuclear safety system to ensure that the standards that are developed are rigorously implemented in practice.

Dr Weightman used castles as a metaphor. All around the world, castles have been constructed following similar principles. They have strong, independent layers of defences, each supporting diverse weapons of strength (e.g. bows and arrows, swords and boiling oil.). They are designed this was to avoid a single point of failure or a common failure mode. However, even in these tested, robust designs, the success depends upon the people, their culture, organisation and leadership.

A robust nuclear safety system has three main, independent pillars: industry, regulators and stakeholders. While remaining independent, each needs to be open and transparent. These three pillars must sit upon deep foundations of values and a vibrant safety culture, with a 'roof' of strong, humble leadership.

This requires inner strength as opposed to the strength of brute force. Inner strength means being strong enough to listen and absorb others' ideas; strong enough to accept challenge; strong enough to welcome new ideas and learn from others, and; strong enough to recognise your own errors and learn from them.

Harmony of the three pillars of industry, regulator and stakeholders is a key goal for the decommissioning of Fukushima. They all share the same goal of reducing the risk and making the station safe.

Dr Weightman then turned to look at the similarities and differences between regulating operations and regulating high hazard degraded fuel facilities. In both situations:

- The licensee has prime responsibility for safety
- The regulator ensures safety
- The regulator is independent
- The regulator is not isolated

In terms of the difference:

- Regulators cannot stop operations to reduce hazards during decommissioning in the way they can during operations
- Regulators want decommissioning as soon as reasonably practicable
- Regulators have to accept that risks may increase in the short term during decommissioning
- Some safety principles that normal apply may have to be balanced against progress.

On-site decommissioning at Fukushima is faced with several issues. The tsunami caused significant damage and disruption. There was fuel in the reactor pools and fuel debris in reactors 1 to 3 (there was no fuel in reactor 4). Contaminated water was in the buildings and the reactor internals were contaminated. There was waste from treating contaminated water as well as contaminated solid material.

The event had left buildings themselves damaged and in a fragile state. There were issues with the ground water getting into the reactor building and picking up contamination. Dose rates in and around reactor buildings 1 to 3 were high.

There were organisational and logistical issues in the decommissioning process, with up to 10,000 people on site at any time. To start with they were all wearing face masks and personal protective equipment. Handling this each day was a significant challenge, and as part of managing the risk balance they were persuaded to wear fewer items in situations where they did not to wear the equipment. There were also social and political issues. The engineering challenges do not exist in a vacuum from these.

A risk based approach is now being used at Fukushima. The first task is to stabilise reactor core debris and minimise the generation of any more contaminated water. The existing contaminated water needs to be treated and debris around the reactor buildings needs to be cleared. This has to be done before anything can be done to the reactors themselves. Once this is cleared then fuel can be removed from the reactor ponds and fuel debris can be located and removed. This requires different inspection and removal techniques, hence this approach is underpinned by a large programme of R&D. There are currently three methods of removing fuel debris under investigation which can be summarised as removing the debris from the top of the reactor, from the bottom or from the side. Even in ten years, it will not be possible to remove all of the debris from the reactor.

By the end of 2011 conditions were stabilised in reactors 1 to 3. By the end of 2014 a massive steel structure gave been built to remove fuel from Unit 4's reactor pond without impacting on the fragile building itself. In total 1,535 fuel rods were removed from the pond. Would the UK industry have the same resources and political support to do the same were it necessary? In May 2015 around 626,000m^3 of contaminated water was retrieved, and by July 2015 the risk of contaminated water in the trenches was reduced to less than 1% of its original post-event state. At the start of 2016 the radiation emanating from the site boundary was reduced to below 1mSv/yr. There is still much to be done, with over 30 years work ahead.

The underlying issues of openness and transparency that many have been pushing for are starting to see progress and the amount of engagement with the stakeholders and local community increases.

Dr Weightman finished his talk by returning to the theme of transition from crisis to calm determined progress. This relies on the three pillars of a robust nuclear safety system working in harmony and upholding values of integrity, openness, transparency and trust. If this is done correctly, then the decommissioning of Fukushima can be an example to the rest of the world.

The final talk of the evening was given by **Dr Mina Golshan** on the past, present and future of regulating the legacy of the UK's nuclear industry. The decommissioning sector in the UK is vast. There are 21 licensed sites that are somehow involved in either decommissioning or waste management. That's almost 50% of all nuclear licensed sites in the UK. This includes Sellafield, 10 shutdown Magnox reactors, 3 research and restoration sites and 7 waste management and fuel-cycle facilities.

Sellafield started life as an ordinance factory before becoming a nuclear site, at first military and later civil. There are more than 60 years of history at the Sellafield site, including major expansion in the 1980s, right up to the present day and the beginning of a new era.

Sites in the process of decommissioning involve many types of technology and designs. These include the Heavy Water Magnox reactor at Winfrith and Dounreay, the UK's first fast reactor. Each of these has different missions, different priorities and different challenges. For Sellafield one of the main challenges is accelerating risk and hazard reduction from some of the legacy facilities. For the Magnox sites the challenge is in completing the decommissioning to a state where they can be put into care and maintenance. For Dounreay the challenge is in completing gradual decommissioning to closure. While there may be many differences, there are strategic links between all of the sites. Understanding these links is important. Reflecting on this, from April 2016, the regulation of Sellafield, decommissioning, fuel and waste were all brought under the same programme.

Dr Golshan summarised the mission of the regulation process in two points:

- Enabling the acceleration of risk and hazard reduction;
- Securing safe, timely and sustainable decommissioning and remediation and waste management.

The importance of decommissioning being safe is perhaps obvious, but it is also important that the process happens over a reasonable timescale with manageable progression. The key to success is the alignment of priorities across all stakeholders and flexibility of approach. There is no one-size-fits-all solution. The process requires working constructively with all stakeholders on achieving optimised safety outcomes.

The programme sought to determine the priorities for each of the different sectors in order to achieve efficient and affective regulation. To this end, the programme was restructured, governance was simplified and the team was refreshed.

The right regulatory strategy is key to determining the way forward. There are measures and metrics that have been developed over the years for assessing regulatory effectiveness, but having the right strategy is one of the key elements.

Once you have a strategy, it is important to communicate it. Everybody needs to know the destination and the pathway leading there. Learning and refining the strategy along the way is also necessary.

There has been a lot of progress in the area of decommissioning over the last decade thanks to the good work of many people. Around April 2015 Magnox Ltd began what was probably the largest restructuring in its history. It went from a company with multiple missions around generation, defuelling and decommissioning to one that was entirely focused on decommissioning. New jobs replace old ones. That has an effect of people. Managing this transition correctly is important. Magnox also moved to a more regionalised model. This change within the industry necessitated a change in the approach to regulation. Within ONR therefore, we had to make changes, refresh the team to bring fresh thinking; a mixture of those with experience of the decommissioning sector, those with experience of other sectors (such as operational facilities), and those with experience of non-nuclear high-hazard industries.

There was recognition that there was a need for additional guidance, both for the inspectors and the licensee. This includes guidance on what is inspected, how it is inspected and what the expectations are.

In these circumstances the management of change becomes very important. When the process of restructuring the licensee organisation began, there were concerns that changes to the regulatory approach was going to mean the introduction of dozens of lengthy assessment and hold points within the management of change process. The approach was instead based around setting a clear strategy, looking at the licensee's high-level structural changes and, sampled the implementation of these changes across a number of sites to gather evidence and build regulatory confidence.

The regulator can't be in a position where on low levels of radioactivity is being cleaned up whilst at other sites there is still work to be done to reduce risks and hazards. . Given limited funding, if the principles of ALARP (as low as reasonably practicable) is applied activity-by-activity or site-by-site then the results across the fleet will not be optimised. There is a need to consider the broader picture across the fleet to secure reduction of risks to ALARP. This is why it is important that the licensee, regulators and Nuclear Decommissioning Authority work to achieve safety outcomes.

At Sellafield, operational priorities have changed over its history, and similarly, the regulatory strategy has had to change in line with those. It is no secret that some facilities on the site have caused significant regulatory concern, however, this is a reflection of the very high standards set by the nuclear industry and the regulator in the UK. It is also the case that some of these facilities were designed and built at a time when the licensing framework did not exist. Over the years, the regulator has pushed for risk and hazard reduction. Bringing forward the safety assessment principles, and with that the concept of periodic safety review, has asked operators to not only judge themselves against the design intent, but to also judge themselves against modern standards. It is as a result of these activities that the shortfalls were identified and are being remedied. This has been gradual, constant work by the licensees, and not something that has occurred suddenly.

In reviewing our regulatory approach, we recognised that a new approach was needed to accelerate risk and hazard reduction. About 3 years ago all stakeholders came together to consider the overriding priority of reducing risk and hazard on the site. This meant agreeing the priority actions of, removing unnecessary bureaucracy and process that don't enhance safety, identifying barriers and, removing distractions and diversions. The adoption of fit-for-purpose solutions was implemented, rather seeking gold-plated ones. The risk appetite was considered, recognising that there will be an increased risk in the short-term in order to reduce longer-term risk. A clear communication strategy was also established between all stakeholders, and at all levels of the organisations.

There have already been successes from adopting this new strategy with stakeholders. Dr Golshan described the specific improvements with regards to legacy ponds. These refer to two facilities at Sellafield: the First Generation Magnox Storage Pond (FGMSP) and the Pile Fuel Storage Pond. She explained that as a result of reaction between Magnox fuel and water the fuel corrodes, leaving quite a deep layer of sludge at the bottom of the pond. As a result of excellent work by the licensee, The Pile Fuel Storage Pond has now has all of the bulk fuel removed, and the next step is to remove the sludge. To date, around 25 tonnes of fuel have been removed from the FGMSP and work is being done every week to remove another skip of fuel.

Legacy silos, such as the Pile Fuel Cladding Silo (PFCS) and Magnox Swarf Storage Silo (MSSS) have also demonstrated significant achievements. At the PFCS 70 penetrations have been completed for instrumentation in preparation for retrievals. The deflector plates involved in depositing waste have been successfully cut into in order to enable start of retrievals. This is a significant milestone and several years earlier than initially planned. The enabling work that is done to these silos brings the facilities a day closer to the ultimate reduction in risk.

There are synergies across the sites. The Magnox Reprocessing Plant is an old facility, but one that is absolutely vital to risk and hazard reduction, and the completion of defueling at Wylfa. If looked at in isolation of this context, as an old facility, one may question why it is being allowed to continue operation. However within this context, its key role to risk and hazard reduction at the site and within the UK in general becomes clear. There is still a long way to go in the decommissioning journey, and this is the end of the beginning. It is important that we continue with innovative thinking to continue making progress.

Dr Mike Weightman thanked the speakers and then opened up the session for a period of discussion, taking questions from the audience.

The first question related to the short-term increases in risk that relate to the decommissioning process, asking how this is assessed.

Dr Golshan responded by clarifying that it there is a potential that the risks may increase. The licensee must look at all of the facets surrounding the activity and do all that they can to reduce the risks associated with the activity to as low as is reasonably practicable. The regulator will look at the safety cases, it will ensures that the licensee has adequate emergency and contingency measures in place and monitors the work as it is carried out. Being ultra-risk averse is not going to lead to the ultimate risk reduction of the legacy.

The second question asked whether the idea of an effectively independent regulator is an accepted model around the world, particularly with new nuclear projects. Dr Mike Weightman highlighted that the International Atomic Energy Agency make available the standards and experience it has developed in this context from around the world so that new regulatory bodies can be set up based on these models of independence or at least compared to them. There are also conventions on nuclear safety that assist in this regard. The concern reinforces the importance of those with experience in the nuclear community helping to advise those with less experience on these matters.

The third question asked what lessons from decommissioning have been fed into the design and regulation of new build stations. Dr Golshan discussed two areas: the funding of decommissioning and ensuring that decommissioning is thought through as part of the design. A pre-construction safety case will not be accepted without this. Ensuring that there will be adequate funding for decommissioning is also embedded into the new build concept.

The final question asked, with regards to Fukushima, whether sufficient funds are being made available for the decommissioning. Dr Mike Weightman explained that this was not proving to be an issue at the present time, but that there would ultimately be a constraint on the funding made available by the Japanese government. There is a need to understand and control the costs, particularly to ensure, via a risk-based and fit for purpose approach, that the funding is being spent effectively.

The Chair for the evening then thanked the speakers a final time, before also thanking the audience and inviting them to continue their discussions over refreshments.

From the Secretary…

As a reminder following on from the last Newsletter (NL92), the **next Hf Annual General Meeting** is planned to be held at the Institution of Civil Engineers on **Tuesday 28th March 2017** when **four of the five current trustee positions** will become available for voting if the number of nominations received in the required timescale beforehand exceeds four. As mentioned previously, **the new chair of the Hazards Forum** will need to be one of the revitalised group of five trustees, where the one trustee position not for election in March 2017 is currently due for consideration in 2018. For more about the AGM, please see https://tockify.com/the.hazards.forum/detail/302/1490715000000.

Brian Neale

Calendar of Events

Please check the Events section of the Hazards Forum website for more information at **www.hazardsforum.org.uk** and to see any updates in the calendar. These may include additional events or perhaps amendments to the Events shown below, where attendance at Hf Events is by invitation.

Date	Event	Venue	Contact/further information
December			
7th	Hf Event: Design Safety – The inherently safer way	Institution of Chemical Engineers, One Portland Place, London W1B 1PN, UK	https://tockify.com/the.hazards.forum/detail/287/1481131800000 ; admin@hazardsforum.org.uk
8th-9th	IET Event: Safety Integrity Levels (SIL) Determination	IET London: Savoy Place, 2 Savoy Place, London WC2R 0BL	http://events.theiet.org/sil/index.cfm?nxtid
12th	ICE Event: frontiers in Green Materials	Institution of Civil Engineers, One Great George Street, Westminster, London, UK, SW1P 3AA	https://www.ice.org.uk/events/frontiers-in-green-materials
January 2017			
18th	SaRS Event - System Safety of Large Projects	RSSB, The Helicon, 1 South Place, London, EC2M 2RC, UK	http://www.sars.org.uk/branches/london-branch/
February			
7th	IET Event: Rail Accident Investigation	Chippenham, UK	http://www.theiet.org/events/local/242783.cfm?nxtId=242429
16th	IET Event: Cyber security	Coventry, UK	http://www.theiet.org/events/local/242392.cfm?nxtId=241708
22nd	ICE Event: Infrastructure investment in an age of devolution - Risks and opportunities	National Council For Voluntary Organisations, 8 All Saints Street, London, United Kingdom, N1 9RL	https://www.ice.org.uk/events/infrastructure-investment-in-an-age-of-devolution
23rd	IET Event: Risk Management – A practitioners Guide	Glasgow, UK	http://www.theiet.org/events/2017/242584.cfm?nxtId=243555
28th	SaRS Event - Corn flakes and safety culture improvement	Atkins, Royal Pavilion, Wellesy Road, Aldershot GU11 1PZ	http://www.sars.org.uk/branches/solent-branch/
March			
14th - 15th	IMechE Event: Non Destructive Testing 2017	Manchester, UK	http://events.imeche.org/ViewEvent?code=CMP6463
15th	SaRS Event - Cyber Security – Different industry approaches?	WSP House, 70 Chancery Lane, London WC2A 1AF	http://www.sars.org.uk/branches/london-branch/
21st	IMechE Event: Late Life Care of Ageing Assets	Institution of Mechanical Engineers, One Birdcage Walk, London, SW1H 9JJ	http://www.imeche.org/latelifecare2017
24th	SaRS Event - How do you know you are SQEP ?	BAWA 589 Southmead Road, Filton, Bristol, BS34 7RG	http://www.sars.org.uk/branches/western-branch/
28th	IMechE Event: ALARP: Risk Management for Engineering	TBC, Midlands, UK	http://www.imeche.org/alarp
28th	Hf Event: Annual General Meeting	Institution of Civil Engineers, One Great George Street, Westminster, London, UK, SW1P 3AA	https://tockify.com/the.hazards.forum/detail/302/1490715000000 ; admin@hazardsforum.org.uk
28th	Hf Event: Advancing technology: the good, the bad and the ... need to manage the hazards (Provisional title)	Institution of Civil Engineers, One Great George Street, Westminster, London, UK, SW1P 3AA	https://tockify.com/the.hazards.forum/detail/301/1490718600000 ; admin@hazardsforum.org.uk
April			
25th	IET Event: Internet of Things: The Security Nightmare – Hype or a Hacker's Dream	Birkenhead, UK	http://www.theiet.org/events/local/239165.cfm?nxtid
May			
10th – 12th	IChemE Event: Hazards 27	ICC, Birmingham, UK	http://www.icheme.org/hazards27

The Hazards Forum's Mission is to contribute to government, industry, science, universities, NGOs and Individuals to find practical ways of approaching and resolving hazard and risk issues, in the interests of mutual understanding, public confidence and safety.

The forum was established in 1989 by four of the principal engineering institutions because of concern about the major disasters which had occurred about that time.

The Hazards Forum holds regular events on a wide range of subjects relating to hazards and safety, produces publications on such topics, and provides opportunities for interdisciplinary contacts and discussions.

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