

Proceedings of the 2018
Committee on Nuclear Regulatory
Activities/Multinational Design
Evaluation Programme Workshop on
Nuclear Supply Chain Management

**NUCLEAR ENERGY AGENCY
COMMITTEE ON NUCLEAR REGULATORY ACTIVITIES**

**Proceedings of the 2018 Committee on Nuclear Regulatory
Activities/Multinational Design Evaluation Programme Workshop on Nuclear
Supply Chain Management**

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COMMITTEE ON NUCLEAR REGULATORY ACTIVITIES (CNRA)

The Committee on Nuclear Regulatory Activities (CNRA) is responsible for NEA programmes and activities concerning the regulation, licensing and inspection of nuclear installations with regard to both technical and human aspects of nuclear safety. The Committee constitutes a forum for the effective exchange of safety-relevant information and experience among regulatory organisations. To the extent appropriate, the Committee reviews developments which could affect regulatory requirements with the objective of providing members with an understanding of the motivation for new regulatory requirements under consideration and an opportunity to offer suggestions that might improve them and assist in the development of a common understanding among member countries. In particular it reviews regulatory aspects of current safety management strategies and safety management practices and operating experiences at nuclear facilities including, as appropriate, consideration of the interface between safety and security with a view to disseminating lessons learnt. In accordance with *The Strategic Plan of the Nuclear Energy Agency: 2017-2022*, the committee promotes co-operation among member countries to use the feedback from experience to develop measures to ensure high standards of safety, to further enhance efficiency and effectiveness in the regulatory process and to maintain adequate infrastructure and competence in the nuclear safety field.

The committee promotes transparency of nuclear safety work and open public communication. In accordance with the NEA Strategic Plan, the committee oversees work to promote the development of effective and efficient regulation.

The committee focuses on safety issues and corresponding regulatory aspects for existing and new power reactors and other nuclear installations, and the regulatory implications of new designs and new technologies of power reactors and other types of nuclear installations consistent with the interests of the members. Furthermore, it examines any other matters referred to it by the NEA Steering Committee for Nuclear Energy. The work of the committee is collaborative with and supportive of, as appropriate, that of other international organisations for co-operation among regulators and consider, upon request, issues raised by these organisations. The Committee organises its own activities. It may sponsor specialist meetings, senior-level task groups and working groups to further its objectives.

In implementing its programme, the committee establishes co-operative mechanisms with the Committee on the Safety of Nuclear Installations (CSNI) in order to work with that committee on matters of common interest, avoiding unnecessary duplications. The committee also co-operates with the Committee on Radiological Protection and Public Health (CRPPH), the Radioactive Waste Management Committee (RWMC), and other NEA committees and activities on matters of common interest.

THE MULTINATIONAL DESIGN EVALUATION PROGRAMME (MDEP)

The Multinational Design Evaluation Programme (MDEP) was established in 2006 as a multinational initiative to develop innovative approaches to leverage the resources and knowledge of the national regulatory authorities who are currently or will be tasked with the review of new reactor power plant designs. MDEP is led by its Policy Group (PG) and the Steering Technical Committee (STC). MDEP comprises 16 nuclear regulatory authorities that actively co-operate to strengthen the effectiveness and efficiency of regulatory design reviews and establish reference regulatory practices to enhance the safety of new reactor designs. The current activities of MDEP are being implemented through design-specific and issue-specific working groups that address cross-cutting issues. The design-specific working groups share information on a timely basis and co-operate on the areas of specific reactor design evaluations, construction oversight and the commissioning and early-phase operation of new reactors, including: EPR, APR1400, AP1000, VVER and HPR1000 designs. The issue-specific Vendor Inspection Co-operation Working Group (VICWG) supports MDEP design-specific working groups to maximise the use of the results obtained from other regulators' efforts in inspecting vendors; and to enhance the understanding of each regulator's inspection procedures and practices by co-ordinating witnessed and multinational inspections of quality assurance arrangements and safety-related components.

Foreword

The main purpose of the 2018 Committee on Nuclear Regulatory Activities/Multinational Design Evaluation Programme Workshop on Nuclear Supply Chain Management was for participants to exchange information and experiences in this area. Sessions were designed to identify emerging risks, sharing commendable practices, lessons learnt and recommendations for reducing risks and promoting safety culture principles in the global nuclear supply chain. As an opportunity to engage with their counterparts, the workshop brought together regulators and stakeholders, including industry representatives, standard development organisations (SDOs), technical support organisations (TSOs) and other international organisations.

Participants shared their insights on the various presentations and discussions that occurred over the two-day workshop, with the goal of identifying oversight practices to help overcome the challenges and risks associated with the nuclear supply chain. Additionally, the workshop culminated with a moderated panel discussion that provided all those involved with the opportunity to reflect on the challenges discussed during the workshop and recommend opportunities for international activities to prepare for new technologies by enhancing the effectiveness of regulatory guidance for the oversight of the licensee's nuclear supply chain management. This included, in particular, highlighting areas where more effort is needed to develop guidance for a risk-informed graded approach for regulatory oversight arrangements in order to improve effectiveness and prepare for the expected demands of new technology.

Following separate conversations within the Multinational Design Evaluation Programme (MDEP) and the Nuclear Energy Agency (NEA) Committee on Nuclear Regulatory Activities (CNRA) regarding emerging risks in the supply chain and counterfeit, fraudulent and suspect items (CFSI) and other safety concerns, the impetus for creating the workshop was based on further enhancing each group's work on supply chain management, particularly apropos to the activities and the programme of work of the MDEP Vendor Inspection Co-operation Working Group (VICWG). This workshop was supplemented by the 2017 conference organised by the International Framework for Nuclear Energy Cooperation (IFNEC) on Global Supply Chain and Localization Issues and Opportunities, which underlined the need for more discussion surrounding two key issues: 1) the global supply chain; and 2) localisation. Moreover, an expected outcome of the workshop was to produce further discussion, an examination of potential future work areas, and a possible follow-up to the 2011 NEA Green Booklet *The Nuclear Regulator's Role in Assessing Licensee Oversight of Vendor and Other Contracted Services*,¹ which examined oversight and safety within the nuclear supply chain.

1. NEA (2011), *The Nuclear Regulator's Role in Assessing Licensee Oversight of Vendor and Other Contracted Services*, OECD, Paris, www.oecd-nea.org/nsd/docs/2011/cnra-r2011-4.pdf.

The CNRA-MDEP workshop was held at the NEA Headquarters in Boulogne-Billancourt (France) on 5-6 November 2018 on the subject of nuclear supply chain management activities. The following topics were selected to be addressed, in addition to an opening plenary session, within the structure of six sessions:

- global supply chain oversight challenges;
- counterfeit, fraudulent and suspect items (CFSIs): lessons learnt;
- advancing early integration of safety culture in the supply chain;
- regulatory approaches for equipment qualification and commercial-grade dedication;
- enhancing international co-operation to prepare for new technologies and emerging challenges;
- panel discussion session: international regulatory activities in the oversight of the global nuclear supply chain.

Acknowledgements

The members of the organising committee wish to acknowledge the excellent contributions of the distinguished panellists and plenary speakers that so generously gave their time and attention to ensuring this workshop was successful. Special appreciation is given to the workshop Chair, Mr Julien Collet, and Deputy Director-General of the French Nuclear Safety Authority (ASN). The organising committee is grateful for the planning and co-ordination, and for the arrangements made by NEA staff, in particular Ms Belkys Sosa, Ms Akane Schmitz-Fraysse and Ms Rebecca Sands, for their outstanding support during the workshop and the development of the proceedings. Special acknowledgement is given to all the members of the organising committee who agreed to facilitate and co-ordinate the sessions, including:



Mr Stuart Allen (ONR, UK) introducing Session 1

Organising committee:

Mr Stuart Allen, Office for Nuclear Regulation (ONR), United Kingdom

Ms Kerri Kavanagh, Nuclear Regulatory Commission (NRC), United States

Mr Olivier Allain, Nuclear Safety Authority (ASN), France

Mr Greg Kaser, World Nuclear Association (WNA)

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Executive summary

The Nuclear Energy Agency (NEA) Committee on Nuclear Regulatory Activities (CNRA) and the Multinational Design Evaluation Programme (MDEP) Vendor Inspection Co-operation Working Group (VICWG) sponsored an international workshop on 5-6 November 2018 on nuclear supply chain management.

The workshop brought together regulators and stakeholders, including industry representatives, standard development organisations (SDOs), technical support organisations (TSOs) and other international organisations to discuss supply chain oversight challenges in a globalised nuclear industry. Over 80 registered participants from 18 different countries attended the workshop, including representatives from the International Atomic Energy Agency (IAEA), the European Union (EU), the World Association of Nuclear Operators (WANO) and the World Nuclear Association (WNA). The workshop also included participation from CNRA members (including the safety culture, operating experience and inspection practices working groups), MDEP members from both the VICWG and Steering Technical Committee (STC), as well as representatives from non-NEA member country regulators, and industry representatives involved in supply chain activities.

Increasingly, vendors, including companies with limited experience in the nuclear industry, are entering the market to supply parts and components for nuclear power plants (NPPs) for both safety and non-safety applications. In this context, globalisation of the nuclear supply chain and new manufacturing technologies raise unique regulatory challenges. For example, the risk of counterfeit, fraudulent and suspect items (CFSIs) entering the supply chain presents an increasing challenge. Participants considered perspectives beyond a traditional supply chain assurance view to include how effective oversight approaches and the establishment of the required safety culture across the licensee's "extended enterprise" can reduce risks and improve nuclear safety.

Internationally, many NPPs are facing increasing demands related to ageing and obsolescent components. A viable solution for NPPs is to purchase commercial components and have them dedicated to meet safety standards. This solution is called commercial-grade dedication (CGD). This process provides reasonable assurance that components purchased from a commercial supplier are equivalent to nuclear-grade items. There is increasing interest by the nuclear industry to use commercial parts and services in safety-related applications beyond what regulatory frameworks initially envisioned under commercial-grade dedication programmes. In addition, reverse engineered approaches and additive manufacturing techniques (3-D printing) are introducing additional benefits and risks. These relatively new topics create additional oversight challenges for regulators.

Workshop participants had the opportunity to meet their international counterparts to discuss the various regulatory approaches to these topics. The workshop highlighted emerging risks and provided recommendations to further improve supply chain

management and oversight arrangements, and considered the need for additional regulatory tools, assessments or international guidance.

Some of the main themes and recommendations identified during the workshop include:

- the need for collaboration between governments, regulators, licensees and the supply chain;
- ways to effectively regulate emerging technologies, the digitalisation of manufacturing, modular construction, and the correct regulatory approach to deal with obsolescent components;
- the need to continue to ensure effective vendor inspection co-operation and programme intelligence exchange;
- consideration of the regulatory risks across the extended enterprise, interface management and their cascading effects upon the supply chain;
- the need to continue focusing on the risks of CFSIs, the regulatory co-operation necessary to mitigate them, and improving information sharing where necessary;
- the need to continue the strong promotion of a positive safety culture in the nuclear supply chain;
- an enhanced knowledge of national supply chain mapping to support regulators in targeting areas of risk, as well as to support enhanced regulatory vendor inspection co-operation;
- the need for a collective understanding of terminology associated with CGD and equipment qualification.

Evaluation of the workshop results were based on questionnaire responses received from the participants at the closing of the workshop. The evaluation showed that the highest value perceived was in meeting and exchanging information, particularly between regulators and industry representatives. Responses also showed that the format selected was highly appreciated and that more workshops of this type could be supported in the future as changes associated with globalisation continue to be reflected in the industry. Overall, discussions between the various participants both in the presentations and question and answer sessions throughout the workshop were extensive and meaningful. The workshop results should enable participants to review their national policies and oversight structures, to identify potential gaps in international commendable practices, and to initiate optimisation of their supply chain management arrangements and oversight programmes.

The recommendations and conclusions from the workshop have been compiled in the present report. The proceedings will serve to inform ongoing activities of the MDEP VICWG and provide the basis for the CNRA to decide on future activities or tasks, as necessary.

List of abbreviations and acronyms

| | |
|-------|---|
| AMRC | Advanced Manufacturing Research Centre (United Kingdom) |
| ANS | Alternative Nuclear Standards |
| ASN | Autorité de sûreté nucléaire (French Nuclear Safety Authority) |
| CFSI | Counterfeit, fraudulent and suspect item |
| CGD | Commercial-grade dedication |
| CNRA | Committee on Nuclear Regulatory Activities (NEA) |
| EC | European Commission |
| EDF | Électricité de France |
| EMIB | EDF Manufacturing Inspection Body |
| EPRI | Electric Power Research Institute (United States) |
| EU | European Union |
| IAEA | International Atomic Energy Agency |
| IFNEC | International Framework for Nuclear Energy Cooperation |
| INSTN | Institut national des sciences et techniques nucléaires (French Nuclear Institute of Nuclear Sciences and Technologies) |
| IRSN | Institut de radioprotection et de sûreté nucléaire (French Institute for Radiological Protection and Nuclear Safety) |
| KINS | Korea Institute of Nuclear Safety |
| MDEP | Multinational Design Evaluation Programme |
| NDT | Non-destructive testing |
| NEA | Nuclear Energy Agency |
| NNSA | National Nuclear Safety Administration |
| NPP | Nuclear power plants |
| NQSA | Nuclear Quality Standard Association |
| NRC | Nuclear Regulatory Commission (United States) |
| OECD | Organisation for Economic Co-operation and Development |
| ONR | Office for Nuclear Regulation (United Kingdom) |
| PG | Policy Group |

| | |
|--------|---|
| PIU | Peaceful Uses Initiative |
| QA | Quality assurance |
| ROP | Reactor oversight process |
| SAHARA | Safety as high as reasonably achievable |
| SMR | Small modular reactors |
| SSC | Structures, systems and components |
| STC | Steering Technical Committee (MDEP) |
| VICWG | Vendor Inspection Co-operation Working Group (MDEP) |
| WANO | World Association of Nuclear Operators |
| WNA | World Nuclear Association |

Organisation of the workshop

Planning

Preliminary planning for the Workshop on Nuclear Supply Chain Management began in January 2018, where the organising committee met by teleconference to determine the workshop's objectives, programme, participation and logistics.

The suggestion for a workshop of this kind came separately from both a Multinational Design Evaluation Programme (MDEP) Steering Technical Committee (STC) meeting and an NEA Committee on Nuclear Regulatory Activities (CNRA) meeting. During the STC meeting, it was discussed that there should be an exploration into emergent risks within the supply chain, beyond large mechanical components. In its goal to enhance work on supply chain management, it was suggested to the MDEP Vendor Inspection Co-operation Working Group (VICWG) by the STC to explore these issues further. Separately, during the CNRA meeting, a recommendation was made to further clarify "emerging risks," so as to expand the work on counterfeit, fraudulent and suspect items (CFSIs). Thus, the idea for the workshop was framed both by the STC and the CNRA within the conversation of potential risks of fraudulent components entering the supply chain.

The two-day workshop was structured to include an opening plenary session, five specific topic sessions, and a final moderated panel discussion to examine international regulatory activities. By April 2018, the CNRA and its Bureau, the MDEP STC, and the PG had all been briefed on the workshop, and an official announcement was made in May 2018.

Participation

Participation in the workshop was open to nuclear industry representatives for new and operating reactors, international organisations and regulatory organisations responsible for supply chain oversight, safety culture, operating experience and vendor inspection programmes. Participation by new reactor design vendors, nuclear suppliers, operating reactor licensees, utilities with multinational projects, and supply chain management professionals was strongly encouraged. Invitations were sent to the following groups.

- CNRA members, particularly the operating experience, inspection practices and safety culture working groups;
- MDEP members;
- representatives from standard development organisations (SDOs);
- industry representatives involved in supply chain activities;
- international organisations and associations, including the EC, the IAEA, WANO and the WNA;
- NEA member countries' nuclear regulatory organisations;

- technical support organisations (TSOs) and third-party organisations.

Language

All presentations and discussions were held in English.

Venue and contact

The workshop took place on 5-6 November 2018 at the NEA Headquarters, 46 quai Alphonse Le Gallo, 92100 Boulogne-Billancourt, France. For any additional information beyond these proceedings, please contact scmworkshop2018@oecd-nea.org.

Summary of the workshop

Mr Julien Collet, Multinational Design Evaluation Programme Steering Technical Committee (MDEP STC) Chair and Deputy Director-General of the French nuclear safety authority (Autorité de sûreté nucléaire - ASN), opened the workshop. Mr Collet welcomed all the participants for coming and thanked the organising committee for their work in putting the workshop together. After briefly describing the key topics for each session, Mr Collet reminded the audience that one of the main objectives of the workshop was to gain useful feedback in order to improve the regulatory framework through international co-operation, and so he encouraged active participation among the participants.

Mr William D. Magwood, IV, Director-General of the Nuclear Energy Agency (NEA), provided the opening remarks, including an overview of the Committee on Nuclear Regulatory Activities (CNRA) and MDEP objectives and development. Mr Magwood went on to emphasise the unique challenges that the nuclear supply chain faces in light of the many new developments in manufacturing technology and global economic conditions. Once these challenges are identified and defined, the collective industry has a better idea of where to focus their energy for all to be involved in finding solutions. As the nuclear supply chain must continue to evolve and adapt its management and oversight processes, the workshop's programme will allow for the examination of current approaches and the discussion of new recommendations. Chief among the priorities of the workshop and the responsibility of each country and organisation, Mr Magwood reiterated the obligation to create and maintain a strong framework for nuclear safety and security, particularly for new entrants, in a global supply chain of growing complexity and diversity.

Plenary session

Emerging challenges with the globalisation of the nuclear supply chain

The Executive Vice President of Rolls-Royce, Mr Chris Tierney, provided the opening plenary speech. The topic of the session was dedicated to addressing the emerging challenges resulting from the globalisation of the nuclear supply chain. As new countries continue to develop their nuclear supply chains and local manufacturing resources, global suppliers will face a new set of challenges when providing nuclear equipment to these new players while they also adjust to new technologies in the industry. Mr Tierney addressed the topic by first discussing a myriad of challenges and their associated risks when entering the nuclear supply chain. Ultimately, these challenges result in a very high entry cost for new entrants that must be managed through a variety of mitigation options. In his presentation and the discussion that followed, Mr Tierney and the workshop's participants identified how to best confront these emerging challenges, mitigate risk and plan for the future.

Areas of emergent risks or challenges identified

Principally, for new entrants into the nuclear supply chain, there are a myriad of challenges in entering into a regulated industry, such as the nuclear industry. These challenges can include different codes and requirements to be met, an uncertain market demand in terms of investment vs. return with low volume but high value characteristics, and in general a very high cost of entry where current supply chain incumbents are limited but already well established. As a result of this high entry cost and the need to invest heavily in both human and organisational capital, there is a certain loss of attractiveness in the nuclear industry due to these challenges and the difficulty in achieving economies of scale, particularly in the face of component obsolescence.

Accordingly, these challenges present their own set of risks to new entrants, including security issues, differences with in-country regulations, language and cultural obstacles, level of experience, export control and matters of counterfeit, fraudulent and suspect items (CFSIs).

Key points and recommendations identified for future activities or tasks

In order to mitigate the risks involved in entering the supply chain and to retain a sense of competitiveness, the opening plenary discussion strongly suggested the need for innovation in both manufacturing and the continued digitalisation of the industry, as well as practices that engage the supply chain early on and encourage standardisation among all actors. It was recommended that this standardisation be sought through a co-ordinated effort between governments, regulators and industry, which will allow for a more collective approach to mitigate the risks highlighted above. As there are many advantages to emerging technologies within the nuclear supply chain, a collaborative approach will aid in the

optimal use of technology to improve and sustain the quality of the supply chain as risks are reduced. This synchronised approach can be further aided by a system of common codes and standards which can provide further guidance in the process to certification. Additionally, a nuclear advanced manufacturing model was recommended to help share experiences and communicate to new entries into the industry how to adapt to the role of supplier.

Session 1

Global supply chain oversight challenges

Mr Stuart Allen, Vendor Inspection Co-operation Working Group (VICWG) Chair and Professional Lead for the Organisational Capability Specialism in the UK Office for Nuclear Regulation (ONR), introduced the speakers for Session 1. In his presentation, Mr Allen first summarised the ONR's approach to supply chain regulation, highlighting the expectation of licensees to establish their own adequate supply chain management arrangements to mitigate risk across the extended enterprise. Mr Allen then provided a brief introduction of the Multinational Design Evaluation Programme (MDEP) VICWG and their activities, including key objectives, achievements and challenges going forward. The objective of this session was to provide an overview of the range of challenges facing the nuclear industry including; licensees, manufactures, vendors and suppliers and national regulators in ensuring an adequate oversight of the licensee's extended enterprise and global supply chain management. Panellists shared anticipated challenges given new technologies and the globalisation of the supply chain.

- Ms Paula Madill, Director of Europe, Middle East and Africa (EMEA) Fuels and Manufacturing Sourcing Global Supply Chain Solutions at Westinghouse, United Kingdom, presented on supplier technical readiness. Outlining a risk reduction programme developed by Westinghouse that includes implementing technical assessments before new suppliers are approved, a supplier scorecards system and an approved supplier list, Ms Madill explained that it is risk assessments like these that help to ensure the predictability and stability of Westinghouse requirements at the start of a programme. Conclusively, Ms Madill explained that this particular program was born out of the challenges associated with ensuring the required capability, capacity and culture in the supply chain.
- The Quality Assurance (QA) Senior Manager from Doosan Corporation in Korea, Mr Jeongsun Kim, presented on the supplier evaluation programme for Doosan. Giving first an overview of quality organisation, management systems, and supplier evaluation and control, Mr Kim then went on to specify Doosan's particular approach to supplier evaluation. Chiefly, applicable codes and standards, customer requirements, and regulation requirements are included in Doosan quality specification, which are then transferred to suppliers as a part of a purchase order. Additionally, beyond code requirements, Doosan verifies if suppliers have established and implemented the adequate measures to prevent counterfeit, fraudulent and suspect items (CFSIs), as well as establishing its own countermeasures against CFSIs at the behest of its customers. Following the evaluation, Doosan then determines if the suppliers are qualified to appear on an Approved Vendor List. After the initial qualification, Doosan then performs procurement control and periodic management to ensure the quality of purchased products. Mr Kim expressed that Doosan is facing the similar difficulties in that many competent suppliers are leaving the industry because of economic recessions

and more severe nuclear regulations and requirements compared to other industries. As result, Mr Kim provided several recommendations for a QA protocol: allow utility owners and major component manufacturers to establish their own control measures besides the periodic QA audit; surveillance during service may be more effective than periodic QA audits for service suppliers; a system to use QA audit results performed by other organisations could be implemented, as most of the audit criteria are the same.

- Mr Chris Tierney, of Rolls-Royce, expanded on the topics he addressed in his opening plenary speech. Among them, he reiterated the most significant global supply chain challenges, the risks and concerns for new supply chain entrants, the management of these risks, and the application of new technologies in planning for the future.
- Mr Henri Paillère, NEA, Head Technical Secretariat for the International Framework for Nuclear Energy Cooperation (IFNEC), presented on IFNEC's activities related to the global supply chain and localisation, issues and opportunities. Briefly covering IFNEC's mission statement, organisational structure, publications output and conferences, Mr Paillère focused on the feedback received from the November 2017 conference "Global Supply Chain and Localisation, Issues and Opportunities, A Conference on the Customer Dialogue." Regarding localisation, customers responded that it can provide positive expectations of job creation and increased public support, but communications are needed to align these expectations with supplier commitments. He reported that a significant part of localisation involved customer investment in preparations to support local content, including training and local business development assistance. From the supplier perspective, localisation can increase cost and risk but can make sense if the customer is willing to invest in local content. As suppliers usually favour a diverse supply chain that promotes competition and supports efficiency, quality assurance is a critical issue in selecting sources. From the regulators' perspective, as regulators operate with a variety of relationships and are directly involved with inspections and the quality programmes of vendors in evaluating sources, there remains an important role for industry bodies to promote qualification and/or self-assessments. Mr Paillère concluded that the main challenge lies in maintaining a long-term relationship with the wider supply chain between vendors and suppliers.

In the presentation and the discussions that followed, a number of key points, areas of emergent risks and challenges as well as some recommendations were identified by the participants.

Key points and areas of emergent risks or challenges identified

In general, the discussion highlighted as a key factor that there are different challenges that present themselves between new build nuclear projects and the ageing nuclear operating fleet. Some licensees and vendors struggle with general equipment failure, with operators seeing a decline in expertise and experience; which therefore leads to potentially selecting inappropriate suppliers. This was highlighted as an overall theme of lack of knowledge management and retention. However, the audience also underlined that vendor reduction of their approved suppliers can increase the complexity and number of lower tier suppliers, which conversely can be more challenging to manage. Mr Paillère's presentation was also

referenced again, with the participants echoing the specific issues that accompany localisation.

Recommendations identified for future activities or tasks

In order to prepare for new technologies and emerging challenges, it was emphasised that collaboration between government, regulators and supply chain partners is crucial, particularly as the industry increases its efforts to electrify and digitise in order to produce cleaner, safer and more competitive power generation. Conversely, this must be met with an enhanced inspection co-operation and intelligence exchange, particularly as risks such as interface management are identified in new build programmes. However, the representative from Doosan suggested that the burden of audits should be reduced, in order to lower costs, ensuring that suppliers remain in the nuclear industry. It was also suggested that such models as the Nuclear Advanced Manufacturing Research Centre (Nuclear AMRC) could be more central to the supply chain, as it is a helpful resource to help industry understand what it means to be a supplier in the nuclear field, which is key to success. The Nuclear AMRC is a collaboration of academic and industrial partners from across the nuclear supply chain, with the mission of helping UK manufacturers win work at home and worldwide.

Session 2

Counterfeit, fraudulent, and suspect items (CFSIs) lessons learnt

Mr Olivier Allain, of the French Nuclear Safety Authority (Autorité de sûreté nucléaire - ASN), France provided opening remarks for this session devoted to discussing the lessons learnt from recent experiences with CFSIs in NEA member countries. Considering the CFSIs first detected in 2012 in Korean NPPs and in France a few years later, some questions were raised for regulators:

- What have we missed?
- Are our inspections really effective enough to detect CFSIs?
- Do we trust our licensees too much?
- What are the root causes?
- Who could help us?

Vendors, licensees, third parties and regulators are altogether working to prevent the risk of CFSIs, a common threat. Mr Allain introduced the five panellists who shared their views on the most important challenges and lessons learnt regarding CFSIs and provided their own insights, perspective and recommendations on the following topics: Elements of a comprehensive oversight programme to protect against CFSI risk; Understanding where the risks are; Strategy and plans to monitor and evaluate potential CFSIs; Communicating the adverse impact of CFSIs on nuclear operations and discussing best practices to work with vendors and suppliers to prevent issues; Rebuilding the trust between regulators and the vendor/industry post CFSIs.

- Mr Greg Kaser, Senior Project Manager from the World Nuclear Association (WNA), which represents the global nuclear industry, provided the industry's perspective. The evidence of the presence of CFSIs in the nuclear supply chain was given. The latest significant cases of falsification and the major countries supplying internationally traded counterfeit goods were listed. WNA is conducting a survey of its members, inquiring as to what actions were taken in their organisation to counter CFSIs in the last five years, if the CFSI incidents need to be reported to customers or to the nuclear safety regulator, and the evolution of the number of CFSI incidents detected. The early results are based on too few respondents to be deemed representative, they suggested that there had not been an increase in CFSI cases and the number of cases was very small. The strategies proposed for preventing the infiltration of CFSIs into the nuclear supply chain affect design and specification, procurement, quality assurance, custody and intelligence.
- Mr Luc Berhault, Technical Director of the Électricité de France (EDF) Manufacturing Inspection Body (EMIB) within the Direction Industrielle of EDF, a representative of the French nuclear power plants' operators, presented the

implementation of EDF's action plan to fight against counterfeit and fraudulent items at the manufacturing phase. EDF has experienced few instances of CFSIs; the affected items were mainly documents such as welders' qualifications or material certificates. However, these cases were potentially of significant safety impact and needed a heavy workload to resolve and to justify the conformance of the impacted components with the corresponding quality requirements. Mr Berhault identified that these cases were essentially isolated cases of wrongdoing by individuals, whose behaviour was exacerbated by a lack of individual and collective nuclear safety culture. Mr Berhault highlighted that although the act of fraud among the variety of encountered cases had limited technical impact, the greatest challenge for the organisation is restoring the confidence after the fact, which requires a lot of effort. Mr Berhault presented the process that EDF has instituted for fighting against counterfeit and fraudulent items; which includes carrying out a different surveillance programme with unannounced inspection in suppliers' facilities and confirmatory testing performed with EDF resources or with the help of external independent laboratories. Due to the lack of a formal programme or organisation to manage information sharing and the liability risks for companies and individuals in sharing information early when a case is encountered, especially at the "suspected" stage, Mr Berhault proposed that CFSI issues could be shared in a new industrial group, the GIFEN, a group of French nuclear industrial companies. Finally, Mr Berhault highlighted examples of good practices to help fight against document fraud, particularly with regards to digitisation of records. For example, he suggested affixed QR code or using block chain technology for testing results.

- Mr Simon Emeny, Global Head for Nuclear Inspection Services at Lloyd's Register (LR), a UK third party inspection agency, presented the role of third parties in CFSIs. First, he shared the observation that most civil nuclear operators do direct a great amount of energy towards the detection of CFSIs. As most CFSI issues happened despite the presence of a quality management system and as the role of third parties is to carry out conformity assessments (i.e. to check that the documents and items are in accordance with standards and documented requirements), he raised the question, "What went wrong in the latest CFSI incidents in the nuclear industry?" To answer this question, Mr Emeny pointed out the risk of cumulative effects of a series of minor changes. In order to prevent the occurrence of CFSIs, Mr Emeny therefore recommended to identify the root causes of these minor changes and to have an intelligent selection of conformity assessments. Mr Emeny also highlighted that an effective CFSI policy should not just cover detection, but also nuclear safety culture, prevention and lessons learnt, and insisted that "prevention of CFSI is better than detection" and "detection confirms prevention." Mr Emeny recommended a common CFSI culture to be found across countries, as supply chains lengthen and merge, and demonstrated through the nine key elements of nuclear safety culture defined by the IAEA that nuclear safety culture itself is the leader in both detection and prevention of CFSIs.
- Mr Weoltae Kim, representative from the Korea Institute of Nuclear Safety (KINS), presented the regulatory actions and follow-suit measures in the context of CFSIs detected in 2012 in Korea. Two operating reactors were shut down by a Korean licensee after discovering forged quality assurance documents affecting items installed in these nuclear reactors. After investigating various QA verification documents and discovering the falsification of equipment qualification reports,

other reactors were shut down. The investigation was extended to documents issued by foreign entities. The assessment of follow-up actions for national issued QA documents was completed in September 2015. The review for foreign issued QA documents is still in process. Mr Kim presented the regulatory actions undertaken in this occasion, especially the method of regulatory investigation; such as the assessment of the licensee's investigation on a sampling basis, the results of this investigation for national and foreign QA documents, and the types of follow-up actions for the affected items. Mr Kim also presented the changes brought by the Korean stakeholders to prevent the recurrence of CFSIs. Relatedly, there has been some noted progress: the revision of the Nuclear Safety Act in 2013, the release of the "Act on the Control and Supervision on Nuclear Power Supplies, etc., for the Prevention of Corruption in Nuclear Power Industry" in 2014, the evolution of the regulator's inspection programme, such as the shortening of inspection intervals, the scope of safety culture inspection and the introduction of vendor inspections and as far as resources, the number of inspections have increased. The follow-suit measures from the utility in its QA system management. Mr Kim remarked that the effectiveness of these evolutions is difficult to evaluate. Finally, Mr Kim highlighted the importance of an adequate legal and regulatory system, and the need of a strong regulatory oversight and QA management programme for the whole supply chain to prevent the recurrence of CFSIs.

- Mr Julien Husse, Head of the Inspection Support Mission at the French Nuclear Safety Authority (ASN), presented the lessons learnt from the recent CFSIs in France that have questioned the robustness of the monitoring and inspection chain, and the action plan being implemented by ASN. The action plan is based on high-level arrangements to be implemented by all the actors of the control chain; including: licensees, suppliers, third parties and the nuclear safety authority. The action plan includes the following initiatives:
 - **To inform:** ASN is about to implement a new process for whistleblower protection to capture and assess every type of irregularity in information, CFSIs included. ASN also intends to continue to inform the stakeholders through its annual report.
 - **To improve oversight and inspection practices:** ASN performs inspections of licensees and suppliers' facilities and headquarters and will increase the focus on CFSIs. ASN will recruit inspectors with expertise in fraud detection, and will develop some specific guidance for ASN inspectors.
 - **To use third parties:** ASN is considering the opportunity to perform confirmatory surveillance with the help of external resources, for example on the non-destructive or destructive testing.
 - **To get the control chain fully involved:** ASN supports certification of nuclear suppliers (e.g. ISO 19443) and securing data.

Currently, ASN is facing challenges due to the variety of cases and causes, the consideration for penalties, and with regard to communications involving the justice systems.

Key points identified

Over the course of the discussion, several definitions of CFSIs were given, however it was widely emphasised that to be considered as a case of counterfeiting or fraud, the violation must be wilful. Additionally, as previously discussed, in addressing issues involving CFSIs, prevention is essential, which is guided by a strong nuclear safety culture. Within the context of nuclear safety culture, the concepts of nuclear safety must be disseminated throughout the whole supply chain, from the licensee to the supplier of tier n, and from the management to the workers. This will help make advancements in both detection and prevention of CFSIs. Moreover, the licensee is the main party responsible for nuclear safety, and needs to be fully aware of this responsibility; when choosing its suppliers and when following up on issues with effective supervision and defining an adequate purchasing policy. The importance of the role of third parties was also highlighted, as they support the work of regulatory bodies, especially when they deliver certificates.

Areas of emergent risks or challenges identified

As there is a wide variety of cases and causes of CFSIs, and there is a risk of cumulative effects from a series of minor cases, improving the notification and reporting tools to facilitate the communication and sharing of information will be key, particularly in the context of potential economic consequences for companies, penal consequences, and for data protection. In order to more easily share information, the development of new technologies to help prevent CFSIs was discussed, including the use of QR codes [QR code is an abbreviation for “Quick Response code”] or block chain technology; for example, to improve the traceability of test results. Another challenge that was identified relates to suppliers with aggressive commercial policies that sell overestimated service provisions.

Recommendations identified for future activities or tasks

The following recommendations were identified at the conclusion of the session:

- Increasing the number of unannounced inspections, at every level of the oversight supply chain.
- Putting in place a common shared database. Although there seemed to be no clear consensus on whether the data should be shared internationally, or who should manage it, nor if separate forums should be created for both industry and regulators.
- Making data directly available on websites and easy to check, regarding the legitimacy of items such as numeric certificates of non-destructive testing (NDT) operators or the use of QR codes on third party certificates.

For regulators:

- Consolidating the legislation to give power of investigation to inspectors and to allow regulators to impose fines.
- Consolidating the regulation to require a strong nuclear safety culture within licensees and suppliers.
- Increasing the number of unannounced inspections.
- Carrying out inspections in vendor’s facilities with the presence of the licensee.

- Training inspectors on CFSIs.
- Focusing on original documents and evidence to prove the authenticity of components.
- Developing a whistleblower protection process to be implemented by regulators.

Session 3

Advancing early integration of Safety culture in the supply chain

Ms Molly Keefe-Forsyth, Human Factors and Safety Culture Specialist at the US Nuclear Regulatory Commission (NRC), provided opening remarks for this session and introduced the panellists. The objective of this session was to discuss the impact of safety culture on the integrity of the supply chain, at each level of the supply chain. A strong nuclear safety culture is important for safe nuclear plants worldwide. Nuclear safety culture in the supply chain is difficult to cultivate both by the regulator and the suppliers. The panellist provided their perspective on these topics.

- Mr Dejun Wang, Project Officer from the National Nuclear Safety Administration (NNSA), People's Republic of China, presented on the establishment of nuclear safety culture for equipment vendors in China. Most recently, China introduced a new law in January 2018 to strengthen nuclear regulation, requiring licensees and related equipment suppliers, construction contractors, and service suppliers to develop and establish a clear-cut nuclear safety culture approach. Mr Wang highlighted that currently, the major issue facing the Chinese nuclear equipment manufacturing industry are mistakes related to human factors. As a result, in recent years China has built up its efforts in addressing nuclear safety culture with initiatives including a customised evaluation and nuclear safety culture scoring system, “risk screening” and “look-back” actions to re-check the progress of previous results. China has organised its own nationwide conference to exchange experience and conducted ten different forums based on different equipment catalogues to enhance the effectiveness of experience exchange. Subsequently, between 2014 and 2018 China has taken enforcement actions or sanctioned vendors who did not abide by the laws and regulations. Looking forward, Mr Wang expressed NNSA's desire to complete the development of an online experience feedback system in order to streamline experience feedback work processes and raise efficiency.
- The Commercial Director from EDF Energy, Hinkley Point C (HPC), Mr Ken Owen, presented on building and maintaining a proper safety culture during industrial collaboration, using Hinkley Point C's current construction as an example. As the HPC supply chain continues to expand and diversify during its construction, Mr Owen spoke of contractual and manufacturing excellence that enable technical, procedural, behavioural and organisational development. These principles are supported through ONR's nuclear safety and regulatory requirements, which are spread across the extended supply chain. Mr Owen encouraged further understanding of how ‘commercial’ parameters could potentially adversely impact nuclear safety and quality, and so thus placed particular emphasis on building a collective understanding within an integrated supply chain. He stressed the ‘Contract’ is the key link for doing business. It is often ignored; but understanding how the ‘commercial’ parameters could potential

adversely impact safety and quality is very important and to change or renegotiate it, if needed. He emphasised the need to educate and to build a collective understanding of ‘Client Leadership’ or the concept of the ‘Intelligent Customer.’ Collaboration is the fundamental key to build, reinforce and sustain an integrated supply chain.

- The representative from the US NRC, Ms Molly Keefe-Forsyth, presented on safety culture for nuclear power plant vendors and suppliers. Ms Forsyth highlighted the progress that nuclear safety culture has made within the NRC since the international community began implementing safety culture measures following the Chernobyl accident. From 1989 to 2011, the commission developed a series of policy statements in response to various safety issues they encountered, and included a revision to their Reactor Oversight Process (ROP) to more fully address safety culture. These efforts culminated in the drafting of a final policy statement that covers all aspects of safety culture for licensees, certificate holders, vendors and suppliers. While the NRC Safety Culture Policy Statement is an expectation rather than a requirement, licensees and certificate holders remain responsible for developing adequate measures to ensure a positive safety culture. Ms Forsyth then addressed how these efforts were applied in practice, with a case study examining how the NRC’s oversight resulted in an eventual improvement of safety culture within a supplier.
- The representative from the Finnish Centre for Radiation and Nuclear Safety (STUK) and inspector, Mr Seppo Mahla, presented on safety culture observations in NPPs and NPP projects in Finland. With a regulatory background that specifies STUK as the authority to provide detailed safety requirements concerning the implementation of safety levels in accordance with the Nuclear Energy Act, the design, construction, operation and decommissioning of nuclear power plants must maintain a strong safety culture. In accordance, STUK has published binding guides for management systems, organisation, and personnel of nuclear facilities to promote good safety culture practices. However, it has been noted that in some cases, suppliers’ licensing organisations had significant power over project organisation, which sometimes resulted in the bypassing of adequately viewing safety or technical parts from the suppliers’ organisations. Overall, STUK has made observations of a weakness in leadership within supplier organisations, particularly where the contractor tries to influence the decision-making of its customer. STUK has continued to work on affecting change in behaviour of management and personnel within the supply chain, encouraging open discussion and no-blame environments.
- Two representatives from the Institut de radioprotection et de sûreté nucléaire (IRSN), Ms Céline Poret, Research Engineer in Ergonomics, and Ms Sophie Beauquier, Deputy Head of the Human and Organisational Factors Section, presented on the consideration of safety culture over the course of the supply chain. With an inherently cross-functional organisational structure, IRSN considers the overall performance of the supply chain to be dependent upon collective and cross-cultural factors. Based on past research from IRSN on cross-functional organisations, it was found that the maximisation of the performance at the individual or local level can go against the overall performance. In order to support this transversal performance, the actors must be aware of the interdependencies between their contributions and the common production as a whole must be made visible. Ms Poret and Ms Beauquier went on to exhibit how this questioning was

applied to a concrete case concerning a supply chain issue involving a licensee, vendor, manufacturer and its suppliers. Following quality review and audits, various local action plans were implemented to strengthen the linkages and the relationships between all stakeholders. Following the implementation of the action plan, the representatives introduced a series of follow-up questions regarding their initial research question.

- Was the perceived impact on the safety of daily activities improved after the implementation of the action plan?
- Do the distributed contributions of each actor in the supply chain contribute to a collective performance that goes beyond performance at every stage?
- Is safety built into the articulation between the different actors of the supply chain and not only from the risk management at each step?
- How do the different interdependencies impact overall performance, including safety?
- Are there any specific risks that emerge in each of these interdependencies?

In the presentation and the discussions that followed, a number of key points, areas of emergent risks and challenges as well as some recommendations were identified by the participants. These are described below.

Key points

Several panellists gave their feedback on one of the key questions of the session: how to identify excellence in an organisation's safety culture and which factors establish a healthy safety culture? While there was a general consensus among the participants that it is easier to identify when safety culture is negative vs. positive, many organisations already have mechanisms in place for identifying excellence, including assessments in line with regulations, observing the attitude and openness of workers to report or stop when unsure, tracking early warnings and transparency, and measuring the clear understanding between accountability and disciplinary or punitive actions. It was suggested during the discussion that it is important for organisations to promote excellence observed in safety culture by sharing their observations, in order to create positive reinforcement regarding safety culture implementation. Both Canada and the United States have already begun this practice, making relevant documentation available online. In general, many workshop participants pointed out that safety culture should not be seen as a burden, but that a healthy safety culture is highly beneficial and a good business opportunity.

Areas of emergent risks or challenges identified and recommendations identified for future activities or tasks

The greatest challenge discussed during this session was that of identifying gaps in safety culture before problem occurs. Representatives from France and the United States responded to this question, highlighting that performance indicators gathered by ongoing periodic assessments are the best way to identify these gaps. As such, inspectors must be trained to look for these indicators, as well as identify what kinds of organisational attributes have been demonstrated and the overall reliability within the organisation. When discussing the risks of fraudulent activity, the representative from NNSA recommended responding to the issue directly; by determining the appropriate response between

punishments or warning the vendor about potential issues, as early as possible. It was explained that through this approach, the goal is to receive feedback as quickly as possible to comply with the technical and managerial requirements. Finally, it was recognised that there must be stronger safety culture and supply chain integration in order to build a more collective understanding among all stakeholders.

Session 4

Regulatory approaches for equipment qualification and commercial-grade dedication

Ms Kerri Kavanagh, Vendor Inspection Co-operation Working Group (VICWG) Vice Chair, US Nuclear Regulatory Commission (NRC), provided opening remarks for this session and introduced the panellists. The objective of this session was to discuss regulatory challenges with commercial-grade dedication (CGD), equipment qualification and reverse engineered components. The panellists provided their specialised perspectives on these topics.

- Mr Marc Tannenbaum, Technical Executive from the Electric Power Research Institute (EPRI), presented on the challenges associated with CGD, equipment qualification and reverse engineering. Among them, he discussed in CGD the difficulty of performing failure modes and effects analysis, bounding functions and uses where end-use application is unknown, and the challenge of identifying critical characteristics. In order to manage these challenges, the importance of terminology as a key foundation for knowledge management and application was reiterated. Mr Tannenbaum shared that a course developed by the EPRI, providing step-by-step guidance to address these challenges, is to be rolled out in 2019. Additionally, Mr Tannenbaum discussed the role and application of reverse engineering for addressing obsolescence, with the most significant uses being its ability to produce a functionally equivalent component for either a simple or complex item and to recover characteristic information for CGD, with the understanding of its inherent risks, underpinning assumption and appropriate information to be provided by the licensee. Mr Tannenbaum then showcased several examples and applications of advanced technologies, such as additive manufacturing or three-dimensional printing.
- The representative from Électricité de France/Direction Ingénierie et Projets Nouveau Nucléaire (EDF/DIPNN), Lead Manufacturing Engineer Mr Charles Wadjou, presented on the manufacturing monitoring and in-shop inspection alternative approach to the EDF doctrine. In his description, Mr Wadjou first described EDF's current manufacturing surveillance approach and challenges, giving context for the drivers of this alternative approach, including issues associated with access to documents, conducting inspections and parts manufacturing without client surveillance. The alternative approach was created based on work done by the EPRI, and was described using the procurement of diesel engine power components as an example. After the demonstration of the commercial grade, the approach then identifies critical characteristics with acceptance criteria, selects the verification method and then identifies the adequate tests and inspections. Mr Wadjou then provided clarity on potential components or parts subject to EN, ISO, API, or other standards; where this alternative approach could be applied.

- Mr Oliver Martin, Project Leader from the European Union (EU) Joint Research Centre, presented on the European Commission project “Modernisation and Optimisation of the European Nuclear Supply Chain”. The drivers of the project were first described, mainly the increasing challenges faced by European utilities on their supply chains, including obsolescence, sourcing new Structures, Systems, and Components (SSC) equipment suppliers, conservatives in practice, and the prevailing attitude of nuclear exceptionalism. The project, which aims to modernise the European nuclear supply chain according to the Safety as High as Reasonably Achievable (SAHARA) principle, contains two key objectives. The first is to accelerate the use of standard non-nuclear industry equipment in nuclear facilities without additional nuclear specific regulations. The second objective is to allow the use of SSC equipment manufactured to Alternative Nuclear Standards (ANS), effectively allowing the general use of SSC equipment manufactured according to nuclear codes and standards different to those normally used in-country. Mr Martin described the project’s benefits in safety and other improvements, including the avoidance of the high risk and cost associated with ‘first-of-a-kind’ designs, a reduced potential for common cause failures, the ability of suppliers to standardise deployment of manufacturing techniques, an increased ease in replacing SSC equipment and thereby reducing the number of unplanned shut-downs, and an increased pool of potential suppliers. Mr Martin shared that the publication of the project’s first report is anticipated for mid-2019.
- Ms Kerri Kavanagh presented on the US regulatory oversight process for accepting CGD. To begin, Ms Kavanagh defined the two principal NRC regulatory requirements for CGD: 1) the control of purchased material, equipment, and services; 2) design control. Under the NRC regulatory acceptance process for CGD, a technical evaluation must be executed in order to identify the technical and quality requirements. Next, it must be determined that the acceptance methods to verify that all technical and quality requirements have been met. Under the NRC, there are four acceptance methods used to determine how technical critical characteristics are verified: 1) Special tests and inspections; 2) A commercial-grade survey (which must be used in conjunction with another method); 3) Source verification; 4) An acceptable supplier/item performance record (which must also be used in conjunction with another method). Ms Kavanagh elaborated that the joint inspections of CGD programmes have been a team effort, conducted between industry and the NRC, forming the basis for NRC’s Addenda NQA-1a-2009, “Quality assurance requirements for commercial-grade items and services”. According to the NRC, future goals for regulation will require verification methods to include simulation and not just physical testing to demonstrate that design requirements have been justified. Ms Kavanagh concluded that based upon their activities in this area, the NRC has identified that the key trends associated with CGD in the supply chain include knowledge transfer, poor technical evaluations, and ineffective implementation of the acceptance methods.

Areas of emergent risks or challenges identified

The regulatory approaches for CGD, reverse engineering, and equipment qualification present quite an array of challenges and risks to be managed. In implementing a new approach where the regulatory position has yet to be fully determined, it was expressed that there must be a clarity of boundaries and an improvement in suppliers’ complete understanding of all requirements and critical characteristics. In particular, Ms Kavanagh

identified that there are issues associated with the understanding and effective application of the appropriate acceptance methods for addressing regulatory challenges with CGD, equipment qualification and reverse engineering. This underlines the need for a collective understanding of terminology as the foundation for improving understanding and reducing potential risks. As the technical and safety functionality boundaries must be understood for an effective application, these approaches must be cautiously applied due to the inherent risks they present. Some further potential risks and additional challenges include:

- inconsistent views on what is a ‘like-for-like’ replacement between suppliers;
- undeclared digital content;
- conservatism in practice and reluctance to change approaches by utilities and regulators;
- increased costs and schedule delays;
- difficulties in receiving approvals;
- the shrinking of an effective and agile supply chain pool.

Key points and recommendations identified for future activities or tasks

Overall, equipment qualification, CGD, and reverse engineering present challenges but also an opportunity for the nuclear industry to benefit from new advanced technologies. In particular, Mr Tannenbaum expressed the benefit reverse engineering can provide for obsolescence, where complete engineering information is not available to support the manufacturing of a replacement part. However, further work and investment is required to support the assessments of these technologies, with adequate knowledge capture and transfer to minimise risks. In consideration of potential changes in licensing practices, such as those that will be required to meet the objectives of the European Commission (EC) project, effective interactions with regulators will be essential. In order to raise regulatory awareness of the benefits and areas of potential risks, it was suggested that examples of where reverse engineering has been successfully applied should be shared with VICWG members. In addition, it was recommended that a path forward be facilitated for any gaps or areas where further work is needed and can be addressed by MDEP or NEA Committees and Working Groups. With a clearer forward trajectory, support can more easily be given to bodies such as the EC, in order to increase awareness and benefits of the approach across the various regulatory, licensees, vendor organisations, etc. Regarding the EPRI course that provides a ‘step-by-step’ process on applying reverse engineering techniques that Mr Tannenbaum discussed, it was suggested that an overview of the course could be useful for VICWG members.

Session 5

Enhancing international co-operation to prepare for new technologies and emerging challenges

Mr Greg Kaser, World Nuclear Association (WNA), United Kingdom, provided opening remarks for this session and introduced the panellists. This session was devoted to providing an overview of the current international activities and tools available for national regulators to ensure adequate oversight of the nuclear supply chain. Panellists also shared anticipated regulatory challenges given modularisation, 3-D printing, new manufacturing technologies, small modular reactors (SMRs), advanced reactors and the globalisation of the supply chain. The panellists provided their focused perspectives on these topics.

- Mr Michael Finnerty, the Deputy Chief Nuclear Inspector for the Office for Nuclear Regulation (ONR), UK, and Multinational Design Evaluation Programme (MDEP) Policy Group Member, provided the first presentation of the session. Mr Finnerty centred on an overview of the regulatory activities of the ONR, with a specific emphasis on the current challenges that the nuclear sector faces nowadays, including the loss of competitiveness against other types of energy, emerging technologies that require different regulatory approaches, different contracting models, and modular construction, with regards to how to ensure that modules built off-site can match the regulations of the licensed site. In order to combat these challenges, Mr Finnerty suggested collaborating with international partners in order to learn from their experiences, highlighting that if international regulatory co-operation can occur, this will then inform national policy and aid in the development of good practice through common regulatory positions. Additionally, Mr Finnerty encouraged the engagement between licensees and developers both early on and throughout the supply chain. Finally, Mr Finnerty suggested that regulators should work to establish a consistent approach as enablers, looking for fitful solutions for construction by focusing on the outcome: a low-carbon agenda.
- Mr Marc Tannenbaum, Electric Power Research Institute (EPRI), provided his insights on new technologies in the nuclear industry, including advanced manufacturing, innovative reactor designs, additive manufacturing and digital equipment. Relating nuclear to other industries in the development of new technologies, Mr Tannenbaum described the process of creating prototypes, experiments, and measuring their progress. However, he argued that in contrast, the nuclear industry contains extra steps in the acceptance and implementation stages of new technologies, requiring the confirmation of suitability for nuclear application and additional regulatory approval. Moreover, it was discussed that the approaches and techniques of nuclear quality assurance programmes must be able to be adapted and modernised in order to accommodate new technologies. Mr Tannenbaum then provided several examples of innovations with new technologies that could be used in the building of SMRs: smart manufacturing, digital process controls and highly accurate measurable elements. Particularly in

the case of smart manufacturing, instead of building to ‘meet’ a design, new technologies can build ‘from’ a design, as certain aspects of conformance in design may be inherent in the processes themselves.

- The Senior Expert in Organisation and Management Systems from the International Atomic Energy Agency (IAEA), Dr Pekka Pyy, presented on IAEA activities in the area of supply chain. Going through the current supply chain and procurement trends and challenges, including traditional nuclear countries phasing out their activities, newcomers entering the industry with ambitious programmes, and longer supply chains due to an increasingly globalised economy, Dr Pyy acknowledged the difficulties in achieving quality along the supply chain. Giving special attention to the human factors associated with these challenges, Dr Pyy particularly emphasised the question of how to transmit a proper safety culture with not only newcomer countries, but also new people coming to the industry. In response to these challenges, Dr Pyy showcased several IAEA initiatives, including safety standards related to procurement and supply chain, recent web tools for better supply chain management, and the Peaceful Uses Initiative (PIU), which seeks to provide information and guidance to Member States regarding good practices for management and procurement of supply chain activities.
- Mr Philippe Malouines, Expert in Nuclear Pressure Equipment Codes and Regulations and Professor Emeritus at the French Nuclear Institute of Nuclear Sciences and Technologies (INSTN), presented on the role of standard development organisations (SDOs) in the harmonised assessment of the nuclear supply chain. Beginning in 2007, SDOs began to produce a document of codes comparisons, because there were certain challenges faced by exporters. In Russia, for example; because they often work with different languages in different locations. However, there has not yet been a comparison of processes for the qualification of suppliers. The challenge for the vendor will be to apply its usual code approach and obtain supporting documentation for different projects with specific requirements. In this respect, Mr Malouines advocated for a harmonisation of documents, where a recognised, common format provides reference to all actors involved in the supply chain. This requires not the invention of anything new, but an adaptation of existing approaches.
- Mr Denis Bourguignon of Bureau Veritas and General Secretary of the Nuclear Quality Standard Association (NQSA), presented on maintaining consistent quality in an international supply chain. Noting that when analysing the whole supply chain in the nuclear sector, one can realise how many actors are involved, from the industry, vendors from other industries, different countries, several regulations and several sets of standards. Focusing on quality management systems and ISO 19443:2018 (Quality management systems -- Specific requirements for the application of ISO 9001:2015 by organisations in the supply chain of the nuclear energy sector supplying products and services important to nuclear safety [ITNS]), Mr Bourguignon outlined the structure, benefits, and latest efforts to supplement ISO 19443 through ISO TS 23406. With the goal of promoting the standardisation of supplier oversight through a big-picture assessment approach, these efforts will allow the supply chain to become more competitive and retain adequate quality.

Key points

Throughout the discussion, it was emphasised on several occasions that regulation is not a barrier. If the nuclear industry can continue working to establish consistency in regulation between stakeholders, it will greatly benefit all those involved. Relatedly, there is a need for the nuclear industry to modernise in order to thrive, which will require a shortening of the timeline between the introduction of new technologies and their regulatory process. On the international stage, there were many examples noted of successful cases of sharing information that have helped to form best practices. Yet in sharing information, all participants were in agreement that the importance of the way information is communicated between actors must be upheld.

Areas of emergent risks or challenges identified

One of the overarching challenges identified in this discussion was the growing need for the nuclear industry to adapt and evolve to the rapid changes it is facing, particularly the rising cost of keeping the industry afloat. While there are many norms attached to the industry, some of these may impede creativity and progress, so it was identified that there is a need to modernise the QA toolbox. In terms of new technologies, these innovations present more opportunities for the industry to adapt for the future, but there are significant challenges attached to their implementation. With modular construction, one of the most difficult tasks will be ensuring that modules built off-site match the regulations of the licensed site in a process very different from the way that things have historically been constructed. In terms of digital equipment, this will also be a very challenging transition for the nuclear industry, as there are certain steps with which the industry feels comfortable, so the methods to achieve the same quality with digital technology will need to be re-imagined. Finally, as mentioned in other sessions, there continue to be challenges with new entrants in terms of safety culture, both with emerging countries and new people arriving to the industry.

Session 6: Panel discussion session

International regulatory activities in the oversight of the global nuclear supply chain

Mr Allen opened the session and introduced the panellists, which included Mr Julien Collet, Deputy Director-General of Autorité de sûreté nucléaire (ASN), Mr Michael Finnerty, Deputy Chief Nuclear Inspector at the Office of Nuclear Regulation (ONR), Alexey Ferapontov, Deputy Chairman of Rostekhnadzor, Franck Lignini, Vice Chair of CORDEL (World Nuclear Association - WNA), and Janne Nevalainen, Project Manager at the Finnish Centre for Radiation and Nuclear Safety (STUK). The objective of this session was to reflect on the challenges discussed during the topical sessions and to highlight areas where more effort is needed to develop guidance for a risk-informed graded approach for regulatory oversight arrangements in order to improve effectiveness and prepare for the expected demands of new technology in the nuclear industry's extended enterprise. The panellists also conferred over possible opportunities to further enhance international co-operation for regulators to ensure adequate oversight arrangements for the effective management of the nuclear supply chain and related vendor inspection activities.

To begin the dialogue, Mr Allen asked the panellists to address the following questions relating to the role of international regulatory activities in the oversight of the global nuclear supply chain:

- What role, if any, should the Committee on Nuclear Regulatory Activities (CNRA) or the Multinational Design Evaluation Programme (MDEP) have to risk-inform the oversight of the nuclear supply chain?
- What should the CNRA or MDEP do now to prepare for new technologies, such as small modular reactors (SMRs)?
- What additional activities could be pursued by the CNRA or the Vendor Inspection Co-operation Working Group (VICWG) given the emergent risks discussed and other challenges in the supply chain and what should the associated ambitions be regarding harmonisation of regulatory standards?
- What activities should the CNRA and MDEP take to further develop co-operation between stakeholders?

The panellists provided their perspective on these topics, with an engaging discussion that followed between the panellists and the workshop's participants. The following paragraphs capture the key challenges and emergent risks identified and the panellists' recommendations for future consideration by the CNRA and MDEP.

Areas of emergent risks or challenges identified

More broadly, the panellists and participants were in agreement that one of the greatest challenges for the industry as a whole is the need to continuously reflect on its most current

issues and risks, as well as how they can be overcome. As the challenges associated with supply chains are considered to be exceptionally complex, including an array of such areas as profit, sustainability, cultural differences, mobility, extended enterprises, joint ventures and interfaces, proposed solutions will need to be well thought out and in consideration of these many factors. In terms of the supply chain in general, new technologies such as digital equipment have a key role for the future, but the challenges discussed in Session 4 need to be overcome. This will include ensuring that ‘fit for purpose’ and ‘fit for nuclear’ (F4N) principles are appropriately applied, in order to minimise the risk of ‘ratcheting the standard’ to all that is associated with nuclear, all the way from the licensee to its extended supply chain. Furthermore, the challenge remains for the supply chain to retain focus on outcomes for meeting safe, right, first-time delivery over cost and schedule pressures. As safety was one of the key themes of the workshop, it was also noted that recognising the risks from counterfeit, fraudulent and suspect items (CFSIs) as the number of cases steadily increase will continue to be a challenge, as well as the need for more effective work through local and collaborative regulatory engagement. Relatedly, the sharing of information on CFSIs at the earliest opportunity will be necessary, recognising that there could be potential commercial sensitivities. Regarding oversight, improving the competencies of certifying bodies will be necessary to ensure that the certificate has value. Licensees also face the task of continuing to ensure early engagement with suppliers, enabling expectations to be clearly articulated and understood. Additionally, it was mentioned that the political pressure for localisation over globalisation will be another challenge to address as the supply chain becomes increasingly globalised.

Recommendations identified for future activities or tasks

As it was largely noted that the challenges to the nuclear industry remain highly complex, the discussion suggested that the effort of removing barriers such as uncertainties and “heterogeneities” in the global regulatory processes continue, in order to promote nuclear industry growth. Thus it was recommended to continue working on an international standardisation or harmonisation of nuclear designs, codes and practices, thereby optimising best practices and lessons learnt throughout the life cycle of nuclear facilities, an internationally accepted nuclear reactor design approval and certification process, and increased benefits to safety, economics, policymakers and the general public. This would include enhancing the collaboration between the different stakeholders for a more effective and strategy-based approach for improving the global nuclear industry, particularly in regards to safety. It was suggested that this collaboration be particularly reinforced through regulatory collaboration, enabling consistency across the industry.

Closing remarks

The Chair of the workshop, Mr Collet, concluded what he considered to be a successful workshop. He noted, in particular, the key takeaways and recommendations of each session and how their lessons can be applied to future MDEP and CNRA activities. Finally, Mr Collet thanked the participants for their thoughtful input throughout the two days, as well as the organising committee’s hard work in realising a productive and useful workshop.

4. General workshop conclusions

A broad range of presentations showcasing an overview of current and emerging challenges in managing the nuclear supply chain were given, along with existing and potential approaches from both industry and regulators to deal with such challenges.

Overall, the 2018 Committee on Nuclear Regulatory Activities/Multinational Design Evaluation Programme Workshop on Nuclear Supply Chain Management provided an effective means for participants to be able to interact and share their knowledge, experience and concerns regarding the management of the nuclear supply chain. A number of helpful practices and recommendations were identified for participants to reflect on and share with their home organisations, based on the goal of adapting to new challenges within the nuclear supply chain while reinforcing a strong nuclear safety culture. Some of the main themes and recommendations identified include:

- The need for collaboration between government, regulators, licensees and the supply chain.
- Supply chain regulatory challenges: How to effectively regulate emerging technologies, the digitalisation of manufacturing, modular construction and the correct regulatory approach to deal with obsolescent components.
- The need to continue to ensure effective vendor inspection co-operation and programme intelligence exchange.
- Consideration of the regulatory risks across the extended enterprise and the interface management, as well as their cascading effects upon the supply chain.
- The need to continue focusing on the risks of counterfeit, fraudulent and suspect items (CFSIs), the regulatory co-operation necessary to mitigate the, and improving information sharing where necessary.
- Continuation of the strong promotion of a positive safety culture in the nuclear supply chain.
- An enhanced knowledge of national supply chain mapping to support regulators in targeting areas of risk, as well as to support enhanced regulatory vendor inspection co-operation.
- The need for a collective understanding of terminology associated with commercial-grade dedication (CGD) and equipment qualification.

The recommendations and conclusions from the workshop will serve to inform ongoing activities of the Multinational Design Evaluation Programme (MDEP) Vendor Inspection Co-operation Working Group (VICWG) and provide the basis for the Committee on Nuclear Regulatory Activities (CNRA) to decide on future activities or tasks, as necessary. The possibility of developing the workshop's findings into further literature, most likely an updated or new green booklet on the topic, is contingent upon the forthcoming response of both the CNRA's and MDEP's Steering Committee and Policy Group.

5. Workshop evaluation form results

5.1 Evaluation form

All participants at the workshop were requested to complete an evaluation form upon the completion of the workshop. The results of this questionnaire are summarised below, and will be used by the NEA Committee on Nuclear Regulatory Activities (CNRA) Multinational Design Evaluation Program (MDEP) and the Vendor Inspection Co-operation Working Group (VICWG) in setting up future workshops and to look at key issues in their respective programmes of work. Of the 84 total registered participants, 34 responses were received.

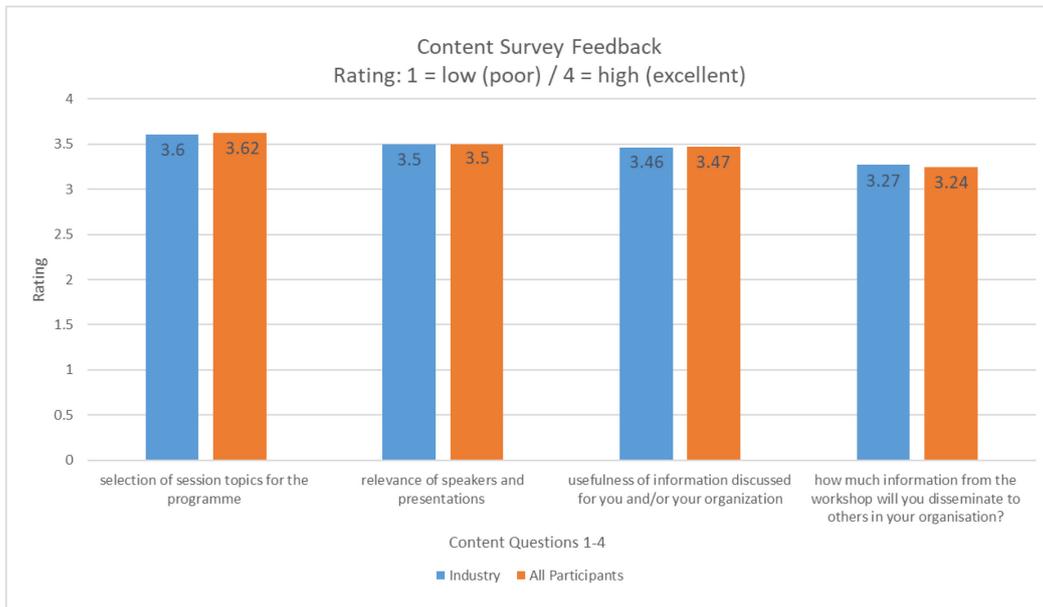
The evaluation form asked questions in three areas: content, format and future workshops. Participants were asked to rate the content and format sections on a scale of 1 to 4 (with 1 being a low/poor score and 4 being a high/excellent score). The future workshops section was a series of four questions to be answered yes or no. The evaluation form's 18 questions were followed by a section for additional comments or suggestions. Responses of industry representatives were compared with the entire group's response in order to isolate and gauge the level of satisfaction of industry participation in the workshop. In general, industry responses were comparable to all participants' responses. Results are provided in the following charts along with a brief written summary.

5.2 Content

This first section of the questionnaire asked respondents to gauge the quality of content in the workshop. The main objective of these questions was to first understand if the content was apropos to the discussions participants were wanting to engage in, and second to see if the content would be useful for participants and their organisations into the future.

The responses to the content questions indicate that overall, there was high satisfaction with the content of the workshop. Most of the participants were happy with the selection of session topics (average 3.62 with a range of response from 3 to 4). The relevance of speakers and presentations was generally praised by all respondents (average 3.5 with a range of response from 3 to 4). The information discussed was perceived to be quite useful for a respondent and/or their organisation (average 3.47 with a range of response from 2 to 4). The lowest content score was that of how much information from the workshop would one disseminate to others in their organisation (average 3.24 with a range of response from 2 to 4), however the score still reflects a fairly high sense of satisfaction.

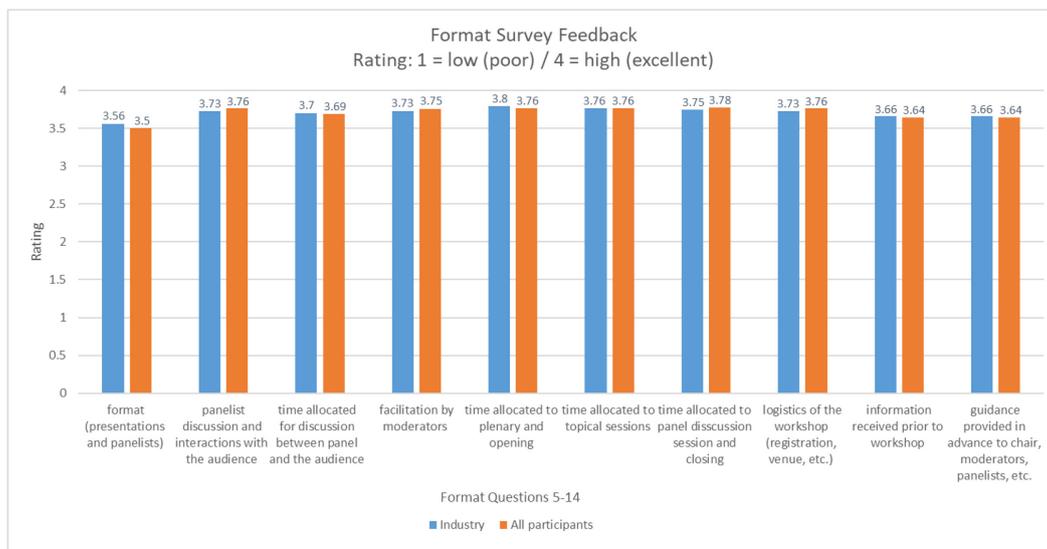
Feedback from participants on the content



5.3 Format

The survey questions regarding format looked at the effectiveness of the sessions and how they were conducted. The responses will provide feedback to the CNRA/MDEP and VIGWG in their preparation and planning for future workshops.

Feedback from participants on the format



The response questions regarding the format of the workshop overall received excellent feedback. The results confirmed that the workshop organisers were successful in preparing and running the workshop. The success of each workshop is dependent on good preparation by the CNRA/MDEP and co-ordination between the facilitators and recorders for each topic. As discussed in previous proceedings, social interaction and informal directions outside the workshop sessions clearly enhances the discussion.

5.4 Future workshops

The final section of the survey focused on future workshops. The main objective of these questions was to understand the need for future workshops, taking into account format, content and frequency. Respondents were asked yes or no to four questions, and were asked to explain further in the comments section if they answered “no”.

Overall, most respondents endorsed the possibility of future workshops, and the results showed that most participants agreed with the existing format, duration and topics addressed.

5.5 Future workshops

Additional feedback from participants is provided below:

- *I think if repeated, the sessions may be similar but in 2 years I'm sure we will have moved on, so please check and maybe rethink topics to remain relevant.*
- *Presentation material should be distributed before the presentation if possible.*
- *The format worked very well. The same topics should be discussed, but more specialised in novel/new ways to manufacture e.g. re-engineering, 3-D printing of components.*
- *The organisation of this workshop was fantastic and very impressive. I'm sure that the participation of industry is essential and dialogue between regulatory and industry is very important.*
- *It might be good to have some working sessions in formatting the conference. Where a specific topic is selected to produce some workshop notes with leads/ideas on how to move forward on some challenges, it would likely require an extension of the duration of the workshop.*
- *It could be interesting to have a presentation from suppliers' points of view.*
- *Great format, short set of presentations followed by discussion. More coffee breaks (max sitting time 1.5 hours), hold presenters to time limits.*
- *CFSIs and safety culture are complementary topics. It was great to schedule them for the same day.*

6. List of participants

| | | |
|---------------------|-------------------------------|--------------------|
| BELGIUM | Vincotte | Philippe CALLENS |
| BELGIUM | Foratom | Richard IVENS |
| BELGIUM | Westinghouse Electric | Julie GORGEMANS |
| CANADA | CNSC | Eric DESGAGNE |
| CHINA | NNSA | Dejun WANG |
| CZECH REPUBLIC | SUJB | Jan JIROUSEK |
| European Commission | European Commission | Oliver MARTIN |
| European Commission | European Commission | Yvan POULEUR |
| FINLAND | STUK | Seppo MAHLA |
| FINLAND | STUK | Janne NEVALAINEN |
| FINLAND | Fennovoima Oy | Tatu HIETALA |
| FINLAND | Fennovoima Oy | Matti KAUKONEN |
| FINLAND | Fennovoima Oy | Maiju LINTUNEN |
| FINLAND | Fennovoima Oy | Ranjit NARAYANAN |
| FINLAND | Fennovoima Oy | Jarkko VIRTANEN |
| FINLAND | Fennovoima | Jussi VUOTI |
| FRANCE | ASN | Olivier ALLAIN |
| FRANCE | ASN | Julien COLLET |
| FRANCE | ASN | Erik DUCOUSSO |
| FRANCE | ASN | Thierry GRANIER |
| FRANCE | ASN | Julien HUSSE |
| FRANCE | ASN | Thierry LECOMTE |
| FRANCE | ASN | Jean-Dominique |
| FRANCE | ASN | Laure MONIN |
| FRANCE | IRSN | Sophie BEAUQUIER |
| FRANCE | IRSN | Marc LE CALVAR |
| FRANCE | IRSN | Karine HERVIOU |
| FRANCE | IRSN | Céline PORET |
| FRANCE | ASAP | Francois COLPART |
| FRANCE | Bureau Veritas | Denis BOURGUIGNON |
| FRANCE | CEA | Eric PICHEREAU |
| FRANCE | COFREND | Francois CHAMPIGNY |
| FRANCE | COFREND | Xavier LE GOFF |
| FRANCE | EDF | Luc BERHAULT |
| FRANCE | EDF | Frederic BOURDIN |
| FRANCE | EDF | Bruno MARQUIS |
| FRANCE | EDF | Fabien SAUVADET |
| FRANCE | EDF/DIPNN | Charles WADJOU |
| FRANCE | ENGIE INEO NUCLÉAIRE | Henri BUSCARINI |
| FRANCE | Framatome | Claude MAYORAL |
| FRANCE | GIIN | Haikel BEN AOUN |
| FRANCE | Institut de Soudure Industrie | Vincent GELAIN |
| FRANCE | INSTN | Philippe MALOUINES |
| FRANCE | Orano | Maritie CHAMBILLE |
| FRANCE | Orano | Virak YUTH |
| IAEA | IAEA | Pekka PYY |

6. List of participants (continued)

| | | |
|-------------------|---|---------------------|
| JAPAN | NRA | Yusuke KASAGAWA |
| JAPAN | Kansai Electric Co., Inc. | Kenji YAMADA |
| JAPAN | Mitsubishi Heavy Industries | Tetsuya TSUJI |
| KOREA | KINS | Sangjin KIM |
| KOREA | KINS | Weoltae KIM |
| KOREA | DOOSAN HEAVY | Jeongsun KIM |
| NEA | NEA | Thomas |
| NEA | NEA | William MAGWOOD |
| NEA | NEA | Kamishan MARTIN |
| NEA | NEA | Malisol OHIRKO |
| NEA | NEA | Henri PAILLÈRE |
| NEA | NEA | Antonio VAYA SOLER |
| NEA | NEA | Belkys SOSA |
| NETHERLANDS | ANVS | Rik VAN DER LINDE |
| NIGERIA | Nigerian Nuclear Regulatory Authority | Bashir DIMARI |
| RUSSIA | Rostechnadzor | Alexey FERAPONTOV |
| RUSSIA | VO "Safety" | Irina GLAZUNOVA |
| RUSSIA | VO "Safety" | Vladimir GORBACHEV |
| RUSSIA | Bureau Veritas | Kirill MIKHALKIN |
| RUSSIA | ROSATOM | Dmitry VASHURKIN |
| SOUTH AFRICA | NNR | Avinash SINGH |
| SPAIN | Asco&Vandellós Nuclear Association (ANAV) | Fernando MIRALLAS |
| SPAIN | CNAT | Raul FERNANDEZ |
| SWEDEN | SSM | Leif KARLSSON |
| SWITZERLAND | Apollo Plus | Natalia AMOSOVA |
| SWITZERLAND | Apollo Plus | John KICKHOFEL |
| UNITED KINGDOM | ONR | Stuart ALLEN |
| UNITED KINGDOM | ONR | Michael FINNERTY |
| UNITED KINGDOM | ONR | Samaneh NOURAEI |
| UNITED KINGDOM | Atomic Acquisitions | Biplab RAKSHI |
| UNITED KINGDOM | EDF Energy | Ken OWEN |
| UNITED KINGDOM | Lloyd's Register | Simon EMENY |
| UNITED KINGDOM | Rolls-Royce | Chris TIERNEY |
| UNITED KINGDOM | SWMAS Ltd - Somerset Energy Innovation | Nick GOLDING |
| UNITED KINGDOM | Westinghouse | Paula MADILL |
| UNITED KINGDOM | ONR | Meenu GANGAHAR |
| UNITED KINGDOM | FORATOM | Nathan PATERSON |
| UNITED STATES | NRC | Kerri KAVANAGH |
| UNITED STATES | NRC | Molly KEEFE-FORSYTH |
| UNITED STATES | NRC | Rodney WHITE |
| UNITED STATES | EPRI | Marc TANNENBAUM |
| UNITED STATES | Westinghouse | Rick EASTERLING* |
| WANO Paris Center | WANO Paris Center | Ingemar ENKVIST |
| WNA | WNA | Greg KASER |
| WNA/CORDEL | WNA/CORDEL | Franck LIGNINI |

Appendix A: Workshop programme

Day 1 | Monday, 5 November 2018

8:30-9:00: Registration and welcoming coffee

9.00-9.15: Welcome and opening remarks

Workshop Chair: Mr Julien Collet, Autorité de sûreté nucléaire (ASN) Deputy Director-General
Nuclear Energy Agency (NEA) Director-General: Mr William D. Magwood, IV

9.15-10.00: Plenary session: Emerging Challenges with globalisation of the nuclear supply chain

Rolls-Royce is a world leading supply chain provider operating across a diverse and technically demanding range of industries including the nuclear supply chain. In the United Kingdom alone, Rolls-Royce has over 300 certified nuclear suppliers in a supply chain that Rolls-Royce has been active in for over 50 years. The guest speaker will discuss the challenges facing global suppliers when providing nuclear equipment to countries developing their nuclear supply chain and local manufacturing resources and discuss emerging challenges with new manufacturing technology and small modular reactors (SMRs).

Plenary Speaker: Mr Chris Tierney, Executive Vice President, Rolls-Royce, United Kingdom – *Emerging Challenges with Globalisation of a Nuclear Supply Chain*

10.00-10.30: Coffee break

10.30-12.00: Session 1: Global supply chain oversight challenges

The objective of this session is to provide an overview of the range of challenges facing industry (manufactures/vendors/suppliers) and national regulators in ensuring adequate oversight of the licensee's extended enterprise global supply chain management. Panellists could share anticipated challenges given new technologies and the globalisation of the supply chain.

- How diversification of manufactures, modular fabrication, innovative manufacturing techniques, SMR, and other new technologies are set to impact the global supply chain in the future
- Concerns about counterfeit, fraudulent and suspect items (CFSIs)
- Safety culture issues
- Equipment qualification, commercial-grade dedication and reverse engineered components

Session co-ordinator: Mr Stuart Allen, Multinational Design Evaluation Programme (MDEP) Vendor Inspection Co-operation Working Group (VICWG) Chair, UK Office of Nuclear Regulation (ONR)

Panellists:

Mr Stuart Allen, Vendor Inspection Co-operation Working Group (VICWG) Chair, ONR – *Regulation of the Civil Nuclear Industry Supply Chain, international co-operation through the MDEP VICWG*

Ms Paula Madill, Director, EMEA Fuels and Manufacturing Sourcing Global Supply Chain Solutions, Westinghouse, UK

Mr Jeongsun Kim, Quality Assurance Senior Manager, Doosan Corporation, Korea – *Supplier Evaluation Program*

Mr Chris Tierney, Executive Vice President, Rolls-Royce

Mr Henri Paillère, NEA, Head Technical Secretariat for the International Framework for Nuclear Energy Cooperation (IFNEC) – *Global supply chain & localisation, outcomes of the IFNEC Nuclear Supplier & Customer Countries Engagement Group activities*

12.00-13.30: Lunch break

13.30-15.30: Session 2: Counterfeit, Fraudulent, and Suspect Items (CFSI) lessons learnt

The objective of this session is to discuss the lessons learnt from recent experiences with CFSIs. Panellists should share the most important challenges and lessons learnt regarding CFSIs and provide their insights and recommendations.

- Elements of a comprehensive oversight program to protect against CFSI risk
- Understanding where the risks are, and why enhanced vigilance is also required for non-safety-related components during construction and operation
- Strategy and plans to monitor and evaluate potential CFSIs
- Communicating the adverse impact of CFSIs on nuclear operations and discussing best practices to work with vendors and suppliers to prevent issues
- Rebuilding the trust between regulators and the vendor/industry post CFSI-related issues

Session co-ordinator: **Mr Olivier Allain**, ASN

Panellists:

Mr Greg Kaser, Senior Project Manager, WNA – *CFSIs in perspective and the nuclear industry's response*

Mr Luc Berhault, Technical Director of the EDF Manufacturing Inspection Body, France – *Implementation of an action plan to fight against fraudulent and counterfeit items within EDF*

Mr Simon Emeny, Lloyd's Register, UK – *CFSI – Prevention before detection*

Mr Weoltae Kim, KINS – *Regulatory Actions and Follow-suit Measures against the Korean NPPs' CFSI-related Issues*

Mr Julien Husse, Head of the Inspections Support Mission, ASN, presents the strategy of control carried out at ASN to address CFSI-related issues

15.30-16.00: Coffee break

16.00-17.30: Session 3: Advancing early integration of safety culture in the supply chain

The objective of this session is to discuss the impact of safety culture on the integrity of the supply chain, i.e. at each level of the supply chain.

- Identifying the attributes of a nuclear-grade supplier in terms of safety and quality management responsibilities
- Ensuring that a positive nuclear safety culture is integrated within the supply chain in the early stages
- Evaluating how the interfaces between the different parts of the supply chain collaborate to ensure safety
- Discussing where the likely roadblocks will be; and recommending a plan of action

Session co-ordinator: Ms Molly Keefe-Forsyth, US Nuclear Regulatory Commission NRC

Panellists:

Mr Dejun Wang, Project Officer, NNSA, People's Republic of China – *The Establishment of nuclear safety culture for equipment vendors in China*

Mr Kenneth Owen, Commercial Director, EDF Energy, Hinkley Point C (HPC), United Kingdom

Ms Molly Keefe-Forsyth, Human Factors/Safety Culture Specialist, NRC – *Safety culture for nuclear power plant vendors and suppliers*

Mr Seppo Mahla, Inspector, STUK, Finland – *Safety culture observation in NPPs and NPP projects in Finland*

Ms Céline Poret, Research Engineer in Ergonomics/**Ms Sophie Beauquier**, Deputy Head of the Human and Organizational Factors Section, IRSN, France – *Considering safety culture over the course of the supply chain: IRSN's approach for R&D and expertise*

17.30-17.45: Closing – Day 1

Day 2 | Tuesday, 6 November 2018

8.30-9.00: Welcoming coffee

Workshop Chair: Mr Julien Collet, ASN Deputy Director-General
Welcome participants to Day 2 of the workshop

09.00-11.00: Session 4: Regulatory approaches for equipment qualification and commercial-grade dedication

The objective of this session is to discuss regulatory challenges with commercial-grade dedication (CGD), equipment qualification, and reverse engineered components.

- Understanding the process for CGD and equipment qualification
- Identifying critical characteristics and verifying acceptability by inspections, tests, or analyses by the purchaser or third-party dedicating entity
- Understanding the acceptance process for items and services
- Evaluating how the interfaces between the different parties of the supply chain work to ensure quality management
- Assessing obsolescence issues and the risks of reverse engineering

Session co-ordinator: Ms Kerri Kavanagh, VICWG Vice Chair, NRC

Panellists:

Mr Marc Tannenbaum, Technical Executive, Electric Power Research Institute (EPRI), United States – *Challenges with Commercial-Grade Dedication, Equipment Qualification, and Reverse Engineering*

Mr Charles Wadjou, Lead Manufacturing Engineer, EDF/DIPNN, France – *Manufacturing Monitoring & In-shop Inspection – Alternative Approach to the EDF Doctrine*

Mr Oliver Martin, Project Leader, European Union (EU), Joint Research Centre – *European Commission Project "Modernisation & Optimisation of the European Nuclear Supply Chain"*

Ms Kerri Kavanagh, VICWG Vice Chair, NRC – *US regulatory oversight of commercial-grade dedication*

11.00-13.00: Lunch break

13.00-15.00: Session 5: Enhancing international co-operation to prepare for new technologies and emerging challenges

The objective of this session is to provide an overview of the current international activities and tools available for national regulators to ensure adequate oversight of the nuclear global supply chain. Panellists could also share anticipated regulatory challenges given modularisation, three-D printing, new manufacturing technologies, SMR, advanced reactors, and the globalisation of the supply chain.

Session co-ordinator: **Mr Greg Kaser**, WNA

Panellists:

Mr Michael Finnerty, Deputy Chief Nuclear Inspector, ONR – *ONR Regulation on nuclear Supply Chain*

Dr Pekka Pyy, Senior Expert, Organization & Management Systems, International Atomic Energy Agency (IAEA) – *IAEA activities in the area of supply chain*

Mr Denis Bourguignon, Nuclear technical and development manager, Bureau Veritas, France – *Challenges in maintaining consistent high quality in an international supply chain*

Mr Philippe Malouines, Expert in Nuclear Pressure Equipment Codes and Regulations, French Nuclear Institute of Nuclear Sciences and Technologies (INSTN)

Mr Marc Tannenbaum, Technical Executive, EPRI – *Challenges Associated with Implementing New Technologies*

15.00-15.30: Coffee break

15.30-17.20: Panel discussion session – International regulatory activities in the oversight of the global nuclear supply chain

The objective of this session is to reflect on the challenges discussed during the topical sessions and highlight areas where more effort is needed to develop guidance for a risk-informed graded approach for regulatory oversight arrangements in order to improve effectiveness and prepare for the expected demands of new technology in the nuclear industry's extended enterprise. The aim is also to identify opportunities to further enhance international co-operation for regulators to ensure adequate oversight arrangements for the effective management of the nuclear supply chain and related vendor inspection activities.

Session moderator: **Mr Stuart Allen**, ONR

Panellists:

Mr Julien Collet, ASN, Deputy Director-General, MDEP STC Chair, and CNRA Member for France

Mr Michael Finnerty, Deputy Chief Nuclear Inspector, ONR and MDEP Policy Group Chair

Mr Alexey Ferapontov, Deputy Chairman, Rostekhnadzor, Russia

Mr Janne Nevalainen, Project Manager, Nuclear Reactor Regulation, STUK

Mr Franck Lignini, World Nuclear Association, Vice Chair of CORDEL, Framatome

17.20-17.30: Closing session

The chair of the workshop will provide a brief summary of the workshop and discuss the key messages and recommendations from the Panel Discussion Sessions on Day 2.

Workshop Chair: **Mr Julien Collet**, ASN Deputy Director-General

17.30: Conclusion

Appendix B: Presentations

The presentations (Appendix B) presented during the workshop can be found on the Nuclear Energy Agency website at www.oecd-nea.org/nsd/workshops/nscm2018/presentations/.