

# **NUCLEAR SAFETY RESEARCH JOINT PROJECTS WEEK**

## **Success Stories and Opportunities for Future Developments**

**9-13 January 2023**

# **PROGRAMME**



# **NUCLEAR SAFETY RESEARCH JOINT PROJECTS WEEK: SUCCESS STORIES AND OPPORTUNITIES FOR FUTURE DEVELOPMENTS**

**9-13 January 2023, 13:00-16:00 CET, Zoom Webinar**

(This online workshop takes place in three-hour slots each day to allow full international participation.)

Since its inception, the NEA has provided a highly flexible and powerful platform for multinational research co-operation, particularly in areas related to providing understandings and insights needed to improve global nuclear safety. For decades, the projects conducted under NEA auspices have enabled nuclear safety regulators and industry from NEA member countries – as well as partners that are not members of the NEA – the ability to share research costs and results that have informed regulations and practices around the world and facilitated the harmonisation of nuclear safety rules and practices around the world.

The **NEA Nuclear Safety Research Joint Projects Week** has been established to recognise the many accomplishments achieved by the international community in the course of these projects over the last four decades. High-level panels and a series of technical sessions will review the main benefits of NEA safety research joint projects and discuss how the established framework, research platforms and networks could support future developments in the nuclear energy sector, thereby facilitating innovation and greater harmonisation.

This workshop brings together stakeholders from the nuclear energy sector, including regulators, representatives from technical support, research and international organisations, as well as industry representatives to share views on research frameworks, platforms and competences needed in order to maintain or develop future collective nuclear safety research in the nuclear energy sector. Based on the experience gained through NEA safety research joint projects, workshop participants will also share recommendations for the development of future collaborative international research ventures at the NEA to support innovation.

## **Workshop objectives**

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The objective of this workshop is to review the experience gained in the last 40 years of NEA nuclear safety research joint projects. Event participants will discuss the benefits of the development of technical bases for the demonstration of safety and reflect on how safety research joint projects contribute to shaping the collective intelligence that connects the industry, regulators and research organisations on key safety aspects. Participants will also exchange on how to preserve key research facilities and key competences currently at risk that contribute to the education of young researchers, as well as the production of high quality data sets for safety codes development and validation; most of these data sets are available to NEA member countries through the NEA Data Bank.

The event will also provide a forum to discuss maintenance and evolution of the established frameworks, research platforms and networks to open up opportunities for supporting the continued safe operation of nuclear power plants and to ease the licensing process of new reactor designs and systems, including small modular reactors (SMRs) and innovative safety systems. In particular, different technology developers, technical and scientific support organisations (TSOs) and experimental researchers operating research facilities will discuss areas for co-operation and resource sharing for experiments, code validation activities and related competences.

## Structure

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The workshop is organised in three main streams:

- During the first day participants will take stock of the existing overall experience and discuss the main benefits of NEA joint projects, as well as opportunities for evolution of the joint projects framework and infrastructures.
- The following three days will be devoted to reviewing concrete examples of joint projects in safety in design, in operation, and in accidents addressing technical fields such as accident analysis and management, fuel safety, safety of systems, structures and components including reliability of innovative design safety solutions, etc., highlighting successful aspects, lessons learnt, as well as current and future challenges.
- The last day will focus on summarising the discussions from the first four days and providing recommendations for future research initiatives.

## Challenges addressed

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The workshop will address the following challenges:

- Challenge 1 – How safety research joint projects could best ensure safety research is carried out in an efficient and effective manner for the benefit of all stakeholders of the nuclear energy sector, given their future expectations for both conventional and a variety of innovative technologies?
- Challenge 2 – How safety research joint projects could better serve development and maintenance of key competences and research infrastructures, including the education of new talent for the future of the nuclear energy sector?
- Challenge 3 – What should be the new approaches and arguments for facilitating decisions from public and private stakeholders of the nuclear energy sector to fund the future safety research joint projects for the benefit of nuclear innovation and safety in general?
- Challenge 4 – What mechanisms should be set to establish future priorities for international co-operation in nuclear safety research?

## Day 1 – **Monday, 9 January 2023**

### **Session 1: Nuclear Safety Research Joint Projects: Benefits and Challenges for the Future**

**Moderator:** William D. MAGWOOD, IV, Director-General, Nuclear Energy Agency (NEA)

**Introduction** ➤ **William D. MAGWOOD, IV**

**13:00-13:20** ➤ **Véronique ROUYER**, Head of the NEA Division of Nuclear Safety Technology and Regulation (SAF)

➤ **A regulator's views**

**13:20-13:45** **Raymond FURSTENAU**, Director, Office of Nuclear Regulatory Research, United States Nuclear Regulatory Commission (USNRC), United States

▶ **A TSO's views**

**13:45-14:10** **Jean-Christophe NIEL**, Director-General, Institut de Radioprotection et de Sûreté Nucléaire (IRSN), France

▶ **A utility's views**

**14:10-14:35** **Manuel CARRASCO**, Deputy Director of the Design and Technology Branch of the New Builds Engineering and Projects Directorate, Électricité de France S.A., France

**14:35-14:50** **Break**

**14:50-16:00** ▶ **Panel discussion**

- *How can joint safety research projects best support the evolution and development of the nuclear sector, as well as the maintenance of key competences and research infrastructures? Which mechanisms can guarantee public and private stakeholder support?*
- **Panellists:** William D. MAGWOOD, IV; Raymond FURSTENAU; Jean-Christophe NIEL; Manuel CARRASCO; Professor Sevostian BECHTA, Head of the Division of the Nuclear Power Safety, Royal Institute of Technology (KTH), Sweden

## **Speakers:**

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- **Véronique ROUYER**, Head of the NEA Division of Nuclear Safety Technology and Regulation
- **Raymond FURSTENAU**, Director, Office of Nuclear Regulatory Research, United States Nuclear Regulatory Commission (USNRC), United States
- **Jean-Christophe NIEL**, Director-General, Institut de Radioprotection et de Sécurité Nucléaire (IRSN), France
- **Manuel CARRASCO**, Deputy Director of the Design and Technology Branch of the New Builds Engineering and Projects Division, Électricité de France S.A., France

## **Panellists:**

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- **William D. MAGWOOD, IV**, Director-General, Nuclear Energy Agency (NEA)
- **Raymond FURSTENAU**, Director, Office of Nuclear Regulatory Research, United States Nuclear Regulatory Commission (USNRC), United States
- **Jean-Christophe NIEL**, Director-General, Institut de Radioprotection et de Sécurité Nucléaire (IRSN), France
- **Manuel CARRASCO**, Deputy Director of the Design and Technology Branch of the New Builds Engineering and Projects Division, Électricité de France S.A., France
- **Professor Sevostian BECHTA**, Royal Institute of Technology, Sweden

## **Moderator:**

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- **William D. MAGWOOD, IV**, Director-General, Nuclear Energy Agency (NEA)



**Mr William D. MAGWOOD, IV**, is the Director-General of the OECD Nuclear Energy Agency (NEA) since September 2014. Prior to this position, he served from 2010 to 2014 as one of the five Commissioners appointed by the US President and confirmed by the US Senate to the US Nuclear Regulatory Commission (NRC). From 2005 to 2010, he provided independent strategic and policy advice on energy, environmental and technology policy issues. From 1998 to 2005, Mr Magwood was Director of Nuclear Energy at the US Department of Energy (DOE). During his tenure, he launched several important initiatives including the Generation IV International Forum (GIF) and the formation of the Idaho National Laboratory (INL). He began his career working as a scientist for Westinghouse Electric Corporation and managing electric utility research and nuclear policy programmes at the Edison Electric Institute. Mr Magwood, a US national, holds Bachelor's degrees in Physics and English from Carnegie Mellon University and a Master of Fine Arts from the University of Pittsburgh.



**Ms Véronique ROUYER** is the Head of the NEA Division of Nuclear Safety Technology and Regulation since August 2019. She supports the Director-General of the NEA in enhancing the technical excellence of the Agency's work and in ensuring high standards of safety in the use of nuclear energy by contributing to the development of effective and efficient regulation and oversight of nuclear installations, and by helping to maintain and advance the scientific and technological knowledge base. Prior to joining the NEA, Ms Rouyer was the Safety Research Director in the French Institut de Radioprotection et de Sûreté Nucléaire (IRSN), the French Technical Support Organisation to the public authorities dealing with radiation protection and nuclear safety. She managed nuclear safety research activities and programmes including numerous co-operative activities that comprised experimental facilities and simulation codes development platforms. In addition, she gained extensive experience in the development and co-ordination of scientific programmes plans as Deputy Director for the scientific projects, strategy, development and partnerships division, a role she held between 2009 to 2016. Previously, she managed and co-ordinated IRSN criticality safety activities, assuming positions of increasing responsibility over 15 years, including in areas such as nuclear fuel cycle facilities and safety assessment and evaluation of the transport of radioactive materials. She was also very involved in academic and professional training activities. Ms Rouyer holds a Graduate Chemical Engineering Master Degree from the Polytechnic Institute of Toulouse and a Master's Degree in Nuclear Engineering from the Institut National des Sciences et Techniques Nucléaires (INSTN).



**Mr Raymond FURSTENAU** has been the Director of Nuclear Regulatory Research at the US Nuclear Regulatory Commission since July 2018. Prior to joining the NRC, from 1987 to 2018, he held several leadership positions in the US Department of Energy's Office of Nuclear Energy. During most of those years, Mr Furstenu provided US government oversight of nuclear facility operations, and nuclear energy research & development programmes at the Idaho National Laboratory. Mr Furstenu holds a BS degree in Applied Science and Engineering from the US Military Academy and

a MS degree in Nuclear Science and Engineering from Idaho State University. He is a registered professional nuclear engineer.



**Dr Jean-Christophe NIEL** is Director General of the French Institute of Radiation Protection and Nuclear Safety (IRSN). Over 30 years Dr Jean-Christophe NIEL has gained a long experience in the control of nuclear safety and in radiological protection through various positions, at the Institut de Radioprotection et de Sûreté Nucléaire (IRSN), French technical safety organisation and at Autorité de sûreté nucléaire (ASN), the French nuclear safety authority. He was Director General of ASN for almost 10 years. The President of the French Republic appointed Jean-Christophe Niel as the head of IRSN in April

2016. He was reappointed in April 2021 for a further five years. Dr Niel currently chairs the NEA Committee on the Safety of Nuclear Installations (CSNI). He has recently been appointed member of the International Nuclear Safety Group (INSAG) by the Director General of IAEA, Raphael Grossi.



Since 2018, **Manuel CARRASCO** has been Deputy Director of the Design and Technology Branch of the Nuclear Engineering and New Build Projects Division of EDF. He is responsible for R&D programmes management, for continuously improving and delivering EDF technical engineering standards and for the monitoring of International Safety Standards. Prior to this appointment, Manuel Carrasco worked in the EDF EPR2 project direction where he was in charge of Safety, Security, Licensing and Nuclear Pressurised Equipment regulation implementation. Before occupying

these positions at EDF, he was Head of the Safety and Reactor Process division at Framatome where he spent around 30 years occupying diverse positions. Manuel Carrasco currently serves as Chair of the EUR association, the utility association addressing the European Utilities Requirements for Generation III NPPs and represents EDF at the the European Nuclear Installations Safety Standards Initiative (ENISS) steering committee.





**Professor Sevostian BECHTA** is the Head of the Division of Nuclear Power Safety at Royal Institute of Technology (KTH), Sweden since September 2011. He has 35 years' experience of R&D in nuclear engineering and safety, reactor thermal hydraulics, fuel behaviour, severe accidents and material science. He is a member of the NEA Working Group on Analysis and Management of Accidents (WGAMA) and a member of the High Scientific Council of the European Nuclear Society. He has authored and co-authored over 100 journal papers and holds ten patents, contributed in writing several NEA state of the art reports, as well as technical reports for both the NEA and IAEA. Prior to joining KTH, he held several research and leadership positions at the Research Institute of Technology of ROSATOM, and Research and Design Institute for Energy Technologies, St Petersburg. He contributed to severe accident management concepts of various VVER designs employing in-vessel melt retention and ex-vessel core catchers, safety systems and new class of functional materials such as sacrificial materials for corium retention. He received his MS and PhD degree in nuclear engineering from St Petersburg Polytechnic State University.

## Day 2 – **Tuesday, 10 January 2023**

### **Session 2: Joint Projects for Safety in Design, Learnings and Perspectives**

**Moderator:** Jinzhao ZHANG, Technical Director, Business Area Global Nuclear, Tractebel (ENGIE), Belgium

**Introduction** ➤ **Didier JACQUEMAIN**, NEA/SAF, Senior Nuclear Safety Specialist

**13:00-13:10**

➤ **Jinzhao ZHANG**

**13:10-14:00**

▶ **Examples of Nuclear Fuel Safety Projects**

QUENCH-ATF, **Dr-Ing Th. Walter TROMM**, Head of the Nuclear Waste Management, Safety and Radiation Research Programme (NUSAFE), Karlsruhe Institute of Technology (KIT), Germany

*CABRI CIP, **Vincent BUSSER**, CABRI CIP Project Manager, Institut de Radioprotection et de Sûreté Nucléaire (IRSN), France*

**14:00-14:50**

▶ **Examples of Primary and Secondary Side Circuit Thermal-Hydraulics, Passive Safety Systems Projects**

ATLAS, **Kyoung-Ho KANG**, Principal Research, Director, Korea Atomic Energy Research Institute (KAERI), Korea

RBHT, **Steve BAJOREK**, Senior Technical Advisor for Thermal Hydraulics (USNRC), United States

**14:50-15:00**

**Break**

**15:00-16:00**

▶ **Panel Discussion:** Perspectives for Nuclear Safety Research Programmes and Frameworks to support Evolutionary and Advanced Designs (e.g. NEA Framework for Irradiation Experiments – FIDES)

▶ **Panellists:** Walter TROMM; Kyoung-Ho KANG; Steve BAJOREK; Jonathan WRIGHT, Head of the Fuel Materials Centre of Excellence at Westinghouse Electric Company, Sweden; Ki-Yong CHOI, Senior Vice-President of Intelligent Nuclear Safety Research Department, KAERI, Korea; François BARRÉ, Deputy Director of Safety Research, Institut de Radioprotection et de Sûreté Nucléaire (IRSN), France

## Speakers:

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- **Dr-Ing Th. Walter TROMM**, Head of the Nuclear Waste Management, Safety and Radiation Research Programme (NUSAFE), Karlsruhe Institute of Technology (KIT), Germany
- **Vincent BUSSER**, CABRI CIP Project Manager, Institut de Radioprotection et de Sûreté Nucléaire (IRSN), France
- **Kyoung-Ho KANG**, Principal Research, Director, Korea Atomic Energy Research Institute (KAERI), Korea
- **Steve BAJOREK**, Senior Technical Advisor for Thermal Hydraulics (USNRC), United States

## Panellists:

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- **Dr-Ing Th. Walter TROMM**, Head of the Nuclear Waste Management, Safety and Radiation Research Programme (NUSAFE), Karlsruhe Institute of Technology (KIT), Germany
- **Kyoung-Ho KANG**, Principal Research, Director, Korea Atomic Energy Research Institute (KAERI), Korea
- **Jonathan WRIGHT**, Head of the Fuel Materials Centre of Excellence at Westinghouse Electric Company, Sweden
- **Steve BAJOREK**, Senior Technical Advisor for Thermal Hydraulics (USNRC), United States
- **Ki Yong CHOI**, Senior Vice-President of Intelligent Nuclear Safety Research Department, KAERI, Korea
- **François BARRÉ**, Deputy Director of Safety Research, Institut de Radioprotection et de Sûreté Nucléaire (IRSN), France

## Moderator:

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- **Jinzhao ZHANG**, Technical Director, Business Area Global Nuclear, Tractebel (ENGIE), Belgium



**Dr Jinzhao ZHANG**, is a Technical Director, Business Area Global Nuclear, at Tractebel (ENGIE). He is in charge of nuclear fuel design, safety analysis and licensing. He has 40 years' experience of R&D, engineering and consulting in nuclear reactor thermal hydraulics, fuel thermal mechanics, multi-physics modelling, uncertainty and sensitivity analysis, safety analysis and licensing. He is an active member of the NEA Working Group on Analysis and Management of Accidents (WGAMA), Working Group on Fuel Safety (WGFS) and Expert Group on Reactor Fuel Performance (EGRFP); the IAEA

Technical Working Group on Fuel Performance and Technology (TWGFPT) and the Pressurized Water Reactors Owners Group (PWROG) Analysis Sub-Committee (ASC). He has contributed to writing or updating safety guides, technical guidance and technical reports for the IAEA and the NEA in his domain of expertise. Currently, Dr Zhang is Chair of the Management Board of the NEA Rod Bundle Heat Transfer (RBHT) Project, and task leader of the NEA WGAMA/WGFS activity to write a Status Report on Good Practices for Analyses of Design Extension Condition without Significant Fuel Degradation (DEC-A) for Operating Nuclear Power Plants. He is also the co-chair of the IAEA Coordinated Research Project on Testing and Simulation for Advanced Technology and Accident Tolerant Fuels (ATF-TS).



**Dr Th. Walter TROMM** is Head of the Programme Nuclear Waste Management, Safety and Radiation Research (NUSAFE) at Karlsruhe Institute of Technology (KIT). In 2014, he was appointed to the executive committee of KIT's Division 3, Mechanical and Electrical Engineering. In 2019 he was appointed as acting head of the Institute of Nuclear and Energy Technology and in 2022 he was appointed scientific spokesperson of the KIT Energy Center. He is active in various national and international committees, at the NEA where he is the German representative at the Nuclear Science Committee

and Data Bank Management Board for the Development, Application and Validation of Nuclear Data and Codes, and at the IAEA where he serves in the Technical Working Group on Advanced Technologies in Light Water Reactors. Furthermore, he is member of the German Alliance of Competence in Nuclear Technology and within the VDI, the Association of German engineers, he is Chairman of the Power Plant Technology Committee and a member of the Energy and Environment Division.



**Dr Vincent BUSSER** obtained his PhD in Mechanics and Materials in France, in which he focused on the studies of the damage of the zirconia layer formed at the outer surface of a fuel rod submitted to a mechanical loading, for instance during a control rod ejection transient. After completing his PhD, he worked at the IRSN on the modelling of fuel and cladding behaviour including base irradiation, transportation and storage conditions with the FUEL+ platform numerical codes. He recently returned to the accidental condition domain, serving as the CABRI International Programme (CIP) project manager at IRSN. IRSN is the operating agent of this programme, involving 15 partners from 12 countries under the aegis of the NEA.



**Dr Kyoung-Ho KANG** is a principal researcher at KAERI since 1995. His major research interests include thermal hydraulic integral effect testing and system-scale safety analysis for pressurised water reactors. He was also involved in the experimental programme for the verification of new safety systems implemented on advanced light water reactors such as the APR1 400, APR+ and iPOWER. Since 2014 he has played a leading role in co-ordinating the NEA ATLAS international joint project with the aim of enhancing safety analysis technology and resolving safety issues. Dr Kang is currently working as director of the KAERI innovative system safety research division at KAERI and is fully responsible for thermal-hydraulic safety R&D.



**Dr Stephen M. BAJOREK** is the Senior Technical Advisor for Thermal-Hydraulics at the US Nuclear Regulatory Commission (NRC) in the Office of Nuclear Regulatory Research, and has forty years' experience in the nuclear industry. He provides guidance for development of the TRACE state-of-the-art thermal-hydraulics code, advanced reactor analysis, and the NRC's thermal-hydraulic test programmes. He is currently leading the NRC's efforts to develop simulation capabilities for advanced non-light water reactors. Prior to joining the NRC staff, he was a member of the faculty at Kansas State University and has over 15 years of industrial experience with Westinghouse as a code developer and analyst. He has authored or co-authored over 200 publications in areas ranging from boiling and two-phase flow, reactor safety, natural convection, and boiling of multi-component fluids. Dr Bajorek received his PhD from Michigan State University, and MS and BS degrees in Mechanical Engineering from the University of Notre Dame.



**Mr Jonathan WRIGHT** is a Fellow Engineer and since 2020 head of the Westinghouse Fuel Materials Centre of Excellence. His current work involves co-ordinating global R&D and membership of international programmes. He has worked with nuclear fuel development for over 20 years in a variety of roles including technical leadership, strategy development and departmental management. Prior to joining Westinghouse in 2005 he helped develop MOX fuel at BNFL and was for three years a secondee at the Halden Reactor Project. He continued to work on advanced fuel pellets at

Westinghouse, BWR cladding development and more recently ATF coated cladding plus Triso fuel for micro reactors. Mr Wright, a dual UK and Swedish citizen, holds a Masters and undergraduate degree in Chemistry from Oxford University and an MBA from Warwick University.



**Dr Ki Yong CHOI** has been working as a principal researcher at Korea Atomic Energy Research Institute (KAERI) since 2000. His major research interests include experimental and analytical works on thermal-hydraulic phenomena and model development related to the advanced light water reactors such as APR1 400, APR+ and SMART. He was also involved in the development of system-scale safety analysis code SPACE and modelling a heat transfer package. He has expertise in the design, operation, control, and scaling analysis of thermal-hydraulic experimental facilities. Code uncertainty analysis is

also one of his research interests. He served as director of nuclear thermal-hydraulic safety and severe accident research division in KAERI until 2019. His responsibilities included managing more than 30 domestic and international projects. During this time, he was engaged in many international co-operation projects. In particular, he played a leading role in co-ordinating the 50<sup>th</sup> NEA international standard problem (ISP-50) and NEA joint projects. He also served as a Working Group on Analysis and Management of Accidents bureau member from 2017 to 2020, where he reviewed and provided expert opinions on the ongoing projects and newly proposed R&D activities. He is currently serving as Dean of the UST-KAERI school which he joined as a faculty member in 2012. He also served as Executive Editor of the journal *Nuclear Engineering and Technology* (2015-2021) and is now serving as associated editor of the Board of Nuclear Energy section of *Frontiers in Energy Research* since 2020. He is a Chair-elect of the Thermal-Hydraulic Division (THD) of the Korean Nuclear Society. Dr Choi is currently working as a senior vice-president of intelligent nuclear safety research department of KAERI and is fully responsible for the nuclear safety R&D. The operation of the research reactors, including HANARO and international research reactors, are also his responsibility.



Since obtaining a PhD in neutronics, **Dr Francois Barré** has spent his career working in the area of nuclear reactors. He has been Deputy Director of Safety Research at France's Institut de Radioprotection et de Sûreté Nucléaire (IRSN) since 2011.

Dr Barré has participated in various research activities in the field of experimental thermal-hydraulics with the Commissariat à l'énergie atomique et aux énergies alternatives (CEA) for 12 years, and with the Japan Atomic Energy Agency (JAEA). He was responsible for the development of the CATHARE code, which was sponsored by Électricité de France (EDF), Framatome, CEA and IRSN and is widely used in several countries for safety analysis.

Within IRSN, he was the Head of a research department involved in severe accidents, nuclear fuels and thermal-hydraulics. As Deputy Director for Safety Research, he participates in the definition of R&D programmes in the field of nuclear safety and fosters international collaboration with most of the countries involved in nuclear energy. He is also actively involved in the European Sustainable Nuclear Energy Technology Platform (SNETP) and in the European Union Framework Programmes for Research and Technological Development.

He has collaborated closely for several years with the NEA; he was Co-chair of the Accident Management Working Group and is currently involved in the Committee on the Safety of Nuclear Installations (CSNI), in particular as a member of the CSNI Programme Review Group, as well in the FIDES Governing Board and in several Joint Projects.

## Day 3 – **Wednesday, 11 January 2023**

### **Session 3: Joint Projects for Safety in Operation, Learnings and Perspectives**

**Moderator:** Alex VIKTOROV, Canadian Nuclear Safety Commission (CNSC), Canada, Director-General, Directorate of Power Reactor Regulation

**Introduction** ➤ **Markus BEILMANN**, NEA/SAF, Nuclear Safety Specialist

**13:00-13:10** ➤ **Alex VIKTOROV**

**13:10-14:00** ▶ **Examples of Fire Research Projects**

*FIRE-DB, **Marina RÖWEKAMP**, Senior Expert, Gesellschaft für Anlagen- und Reaktorsicherheit (GRS), Germany*

*PRISME, **Sylvain SUARD**, Head of Fire Experimentation Laboratory, (IRSN), France*

**14:00-14:25** ▶ **Example of a Human Technology and Organisation Project**

*Halden HTO, **Andreas BYE**, Chief Scientist, Programme Manager of the OECD NEA Halden Human-Technology-Organisation (HTO) Project, Institute for Energy Technology (IFE), Norway*

**14:25-14:50** ▶ **Example of a Material Ageing Project**

*SMILE, **Lotta NYSTRAND**, Senior Technical Sales Manager, Studsvik, Sweden*

**14:50-15:00** **Break**

**15:00-16:00** ▶ **Panel Discussion:** Perspectives for Nuclear Safety Research Programmes and Frameworks to Support Safe Operation of Nuclear Facilities

▶ **Panellists:** Marina RÖWEKAMP; Sylvain SUARD; Andreas BYE; Lotta NYSTRAND; Jean SMITH, Electric Power Research Institute (EPRI), US; Raoul AWAD, Federal Authority of Nuclear Regulation (FANR), UAE; Wei GAO, Nuclear Power Operations Research Institute (NPRI), China



## Speakers:

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- **Marina RÖWEKAMP**, Senior Expert, Gesellschaft für Anlagen- und Reaktorsicherheit (GRS), Germany
- **Sylvain SUARD**, Head of Fire Experimentation Laboratory, (IRSN), France
- **Andreas BYE**, Chief Scientist, Programme Manager of the OECD NEA Halden Human-Technology-Organisation (HTO) Project, Institute for Energy Technology (IFE), Norway
- **Lotta NYSTRAND**, Senior Technical Sales Manager, Studsvik, Sweden

## Panellists:

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- **Marina RÖWEKAMP**, Senior Expert, Gesellschaft für Anlagen- und Reaktorsicherheit (GRS), Germany
- **Sylvain SUARD**, Head of Fire Experimentation Laboratory, (IRSN), France
- **Andreas BYE**, Chief Scientist, Programme Manager of the OECD NEA Halden Human-Technology-Organisation (HTO) Project, Institute for Energy Technology (IFE), Norway
- **Lotta NYSTRAND**, Senior Technical Sales Manager, Studsvik, Sweden
- **Jean SMITH**, Electric Power Research Institute (EPRI), United States
- **Raoul AWAD**, Federal Authority of Nuclear Regulation (FANR), UAE
- **Wei GAO**, Nuclear Power Operations Research Institute (NPRI), China

## Moderator:

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- **Alex VIKTOROV**, Canadian Nuclear Safety Commission (CNSC), Canada, Director-General, Directorate of Power Reactor Regulation



**Mr Alexandre (Alex) VIKTOROV** has been with the CNSC, the Canadian regulatory authority for over 25 years, and currently hold the position of the Director General for Power Reactor Regulation. As such, he has responsibility for the licensing and regulatory oversight of all power reactors in the country. Prior to becoming the DG, he had been involved or led diverse activities and projects within the CNSC, such as relicensing and subsequent execution of oversight at Pickering nuclear power plant, regulatory evaluation of safety analysis with particular focus on best estimate and uncertainty methodology, Design Extension Conditions, implementation of Canadian post-Fukushima actions, fuel and containment behaviour. Before joining the CNSC, Alex was engaged in research and safety analysis of nuclear facilities.



**Dr Marina RÖWEKAMP** holds a Diploma in Physics and PhD (Dr. rer. nat.) in Physical Chemistry/Materials Science from University of Bonn, Germany. She is the Senior Chief Expert for Hazards (internal and external with a specific focus on fires) and for Probabilistic Safety Assessment (PSA) at GRS (Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) gGmbH) – the Federal German Nuclear Technical Safety Organisation (TSO) – where she has served for more than 34 years. She is the Chair of the NEA Fire Incidents Records Exchange (FIRE) Project for all six project phases, the NEA CSNI Expert Group on Fire Risk (EGFR), the NEA joint projects PRISME 2 and PRISME 3 and is current Vice-Chair of NEA CSNI Working Group on Risk Assessment (WGRISK) after having been Chair for seven years. She is the German member of the NEA joint projects HEAF and HEAF 2.



**Dr Sylvain SUARD** is the Head, since 2016, of the Fire Experimental Laboratory at the Institut de Radioprotection et de sûreté Nucléaire (IRSN). He is also the IRSN Project Leader of the third phase of the NEA PRISME joint project and Vice Chair of the Programme Review Group (PRG) for the OECD HEAF joint project. Prior to this, he conducted researches in the field of fire modelling, sensitivity analysis and verification and validation of numerical models. He received a Master's degree in fluid mechanics and energetics flows from Paris VI University and a PhD in Combustion, Energetic and Thermal Sciences from the University of Provence.



**Mr Andreas BYE** is Chief Scientist at IFE (Institute for energy technology) in Norway and is heading the NEA Halden Human-Technology-Organisation (HTO) Project since 1<sup>st</sup> January 2021. He has been working at IFE for more than 30 years focusing on Human Factors and Human Reliability Analysis (HRA) work. Andreas Bye is member of the international HRA Society Board and the steering group of the Norwegian Human Factors in Control Association.



**Ms Lotta NYSTRAND** is Senior Technical Sales Manager at Studsvik, Sweden, with 30 years of working experience mainly involving the corrosion of fuel and reactor materials. Her experience varies from Senior Technical Sales Manager to Project Management, and to corrosion of Fuel and Reactor Materials and to Failure Analysis. She holds a MS (1987) in Engineering Physics, from the Chalmers University of Technology in Gothenburg, Sweden.

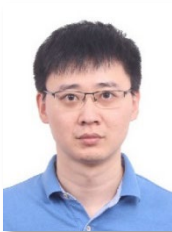


**Dr Jean SMITH** is Programme Manager for the International Materials Research (IMR) Program at the Electric Power Research Institute (EPRI). She joined EPRI in 2010 as a Senior Project Manager in the Materials Reliability Programme (MRP), and prior to her current position, she was a Principal Technical Leader in IMR. In both IMR and MRP, her research focused on irradiated materials testing, environmentally-assisted fatigue, and failure analysis support. Previously, Dr Smith was a corporate engineer at Exelon (now Constellation Energy) providing support to the nuclear fleet in the areas of materials degradation management, corrosion prevention, and component failure analysis. She also held a graduate research appointment at Argonne National Laboratory where she investigated the reduction of fatigue life of austenitic stainless steels exposed to light water reactor environments. Dr Smith began her career in the petroleum industry as a metallurgist for Texaco Research and Development supporting all aspects of petroleum production including exploration, refining, and finished products. She holds a Bachelor of Science in metallurgical engineering from Missouri University of Science and Technology and Master of Science and doctorate degrees in materials engineering from Rensselaer Polytechnic Institute.



**Mr Raoul AWAD** is the Deputy Director General leading the Operations Division at the UAE Federal Authority for Nuclear Regulation (FANR) where he is charged with carrying out regulatory and advisory functions in the areas of nuclear and radiation safety, safeguards, and security in accordance with UAE nuclear law. Previously, he was the Director General of Regulatory Improvement and Major Projects Management Directorate at The Canadian Nuclear Safety Commission (CNSC). He was responsible for supporting the CNSC's mission and mandate by managing the licensing of new

innovative nuclear technologies including small modular reactors, implementing the CNSC management system, managing the planning and performance process, and co-ordinating cross-cutting corporate improvement initiatives. Until 2016, he was the Director General of Security and Safeguards Directorate. In this capacity, he was responsible for developing, implementing and maintaining programmes to ensure that adequate security measures were in place for the protection of nuclear facilities and nuclear material in Canada and to ensure Canada's conformity with international obligations and commitments. In addition, he was responsible for developing, implementing and maintaining CNSC's Nuclear Emergency Management Programme. Until 2009, Mr Awad worked as Director of the Operation and Engineering Assessment Division in the CNSC, where he was responsible for providing regulatory leadership and expertise on mechanical, civil and material engineering. Prior to 1997, Mr Awad worked on multiple projects related to design, inspection and assessment and multiple research projects. In 1980, Mr Awad completed a mechanical engineering degree and in 2004, he completed a master's degree in Business Administration at Université du Québec à Montréal (UQAM). He has published a number of Technical Papers and Articles in the area of structure integrity and of key safety-related structures, systems, and components.



**Mr Wei GAO** has been a PSA engineer in the CNRP Nuclear Power Operations Research Institute (NPRI) since 2021. He is currently the team leader for NPRI's risk-informed decision making programme. From 2019 to 2020, he was a graduate research associate at Ohio State University and conducted research on risk and reliability analysis. After graduating, he served as a PSA engineer at the Shanghai Nuclear Engineering Research and Design Institute (SNERDI) from 2011 to 2018. He was the team leader for several Seismic PSA projects. He also developed some PSA-related software,

including a fault tree solver and a risk monitor system. Wei Gao holds a Bachelor's degree in nuclear engineering and technology from Harbin Engineering University and a Master's degree in nuclear energy science and engineering from SNERDI.

## Day 4 – **Thursday, 12 January 2023**

### **Session 4: Joint Projects for Safety in Accidental Situations, Learnings and Perspectives**

**Moderator:** *Hideo NAKAMURA, Japan Atomic Energy Agency (JAEA), Japan, Technical Associate*

**Introduction** ➤ **Martina ADORNI**, NEA/SAF, Nuclear Safety Specialist

**13:00-13:10** ➤ **Hideo NAKAMURA**

**13:10-14:00** ▶ **Examples of Containment Thermal-Hydraulics, Mitigation Systems and Hydrogen Risk Management Projects**

*THAI/THEMIS, **Sanjeev GUPTA**, Deputy General Manager, Head of Reactor Safety & Engineering, Becker Technologies, Germany*

*HYMERES/PANDA, **Domenico PALADINO**, Leader Experimental Thermal-Hydraulics group at the Paul Scherrer Institute, Switzerland*

**14:00-14:25** ▶ **Example of an Accident Progression and Melt Coolability In-Vessel and Ex-Vessel Project**

*ROSAU, **Jeremy LICHT**, Nuclear Engineer, Principle Investigator for the ROSAU Project, Argonne National Laboratory, US*

**14:25-14:50** ▶ **Example of a Source Term Project**

*STEM/ESTER, **Christophe MARQUIE**, Deputy Head of the Experimental Department, Institut de Radioprotection et de Sûreté Nucléaire (IRSN), France*

**14:50-15:00** **Break**

**15:00-16:00** ▶ **Panel Discussion:** Perspectives for Nuclear Safety Research Programmes and Frameworks to Enhance Management of Accidents

▶ **Panellists:** Sanjeev GUPTA; Domenico PALADINO; Jeremy LICHT; Christophe MARQUIE; Katharina STUMMEYER, Head of Division, Project Management Agency, Gesellschaft für Anlagen- und Reaktorsicherheit, (GRS), Germany; Won-Pil BAEK, Senior Research Fellow, Korea Atomic Energy Research Institute (KAERI), President of the Korean Nuclear Society, Korea

## Speakers:

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- **Sanjeev GUPTA**, Deputy General Manager, Head of Reactor Safety & Engineering, Becker Technologies, Germany
- **Domenico PALADINO**, Leader Experimental Thermal-Hydraulics group at the Paul Scherrer Institute, Switzerland
- **Jeremy LICHT**, Nuclear Engineer, Principle Investigator for the ROSAU Project, Argonne National Laboratory, United States
- **Christophe MARQUIE**, Deputy Head of the Experimental Department, Institut de Radioprotection et de Sûreté Nucléaire (IRSN), France

## Panellists:

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- **Sanjeev GUPTA**, Deputy General Manager, Head of Reactor Safety & Engineering, Becker Technologies, Germany
- **Domenico PALADINO**, Leader Experimental Thermal-Hydraulics group at the Paul Scherrer Institute, Switzerland
- **Jeremy LICHT**, Nuclear Engineer, Principle Investigator for the ROSAU Project, Argonne National Laboratory, United States
- **Christophe MARQUIE**, Deputy Head of the Experimental Department, Institut de Radioprotection et de Sûreté Nucléaire (IRSN), France
- **Katharina STUMMEYER**, Head of Division Project Management Agency, Gesellschaft für Anlagen- und Reaktorsicherheit, (GRS), Germany
- **Won-Pil BAEK**, Senior Research Fellow, Korea Atomic Energy Research Institute (KAERI), President of Korean Nuclear Society, Korea

## Moderator:

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- **Hideo NAKAMURA**, Japan Atomic Energy Agency (JAEA), Japan, Technical Associate



**Dr Hideo NAKAMURA** was born in 1956 at Nagoya, Japan and he received BA in Nuclear Engineering (1979), MS in Crystalline Material Engineering (1981) and PhD in Nuclear Engineering (1992), all from Nagoya University. He joined the former Japan Atomic Energy Research Institute (JAERI) at Tokai, Japan in 1981 to work for the ROSA (Rig-of-Safety Assessment) programme to study accident thermal-hydraulic phenomena for both BWR & PWR with prototypical integral-effect tests and separate-effect tests as well as safety analysis code/model developments. He was the head of the Thermo-hydraulic Safety Research Group from 2001 to 2013 involving DBA, BDBA and SA, and the head of operating agent for the NEA ROSA and ROSA-2 joint projects with LSTF experiments for LWR safety assessments from 2005 to 2012. The project was terminated to concentrate on analyses of the Fukushima Daiichi accident in 2011. He was an executive editor of *Nuclear Engineering and Technology* from 2015 to 2020. Currently, he is a Technical Associate at the Japan Atomic Energy Agency (JAEA), where he has served since 2018, and Chair of the NEA Working Group on Analysis and Management of Accidents (WGAMA) since 2022.



**Dr Sanjeev GUPTA** is Deputy General Manager, and Head of the Reactor Safety and Engineering divisions of Becker Technologies in Eschborn, Germany. He obtained his PhD in Fluid Mechanics from the École des Mines de Nantes, France. Dr Gupta joined Becker Technologies GmbH in 2008 as Head of the Experimental Programme. Before joining Becker Technologies, he worked with the French Atomic Energy Commission (CEA), France and the Paul Scherrer Institut (PSI), Switzerland, on large scale, experimental test facilities in hydrogen safety and nuclear reactor thermal-hydraulics. The current focus of his work is on severe accident research in LWRs with particular focus on combustion risk and source term issues. His current work responsibilities include the development and management of international R&D and industry projects. He is programme manager for the ongoing international joint nuclear safety project NEA THAI Experiments on Mitigation measures, and source term issues to support analysis and further Improvement of Severe accident management measures (THEMIS) and actively involved in NEA activities such as the Working Group on Analysis and Management of Accidents (WGAMA). Dr Gupta is also co-ordinating the ongoing international in-kind project IPRESCA related to source term research. He is Governing Board member of the European SNETP Association and actively involved in IAEA activities as an Expert and Lecturer.



**Dr Domenico PALADINO** is Leader of the Experimental Thermal-hydraulics group at the Paul Scherrer Institute, Switzerland. He graduated in Nuclear Engineering from la Sapienza Università di Roma in Italy and he holds a PhD in Energy Technology from the KTH Royal Institute of Technology in Sweden. He works at the Paul Scherrer Institute in Switzerland as Leader of the Experimental thermal-hydraulics group and manager of projects with experiments carried out in the the Multipurpose Integral Test Facility for LWR Safety Investigations (PANDA) thermal-

hydraulics facility. His research activities imply nuclear safety, containment thermal-hydraulics experiments and analyses.



**Mr Christophe MARQUIE** graduated in 1996 from Centrale-Supelec engineering school with a specialty in nuclear engineering. Since then he has been working at the Institut de Radioprotection et de Sûreté Nucléaire (IRSN), first as test director on the CABRI reactor devoted to the study of reactivity accidents, as well as on FBR and PWR reactors. He participated to the REPNA-1 task force implemented under the NEA's aegis. In 2001, he became project engineer for the CABRI project in charge of experimentation and hot lab co-ordination for the NEA CIP Project. In 2005, he was

nominated as head of the engineering laboratory in charge of the design of test devices for IRSN safety research like CABRI test devices (CIP project) or CHIP facility (STEM Project). In 2015, he became project leader for the ODOBA (project devoted to concrete ageing) and DENOPI (spent fuel pool accidents project). As such, he participated to the NEA CAPS ASCET (concrete ageing) and the NEA PIRT on Spent Fuel Pool. Since 2019, he is deputy head of the experimental department in Cadarache in charge of severe accident and ageing projects. He is also project leader of the ESTER project.



**Dr Jeremy LICHT** is a Nuclear Engineer in the Nuclear Science and Engineering Division at Argonne National Laboratory. One of his roles at Argonne is principal investigator for the NEA ROSAU project that is the focus of this conference's presentation. He received his BS in Physics and MS/PhD in Nuclear Engineering and Engineering Physics from the University of Wisconsin. Following this, Jeremy worked at the Canadian Nuclear Laboratories (formally AECL) for five years supporting CANDU-related experiments and analyses in reactor safety. In 2013 he moved back to the

United States to work at Argonne, where he has since been supporting reactor safety and non-proliferation activities.





**Dr Katharina STUMMEYER** is Head of the Project Management Agency at the Gesellschaft fuer Anlagen- und Reaktorsicherheit (GRS) gGmbH. This specialised division of GRS implements and co-ordinates nuclear safety research programmes on behalf of German Federal Ministries. The topics covered range from reactor safety research programmes to research on waste management and on nuclear decommissioning. She has extensive experience in research management and a profound overview of the German nuclear safety research community. She is engaged in the German

Alliance for Competence in Nuclear Technology and the current spokesperson of the German Network of Project Management Agencies in Research Funding. On the international level, she is vice-chair of the NEA Nuclear Education, Skills and Technology (NEST) Framework, member of the NEA Gender Balance Task Group, member of the Committee on the Safety of Nuclear Installations (CSNI) and active in several joint projects. She graduated in 2000 from the Leibniz University in Hanover and holds a Doctoral degree in Natural Sciences (Dr. rer. nat). She was active as researcher at the MH Hannover (X-Ray Crystallography and radiation protection) before she joined GRS in 2009.



**Dr Won-Pil BAEK** is a senior research fellow at the Korea Atomic Energy Research Institute (KAERI) and President of the Korean Nuclear Society. Dr Baek graduated from nuclear engineering department of Seoul National University in 1982 and completed his master and PhD degrees in nuclear engineering at KAIST in 1984 and 1991, respectively. Dr Baek worked for Doosan Heavy Industries as an engineer and for KAIST as researcher and research professor before joining KAERI. In 2001, he was invited by KAERI to lead the Thermal Hydraulics Safety Research Group. In 2007 his role was

expanded to include severe accident and heavy water reactor safety R&D. He promoted to Vice President for Nuclear Safety Research in 2010, Executive Vice President in 2015, and Acting President for several months in 2019. In particular, he led the design, construction and initial operation of the ATLAS facility. Dr Baek chaired the Committee on the Fukushima Accident as well as the Thermal Hydraulics and Safety Division of the Korean Nuclear Society. He has also served as member of the advisory committees of several government ministries including MSIT, MOTIE, NSSC, MOFA and MOIS. Dr Baek has been very active in NEA working groups and committees since 2002. He was a member of the Working Group on Analysis and Management of Accidents (WGAMA), the Programme Review Group as well as the Bureau of Committee on the Safety of Nuclear Installations (CSNI). He is now a Vice Chair of the NEA Steering Committee on Nuclear Energy. He was also a key player in establishing the NEA SERENA project, ISP-50, and ATLAS projects. Dr Baek co-authored several books (all in Korean), including *Critical Heat Flux*, *Nuclear Safety*, *Nuclear Debate*, and recently *Controversy and Truth of Fukushima Nuclear Accident*.

## Day 5 – Friday, 13 January 2023

### Session 5: Future Needs for International Co-operation in Nuclear Safety Research

**Moderator:** William D. MAGWOOD, IV, Director-General, Nuclear Energy Agency

**Introduction** ➤ Didier JACQUEMAIN, NEA/SAF, Senior Nuclear Safety Specialist

**13:00-13:10**

➤ William D. MAGWOOD, IV

**13:10-13:30**

▶ **Post-Fukushima Daiichi Co-operative Safety Research Projects and Opportunities for Future Research**, Toyoshi FUKETA, Advisor, Nuclear Regulation Authority (NRA), Japan

**13:30-13:50**

▶ **Nuclear Innovation-2050: An NEA Initiative to Foster Innovations in the Nuclear Sector**, Fiona RAYMENT, OBE FREng, Chief Science and Technology Officer, National Nuclear Laboratory (NNL), the United Kingdom

**13:50-14:10**

▶ **Addressing Future Research Prioritisation under the NEA Committee on the Safety of Nuclear Installations (CSNI) Auspices**, Vesselina RANGUELOVA, Deputy Head of the NEA Division of Nuclear Safety Technology and Regulation

**14:10-14:30**

▶ **Better Addressing the Challenge of Joint Projects Data Preservation and Dissemination**, Didier JACQUEMAIN

**14:30-14:45**

**Break**

**14:45-15:00**

▶ **Brief summary of the key outcomes of workshop sessions**, Didier JACQUEMAIN

**15:00-16:00**

▶ **Concluding panel discussion**

• *What mechanisms to establish priorities for future international co-operation in nuclear safety research? Which frameworks to address future safety research?*

• **Panellists:** William D. MAGWOOD, IV; Jess GEHIN, Associate Laboratory Director, Nuclear Science and Technology, Idaho National Laboratory, United States; Fiona RAYMENT; Jean-Christophe NIEL; Toyoshi FUKETA; Aline DES CLOIZEAUX, Director, Division of Nuclear Power, Department of Nuclear Energy, International Atomic Energy Agency (IAEA); Roger GARBIL, Head of the Fission Section, Euratom Research Unit, Directorate General for Research and Innovation, European Commission

## **Speakers:**

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- **Toyoshi FUKETA**, Advisor, Nuclear Regulation Authority (NRA), Japan
- **Fiona RAYMENT**, OBE FREng, Chief Science and Technology Officer, National Nuclear Laboratory (NNL), the United Kingdom
- **Vesselina RANGUELOVA**, Deputy Head of the NEA Division of Nuclear Safety Technology and Regulation
- **Didier JACQUEMAIN**, NEA/SAF, Senior Nuclear Safety Specialist

## **Panellists:**

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- **William D. MAGWOOD, IV**, Director-General, Nuclear Energy Agency (NEA)
- **Jess GEHIN**, Associate Laboratory Director, Nuclear Science and Technology, Idaho National Laboratory, United States
- **Fiona RAYMENT**, OBE FREng, Chief Science and Technology Officer, National Nuclear Laboratory (NNL), the United Kingdom
- **Jean-Christophe NIEL**, Director-General, Institut de Radioprotection et de Sûreté Nucléaire (IRSN), France
- **Aline DES CLOIZEAUX**, Director, Division of Nuclear Power, Department of Nuclear Energy, International Atomic Energy Agency (IAEA)
- **Roger GARBIL**, Head of the Fission Section, Euratom Research Unit, Directorate General for Research and Innovation, European Commission

## **Moderator:**

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- **William D. MAGWOOD, IV**, Director-General, Nuclear Energy Agency (NEA)



**Dr Toyoshi FUKETA** was sworn in as a Commissioner of the Nuclear Regulation Authority (NRA) on 19 September 2012, when the NRA was established as a new regulatory body of Japan after the Fukushima Daiichi nuclear accident. After five years as Commissioner, he served as the Chairman of the NRA for another five-year term from September 2017 to September 2022. Prior to becoming a Commissioner of the NRA, Dr Fuketa engaged in nuclear safety research programmes at the Japan Atomic Energy Research Institute (JAERI) and Japan Atomic Energy Agency (JAEA) for 25 years

and performed various experiments regarding reactor fuel behaviour – particularly during reactivity-initiated accidents, loss-of-coolant accidents and severe accidents. Numerous data and findings from these studies have directly and indirectly provided the technical basis for regulatory standards. He was honoured by ASTEM international with the William J. Kroll Zirconium Medal. At the NEA, Dr Fuketa was a long-standing member of the CSNI and its Working Group Fuel Safety (WGFS), and chaired the committee and the working group, respectively. He contributed to the Halden Reactor Project, the CABRI International Project, the LOFC Project, and other joint projects as a member of their respective organising committees. Dr Fuketa received a PhD (1987), a MS (1984) and a BS (1982) in Mechanical Engineering Science from the Tokyo Institute of Technology.



**Dr Fiona RAYMENT OBE, FEng** has dedicated 30 years to the nuclear sector with extensive strategic and operational experience. She is a chartered chemist and engineer with a PhD in chemistry from University of Strathclyde, Glasgow and is a fellow of the Royal Academy of Engineering, the Royal Society of Chemistry and of the UK Nuclear Institute. She has an MBA from Manchester Business School. She has recently served as a member of Euratom's Science and Technology Committee, the Idaho National Laboratory's Nuclear Science and Technology Advisory Committee, the American Nuclear

Society Board, the UK Nuclear Institute and is immediate past chair of the UK Nuclear Skills Strategy Group. Her other roles across the sector include being a member of the Nuclear Industry Council and the Office of Nuclear Regulation Chief Nuclear Inspector's Independent Advisory Panel. She is chair of the Scientific Advisory Committee of the Energy Division at CEA – the French Alternative Energies and Atomic Energy Commission, a Non-Executive Member of the UK Space Agency Steering Board and patron of Women in Nuclear UK. In addition to representing the UK at a variety of international meetings, she is a regular keynote and plenary speaker at international nuclear conferences and is a vice chair of the NEA Steering Committee Bureau and Policy Director of the Generation IV International Forum. She has long advocated widening participation in science and engineering and champions our sector-leading approach to diversity and inclusion. She was awarded an OBE in 2017 and the French Légion d'Honneur in 2020.



**Ms Vesselina RANGUELOVA** is Deputy Head of the Division of Nuclear Safety Technology and Regulation at the Nuclear Energy Agency (NEA) since October 2021. Ms Rangelova is leading the NEA support to the NEA Committee on the Safety of Nuclear Installations (CSNI), responsible for the safety research implemented under the auspices of the NEA. Prior to joining the NEA, she was the Head of the IAEA Safety Assessment Section defining and implementing IAEA activities on nuclear power plant design safety and safety assessment. She is also the only woman to have led an IAEA operational safety review team (OSART), leading over ten of the around 200 OSART missions that have been conducted to date – in particular several of those performed for nuclear power plants in Canada, China, France, Finland, Russia, the UK and the US. Prior to her assignment to the IAEA she worked for the European Commission and contributed to the development of Euratom research programmes on nuclear power plant safety, the EU directive on Nuclear Safety and Post-Fukushima stress tests for EU nuclear power plants. Altogether, Ms Rangelova has more than 35 years of experience in nuclear safety assessment. Ms Rangelova, a Bulgarian national, has a Master's of Science in Nuclear Engineering from Moscow Power Engineering University, Russia and also obtained a Post-Graduate Diploma in Probabilistic Safety Assessment from Manchester University, UK.



**Dr Didier JACQUEMAIN** is a Senior nuclear safety specialist at the NEA since January 2020. He is a technical advisor for the working groups active under the Committee on the Safety of Nuclear Installations (CSNI) and a technical co-ordinator for the NEA joint nuclear safety research projects. Before joining NEA, he worked for 27 years at the French Institut de Radioprotection et de Sécurité Nucléaire (IRSN) in the nuclear safety research area and was mostly involved in research programmes on fuel safety, severe accidents and ageing with an active contribution to international research projects in nuclear safety. He received a PhD in physical chemistry from the Weizmann Institute of Science (Israel) in 1992 and graduated from the École Supérieure de Chimie Industrielle de Lyon in 1988. His book on Nuclear Power Reactor Core Melt Accidents was published in 2015.



**Mr Jess GEHIN** became Associate Laboratory Director for the Idaho National Laboratory (INL) Nuclear Science & Technology (NS&T) Directorate in March 2021 after serving as chief scientist for the directorate since 2018. Over his 28-year career, he has built national strategies and priorities for nuclear energy, led complex projects and organisations, and developed strong relationships with senior leaders within the INL, Department of Energy and federal sponsors, as well as other laboratories, companies, and universities. In support of the DOE Office of Nuclear Energy, he served as the national technical director for the DOE Micro-reactor Programme. He expanded NS&T's strategic direction and helped develop and establish key projects to build advanced reactors at INL, such as the Department of Defense's demonstration micro-reactor Project Pele, and the Micro-Reactor Applications Research Validation and Evaluation (MARVEL) Project. Previously, he held research and leadership positions at Oak Ridge National Laboratory (ORNL) in nuclear reactor core physics, reactor core and system technologies, reactor modelling and simulation, and fuel cycle reactor applications. While at ORNL, he served as Director of the Consortium for Advanced Simulation of Light Water Reactors. He earned a Bachelor's degree in nuclear engineering from Kansas State University, and master's and doctoral degrees from the Massachusetts Institute of Technology. He was an associate professor at the University of Tennessee, is a Fellow of the American Nuclear Society, and has authored or co-authored more than 120 peer-reviewed journal and conference articles, technical reports, and conference summaries.



**Ms Aline DES CLOIZEAUX** is Director, Division of Nuclear Power, in the Department of Nuclear Energy of the International Atomic Energy Agency. Before joining the Agency, Ms des Cloizeaux worked as Director, Civil Nuclear and Equipment Business Line at Naval Group, Programme Director at Framatome, Large Investment Projects SVP at Orano, and held various positions at Areva and Cegelec, in Paris, France. She is Vice-President of the IAEA Chapter of Women in Nuclear. Ms des Cloizeaux holds a Master's degree in Science and Engineering Technology from the École Polytechnique, a Master's degree in Civil Engineering Technology from the École Nationale des Ponts et Chaussées and an MBA from the Collège des Ingénieurs.



**Mr Roger GARBIL** is Head of the Fission Section of the Euratom Research Unit of the Directorate General for Research and Innovation, at the European Commission in Brussels, Belgium. Graduating in 1995 as a Nuclear Physicist from the University of Saint-Etienne, France, he has worked in nuclear fusion and fission research for over 25 years. He is a promoter of Euratom research and training activities and innovation, cross-cutting infrastructures, education, training, mobility and international co-operation through the IAEA, GIF and NEA.

## **Notes**

