5th ASEM Seminar on Nuclear Safety
Translating Commitments into Actions- Addressing Nuclear Safety Challenges in the 21st Century

CO-CHAIRS' SUMMARY REPORT

1. The 5th Asia-Europe Meeting (ASEM) Seminar on Nuclear Safety was convened in Beijing, China on 28-30 March 2018, hosted by China and co-sponsored by Czech Republic, Finland, France, Hungary, Lithuania, Pakistan, Singapore, Spain, Switzerland, United Kingdom and Viet Nam. The theme of the seminar was "Translating Commitments into Actions-Addressing Nuclear Safety Challenges in the 21st Century", which aimed to provide a platform to continue discussions on the most prominent topics on nuclear safety identified by the previous seminars as well as the nuclear industry, so as to promote exchanges and cooperation among ASEM partners. The ASEM Nuclear Safety Seminars previously were held in Singapore, Lithuania, Indonesia and Spain since 2012, which successfully facilitated nuclear safety discussions and best practice exchanges among ASEM partners. This 5th Seminar continued the dialogue and explored possibilities for future cooperation within the ASEM framework. Over 200 representatives from 28 ASEM partners and relevant international organizations, namely IAEA, OECD, WANO and WENRA, attended the seminar. Delegates were mainly from governmental policy-making bodies, nuclear regulatory bodies, nuclear enterprises, research institutions and universities.

2. The seminar was co-chaired by Mr. GUO Lingquan, Section Head, Networks Management and Partnership Section, Office of Safety and Security Coordination, Department of Nuclear Safety and Security, IAEA; Mr. Zaheer Ayub Baig, Chairman, Pakistan Nuclear Regulatory Authority; Mr. Richard McClay, Head of Engineering for Ultra Electronics, UK; Mr. Alfredo de los Reyes, Head of International Relations, Spanish Nuclear Safety Council; and Ambassador Dr. György Molnár, Special Representative of the Minister of Foreign Affairs and Trade for Arms Control, Disarmament and Non-Proliferation, Hungary.

OPENING SESSION

3. **H. E. Mr. LIU Hua,** Vice Minister, Ministry of Ecology and Environment (MEE) & Administrator, National Nuclear Safety Administration (NNSA), China, shared a series of overall policies and latest practices China adopted on nuclear safety

regulation. He emphasized that China attached great importance to nuclear safety and established a nuclear safety regulation system which not only went well with China's national circumstances but also kept pace with international common practices. Since the Chinese President Mr. XI Jinping proposed a sensible, coordinated and balanced approach to nuclear security at the third Nuclear Security Summit in 2014, China has made enormous progress in strategic planning, legislation improvement, capacity building and international cooperation in the field of nuclear safety and security regulation. China stood ready to strengthen communication and cooperation with ASEM partners on nuclear safety.

4. **H. E. Mr. WANG Yiren,** Vice Chairman, China Atomic Energy Authority, gave a brief overview of the development of nuclear industry in China. He pointed out that the utilization of nuclear energy was important to China in ensuring its energy supply and pursuing a better energy mix. China firmly adhered to the principle of "safety first" in using nuclear energy, put emphasis on technology innovation to improve the inherent safety of nuclear power, attached importance to nuclear security capacity building, strived to enhance nuclear emergency preparedness and response, strengthened public communication and information sharing, and improved radioactive waste management. China developed a comprehensive and complete nuclear industry and would like to cooperate with all interested parties on peaceful use of nuclear energy. With the well-established collaboration mechanisms between China and other ASEM partners, China was ready to help countries in need to improve nuclear energy infrastructures, and to join hands with all partners to build a community of shared future for peaceful use of nuclear energy.

5. **H. E. Ambassador WANG Qun**, Director-General, Department of Arms Control, Ministry of Foreign Affairs, China, highlighted the significance of strengthening the collaboration on nuclear safety among the ASEM partners and put forward four proposals in this regard. Firstly, to bear in mind the sense of creating a community of shared future for mankind and work together to deal with nuclear safety challenges. All nations should uphold the idea of win-win cooperation and the spirit of mutual respect and equal consultation when exploring new ways of strengthening nuclear safety. Secondly, to improve the infrastructure and build a reliable firewall for nuclear safety. With this in mind, countries should enhance policy coordination and share best practices. Thirdly, to encourage technology innovation and upgrade nuclear safety measures. By supporting and encouraging technological innovation to promote third and fourth generation nuclear power technology, we can break the safety bottleneck and enhance public confidence for the sustainable development of nuclear industry. Fourthly, to uphold the principle of achieving shared growth through discussion and collaboration and improve the international nuclear safety governance. Emphasis should be put on helping emerging countries with nuclear power, in particular the developing countries, to build safety infrastructures and strengthen capacity building.

6. **H.E.Mr. Juan Carlos Lentijo**, Deputy Director General of the IAEA, mentioned that there were many nuclear safety challenges facing us, such as aging management and life extensions of nuclear reactors, disposal of more radioactive waste and spent fuel, safety and security of radioactive sources, the aging of workforce in nuclear industry etc. IAEA promoted international cooperation to foster nuclear safety and

security worldwide. IAEA offered peer reviews and advisory services upon request. The Agency assisted countries in building or strengthening regulatory systems and helped to meet the associated challenges that radioactive sources must be kept safe and secure at all time, and their irradiation doses in operating conditions or medical procedures must be minimized. IAEA offered a wide spectrum of training courses and capacity-building programmes.

7. **H. E. Professor LUI Pao Chuen**, Advisor, National Research Foundation (NRF), Singapore, introduced Singapore's practice of building capabilities in nuclear safety. Singapore launched the Nuclear Safety Research and Education Programme which covered three key tasks of human resources development and retention, education and training, knowledge networking. In capacity building, the first thing was to develop and train people. The second thing was to educate and train, not just nuclear experts, but also policy-makers and the general public. The third thing was to learn through networking and collaboration. He emphasized the need for a good capacity-building strategy to ensure nuclear safety.

8. **H. E. Mr. Pham Cong Tac**, Vice Minister, Ministry of Science and Technology, Viet Nam, pointed out that Viet Nam had actively participated and been a responsible member of international conventions and treaties on nuclear safety. Infrastructure for emergency response in Viet Nam had been gradually improved, meeting the existing requirements. The National Environmental Radioactive Monitoring Network had been planned and built. With regard to the management of disused radioactive sources, Viet Nam was launching a national project to collect these vulnerable sources into radioactive source storage by most to ensure safety requirements. Viet Nam wished to intensify its cooperation with China in sharing information and experience in the field of radiation environmental monitoring, radioactive dispersion calculation, emergency preparedness and response, and cooperation in nuclear safety research.

9. **H. E. Mr. Kestutis Kudzmanas**, Ambassador, Ministry of Foreign Affairs, Lithuania, emphasized that Lithuania had always believed in the highest priority for nuclear safety throughout the whole nuclear plant cycle. Development of new nuclear energy projects should strictly follow the principles of transparency and the highest international environmental and nuclear safety standards. The IAEA specialized missions could bring the maximum expected added value if all related modules of IAEA missions were implemented in full scope at the appropriate stages of the project development. Selective approach towards safety should be eliminated, as nuclear safety was comprehensive and must be seen as such. Countries developing nuclear power were obliged to follow the principles of transparency and responsibility for the whole nuclear power plant cycle. It should be crystal clear that nuclear safety must come first.

10. **H.E. Mrs. Rosario Velasco**, Vice President, Spanish Nuclear Safety Council, appreciated the Seminars on Nuclear Safety which were an optimal frame to exchange

experiences and practices on the most important issue to all of us: the safety of our workers, our citizens and our environment. She reiterated that the Spanish Nuclear Safety Council was very much committed to enhance the collaboration with other regulators in the world since this was the most standing instrument to increase our knowledge in such a complex matter as nuclear safety. ASEM was proved to be a unique instrument for the open dialogue among our countries with excellent results.

Session I: New Opportunities and Challenges since Fukushima Accident

11. The first session was chaired by **Mr. Guo Lingquan**, Head of Networks Management and Partnership Section, Department of Nuclear safety and Security, IAEA. He opened this session by highlighting the post-Fukushima implications and challenges: the Fukushima Daiichi accident profoundly affected our work on the international, regional and national levels. Today, seven years after the accident, the global nuclear community faced three major challenges: the momentum of nuclear safety achieved through the implementation of the Action Plan could not be lost; lessons from the accident must be learned and our work needed to build upon them; what we learned should not be only applied to nuclear power programme. Going forward, strengthening nuclear, radiation, transport and waste safety needed to be considered in a more comprehensive manner.

12. Mr. Guo also gave an overview on the recent development and activities conducted by IAEA. After the Fukushima Daiichi accident, IAEA developed the Action Plan on Nuclear Safety, aimed to strengthen the global nuclear safety framework in light of the accident. As part of this programme, Member States and the IAEA took actions in 12 thematic areas and progress was made all around the world. The Agency identified development of leadership for safety as a priority. An IAEA Safety Requirement on Leadership and Management for Safety was published and Member States requested support to implement it as well as other relevant safety standards in this area. Although the IAEA offered a number of activities to assist Member States in improving their safety culture, all of these activities were addressed to middle or senior managers. IAEA thus developed an International School of Nuclear and Radiological Leadership for Safety that focused on leadership for nuclear and radiological safety both in normal and emergency situations. It targeted young and mid-career professionals who could influence safety in their daily work not only now, but also throughout their future careers. The Pilot School took place last year in France with regional implementation being planned.

<u>Part I: Seven years after Fukushima accident—latest reflections on lessons learned</u>

13. **Mr. Zdenek Tipek,** Deputy Chair for Nuclear Safety, Czech State Office for Nuclear Safety, touched upon the main causes of the three most serious NPP accidents in the past years, namely three miles island in 1979, Chernobyl NPP accident in 1986 and Fukushima NPS accident in 2011. He briefed activities/actions taken after Fukushima NPP accident, including European Stress Test; upgrade of existing international requirements/guides (IAEA and OECD/NEA). He also provided additional information about practical experience from his own country.

14. **Dr. Ms. Lee Youngeal**, Manager of Department of International Cooperation, Korea Institute of Nuclear Safety, focused on major Post-Fukushima actions taken and its implication on nuclear safety policy. She concluded with the following reminder points: immediate follow-up with additional measures; legal bases for the regulatory control of severe accident to reflect Vienna Declaration (VDNS); making better use of regulatory experience and international peer review services; experience sharing and commitment to the global nuclear safety; proactive information release and regulatory oversight of safety culture; important role of international cooperation with neighboring countries.

15. **Mr. Satoru Toyomoto**, Director, Nuclear Accident Response Office, Agency for Natural Resources and Energy, Ministry of Economic, Trade and Industry (METI), Japan, mainly introduced the status of Fukushima Daiichi nuclear reactor decommissioning. He provided the latest update information on the efforts for decommissioning and contaminated water management. He also provided further information about the Fukushima Advisory Board established by the Japanese government. Its mandate was to support decommissioning and contaminated water management and enhance cooperation with international communities including IAEA, OECD/NEA and bilateral frameworks with US, UK, France and Russia.

Part II: New opportunities and challenges on nuclear safety

16. **Mr Ho Nieh**, Head of Division of Nuclear Safety Regulation and Technology, OECD/NEA. He explained the overview of NEA on its organization and functions and introduced the nuclear safety cooperation programme in NEA including Committee on Nuclear Regulatory Activities (CNRA); Committee on Safety for Nuclear Installations (CSNI); Nuclear safety research joint projects; and Multinational Design Evaluation Programme (MDEP). He proposed a new challenge of regulating and enabling the innovation of nuclear technologies, followed by three opportunities supported from NEA: accident tolerant fuel, digital instrumentation and control, advanced and small modular reactors. he concluded that innovation of nuclear technologies continued to occur and might require the evolution of regulatory programme, and early engagement of the regulatory, industry and research communities could enable new technologies to help ensure safety.

17. **Mr. Chai Guohan,** Deputy Director General, Nuclear and Radiation Safety Centre from China, gave a comprehensive presentation about the nuclear safety challenges and practices in China, including strategic position of nuclear safety in China; situation of nuclear energy development and nuclear safety regulation in China; safety review of its advanced reactor projects; five-year plan of nuclear safety; major improvement of safety-related requirements. He also provided several challenges faced by Chinese regulator to regulate its nuclear activities and facilities. At the end, he highlighted the importance of international cooperation, in particular the establishment of international consensus safety standards.

18. **Mr. Jean Pierre Gros**, the representative of ORANO from France provided his views on the reprocessing recycling plant: safety and key issues after Fukushima. He shared the general safety principles including the defense in depth, ALARA approach, necessary safety functions; main specification for reprocessing recycling facilities; he also focused on the consideration of experience feedback for reprocessing recycling plant, including follow-up actions/requirements requested by French regulatory authority to address the additional safety evaluations for the reference fuel cycle facilities. As a conclusion, he highlighted three points: 1. Safety of reprocessing recycling plants differs from NPPs safety; 2. Safety of the future Chinese Reprocessing Recycling plant would be at the level of, or better than the La Hague reprocessing and Melox recycling plants;3. Fukushima accident feedback should be fully integrated in the future plant.

19. **Mr. Richard McClay**, Head of Engineering for Ultra Electronics,UK, touched upon "I&C Remote Monitoring post Fukushima". Firstly, he briefly introduced its company,and focused on the lessons learned post Fukushima in the area of radiation monitoring, including the lessons learnt beyond design basis events, considerations for remote radiation monitoring and detection technology environmental conditions.

Part III: Implementation of international nuclear safety instruments

20. **Mr. Sergey Demin**, Director General, Rosatom East-Asia,Russia, gave a speech on compliance of Russian projects with Post-Fukushima safety requirements. He provided an overview by the Rosatom on the lessons learned post Fukushima for the Russian design (VVER reactors). All VVER based NPPs in operation or under construction were in compliance with the latest safety requirements and conformed to all active Russian and International safety standards including IAEA recommendations. The benefits of this evolutionary approach were safe operating, reduction in design time and cost and easy engineering solutions reference. ROSATOM was a step ahead of time, continuously developing and implementing its safe and reliable technologies.

Part IV: Threats and opportunities arising from the use of digitalization / artificial

intelligence

21. **Mr. Joakim Bergroth**, Fortum from Finland, provided his perspectives on the challenges and opportunities brought to the nuclear safety by the digitalization. He shared several innovated projects developed recently to improve safety, namely Virtual Reality Control Room, 360 video annotation software, Augmented Reality and Data Analytics. At the end, he also shared some insights about the experience of systematic research and development projects. For instance, development through proof of concepts, verified feedback from end users at the plant, etc.

Conclusions:

22. Nine speakers from Czeck Republic, Korea, Japan, China, France, UK, Russia, Finland and OECD/NEA provided their informative and interesting reports to address these four sub-sessions, from their presentations, the update information about the lessons learned; actions taken to reflect the post Fukushima; challenges identified from the process; new opportunities identified; national practices and possible solutions have been provided and shared for the 1st session. The priorities and challenges identified from the 1st session could address the general or cross-cutting areas such as:

- Continuous lessons learned from Fukushima accident;
- How to reflect these lessons into their national system;
- Innovation of R&D projects including new nuclear technologies;
- Revolution of Regulatory programme;
- Different nature and experience feedback for reprocessing recycling plant;
- Regulatory oversight of safety culture;
- Information exchange and knowledge sharing;
- Regional and international cooperation and partnerships, and etc.

23. Numerous suggestions provided by the speakers which, to some extent, addressed the above challenges:

- International efforts to support the decommissioning and contaminated water management of Fukushima NPP in Japan;
- Early engagement of the regulatory, industry and research communities to embrace new technologies and help to ensure safety;
- Harmonization of international requirements/guidance;
- Establishment of international consensus safety standards;
- Making better use of regulatory experience and good practice;
- Making better application of international peer review services;
- Commitment to the global nuclear safety;
- Proactive information release;
- Important role of regional and international cooperation, in particular with neighboring countries.

24. The first session concluded that maintaining a high level of nuclear safety was a big responsibility for all countries. A major factor that contributed to the Fukushima accident was the widespread assumption in Japan that its nuclear power plants were so safe that an accident of this magnitude was simply unthinkable. We learned that there could be no grounds for complacency about nuclear safety in any country. The Fukushima Daiichi accident underlined the vital importance of effective international cooperation.

Session II : Nuclear Safety Oversight

Part I: Legislation & regulation

25. **Ms. Li Jingyun**, Deputy Director of MEE, China, made a comprehensive introduction on the newly adopted China's Nuclear Safety Law. It was highlighted that air pollution due to use of coal was among the top concerns of the public in the past several years. To control the air pollution, several fire power plants, steel mills and cement plants had been abandoned and priority was given to nuclear power to build a beautiful China. Currently China had 56 NPP Units at 13 sites at different stages of operation and construction. To safely operate and regulate these plants and control the air pollution, China issued Nuclear Safety Law, Prevention and Control of Radioactive Law and New Environmental Law. Due to promulgation and implementation of these laws, safety of nuclear power plants and radioactive materials was enhanced, environmental protection ensured and CO2 emission reduced. Other improvements made were streamlining administrative procedures, safety assessment of site selection, spent fuel reprocess and disposal,emergency preparedness and response and international cooperation.

26. **Mr. Stepan Kochanek,** Head of Legal Division, Czech State Office for Nuclear Safety,made a presentation on challenges of modern regulatory processes. It was highlighted that currently many challenges like technological complexity, high expenses, risk of accidents, and public attitude were faced by the nuclear industry. But on the other hand, nuclear energy was a stable source friendly to energy security and environment protection. To overcome these administrative and organizational problems, quality of legislation and regulations, and qualified and skilled manpower could be the major tools.

27. **Mr. Hiroshi Nunota,** Risk Assessment Office, Oversight Planning and Coordination Division, Nuclear Regulation Department, Nuclear Regulation Authority (NRA),Japan,introduced the Experience of Improvement of Nuclear Regulation in Japan. There were 59 NPPs in Japan. It was highlighted that new regulatory requirements, peer reviews and self-assessment, and inspection reforms were the best tools to enhance safety. The defense in depth principle should be strictly followed and implemented. Safety assessment/reassessment in case of natural hazards should be carried out periodically. Seismic and tsunami should be accurately

evaluated with emergency preparedness and response plans improved accordingly. New regulatory requirements and other new requirements are being back-fitted to the existing plants under the legal framework. It was concluded that Japan had been pursuing continuous improvement of safety at NPPs.

Part II: Licensing & authorization

28. **Mr. Vidas Paulikas**, Deputy Head for Radiation Safety, State Nuclear Power Safety Inspectorate - VATESI，Lithuania made a presentation on "Challenges of authorization of decommissioning and development of radioactive waste management infrastructure". It was highlighted that Ignalina NPP completely suspended the production of electricity in December 2009 and since January 2010 decommissioning was the major activity and consequently licensing of decommissioning, and supervising the post operation, dismantling and decontamination activities were challenges for regulatory body. Similarly, interim storage of spent fuel and radioactive waste management was also a challenge for the regulatory body.

29. **Mr. Mohammad Rahman** Director General (Chairman Secretariat), Pakistan Nuclear Regulatory Authority gave a presentation on"Licensing and Authorizations of Nuclear Installations by Pakistan Nuclear Regulatory Authority". Licensing process and regulatory framework were briefly described in this presentation. It was highlighted that review and assessment and inspection were the major tools for decision making for licensing of a nuclear facility. It was concluded that PNRA developed a robust regulatory infrastructure with effective processes and mechanisms to ensure the safety of workers, public and environment from the harmful effects of ionizing radiations and that PNRA had an effective regulatory framework and associated core processes for licensing, review & assessment, and inspection & enforcement.

Part III: Enforcement & inspection

30. **Mr. HAO Xiaofeng** Deputy Director-General, Department of Nuclear Power Safety Regulation, MEE/NNSA, China, made a presentation on "Inspection and Enforcement Performed by NNSA". The responsibilities of NNSA includes: to develop and issue NNSA Integrated Management System, organize training for supervisors, investigate and assess significant event and accidents and etc. The Nuclear Safety Act authorized NNSA to conduct inspections. Various type of supervisions were conducted by NNSA to cover a wide range of supervision areas. It was highlighted that six regional offices were mainly responsible for supervision and enforcement. NNSA issued annual supervision plan while regions issue weekly plan for supervision. NNSA applied administrative penalty which included written warnings, correction with time limit, fine, confiscation of illegal gains and property, orders for suspension of production and suspension or revocation of the license.

NNSA conducted internal and external assessment for the improvement of their supervision and enforcement process.

31. **Mr. Frederick Joureau,** Director of International Affairs, French Nuclear Safety Authority(ASN) and **Mr. Cyril Pinel,** Director of International Affairs in IRSNfrom France jointly gave a presentation on "Nuclear safety oversight". Outlines of the presentation were general overview of French nuclear facilities, national regulatory framework, organization and means, main challenges on nuclear safety and radiation protection and commitment in EU Directives implementation. Main challenges highlighted by ASN were extension of NPP operating life beyond 40 years, Fukushima follow-up, periodic safety review of research reactors and fuel cycle facilities, and building new nuclear installations.

Part IV: Self-assessment and peer review

32. **Dr. Mike Redmond** Nuclear Safety Principal Inspector,Delivery Management Group Lead for Operational Design Topics, GDA of UK HPR1000, Office for Nuclear Regulation, UK,made a presentation on "Effectively Regulating New Nuclear Build in the UK-Aspects of Self-assessment and Peer Review". It was pointed out that the Office for Nuclear Regulation was created as independent authority body in April 2014 with the mandate to look after the activities of nuclear safety, nuclear site conventional health and safety, nuclear security, nuclear safeguards and transport of radioactive materials. The regulators in UK carried out Generic Design Assessment (GDA). UK regulators also conducted IRRS missions in 2006, 2009, 2013 & a follow-up mission in 2014. Next full scope mission was planned in 2019.

Conclusions:

33. **Mr. Zaheer Ayub Baig**, Chairman, Pakistan Nuclear Regulatory Authority, chaired this session. It was his opinion that ASEM was a good forum for knowledge sharing and information exchange and learning from the experience of each other. As a way forward, he proposed that the scope of this meeting may be further expanded. He suggested that the topics on safety and security interface, and cyber security may also be included in the future ASEM meetings. In case of time limitations, parallel sessions may be considered. He also expressed his deep gratitude towards Chinese Government and the Ministry of Foreign Affairs and the Organizers of the meeting for making such wonderful arrangements and providing opportunity to exchange experiences.

Session III: Industry Practice on Nuclear Safety

34. The third session was chaired by **Mr. Richard McClay**, Head of Engineering for Ultra Electronics, UK. Though the presentations in this session seemed to be on diverse subjects, they had a number of common themes. Mr. McClay concluded that

the following topics were worthy of further discussions. Closer cooperation between regulators and licensees is key to future success. It led to greater understanding, less conflict and less long term running costs. The human factor/interaction was a theme which ran through most of the presentations, which was a key influence over all areas of responsibility. At a designer level, planning for the changes that regulators might require and allowing flexibility in a program were also important. At a government or regulator level, planning for the future development or research was probably the most important of all as it is the only way we will maintain and expand our industry.

Part I: Update of safety measures after Fukushima accident

35. **Mr. LIU Wei,** General Manager, China Nuclear Power Engineering Co. Ltd, made a presentation on "Technical Overview & Post-Fukushima Accident Improvements of HPR1000". He mainly introduced the design characteristics, feedback from Fukushima accident and engineering progress of HPR1000. It was an advanced PWR developed by China National Nuclear Corporation (CNNC), which integrated advanced technical features on the basis of proven technology and reflected the lessons taken from the Fukushima accident. The three distinctive design characteristics, namely 177-fuel-assembly core, double-shell containment and single unit layout, fully reflected the safety principle of defense in depth, redundancy, diversity and independence. The reactor provided a safe, clean, economic and reliable global energy solution, satisfying the latest nuclear safety codes and meeting the application requirements of Generation III NPP.

36. **Dr. Jiří Žďárek**, Vice-president for Business Development Division of Integrity and Technical Engineering, ÚJV Řež, Czech Republic, focused on the "Present status of large-scale facility to prove the IVMR for VVER 1000". He introduced that over a hundred of small-scale tests were performed and lessons learned from other types of large-scale facilities were used to build the large-scale IVMR facility. Large-scale facility THS-15 was built with significant margin to the recommended HF values along the whole height of the cooling channel. First experiment with provided profile was finished without any problem. Several upgrades of the facility were prepared to assure further even more demanding operation.

37. **Mr. Syed Ziauddin**, Member (Engineering), Pakistan Atomic Energy Commission (PAEC), made a presentation titled "Update of Safety Measures after Fukushima Accident in Chashma Nuclear Power Plants". Fukushima Response Action Plan (FRAP) was embarked upon for its operating Chashma Nuclear Power Plants to re-assess safety in the light of Fukushima accident. Mr. Syed comprehensively introduced the safety measures Chashma Nuclear Power Plants adopted in the field of external natural hazards, make-shift AC power and DC power capacity, fire protection and control, emergency core cooling, hydrogen hazard and containment integrity, spent fuel pool and emergency preparedness.

38. **Dr. Philip Rogers**, MEng PhD CEng MIMechE, Business Manager for Frazer-Nash Consultancy Ltd., UK, gave a presentation on "Frazer-Nash and the UK Nuclear Innovation Programme". He emphasized that the UK government was committed to an ambitious Nuclear Research and Development Programme. Funding was provided to deliver R&D in advanced materials and manufacturing, recycling fuel for future reactors, reactor design and future nuclear fuels. The objective of safety research programme was to develop a plan for an integrated R&D programme to advance the UK's safety engineering capability through a detailed assessment of previous GDAs, current research and engagement with industry.

Part II: Safety measures for new reactors

39. **Mr. Dong Yujie**, Deputy Director of the Institute of Nuclear and New Energy Technology, Tsinghua University, introduced the Status of HTR-PM, a 200MWe high temperature gas-cooled reactor(HTGR) demonstration power plant constructed in China. The first reactor module had been installed since October 2017. And verification testing, fuel producing, component manufacturing were making good progress. He stressed that the role of HTR-PM was to replace Coal-fired Power Plant in population dense region, generating both heat and power. HRT-PM would reach the safety feature of generation IV NPP by eliminating off-site emergency response through a Meltdown-Proof Reactor.

40. **Mr. Claude MAYORAL**, Safety&Licensing Manager, Framatome, France, made a presentation titled "Considerations on harmonization of safety assessment of new reactors design". The following four conclusions could be drawn from his introduction. Firstly, high level nuclear safety objectives reached a certain level of harmonization and were comparable between countries. Secondly, application of specific national regulatory approaches and safety assessment processes could have an important impact on the design of a reactor. Thirdly, EPR had been adapted to fit with various country-specific regulatory and customer requirements. Lastly, among the adaptations that had to be implemented, some of them originated from country-specific safety approaches.

Part III: Harmonization of safety standards and codes

41. **Mr. Nicolas FEVRIER**, Director, Department of Engineering and New Nuclear Projects of EDF, France, mainly focused on harmonization of standards & codes. He pointed out that harmonization of standards and codes contributed to significant growth of nuclear capabilities and to high level of safety which must remain our overriding priority. As nuclear energy was part of a nation energy policy and was locally regulated, harmonization should give the common set of rules to guarantee the international community that the best practices were taken into consideration.

42. **Mr. Hans Wanner**, WENRA Chair and Director General of the Federal Nuclear Safety Inspectorate, Switzerland, made a presentation on "Harmonization of Safety Standards". He introduced WENRA's mission of developing Safety Reference Levels for harmonization of nuclear safety in Europe, aiming at achieving no substantial differences among countries in national safety requirements and in their implementation in the nuclear installations. And he concluded that WENRA achieved a high level of harmonization of nuclear safety in its member states. Safety Reference Levels were reviewed with regard to the lessons learned from the Fukushima accident. Safety Reference Levels for the waste management had been and would be further developed.

43. **Mr. Hans-Michael KURSAWE**, President of Business Unit Nuclear Energy TÜV SÜD Industry Service Division, Germany, gave his presentation on "Requirements for the harmonization of safety standards and codes". He raised the issue of nuclear regulation difference in various countries which posed challenges to international supply chain. In his opinion, the control of reactivity, cooling of nuclear fuel, confinement of radioactive material and protection of plant personnel and environment of radioactive exposure were key objectives of nuclear safety. Currently, there were no harmonized nuclear safety codes and standards available to meet the required safety level. Different local safety codes and standards resulted in a variety of ways to reach these goals and thus led to a complex requirement management.

Part IV: Establishment of radioactive waste management infrastructure

44. **Mr. Petteri Tiippana**, Director-General, Radiation and Nuclear Safety Authority, Finland, made a presentation titled "Why have we succeeded in spent fuel disposal in Finland". He shared Finland's experience in spent fuel disposal by attributing the progress and success in two key factors. The first one was political will, courage and responsibility to find the end-solution. The Finnish Government developed national strategies for spent fuel disposal and set strong requirements for waste management. And the second one was the persistent and committed implementation and regulation. In his regard, regulators actively participated in the follow-up and reviewed the spent fuel disposal program. And the regulatory approach was paralleled with on-going research and development in the field of spent fuel disposal.

Session IV: Capacity Building on Nuclear Safety

45. The fourth session was chaired by **Mr. Alfredo de los Reyes**, Head of International Relations, Spanish Nuclear Safety Council. After the discussion, he drew a conclusion that capacity building helped to ensure high level of nuclear safety. He identified that human resources development (education and training), safety

culture, knowledge management, integrated management system were major issues in nuclear safety capacity building. Meanwhile, he found limited manpower and aging of the existing one, need of involvement on in-house, national and international experts, motivation of all the experts in any phase, need of engagement of the whole organization (safety culture) and difficulties to get used to new tools as integrated management system were major challenges facing capacity building on nuclear safety.

Part I: Human resources development

46. **Mr. WANG Xuewu**, Chair, Department of Engineering Physics, Tsinghua University, made a presentation on "Practice of Education on Nuclear Science and Engineering". He mainly introduced the higher education on nuclear science & engineering at Tsinghua University, and nuclear safety promotion practice on campus. China Society of Radiation Protection was founded in November 2017 by the Department of Engineering Physics with an aim to promote the science of radiation protection. International Master Program in Nuclear Engineering and Management (TUNEM) is an international master degree program for training high-level engineering and management talents in the field of nuclear power, which also provides a half-year on-spot internship at nuclear related enterprises.

47. **Ms. Rahila Hammad**, Director of the Directorate of Human Resource Development (HRD), Pakistan Nuclear Regulatory Authority(PNRA), gave her presentation titled "Human Resource Development at PNRA". She found the main challenges facing the PNRA in human resources development were limited manpower, aging of existing manpower, lack of structured training program and limited physical infrastructure. And she also gave solutions to address these issues through the following means: fellowship programme, training needs assessment, in-house capacity building and international collaboration for capacity building.

48. **Professor Lim Hock**, Nuclear Research and Safety Initiative, Singapore, made a presentation on "A Singapore-France collaboration for human resource development in nuclear safety". He shared an example of cooperation among the Singapore Nuclear Research and Safety Initiative (SNRSI) and the French TSO Radiation Protection and Nuclear Safety Institute (IRSN) in radiation protection, transportation of radioactive materials, surveillance of environmental radioactivity, planning and preparing for emergency response,regulatory control of radiation protection in medical applications, legal and regulatory basis for nuclear and radiation safety.

Part II: Fostering a strong safety culture

49. **Mrs. Rosario Velasco**, Vice President, Spanish Nuclear Safety Council, made a presentation on "Perspectives on Safety Culture at the CSN". She proposed five basic principles of safety culture: leadership for safety at all hierarchical levels; all the staff

had individual responsibility in demonstrating a behavior at any circumstance oriented to safety; a culture that promoted safety facilitates cooperation and communication; global approach to safety assured by working in a systematic way; incentive continuous improvement; training and self-assessment at all organizational levels. He also identified the following challenges in fostering a strong safety culture: identify and perform a safety culture assessment method suitable for the regulator, define an action plan based on the safety culture assessment conclusions, engage the organization in the principles of safety culture defined in the safety culture policy.

50. **Dr. Christine Wassilew**, Head of Division of International Cooperation, Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, Germany, made a presentation on "Nuclear Safety during Nuclear Phase-out Managing the Change". She shared German experiences of ensuring safety during a 20-year period of phase-out. Germany put its emphasis on implementing responsibilities, keeping regulatory requirements updated, implementing safety improvements in the NPPs in operation, monitoring the situation of the personnel in the NPP, adapting to the supervision programs and staying internationally connected.

Part III: Integrated Management System

51. **Ms. CHENG Jianxiu**, Deputy Chief Engineer, Nuclear and Radiation Safety Centre, MEE/NNSA, China, gave a presentation on "Integrated Management System for Nuclear and Radiation Safety Regulation". She found that integrated management system (IMS) was a very useful management tool for kinds of organizations. Through IMS planning and construction, all relevant elements were integrated in a complete and harmonious system. It could strengthen self-restraint and knowledge management both for individuals and organizations. Although IMS was not so easy for regulators at the very beginning, it would be useful for them when they were familiar with it.

Part IV: Knowledge Management

52. **Mr. Fernando Castello**, Commissioner, Spanish Nuclear Safety Council, made his presentation on "Knowledge Management in Spain: CEIDEN and PEPRI platforms on Fusion Energy and Radiation Protection". It was highlighted that his department collaborated with national platforms to define and develop joint projects and presented a common position for national and international commitments and proposals. It was challenging to promote cooperation in R&D of all the national stakeholders to ensure highest levels of safety and exchange of information with other international entities.

Session V: Emergency Preparedness and Response

53. The Session was chaired by Ambassador **Dr. György Molnár**, Special Representative of the Minister of Foreign Affairs and Trade for Arms Control, Disarmament and Non-Proliferation,Hungary. The chair underlined that the responsibility for ensuring and regulating nuclear safety, including Emergency Preparedness and Response, rest with individual states. However, international cooperation was also crucial, and the IAEA played an important coordinating role through safety standards related to emergency preparedness and response and by maintaining the International Emergency Preparedness and Response Framework and its own Incident and Emergency System. Exercises were also an integral part of Emergency Preparedness and Response arrangements because they helped test EPR capabilities in areas which lacked real life experience. In this context preparedness meant taking actions that created the conditions to address emergencies before they happened by streamlining decision making in case of such incidents. Good preparedness in advance of any emergency could substantially improve the effectiveness of response arrangements and capabilities designed to minimize the impact of eventual nuclear or radiological incidents. The chair pointed out that as the presentations have clearly reflected, EPR was not only an important but also a unique area within nuclear safety, because it helped to prepare for the worst by building tools and capabilities useful in the best of times.

Part I: National emergency response measures

54. The presentation of **Mr. Li Fan**, Deputy Director, Department of Emergency and Safety Regulation, CAEA, mainly touched upon progress made in China's nuclear emergency work. Concerning basic policies and principles, he outlined the legal, regulatory and standards system, as well as the principle measures and capacity building for EPR. Concerning progress achieved over the past five years and outlook for the future he referred to the release of the relevant white paper, the improvement of rescue forces, establishment of the technical support centers, construction of infrastructures, breakthroughs in scientific innovation, exercises and training, as well as, public communication. He highlighted that China was willing to carry out more cooperation and exchange in nuclear emergency field with all countries and international organizations.

55. The presentation of **Mr. Muhammad Nadeem Hussain**, Project Director, National Radiation Emergency Coordination Centre, Pakistan Nuclear Regulatory Authority, shared the national arrangements of Pakistan for preparedness and response to nuclear or radiological emergencies. He summarized managing nuclear or radiological emergencies and arrangements aimed at meeting international obligations. He also outlined the legal basis, the national regulatory framework and stakeholders for EPR, and the mechanism to regulate arrangements, and the implementation of international obligations related to Early Notification and Assistance Conventions plans, as well as procedures and exercises.

56. The presentation of **Mr. Nguyen Tuan Khai**, Director General, Agency for Radiation and Nuclear Safety covered the measures to enhancing Viet Nam's radiological and nuclear response capabilities. He outlined the development of radiation and nuclear technique applications in the fields of health care, industry and research. He alluded to the establishment of international and national regulations and enhancement of technical capability including detection and response. He also covered the area of the enhancement of international and regional cooperation.

57. The presentation of **Mr. Muhammad Ajmal Zafar**, Director, Nuclear and Radiological Emergency Support Centre (NURESC) was entitled "Nuclear Emergency Management System(NEMS) in Pakistan". He explained the coordinating role of NURESC in implementing NEMS with the collaboration with other stakeholders. He explained the on-site, off-site, national and international roles and responsibilities of these stakeholders in carrying out response measures in different types of nuclear and radiological emergencies. He also referred to the coordination mechanism and the training of stakeholders.

Part II: International and regional coordination

58. In his presentation **Professor Bernard Tan**, Chairman, Advisory Committee for Radiation Protection and Nuclear Science, National Environment Agency emphasized the necessity of international coordination in emergency preparedness and response in case of nuclear or radiological emergencies. He also underlined the significance of regional co-ordination with a special focus on ASEAN, including the role of the network of national regulatory agencies (ASEANATOM). He also highlighted the importance of public communication in nuclear or radiological emergencies.

59. The presentation of **Mr. Csaba Balogh**, Nuclear Emergency Management section, Hungarian Atomic Energy Authority was entitled "International and Regional Coordination in the Field of Emergency Preparedness in Hungary". Concerning international cooperation, he pointed out the central role of the IAEA by cataloguing the relevant conventions, as well as various IAEA activities and exercises. Regarding regional cooperation, he referred to the European Commission activities and listed the EURATOM Directives. He also outlined Hungary's bilateral agreements in EPR.

60. In his presentation **Dr. Lee Fook Kay**, Chief Science and Technology Officer, Ministry of Home Affairs summarized Singapore's efforts in radiological-nuclear safety and security. He outlined the whole-of-government approach in crises management and civil emergency. He also introduced the incident management structure and the response capabilities of Singapore.

Part III: Synergy between nuclear safety and security

61. The presentation of **Mr. Xu Zhenhua**, Deputy Director General, China State Nuclear Security Technology Center was entitled "The synergy between nuclear Safety and Nuclear Security". He pointed out that the nuclear safety and security shared the same goal of protecting the public and the environment. Then he explained the definitions and scopes of nuclear safety and security, the relevant conventions, standards and guidance, and the competent Chinese and international authorities and IAEA safety and security resolutions. He drew attention to the need for synergy between safety and security and recommended way forward. He also introduced the main function and activities of China National Centre of Excellence on Nuclear Security and expressed the willingness to enhance nuclear security and safety with other partners by making full use of the Centre.

62. The presentation of **Mr. Gabriel Martinez,** the General Manager of Tecnatom subsidiary in China, addressed the regulatory framework of NPPs in Spain, with a special focus on their long-term operation and aging management including general licensing and requirements of license renewal before and after 40 years of lifetime. He also summarized the dismantling and strategic decontamination and decommissioning (D&D) activities, as well as new aging management programme under development for the future.

Visit to China International Nuclear Industry Exhibition and Field Tour to Nuclear Facilities in Relevant Chinese Institutions

63. During the seminar, the organizer arranged a tour to the 2018 China International Nuclear Industry Exhibition, one of the world's largest exhibition in its kind. With the theme of "Innovation & Cooperation: Nuclear Energy Powering Beautiful Life", the exhibition provided a platform for more than 200 enterprises from home and abroad to showcase their most advanced technology and innovated products. Participants were briefed with the latest development of "Hualong One", EPR, AP1000, CAP1400 nuclear power technologies, Traveling Wave Reactor, nuclear medical facilities and industrial application of nuclear technology, etc.

64. Guided tour was arranged to visit the 10 MW High Temperature Gas-cooled Reactor in the Institute of Nuclear and New Energy Technology in Tsinghua University, China's National Center of Excellence on Nuclear Security, China Experimental Fast Reactor at the China Institute of Atomic Energy. Cultural activity of climbing the Great Wall was commended by the delegates as well.

Closing session: Way Forward — follow-up Actions on Nuclear Safety Cooperation within ASEM Framework

65. In his closing remarks, **H.E. Mr. XIE Bohua**, Ambassador & ASEM Senior Official of China, pointed out ASEM has made great contribution in promoting political trust and practical cooperation among its partners since its establishment over two decades ago. In this new era, we should work together to enable ASEM to fulfill

its potential and make it a significant platform for addressing common challenges facing the two regions. He reiterated that China fully support the role of ASEM in promoting mutual understanding, broadening consensus and strengthening cooperation among its partners. He called upon all ASEM partners to stick to principles of mutual respect and making decisions by consensus, and to jointly address nuclear safety challenges by actively conducting policy exchanges and practical cooperation so as to facilitate the construction of a new ASEM partnership.

66. **Ms. DONG Zhihua,** Deputy Director-General, Department of Arms Control, MFA, China, wrapped-up the seminar. She pointed out that the seminar achieved its objectives and discussions was highly professional and effective. A total of 44 highly qualified keynote speakers presented their views from different perspectives, reflecting latest update on safety standards, newly introduced regulatory measures, cutting-edge technology innovation, best practice on capacity-building and emergency response. There was genuine and keen interest in professional exchanges and sharing best practices.

67. She further pointed out that broad consensus was further forged on the importance of strengthening cooperation on nuclear safety. Fukushima Accident greatly aroused the international community's concern and attention to nuclear safety. Safety must come first all the time throughout the whole life cycle of any NPP, from site selection to waste management and decommissioning. Nuclear safety concerned us all, including countries embarking on or expanding the use of nuclear power, or those engaging in decommissioning. Even for countries without nuclear industry, they may be concerned about the nuclear safety of neighboring countries. Governments should be transparent on their nuclear safety situations and policy, and continuously strive to improve the nuclear safety capacity on both national and facility levels.

68. She stressed that the IAEA as well as regional organizations or mechanisms help set the nuclear safety standards and promote implementation. Peer review missions and advisory services were useful tools to help national governments build capacity in this regard. Innovation was a driving force for improving nuclear safety and the sustainable development of nuclear power industry. The involvement of the nuclear industry circles were critically crucial in the promotion of nuclear safety. This seminar benefited greatly from the participation of the industry sector. The visit to the International Nuclear Industry Exhibition also enriched the whole seminar.

69. She also observed that in terms of the nuclear safety in the Asia-Europe region, although much had been improved, a lot more needed to be done, and continuous improvement and harmonized approach was proposed. On the way forward, the seminar provided its added value with wide representation, real expertise and valuable recommendations. This seminar also kept the momentum of ASEM consideration on nuclear safety since 2015 in Spain. She encouraged ASEM partners to take leadership and pass on the torch by hosting the next workshop. And she extended her appreciations to all delegates for their active participation and contribution.

70. The results of this seminar would be reported to the ASEM Senior Officials. Participants extended their appreciations to the Chinese Government for hosting the seminar. They also expressed their interests in continuing the dialogue on nuclear safety within the ASEM process and expected that the seminar to continue to be held in the future.