

## Symposium on One Year after the Fukushima Nuclear Accident – the Way Forward with Safety and Risk Engineering



### Program:

Time	Session
13:00 ~ 13:45	<b>Registration, and Greetings to Speakers and Guests</b>
13:45 ~ 14:00	<b>Opening and Welcome Note</b> by Ir Dr B.L. Luk, Chairman of Hong Kong Nuclear Society
14:00 ~ 14:10	<b>Welcome Speech</b> by Ir Edmund Leung Kwong-ho, Chairman of the Energy Advisory Committee
14:10 ~ 14:50	Guest Speech #1: <b>Crossroad of Severe Accident in the Fukushima Dai-ichi NPP Accident</b> Prof. Akira Yamaguchi, Osaka University, Japan
14:50 ~ 15:20	Guest Speech #2: <b>Sensors Needs for Design Basis and Beyond Design Basis Harsh Environments</b> Dr Bruce Hallbert, Idaho National Laboratory, U.S.A.
15:20 ~ 15:40	Coffee/Refreshment Break
15:40 ~ 16:10	Guest Speech #3: <b>Taiwan's Response and R&amp;D Changes to Fukushima Dai-ichi NPP Accident in Japan</b> Dr Tsu-Mu Kao, Institute of Nuclear Energy Research, Taiwan
16:10 ~ 16:40	Guest Speech #4: <b>One year after : An Overview of the Consequences of Fukushima Dai-ichi Accident in France</b> Dr Jean-Christophe Gariel, the Environment Department, IRSN, Paris, France
16:40 ~ 17:10	Guest Speech #5: <b>Insights, Thoughts and Effects of the Fukushima Accident</b> Dr Ren Jun Sheng (任俊生博士), Nuclear Safety Expert Commission of the State Ministry of Environmental Protection, China (國家環保部核安全專家委員會委員)
17:10 ~ 17:40	<b>Discussion Forum</b> chaired by Ms Christine Loh, CEO, Civic Exchange
17:40 ~ 17:50	<b>Closing Remark</b> by Ir Dr Herman Tsui, Co-Chair of Organizing Committee

### Chairman Message

Honourable Guests, Distinguished Speakers, OC Members, HKNS members, Ladies and Gentlemen,

I would like to take this opportunity to extend my warmest welcome to all of you for attending this Symposium organized by Hong Kong Nuclear Society and the Department of Mechanical and Biomedical Engineering, City University of Hong Kong. Hong Kong Nuclear Society is a newly formed non-profit making organization aiming at increasing nuclear literacy in Hong Kong, facilitating the understanding of nuclear technologies, and also providing a forum for a rational exchange of information between different disciplines.

On 11<sup>th</sup> March last year, a severe nuclear accident occurred at the Fukushima Dai-ichi Nuclear Power Plant in Japan. This disastrous accident has shocked the world and has drawn public concerns on nuclear safety. Governments around the world have conducted extensive safety reviews on their existing nuclear power plants. Some countries, like Germany, Switzerland and Italy are withdrawing from nuclear energy. Majority of countries, like France, UK, and US have pledged their continued support for nuclear energy. Our Chinese Government has also continued its commitment to nuclear power in order to meet the increasing energy demand in our country together with the prominent need in reducing the greenhouse gases emissions from fossil fuel power stations. The recent operation of an experimental fast breeder reactor indicates that China is actively developing the state-of-the-art nuclear power technology to improve fuel utilisation and reduce nuclear waste of long half-life.

As it is almost one year past the accident, this symposium is a timely event for experts from Japan, China, Taiwan, France and USA to share their knowledge on nuclear safety and risk engineering issues and also views on how their countries reached their decisions and the way forward for the nuclear industry in their jurisdictions.

As we have only a couple of months to plan this event, I would like to express my sincere thanks to the organising committee members especially Dr Louis Liu, Dr Vincent Ho, and Dr Herman Tsui for their hard work and efforts in organising this symposium within such a short period of time. Also, I would like to thank the financial sponsors for providing funding support and also all the supporting organisations for helping us to disseminate the symposium information to their members.

Last but not least, I would like to invite all the participants and supporting organisations to work together to enhance the nuclear literacy in Hong Kong and also provide constructive views and discussion on the way forward for the nuclear industry in this region.

Dr Bing L. Luk

Chairman

Hong Kong Nuclear Society

**Guest Speech #1: Title: Crossroad of Severe Accident in the Fukushima Dai-ichi NPP Accident**

**Prof. Akira Yamaguchi**

March 11 of 2011 is the day that should be engraved in the heart of nuclear societies. The 2011 earthquake off the Pacific coast of Tohoku occurred at 14:46 Japan Standard Time on March 11. All the nuclear power plants in the Eastern Japan along with the Pacific Ocean coastline have successfully shutdown according to the earthquake ground motion. In 40 minutes, the first tsunami struck the Fukushima Dai-ichi Nuclear Power Station. The tsunami height was 15 m at maximum which was far beyond the design tsunami height. It caused the submergence in seawater of the emergency power supply and seawater systems. It results in the station black out and loss of ultimate heat sink in the units 1-4 of the Fukushima Dai-ichi Nuclear Power Station. To make the matter worse, hydrogen explosion in the reactor building took place, which has every effort for recovery all fail. Consequently the reactor cores were seriously damaged and the nuclear fuel melted which lead to the radioactive material release to the environment. Evidences currently available indicate no seismic structural failure of safety systems and components. The tsunami and the station blackout gave intense impact on the nuclear system resulting in the radioactive material release.

Fundamental concept of the nuclear safety is the defence-in-depth. It consists of three fundamental approaches for prevention, mitigation and emergency preparedness. Other nuclear power plant such as Fukushima Dai-ni and Onagawa sustained serious influence from the earthquake and tsunami. The crossroad in the accident progression is discussed and essential lessons-learned are identified. It seems that success or failure of the individual defense line also depends significantly on the practical and efficient usage of the probabilistic risk assessment and accident

**Speaker's bios:** Prof. Akira Yamaguchi, PhD, Osaka University, Department of Energy and Environment, Japan. Prof. Yamaguchi holds BS (1979) and MS (1981) degrees in Nuclear Engineering from the University of Tokyo, Japan. He continued his research on the nuclear safety and he received his Ph.D degree in the field of Fluid-Structure Interaction in Nuclear System from the University of Tokyo in 1984. He joined Power Reactor and Nuclear Fuel Development Corporation (PNC) which is the national research institute for nuclear fuel cycle and fast breeder reactor development project. Since 2006, he has been Professor of Osaka University, Department of Energy and Environment.

Prof. Yamaguchi has more than 30 year experience in the nuclear engineering and safety. He is currently a member of special committees of the Nuclear Safety Committee, New Nuclear Policy-planning Council of Atomic Energy Commission in Japan and other committees of Japanese Nuclear Regulatory Body. He is the Chair of Risk Technology Committee for PRA standards development in the Atomic Energy Society of Japan.

**Guest Speech #2: Title: Sensors Needs for Design Basis and Beyond Design Basis Harsh Environments**

**Dr Bruce Hallbert**

Existing sensors used in nuclear power plants are or may be insufficient: 1) to withstand with assurance the environmental conditions and harsh environments, 2) to cover the range of conditions that may be encountered - would fail before doing so and 3) to measure parameters needed for accident management and long-term plant recovery efforts. In this talk, advances in I&C technologies needed to address post accident management and long term recovery issues will be discussed. Also, enabling technologies such as materials, sensors, robotics, communications, and radiation hardened electronics which are needed to enhance operational awareness will be addressed.

**Speaker's bios:** Dr Bruce Hallbert is the Director of Nuclear Science Enabling Technologies at the Idaho National Laboratory, a U.S. Department of Energy National Laboratory located in Idaho Falls, Idaho. He has a broad background in the international nuclear industry having worked over 25 years with national and international agencies on issues that include: nuclear plant instrumentation & control technologies, probabilistic risk assessment; human reliability analysis; advanced reactor control room design and staffing; advanced alarm systems; emergency operating procedures, accident management; management and organizational factors; safety culture and the risk impact of operational accidents. He is the research pathway lead of Instrumentation, Information, & Control Systems research for the DOE-sponsored Light Water Reactor Sustainability Program (LWRS) and the national technical director of Advanced Sensors and Instrumentation research for the DOE-sponsored Nuclear Energy Enabling Technologies program. He currently serves as the President of the International Association of Probabilistic Safety Assessment and Management and is the US representative to the International Atomic Energy Agency (IAEA) for nuclear power plant instrumentation and controls. He serves as a member of the board of external advisors to the Ohio State University and the University of Tennessee departments of Nuclear Engineering. He received his doctorate (Ph.D.) in Interdisciplinary Engineering from Vanderbilt University in Nashville, Tennessee.

**Guest Speech #3: Title: Taiwan's Response and R&D Changes to Fukushima Dai-ichi NPP Accident in Japan**

**Dr Tsu-Mu Kao**

A State of Emergency was declared on March 11, 2011 by Japan's nuclear regulator, NISA (Nuclear and Industrial Safety Agency), on the Fukushima Dai-ichi nuclear plant after a serious earthquake and subsequent tsunami struck and crippled the plant, causing reactors in a devastated conditions and radioactivity releases. On April 12, NISA upgraded the severity of the Fukushima Dai-ichi accident to highest INES (International Nuclear and Radiological Event Scale) Level 7.

As a neighbor of Japan, Taiwan's AEC (Atomic Energy Council) formed a special taskforce to monitor the situation at Fukushima daily by various channels and post the plant conditions on the website. Several press conferences were held since the accident occurred. Taiwan's AEC also cooperates with other government agencies to take a series of actions such as: monitoring the

environment radiation level, sampling import goods from Japan, and surveying contamination of travelers from Japan, etc.

For the plant examinations, AEC requested the TPC (Taiwan Power Company) to verify the capability of NPPs (Nuclear Power Plants) to respond both the DBA (Design Basis Accident) and beyond-DBA accident. That includes 11 near-term and 1 mid-term actions. Those actions will be introduced in detail. The changes of Taiwan's nuclear R&D to Fukushima Dai-ichi NPP Accident will be addressed. The AEC/INER (Institute of Nuclear Energy Research) will continuously collect and monitor the most current plant conditions at Japan and will review TPC's countermeasures and perform necessary inspections for all NPPs in Taiwan to ensure plant safety. Taiwan, as part of global nuclear community, hopes to participate in the international forum to discuss and share lessons learned from Fukushima Dai-ichi Accident.

**Speaker's bios:** Dr Tsu-Mu Kao, PhD, Deputy Director of Nuclear Safety Technology Center, Institute of Nuclear Energy Research, Taiwan. Dr Kao holds BS (1980) and MS (1982) degrees in Nuclear Engineering from National Tsing-Hua University, Taiwan. He received his Ph.D. degree in the field of Probabilistic Risk Assessment (PRA) from the Massachusetts Institute of Technology (MIT), USA in 1998. Currently, he serves as the Deputy Director of the Nuclear Safety Technology, Institute of Nuclear Energy Research (INER), Atomic Energy Council. He is also a certified professional engineer of Radiation Protection and a certified BWR-6 (Boiling Water Reactor, model 6) Senior Reactor Operator.

Dr Kao has more than 29-year working experiences in the nuclear industry (6 years in Maanshan Nuclear Power Station (MNPS, a PWR (Pressurized Water Reactor)), Taiwan Power Company), nuclear regulation (3 years as BWR & PWR Regulatory Resident Inspector, Atomic Energy Council), and nuclear and non-nuclear R&D (over 20 years for INER). Dr Kao was elected as a member of Board of Directors of International Association for PSAM (Probabilistic Safety Assessment and Management) in 2006 (to 2014).

#### **Guest Speech #4: One year after : An Overview of the Consequences of Fukushima Dai-ichi Accident in France**

##### **Dr Jean-Christophe Gariel**

The French Institute for Radiological Protection and Nuclear safety (IRSN) is a Technical Safety Organisation (TSO) in charge of assessing nuclear and radiological risks. The presentation will focus on the actions that were performed by IRSN during and following the Fukushima Dai-Ichi accident. In a first part, we will focus on the technical assessment that IRSN produced during the first months of the crisis. A particular focus will be made on the aspects related to the assessment of the consequences of the atmospheric and marine releases. In a second part, a description of the consequences of the Fukushima Dai-ichi accident on the nuclear industry in France will be presented. In particular, the main conclusions of the Complementary Safety Assessments (CSA) requested by the government to the nuclear operators will be discussed.

**Speaker's bios:** Dr Jean-Christophe Gariel received his PhD in Geophysics from Grenoble University (France) in 1988. From 1988 to 1990, he was an associate researcher at Columbia University (USA), Lamont Doherty Geological Observatory. His research topic was "Seismic hazard assessment for New

York City”. From 1990 to 1991, he was an associate researcher at Kyoto University (Japan), and his research topic was “Prevision of ground motion for giant earthquakes off Japan coasts (Nankai and Tonankai areas)”. From 1991 to 1996, he was a researcher at French Nuclear Safety Institute (IPSN). He was in charge of the evaluation of seismic hazard for nuclear installations in France. From 1996 to 1999, he was the head of a laboratory in charge of the evaluation of seismic hazard for nuclear installations in France (IPSN, Paris, France). From 1999 to 2003, he was the head of a division in charge of the study of the transfer of radionuclides in the environment (IPSN, Cadarache, France). From 2003 to 2007, he was the head of a division in charge of the study of the transfer and effects of radionuclides in the environment that belonged to Institute for Radiological Protection and Nuclear Safety. (IRSN, Cadarache, France). For 2007 to 2011, he was the Deputy Director of the Environment and Emergency operations Department (IRSN; Paris, France). He is currently the Director in charge of the Environment Department (IRSN, Paris, France). Besides, Dr Gariel is a member of the French Association for Earthquake Engineering, Member of the French Society for Radiological Protection.

#### **Guest Speech #5: Insights, Thoughts and Effects of the Fukushima Accident**

##### **Dr Ren Jun Sheng (任俊生博士)**

The presentation will offer insights from the Fukushima accident. It will also highlight issues in nuclear safety to be focused upon, including the topic of ultimate safety and its consideration, and provide a general view on the current nuclear safety status in China.

**Speaker’s bios:** Dr Ren Junsheng is a member of the Nuclear Safety Expert Commission of the State Ministry of Environmental Protection. He completed his PhD study in Nuclear Power Engineering and Safety. He was engaged in the regulatory authority in nuclear safety in China before 2002, and held positions as Deputy Director and Chief Engineer of the Nuclear Safety Centre of the State Ministry of Environmental Protection, being responsible for the safety assessment and monitoring of a number of nuclear power stations. He took up responsibilities at the China Guangdong Nuclear Power Holding Company (CGNPC) since 2002, taking up positions as the Deputy President and Chief Engineer of the CGN Design Company, Chief Engineer of the China Guangdong Nuclear Power Engineering Company, Safety Director of the Daya Bay Nuclear Power Operations & Management Company, and the Deputy Chief Engineer of CGNPC. He has served in the nuclear industry for nearly 30 years, in areas including design, engineering, operation and nuclear safety regulation.



### About Hong Kong Nuclear Society (HKNS)

HKNS is a non-profit making organisation for professionals interested or working in the nuclear related disciplines. It was established by a group of individuals who recognised the need to establish a platform for professionals working in the diverse fields of nuclear science and technology to share knowledge and exchange information. The Society also aims at providing impartial technical information and views on the related subject matter to the general public in order to enhance the nuclear literacy in Hong Kong and regions nearby.

### The Objects of HKNS

- a) To increase nuclear literacy in Hong Kong and regions nearby;
- b) To promote and contribute to the advancement of principles, disciplines, technology, and applications in nuclear science and engineering;
- c) To facilitate the understanding of nuclear science and engineering;
- d) To provide a forum for a rational exchange of information;
- e) To serve as an advisory body on the topic related to nuclear science and engineering;
- f) To engage in communication and interaction among public, organizations and individuals;
- g) To enhance international cooperation and facilitate information sharing and exchange;
- h) To disseminate information and concepts to all interested individuals and entities;
- i) To liaise and collaborate with professional Institutions in the advancement of nuclear literacy; and
- j) To do of all such other lawful things as are necessary to the attainment of the above objects.

### Symposium Organising Committee

Chairman:	Ir Dr B.L. Luk
Co-Chair:	Ir Dr Herman Tsui
Program Chair:	Ir Dr Vincent Ho
Secretary:	Dr Louis Liu
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