2019 International Joint-Workshop

CANSAS-SAMRC

8th International Workshop on Current CANDU Safety issues & Resolution

CANDU Safety Association for Sustainability (CANSAS-2019)

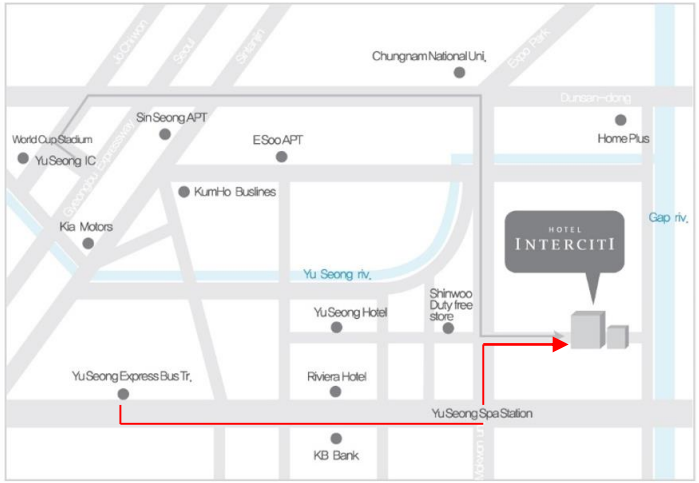
2019 International Workshop

Post-Fukushima Challenges on Severe Accident Mitigation and Research Collaboration (SAMRC-2019)

November 6 (Wed) – 8 (Fri.), 2019
Hotel INTERCITI, Daejeon, Korea

Organized by
Korea Atomic Energy Research Institute (KAERI)
Korea Institute of Nuclear Safety (KINS)

Sponsored by
Korean Nuclear Society (KNS)
International Atomic Energy Agency (IAEA)
Canadian Nuclear Safety Commission (CNSC)



Contact information

Dr. Kwang Soon Ha
Principal Researcher
Head of Accident Mitigation Research Team
Korea Atomic Energy Research Institute (KAERI)
Daejeon, 34057, Korea
Mail : tomo@kaeri.kr
Phone : +82-42-868-8653

CANSAS-2019 OVERVIEW

Background

(1) CANSAS (CANDU Safety Association for Sustainability) was formed in the year 2000 in Korea with members from major Korean nuclear organizations working on CANDU technology which was extended to global participants from 2012. Since then, CANSAS conducts international workshops every year on the latest progress in PHWR (Pressurized Heavy Water Reactor) technology

(2) The main objective is to create a forum for sharing of expertise among the nuclear safety experts from countries operating PHWR.

(3) Experts from the regulatory bodies and research institutes, operating industries as well as designers and suppliers from around the world are invited to attend CANSAS.

(4) The history of the CANSAS International workshop is as follows;

- 1st CANSAS 2012, 2012 11/29-30, hosted by Korea (KAERI)
- 2nd CANSAS 2013, 2013 11/28-29, hosted by Korea (KAERI)
- 3rd CANSAS 2014 / PHWR Safety 2014, 2014 6/23-26, hosted by Canada (CNSC/KAERI)
- 4th CANSAS 2015 / NHNRTH-2015, 2015 12/8-11, hosted by India (AERB/KAERI/CNSC)
- 5th CANSAS 2016 / NUTHOS 11, 2016 10/12-14, hosted by Korea (KAERI/CNSC/AERB/IAEA)
- 6th CANSAS 2017, 2017 11/3-5, hosted by China (KAERI/CNSC/AERB/Qinshan NPP)
- 7th CANSAS 2018 / ISAMC 2018, 2018 10/15-18, hosted by Canada (KAERI/CNSC/IAEA)
- 8th CANSAS 2019 / SAMRC 2019, 2019 11/6-8, hosted by Korea (KAERI/CNSC/IAEA)

Topics

- Plenary: International Collaboration for PHWR R&D Works
- Session I: Accident Management (EOPs, SAMGs) & Source Term
- Session II: Current Safety Issues (Physics, Fuel, Spent Fuel Pool, Safety Analysis)
- Session III: Aging & Life Management, Long-Term Operation

Organization Committee

Scientific Advisory Committee:

N.D. Seo (KINS, CANSAS President, Chair), Ms. Velshi (CNSC, President), S.A. Bhardwaj (AERB, Cahirman), M. Krause (IAEA, Scientific Secretary)

Technical Committee:

N. Mesmous (CNSC), Y.M. Song (KAERI), J.Y. Jung (KAERI), J.H. Bae (KAERI), J.H. Choi (KEPCO-ENC), S.M. Kim (KHNP-CRI), Y.H. Kim (KAIST), D.J. Lee (UNIST), V.S. Krishnan (COG), M. Chen (CNNP), A.K. Nayak (BARC)

Organizing Officer:

Jong Yeob Jung (KAERI): agahee@kaeri.re.kr, +82-42-868-8962

http://casas-samrc.info

SAMRC-2019 OVERVIEW

Background

(1) Strengthen regional collaborative research network in the area of severe accident mitigation, such as exchange of information and expertise for the experimental and analytical investigations on the SA phenomena, development of SA mitigation features, common use of large scale experimental facilities, like corium research platform, hydrogen and aerosol test facility

(2) Enhance the regional nuclear reactor safety by developing creative severe accident mitigation technologies and balanced regulatory framework

(3) Cultivate human resources and expertise in the area of nuclear safety

(4) Develop collaborative research network among China-EU-Japan-Korea-USA

The history of the SAMRC International workshop is as follows;

- SAMRC-2015, 2015. 11. 9-11, Daejeon, Korea, hosted by Korea (KAERI, KINS, KNS)

Scope

Experimental and analytical investigations on severe accident progression, severe accident mitigation, prediction and prevention of environmental contamination, SAMG, regulatory efforts for the resolution of SA issues

Topics

- Plenary: Post-Fukushima Challenges in Severe Accident Mitigation
- Session I: : Fission Product Behavior-I
- Session II : Fission Product Behavior-II
- Session III: : Ex-vessel (Debris bed coolability, Hydrogen and MCCI)
- Session IV: Plan Application
- Session V: PSA

Organization Committee

Technical Program Committee:

J.H. Song (KAERI, Chair), K.S. Ha (KAERI), H.C. Kim(KINS), M.S. Jae(HYU), D.W. Jerng(CAU), Y.J. Cho (KINS), H. S. Park(POSTECH), J.W. Yeon(KAERI), J.H. Park(KAERI), S.Y. Kim(KAERI), S.M. An(KAERI), J.T. Kim(KAERI)

Local Organizing Committee:

D.G. Son (KAERI), S.I. Kim (KAERI), S.H. Kim(KAERI), J.Y. Kang(KAERI), J.H Ham(KAERI), S.M. Kim(KAERI)

06-08, Nov. 2019, Hotel INTERCITI, Daejeon, Korea

OVERALL PROGRAM

	Time	Oak hall	Pine hall-A	Pine hall-C
Nov.06. (Wed.)	13:00	Registration		
	13:30-18:00	CANSAS (Session I) **Accident Management & Source Term**		SAMRC (Session I) **Fission Product Behavior (I)**
Nov.07. (Thur.)	08:30	Opening Ceremony		
	09:00-12:30	Plenary Session		
	12:30-14:00	Lunch (Short-Rib soup, 2F Yettl Restaurant)		
	14:00-18:00	CANSAS (Session II) **Current Safety Issues**	SAMRC (Session III) **Ex-vessel**	SAMRC (Session II) **Fission Product Behavior (II)**
	19:00-20:30	Dinner (Western food, 3F Pine hall)		
Nov.08. (Fri.)	08:30-11:00	CANSAS (Session III) **Aging & Life Management**	SAMRC (Session V) **PSA**	SAMRC (Session IV) **Plant Application**
	11:00	Adjourn		

OPENING CEREMONY

Opening Ceremony (Nov. 07. (Thur) 08:30 – 08:40, Pine hall A & C)

08:30-08:40	**Welcome Address**	Jin Ho Park (Vice President, KAERI)
	Congratulatory Remarks	Namduk Suh (President, CANSAS)

PLENARY SESSION

SAMRC: Plenary Session (Nov. 07. (Thur) 08:40 – 10:40, Pine hall A & C) **Chair:** Kwang Soon Ha (KAERI)

08:40-09:10	SAMRC-P1	**Current Issues and Future Works for Severe Accident** Richard Lee (US NRC)
09:10-09:40	SAMRC-P2	**Current Status of JAEA D&D Effort and International Cooperation Toward Decommissioning of Fukushima Daiichi NPP** Washiya Tadahiro (JAEA)
09:40-10:10	SAMRC-P3	**Status of PSA Methodology Development on Site Risk Assessment** Dong Ha Kim (HYU)
10:10-10:40	SAMRC-P4	**Post-Fukushima Challenges on the Severe Accident Research** JinHo Song (KAERI)
10:40-11:00	**Coffee Break / Group Photo**	

CANSAS: Plenary Session (Nov. 07. (Thur) 11:00 – 12:30, Pine hall A & C) **Chair**: Jong Yeob Jung (KAERI)

11:00-11:30	CANSAS-P1	**Overview of COG Safety & License and Development Progress** Wei Shen (COG)
11:30-12:00	CANSAS-P2	**Application of Modified 37 Element Fuel Bundle in Wolsong NPP** Eunki Lee (KHNP-CRI)
12:00-12:30	CANSAS-P3	**The Severe Accident Practical Elimination Concept** Noreddine Mesmous (CNSC)

CANSAS-2019 PROGRAM

Session I: Accident Management & Source term — Nov. 06 (Wed), 14:00 – 17:40, Oak hall — Chair: Seon Oh YU (KINS), Mi Ro Seo (KHNP)

14:00	C11	**Severe Accident Simulation for CANDU Reactor by Using CAISER Code** Jun Ho Bae (KAERI)
14:25	C12	**Demo Calculation of LBLOCA for CANDU Reactor by Using MARS-CAISER** Donggun Son (KAERI)
14:50	C13	**Heat Transfer Model for Initial Heat-up and Ablation of Lower Head Vessel Wall** Jun-young Kang (KAERI)
15:15	C14	**A Study on CANDU-6 Plant Responses during Station Blackout without Mitigation Actions** Seon Oh Yu (KINS)
15:40		Coffee break
16:00	C15	**Detailed Analysis Results for MCCI phenomena of CANDU Type NPPs** Mi Ro Seo (KHNP)
16:25	C16	**Review of Applicability of Lumped Parameter Codes to Containment Thermal-Hydraulics during the Severe Accident** Chang Hwan Park (F&C)
16:50	C17	**The Current Status of Emergency Response Modelling in the UK** Garth Rowlands (Corporate Risk Associates)
17:15	C18	**Developing a Framework of Evaluating Radioactivity Release and of Dose Calculation Covering Severe Accident of PHWR** Tae Woon Kim (NESS)

Session II: Accident Management & Source term — Nov. 07 (Thur), 14:00 – 18:00, Oak hall — Chair: Jongho Choi (KEPCO E&C), YongMann Song (KAERI)

14:00	C21	**Controlling CANDU Operational Reactivity Transients with Intense Accelerator-driven Photoneutron Sources** Douglas Fynan (UNIST)
14:25	C22	**Effects of Pressure Tube Deformation on Reactivity in PHWR** Eunhyun, Ryu (KAERI)
14:50	C23	**Thought on HWR Fuel Safety Targets for DEC without Significant Fuel Degradation** Jongho Choi (KEPCO E&C)
15:15	C24	**Dose Analysis Results of 37M Fuel Loaded Core Based on Domestic Regulatory Requirements** Hoon Choi (KHNP CRI)
15:40		Coffee break
16:00	C25	**Considerations for Spent Fuel Pool Accident in CANDU** Jong Yeob Jung (KAERI)
16:25	C26	**The study for Spent Fuel Cooling using Microencapsulated Phase Change Material Slurry** Jin Yoo (NESS)
16:50	C27	**A Feasibility Study for Onset of Zircaloy Fires Following an Adiabatic Heatup of Fuel Bundles in PHWR SFPs** Yongmann Song (KAERI)
17:15	C28	**Containment Filtered Vent System Capability Following an Unmitigated Station Blackout Accident in Wolsong Plants** Yongmann Song (KAERI)
17:40	C29	**The Approach to Deterministic Safety Analysis of Common Mode Events** Neman Ali (Bruce Power)

Session II: Accident Management & Source term — Nov. 08. (Fri), 08:30 – 11:00, Oak hall — Chair: Gyeong-Geun Lee (KAERI)

08:30	C31	**Effects of Short Range Ordering on Mechanical Properties in Zr-2.5%Nb Pressure Tube Material** SungSoo KIM (KAERI)
08:55	C32	**Effect of Ordering on In-reactor Performance of Zr-2.5Nb Pressure Tubes** Young Suk Kim (KAERI)
09:20	C33	**FFS Assessment of Pressure Tubes based on the Latest CSA N285.8** Ji-Hoon Kang (KHU)
09:45	C34	**Zr-Hydride Formation According to Cooling Rate** Sang-yeob Lim (KAERI)
10:10	C35	**Study of the Effect of Crystallographic Orientations on Irradiation-induced Creep Deformation of Pressure Tubing in CANDU6** Dong Hyun Ahn (KAERI)
10:35	C36	**Application of Multilevel Modeling on the In-reactor Diametrial Expansion of Pressure Tubes** Gyeong-Geun Lee (KAERI)

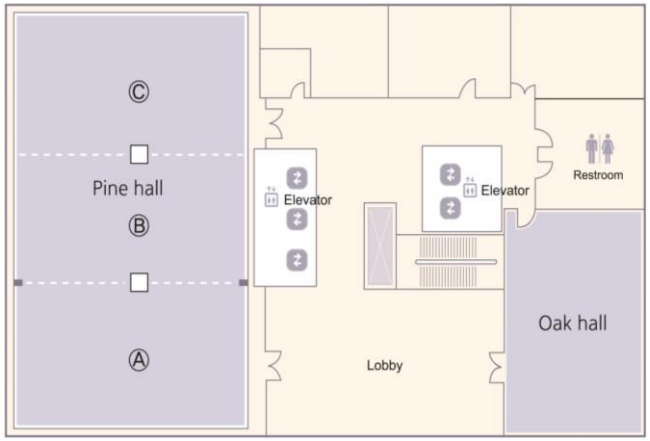
SAMRC-2019 PROGRAM

Session I : Fission Product Behavior (I) — Nov. 06 (Wed), 13:30 – 17:00, Pine hall C — Chair: Akira Nakayoshi (JAEA), Jei-Won Yeon (KAERI)

14:00	022	**Introduction to Activity of OECD/PreADES** Akira Nakayoshi (JAEA)
14:30	023	**Structural Characterization and First-Principle Understanding of Zr Doped Fluorite UO_2** SangHo Lim (KAERI)
14:50	011	**Realization of Multiple Purposes to Mitigate SA Progression through Adopting Technologies from other Industrial Areas** Dong Hoon Kam (KAIST)
15:10	024	**Evaluation of Volatile Iodine in Pool under Severe Accident Condition** Thi Thanh Thuy Nguyen (UST/KAERI)
15:30		Coffee break
16:00	008	**Activities of Severe Accident Chemistry Group of KAERI on Chemical Behavior of Iodine and Tritium** Jei-Won Yeon (KAERI)
16:20	025	**Formation of Volatile Iodine from Decomposition of Sodium Iodate at High Temperature** Minsik Kim (KAERI)

Session II: Fission Product Behavior-II — Nov. 07 (Thur), 14:00 – 18:00, Pine hall C — Chair: Taizo Kanai (CRIEPI), Kwang Soon Ha (KAERI)

14:00	004	**Development of Technical Basis for Filtered Containment Venting System in CRIEPI Japan** Taizo Kanai, Masahiro Furuya ,Satoshi Nishimura, Yoshihisa Nishi (Central Research Institute of Electric Power Industry)
14:20	003	**Accurate Calculations of Decontamination Factors on Aerosol Particles with Bubble Size Distribution during Pool Scrubbing** Yoonhee Lee, Yong Jin Cho, Inchul Ryu (Korea Institute of Nuclear Safety)
14:40	006	**Numerical Study of the Flow Characteristics and Influencing Factors of Gas Jet into Water** Dandi Zhang, Lili Tong, Xuewu Cao (Shanghai Jiao Tong University)
15:00	009	**Preliminary Experimental Study on Influencing Factors of Aerosol Retention by Pool Scrubbing** Yuxiang Li, Junhao Wang, Lili Tong, Xuewu Cao (Shanghai Jiao Tong University)
15:20	034	**Containment pressure control in case of a severe accident - Comparison of various system designs and operating approaches** Matthias Braun, Markus Hupp, Axel Hoefer, Gerben Dirksen (Framatome GmbH)
15:40		Coffee break
16:00	014	**Experiments of Aerosol Deposition and Removal during Steam Generator Tube Rupture** Byeonghee Lee (KAERI)
16:20	015	**MELCOR analysis on OPR1000 in SGTR scenario** Sung Il Kim (KAERI)
16:40	001	**Thermal-hydraulic Analysis of Inter-System Loss of Coolant Accident in OPR1000** Young Su Na, Song-Won Cho, Kwang Soon Ha (KAERI)
17:00	010	**Aerosol Deposition with High Reynolds Number in 2inch Straight and 90° Bend Pipes** Doo Yong Lee (FNC Technology)
17:20	013	**Analyses on Sub-Critical Boron Concentrations for Conventional Pressurized Water Reactor during the Reflooding Phase of a Severe Accident** Yoonhee Lee, Yong Jin Cho, and Kukhee Lim (Korea Institute of Nuclear Safety)



SAMRC-2019 PROGRAM

Session III: Ex-vessel (Debris bed coolability, Hydrogen and MCCI) — Nov. 07 (Thur), 14:00 – 18:00, Pine hall A — Chair: Jongtae Kim (KAERI), Sang Mo An (KAERI)

14:00	016	**Ex-vessel Core Melt Stabilization Principles for New and Operating NPPs** Manfred Fischer and Torsten Keim (Framatome GmbH)
14:30	017	**Research Activities on Ex-Vessel Debris Coolability at KTH** Weimin Ma (KTH)
15:00	018	**Ex-vessel Debris Coolability and Stabilization Research at KAERI with Recent Experimental Progress** Sang Mo Ahn (KAERI)
15:20	019	**Development of Simplified Ex-vessel Debris Bed Coolability Analysis Codes (CORONA)** Jaehoon Jung (KAERI)
15:40		Coffee break
16:00	007	**Recent Updates in Models to Predict the Coolability of Corium Debris Bed** Park Hyun Sun (POSTECH)
16:20	020	**Application of MAAP5 Corium Coolability Models on Korean High Power Reactor** Byung Jo Kim (KEPCO E&C)
16:40	021	**Influence of Melt Jet Breakup on the Debris Bed Formation in the Reactor Cavity** Hyoung-Tak Kim (KMOU)
17:00	031	**Numerical Study of the Light Gas Behavior During Spray Injection in TOSQAN-113** Seokwon Whang (POSTECH)
17:20	032	**SPARC-PAR Experimental Simulation of PAR-induced Hydrogen Stratification** Jongtae Kim (KAERI)
17:40	033	**Validation and Application of a Central-upwind Scheme for Detonative combustions of Hydrogen** Dehee Kim (KAERI)

Session IV: Plant Application — Nov. 08. (Fri), 08:30 – 11:00, Pine hall C — Chair: Rae Joon Park (KAERI), Kookhee Lim (KINS)

08:30	026	**Code Status and Future Challenges in Severe Accident Analysis** Larry Humphries (SNL)
09:00	027	**Derivation of Contact Pressure Between a Penetration Tube and Hole of a Reactor Lower Head Under Severe Accidents** Kukhee Lim (KINS)
09:20	005	**Evaluation of Creep Rupture of RCS Boundary for an APR1400 SBO Accident** GAEUL CHOI (FNC Technology)
09:40	028	**Accident sequence analysis of SBO in SMART100 using MELCOR** Jaehyun Ham (KAERI)
10:00	029	**Prediction of Hydrogen and Carbon Monoxide Combustion Risk Using MELCOR Code: Its Limitation and Future Direction** Sung Joong Kim (HYU)
10:20	030	**Challenges of IVR-ERVC Assessment from the Perspective of Thermal Behavior in Highly Turbulent Oxide Pool** Seokwon Whang and Hyun Sun Park (POSTECH)
10:40	012	**An Analysis of a Severe Accident Sequence during an SBLOCA in SMART Using the CINEMA-SMART Code** Hyung Seok Kang (KAERI)

Session V: PSA — Nov. 08. (Fri), 08:30 – 11:00, Pine hall A — Chair: Tae Woon Kim (KAERI), Sung-yeop Kim(KAERI)

08:30	039	**Atmospheric Transport Analysis of the Fukushima Daiichi Accident** Nathan Bixler (SNL)
09:00	035	**Status of Level 1 PSA Model Development Reflecting Severe Accident Prevention Measures** Seong Kyu Park (ACT)
09:20	036	**Status of Level 2 PSA Model Development Reflecting Severe Accident Mitigation Measures** Gunhyo Jung (FNC Technology)
09:40	037	**Safty Assessment Improvement through KHNP SOARCA Project** Hyungho Lee (KHNP)
10:00	038	**Effectiveness of External Water Injection Performance in Fukushima Accident** Tae Woon Kim (KAERI)