

The 11th European Review Meeting on Severe Accidents Research

May 13-16, 2024

KTH Royal Institute of Technology, Stockholm, Sweden

Technical Program

MONDAY, MAY 13th, 2024

8:00 Registration

WELCOME AND OPENING (Room Nya Matsalen)

Chairs: S. Bechta (KTH), F. Gabrielli (KIT)

09:00 Welcoming Addresses

S. Östlund, Vice President of the KTH

09:10 M. Knochenhauer, Director General, Swedish Radiation Safety Authority (SSM)

09:20 Opening of the ERMSAR2024 Conference

L.E. Herranz (CIEMAT), Coordinator of the SEAKNOT project

PLENARY SESSION: 'SINGULAR CAREERS IN THE SEVERE ACCIDENT RESEARCH'
(Room: Nya Matsalen)

Chairs: L. E. Herranz (CIEMAT), T. Lind (PSI)

09:30 Reflections on a career in reactor safety: Severe Accident Code Development
Dr Randall Gauntt (MELCOR Code Development Manager, Retired Sandia National Laboratories)

09:50 Progress in Predicting Reactor Pressure Vessel Failure
J. Rempe (Rempe and Associates, LLC)

10:10 Your Research Maps: Needs and challenges with scaling consideration
H. Nakamura (JAEA)

10:50 Coffee break

	Room: Nya Matsalen	Room: Gröten
	Session 2.1 Severe Accident Scenarios	Session: 1.1 In-vessel Corium and debris coolability
	Chairs: S. Gupta (Becker Tech. GmbH), D. Jacquemain (OECD/NEA)	Chairs: F. Gabrielli (KIT), A. Miassoedov (IAEA)
11:10	SEAKNOT: Looking Ahead of Severe Accident Research L. E. Herranz (CIEMAT)	IVMR Modelling with Transient Effects during Molten Pool Formation and Stabilization – Outcomes from Models' Comparison Performed in the IAEA CRP J46002 L. Carénini (IRSN)
11:35	ASTEC core degradation calculations in support of Level-2 Probabilistic Safety assessment for 1300MWe French reactors: methodology and preliminary results M. Monestier (IRSN)	Numerical Analysis of Melt Penetration Behavior in the Control Rod Drive Housing of Fukushima Daiichi Nuclear Power Station Unit-2 X. Li (JAEA)
12:00	MELCOR Analyses for Investigation on Hydrogen Management during BWR Severe Accidents with the Filtered Containment Venting System Y. Kojima (Waseda University)	Reactor pressure vessel integrity during severe accident with core meltdown: characterization of material parameters, structure integrity assessment and thermal-hydraulic assessment P. Gal (UJV)
12:25	On the progress made in safety assessment and severe accident management as part of the French Fukushima post-accident research programme A. Bentaib (IRSN)	Improvement of thermochemical corium stratification accounting for uranium and zirconium composition difference in metallic and oxide phases R. Le Tellier (CEA)

12:50

Lunch break

	Room: Nya Matsalen	Room: Gröten
	Session 2.2 Severe Accident Scenarios	Session: 1.2 In-vessel Corium and debris coolability
	Chairs: A. Bentaib (IRSN), L. E. Herranz (CIEMAT)	Chairs: L. Carénini (IRSN), T. Hollands (GRS)
14:30	Horizon Euratom ASSAS project: Can machine-learning make fast and accurate severe accident simulators a reality? B. Poubeau (IRSN)	Stainless Steel Oxidation at both Solid and Liquid State Under Ar-H₂O Gas Mixture in Severe Accident Conditions M. Nasselahsen (CEA)
14:55	Preliminary Strategies for Training Dataset Generation and Surrogate Modeling of SBO Management Measures in PWR C. D'Alessandro (PSI)	A Thermodynamic Study of Molten Pool Stratification Morphology E. Chen (China Nuclear Power Eng. Co.)

15:20	Analysis of accident progression behavior and simulation of FP release into the environment using MELCOR code for the Fukushima Daiichi Nuclear Power Station Units 1 to 3 M. Himi (CRIEPI)	In-Vessel Corium Thermochemistry Benchmark based on MASCA Experimental Data R. Le Tellier (CEA)
15:45	Long-term severe accident management at Loviisa NPP M. Harti (Fortum Power and Heat Oy)	Coolability of a Corium Pool in a Debris Bed – Calculation of Critical Heat Flux (CHF) Tests with the ASTEC Code J. A. Zambaux (IRSN)

16:10 Coffee break

	Room: Nya Matsalen	Room: Gröten
	Session 2.3 Severe Accident Scenarios: U&S analysis	Session 4.1 Severe Accident Scenarios: Small Modular Reactors
	Chairs: O. Coindreau (IRSN), S. Paci (University of Pisa)	Chairs: F. Gabrielli (KIT), D. Jacquemain (OECD/NEA)
16:30	Major Achievements of the EC MUSA Project L. E. Herranz (CIEMAT)	SASPAM-SA: Assessment of the relevance and applicability of existing experimental databases to iPWR T. Lind (PSI)
16:55	Source Term Uncertainty Analysis of Filtered Containment Venting Scenarios in Nordic BWR S. Galushin (Vysus Group)	Numerical Investigation of Natural Circulation Inside a Scaled-Down Prismatic Modular Reactor By RHYS M. Shewitah (Minia University)
17:20	Uncertainty and Sensitivity Analysis of the ASTEC Source Term Results of a MBLOCA Scenario with the Activation of Severe Accident Management Actions in a Generic KONVOI Plant A. Stakhanova (KIT)	Development of a LW-SMR dry containment model with containmentFOAM C. Vázquez-Rodríguez (FZJ)
17:45	Source Term Uncertainties in unmitigated SBO sequences in a PWR-1000: Insights from the EU-MUSA project R. Iglesias (CIEMAT)	Comparison of a DBA sequence in a generic iPWR between MELCOR and ASTEC codes G. Grippo (ENEA)

18:10 Adjourn

TUESDAY, MAY 14th, 2024

	Room: Nya Matsalen	Room: Gröten
	Session 2.4 Severe Accident Scenarios: U&S analysis	Session 4.2 Severe Accident Scenarios: Small Modular Reactors
	Chairs: M. Angelucci (University of Pisa), L. E. Herranz (CIEMAT)	Chairs: T. Lind (PSI), A. Bentaib (IRSN)
09:00	Synthesis of Source Term Assessments for a Loss-Of-Cooling Accident in a Spent Fuel Pool: Uncertainty and Sensitivity Analyses and Potential Benefit of Water Injection by Spray System O. Coindreau (IRSN)	Analysis of Postulated Severe Accidents in Generic Integral PWR Small Modular Reactors in the frame of the Horizon Euratom SASPAM-SA Project F. Gabrielli (KIT)
09:25	Uncertainties on Fission Product Release for a Loss-Of-Cooling Scenario in a Spent Fuel Pool with MELCOR2.2 M. Garcia (CIEMAT)	Update on Severe Accident Analysis Research at CNL for Small Modular and Advanced Reactor Designs A. Morreale (CNL)
09:50	Uncertainty and Sensitivity Analyses of Severe Accident Codes Using the ACE Algorithm-based Surrogate Model Kwang-II Ahn (KAERI)	Application of the Probabilistic Method to Propagate Input Uncertainty on a DBA Sequence in a Generic iPWR G. Grippo (ENEA)
10:15	System Identification and Ranking Table (SIRT) for chemical thermodynamics of severe accidents C. Journeau (CEA)	Comparison between EDF MAAP5.04 and ASTECv3 codes on an hypothetical Severe Accident on the ELSMOR project NUWARD-Like SMR Design J. Bittan (EdF)

10:40 Coffee break

	Room: Nya Matsalen	Room: Gröten
	Session 3.1 Ex-vessel corium interactions and coolability	Session 6.1 Hydrogen risk and Containment behavior
	Chairs: L. Carénini (IRSN), M. Hupp (Framatome GmbH)	Chairs: I. Kljenak (IJS), S. Gupta (Becker Tech. GmbH)
10:55	Results of the SSM-SICOPS melt tests in the frame of the EU-SAFEST project G. Langrock (Framatome GmbH)	AMHYCO Project Overview and First Outcomes G. Jiménez (UPM)
11:20	Ex-Vessel stabilization of corium: An analysis of corium-concrete interaction with top flooding for siliceous concrete F. Fichot (IRSN)	Outcomes of the experimental and numerical work on the operational behavior of passive autocatalytic recombiners in the late phase of a severe accident in the framework of the AMHYCO project E.-A. Reinecke (FZJ)

11:45	Fluids Mixing Modelling with Phase Change for Molten Corium-Concrete Interaction I. Khurshid (Khalifa University)	Assessment of Unmitigated Combustion Risk in Late Phase Within the AMHYCO Project S. Kelm (FZJ)
12:10	Characterisation of prototypic ex-vessel fuel debris simulating MCCI at Fukushima Daiichi C. Journeau (CEA)	Heat Removal to Large Water Pools – Macroscopic Modelling of Microscopic Phenomena in the Simulation Code AC²/COCOSYS C. Spengler (GRS)

12:35 Lunch break

PLENARY SESSION: ‘REGULATORY PERSPECTIVE AND APPROACHES FOR SEVERE ACCIDENTS IN SMALL MODULAR REACTORS’ (Room: Nya Matsalen)

Chairs D. Jacquemain (OECD/NEA), A. Miassoedov (IAEA)

14:00 U.S. NRC Regulatory Perspective and Approaches for Severe Accidents in Small Modular Reactors

Jason Schaperow, (USNRC Office of Nuclear Reactor Regulation)

14:20 The Canadian Nuclear Regulatory Role, Approaches and Challenges for Severe Accidents in Small Modular Reactors

Samuel Gyepi-Garbrah (Canadian Nuclear Safety Commission)

14:40 Beyond Design Basis Analysis: Regulatory Perspective on New Reactor Designs

Ali Tehrani (Office for Nuclear Regulation, UK)

15:00 Applicability of new Swedish regulations to Small Modular Reactors – Opportunities and challenges of a performance based approach

A. O. Mowitz (Swedish Radiation Safety Authority, SSM)

15:30 Poster Session & Coffee break

MELCOR 2.2 analyses of passive systems modeling based on the PANDA facility experiments

M. Malicki (PSI)

Model Development for the Simulation of Fission Product Release from Molten Pools

F. Krist (PSS-RUB)

Severe Accident Sequence of LOCA for APR1400 using CINEMA Computer Code

Rae-Joon Park (KAERI)

Comparative Study of the Hydrogen Distribution Among Different PWR-W Lumped-Parameter and 3D Containment Models with GOTHIC 8.3 (QA)

A. García-Herranz (UPM)

Thermophysical property measurement of oxide melts using aerodynamic levitation

Y. Gong (CNPE)

PLINIUS – experimental platform for nuclear excellence

A. Bachrata (CEA)

Thermodynamic Evaluation of Liquid-Gas Surface Tension for U-O-Zr Mixtures Using the Butler Equation

A. Tourneix (CEA)

Analysis of combustible gases distribution with accident management action in a generic PWR-W containment

J. Fontanet (CIEMAT)

Development of 3D view application debrisEye for decommissioning of Fukushima Daiichi Nuclear Power Plant

T. Yamashita (JAEA)

Thermal shock resistant geopolymers as refractory material for core catcher

B. Mészáros (UJV)

Investigation of New Inorganic Materials for Nuclear Industry under Severe Accident Conditions

J. Hrbek (UJV)

Modeling of pool scrubbing and sensitivity analysis using GOTHIC

X. Wang (KTH)

MELCOR analyses of Severe Accident sequences in an integral PWR with passive systems

F. Giannetti (Sapienza University of Rome)

Development of severe accident simulation code for sodium-cooled fast reactors: SIMMER-V (2) Development and verification of detailed fuel pin model

S. Ishida (JAEA)

Analysis of the combustion risk mitigation inside the containment during a postulated severe accident in a PWR using the code package AC2

M. Mürer (PSS-RUB)

Uncertainty quantification analysis with radiological consequences for a loss of cooling accident in a spent fuel pool

M. D'Onorio (Sapienza University of Rome)

THS-15 Experimental Facility: Effect of Surface Roughness on CHF Values

D. Batek (UJV)

Cooperative Nuclear Safety Research Activities at the Nuclear Energy Agency in Response to the Fukushima-Daiichi Accident

Y. Kumagai (OECD/NEA)

Filtration efficiency of electrostatic precipitator for iodine particles in different gas atmospheres simulating the severe accident scenarios

S. Basnet (University of Eastern Finland)

Study on AP1000 accident diagnosis and treatment for loss of monitoring and control

Y. Yu (China Nuclear Power Engineering Co.)

Failure modes of the reactor coolant pressure boundary in high-pressure core melt accident scenarios

C. Bläsius (GRS)

Parametric sensitivity studies for RELAP/SCDAPSIM model of QUECH-20 test

N. Elsalamouny (LEI)

Assessment of how Zr-clad oxidation affects the speciation and release of FPs under accidental conditions

C. Riglet-Martial (CEA)

LPM vs. 3D Analysis of an In-Vessel LBLOCA Sequence using the ALMARAZ NPP GOTHIC Containment Model

C. Gabicagogeascoa-Cuesta (UPM)

Some results of the AMICO project

G. Langrock (Framatome GmbH)

Effect of the Stages of the Accumulators on THE Hydrogen Production During LOCA+SBO in BNPP VVER-1000

A. Hosseini (Shahid Beheshti University)

Comparative Study of Two Experimental Configurations with an Internal Compartment in the PANDA Facility

S. Arfinengo-del-Carpio (UPM)

Numerical Simulation of LIVE2D Two-Layer Melt Pool Experiment

P. Guo (Tsinghua University)

Severe Accident R&D in UJV Group

P. Vácha (UJV)

Investigation of IVMR Strategy for BNPP-1 VVER 1000

A. Najafi (Sharif University of Technology)

Assessment of RELAP5-3D condensation models for small modular reactor passive safety

P. K. Bhowmik (INL)

V&V of nuclear fuel oxidation behavior in sleeveless SiC-matrix during air ingress accident

Y. Nishimura (University of Tokyo)

Numerical Analyses on Melt Water Interactions with Super Absorbing Polymers Added to the Cooling Water

M. Buck (University of Stuttgart)

	Room: Nya Matsalen	Room: Gröten
	Session 3.2 Ex-vessel corium interactions and coolability	Session 5.1 Severe accident scenarios: Model development and validation
	Chairs: S. Bechta (KTH), P. Piluso (CEA)	Chairs: M. Angelucci (University of Pisa), F. Gabrielli (KIT)
17:00	Production of prototypic corium in the VULCANO facility using uranothormite and induction heating A. Denoix (CEA)	Formulation of material property formula for calculation of damage in reactor pressure vessel during accident evaluation K. Shimomura (JAEA)
17:25	Overview of Ex-Vessel Severe Accident Scenarios Simulations at UJV Rez J. Komrska (UJV)	Correlation Development for the Determination of Aerosol Particle Retention in Liquid Pools J. Rehrmann (PSS-RUB)
17:50	Simulations of FLOAT debris quenching experiments M. Uršič (JSI)	In Vessel Melt Retention 0D model for integral Pressurized Water Reactors M. Principato (Sapienza University of Rome)

18:15 Adjourn

WEDNESDAY, MAY 15th, 2024

PLENARY SESSION: 'LOOKING AHEAD IN SA RESEARCH' (Room: Nya Matsalen)

Chairs: L. Carénini (IRSN), S. Gupta (Becker Technologies GmbH)

09:00 Incoming Euratom Research funded Projects on Severe Accident and Nuclear Safety

A. Iorizzo (European Commission)

09:10 Recent IAEA Activities Related to Severe Accidents

A. Miassoedov (IAEA)

09:20 Status and Perspectives in NEA Joint Nuclear Safety Research Projects in the Severe Accident Area

D. Jacquemain (OECD/NEA)

10:30 Coffee break

	Room: Nya Matsalen	Room: Gröten
	Session 7.1 Source term	Session 5.2 Severe accident scenarios: Model development and validation
	Chairs: O. Coindreau (IRSN), A. Bentaib (IRSN)	Chairs: A. Stakhanova (KIT), T. Hollands (GRS)
10:45	The Reduction of Radiological Consequences of design basis and extension Accidents: re-assessment of calculation results and main outcomes of the R2CA project N. Girault (IRSN)	Assessment of pH-values in water pools during severe accidents in PWR using the lumped parameter code COCOSYS L. Anschuetz (Framatome GmbH)
11:10	Progress in understanding fission products remobilization behaviour and hydrogen risk in water cooled reactors under severe accident conditions: OECD/NEA THAI-3 project S. Gupta (Becker Technologies GmbH)	Modeling of oxidation behavior of Accident Tolerant Fuel by using AC² G. Stahlberg (PSS-RUB)
11:35	Source Term Assessment for a VVER-1000 Reactor Equipped with Filtered Venting: Sensitivity Study of the Impact of Different Forms of Iodine in the Containment M. Kotouc (UJV)	ASTEC validation of SFP Dewatering using Results from the DENOPI project L. Laborde (IRSN)
12:00	Source Term Dispersion Analysis and Construction of the Risk Map around the Peach Bottom Unit-2 Plant Using the ASTEC and JRODOS codes O. Murat (KIT)	A review of correlations of stainless steel oxidation in steam, and modeling the reaction with MELCOR T. Sevón (VTT)

12:25 Lunch break

	Room: Nya Matsalen	Room: Gröten
	Session 7.2 Source term	Session 6.2 Hydrogen risk and Containment behavior
	Chairs: L. E. Herranz (CIEMAT), S. Gupta (Becker Tech. GmbH)	Chairs: I. Kljenak (IJS), S. Kelm (FZJ)
14:00	Effect of Boric Acid on Fission Product Tellurium and Iodine in Severe Accident-Like Conditions: Analysis with X-Ray Photoelectron Spectroscopy F. Börjesson Sandén (Chalmers University of Technology)	Validation of REKO-DIREKT and ContainmentFOAM-9 Code Coupling Using THAI-HR Experiments L. Serra Lopez (UPM)
14:25	Local measurements on particle mass transfer in gas-liquid flows A. Ramos Perez (PSI)	THAI Experiment on Iodine Absorption Capacity of Pre-Stressed Paint Coatings on Different Surfaces K. Dieter (Becker Techn. GmbH)
14:50	New Experimental Devices for Severe Accident Study: a Laser Based Approach Y. Pontillon (CEA)	Validation of the PARUPM and GOTHIC 8.3 Code Coupling using THAI Hydrogen Recombination Tests A. Domínguez-Bugarín (UPM)
15:15	On the progress made in source terms evaluation and possible open issues relative to advanced technologies L. Cantrel (IRSN)	

15:40 Coffee break

	Room: Nya Matsalen	Room: Gröten
	Session 7.3 Source term	Session 6.3 Hydrogen risk and Containment behavior
	Chairs: T. Lind (PSI), F. Rocchi (ENEA)	Chairs: I. Kljenak (IJS), S. Kelm (FZJ)
16:00	Gaseous and aerosol formations in the pseudo-binary CsI-MoO₃ reaction system M. Rizaal (JAEA)	Evaluation of hydrogen risk and its mitigation strategies adopted in isotope manufacturing building C. Peng (Shanghai University)
16:25	Experimental study on removal effect of radioactive materials in the course of the leakage through the equipment hatch K. Nakamura (CRIEPI)	The Scaling of Turbulent Flame Acceleration and Detonation Transition for Hydrogen-Air mixtures in the RUT Facility M. Kuznetsov (KIT)

16:50 Adjourn

19:00 Conference Dinner

THURSDAY, MAY 16th, 2024

	Room: Nya Matsalen	Room: Gröten
	Session 9.1 Severe Accident Scenarios: Accident Tolerant Fuels	Session 8.1 Severe Accident scenarios: Fast Reactors
	Chairs: S. Gupta (Becker Tech. GmbH), M. E. Cazado (KIT)	Chairs: A. Stakhanova (KIT), F. Gabrielli (KIT)
09:00	Overview of KIT activities on ATF cladding materials M. Steinbrück (KIT)	Preliminary Evaluation of Reactivity Insertion during BDBA-LOCA of Super Fast Reactor K. Matsuoka (Waseda University)
09:25	Application of AC²/ATHLET-CD and ASTEC for ATF Experiments in the Frame of OECD QUENCH-ATF and IAEA CRP ATF-TS T. Hollands (GRS)	Development of severe accident simulation code for sodium-cooled fast reactors: SIMMER-V (1) Overview of the SIMMER-V code development H. Tagami (JAEA)
09:50	The CODEX-ATF experiment R. Farkas (EK-CER)	Experimentation & simulation of ablated surface by jet impingement for core-catcher safety issue N. Seiler (CEA)

10:15 Coffee break

CLOSING PLENARY SESSION (Room: Nya Matsalen)

Chairs: L.E. Herranz (CIEMAT), F. Gabrielli (KIT)

10:45 Summary and conclusions of the plenary sessions
L.E. Herranz (CIEMAT), Coordinator of the SEAKNOT project

11:00 Summary and conclusions of the technical sessions
NUGENIA TA2 Leaders

11:30 Concluding Remarks and Introduction of ERMSAR2026
L.E. Herranz (CIEMAT), Coordinator of the SEAKNOT project
F. Gabrielli (KIT)

11:40 Closing of the conference

14:30 NUGENIA TA2 Meeting (Restricted) (Room: Gröten)

FRIDAY, MAY 17th, 2024

Technical visit to the Westinghouse Thermal-Hydraulic Testing Laboratory in Västerås,
<https://youtu.be/Mn4aoww73lE?si=p9hiSovOr6612iPg>

Note: max. 40 participants

Schedule

- 11:00** Departure from Nymble
- 12:45** Arrival at Westinghouse facility in Västerås
- 13:00** Technical tour
- 16:00** Departure to Stockholm
- 17:30** Arrival at Nymble