



# ANS Meetings

## 18th International Topical Meeting on Nuclear Reactor Thermal Hydraulics (NURETH-18)

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### Official Program

August 18-23, 2019

Portland, OR

Marriott Portland Downtown Waterfront





# ANS Meetings

18th International Topical Meeting on Nuclear Reactor Thermal Hydraulics (NURETH-18)

*Our most sincere thanks to our sponsors for their support of NURETH-18*

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# Welcome to Nureth-18

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It is our great pleasure to welcome all the participants to the 18th International Topical Meeting on Nuclear Reactor Thermal Hydraulics (NURETH-18), held August 18–22, 2019, in Portland, Oregon, United States.

Since the first meeting in 1980, NURETH-series meetings have been the largest international forums to present and discuss advancement in research, development, and applications of topics related to nuclear reactor thermal hydraulics and related fields. The NURETH-18 meeting was organized by the Thermal Hydraulics Division of the American Nuclear Society (ANS) in cooperation with the ANS Eastern Washington Section, Oregon State University, and many other co-sponsoring organizations.

NURETH-18 covers a wide range of thermal hydraulics topics associated with the different types of current- and future-generation nuclear reactors. Approximately 800 abstracts and 600 draft papers were submitted to the meeting. We express our sincere gratitude to the authors, reviewers, and participants in this conference.

The NURETH-18 technical program consists of 545 oral presentations that will be delivered in four full days. Our honorary chairs, Professor Yassin Hassan, Professor Hisashi Ninokata, and Dr. Joy Rempe, will address the Monday morning opening plenary session. This year we are including exciting plenary addresses on the thermal hydraulics of nuclear propulsion for space exploration and advancements in microreactors. Publication of selected papers in archival journals will also be arranged.

NURETH-18 is also a venue for organizations to showcase their expertise in nuclear reactor technology and for participants to enjoy several opportunities to meet sponsors who exhibit their products and services to the nuclear reactor thermal hydraulics community.

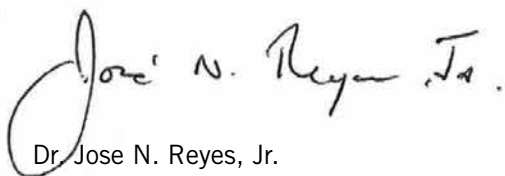
We were deeply saddened to learn of the passing of three giants in reactor thermal hydraulics and multiphase flow, **Professor Bal Raj Sehgal** (February 26, 2018, at age 84), **Professor Dr. George Yadigaroglu** (October 25, 2018, at age 80), and **Professor Geoffrey F. Hewitt** (January 18, 2019, at age 85). These outstanding researchers, teachers, and mentors have served as lights to our industry—enduring examples of the highest level of integrity, scholarship, and collegiality to which we should all aspire. Ad-memoriam sessions will be held on Monday and Tuesday, August 19 and 20, 2019, celebrating their legacies and honoring their remarkable and steadfast contributions to our field.

We thank all the session organizers and session chairs/co-chairs, and also the members and volunteers for their time and effort in maintaining the high quality of the NURETH program. We offer our sincere thanks to the members of the Technical Program Committee, the Local Organizing Committee, and the Eastern Washington Section of ANS. Without their dedication, NURETH-18 would not have been possible.

Finally, we hope that all the participants will find the meeting very productive and that your stay in Portland, the City of Roses, is very enjoyable.

Sincerely,

**General Chairs of 2019 NURETH-18**



Dr. Jose N. Reyes, Jr.  
Chief Technology Officer & Co-Founder  
NuScale Power



Dr. Kurshad Muftuoglu  
Principal Engineer & Technologist  
GE Hitachi Nuclear Energy



Dr. Mark Peters  
Laboratory Director  
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Mr. Kevin Zwijsen



# Daily Schedule

## Sunday, August 18

3:00-6:00 pm	Registration	Hotel Lower Level Registration Desk
6:00-7:30 pm	Welcome Reception (host Dinner)	Salons E-F

## Monday, August 19

7:30 am-5:00 pm	Registration	Hotel Lower Level Registration Desk
9:00-10:30 am	Opening Ceremony and Plenary—I	Salons E-F
9:00 am-5:00 pm	NURETH EXPO	Salon G-I
10:30-10:50 am	Coffee Break	Ballroom Foyer, Salons E-F
10:50 am-12:00 pm	Opening Plenary—II	Salons E-F
12:00-1:30 pm	Lunch (hosted lunch in Expo)	Salon G-I
1:30-3:00 pm	Parallel Technical Sessions 1 <ul style="list-style-type: none"> <li>• Computational Multi-Fluid Dynamics—I</li> <li>• Benchmark Study of the Accident at the Fukushima Phase 2—I</li> <li>• Computational Fluid Dynamics—I</li> <li>• Celebrating the Legacies of Geoff Hewitt and George Yadigaroglu—Panel</li> <li>• Fundamental Thermal Hydraulics: Experiments—I</li> <li>• Thermal Hydraulics in Advanced Reactors: General—I</li> <li>• Thermal Hydraulics in Lead-Cooled and Lead-Bismuth-Cooled Fast Reactors—I</li> <li>• Boiling and Condensation Fundamentals—I</li> <li>• BEPU Analysis and Challenges in Licensing</li> <li>• Operation and Safety of Existing Reactors: General—I</li> <li>• Verification and Validation: General—I</li> <li>• CHF and Post CHF Heat Transfer, Flooding and CCFL—I</li> </ul>	Columbia Eastside Pearl Mt. Hood Salon A Salon B Salon C Salon D Sunstone Salmon Douglas Fir Meadowlark
3:00-3:30 pm	Coffee Break	Ballroom Foyer, Salons E-F
3:30-5:00 pm	Parallel Technical Sessions 2 <ul style="list-style-type: none"> <li>• Benchmark Study of the Accident at the Fukushima Phase 2—II</li> <li>• Computational Multi-Fluid Dynamics—II</li> <li>• Computational Fluid Dynamics—II</li> <li>• Computational Thermal Hydraulics: General—I</li> <li>• Fundamental Thermal Hydraulics: Experiments—II</li> <li>• Thermal Hydraulics in Advanced Reactors: General—II</li> <li>• Thermal Hydraulics in Lead-Cooled and Lead-Bismuth-Cooled Fast Reactors—II</li> <li>• Boiling and Condensation Fundamentals—II</li> <li>• Instabilities and Nonlinear Dynamics</li> <li>• Operation and Safety of Existing Reactors: General—II</li> <li>• Verification and Validation: General—II</li> <li>• CHF and Post CHF Heat Transfer, Flooding and CCFL—II</li> </ul>	Eastside Columbia Pearl Mt. Hood Salon A Salon B  Salon C Salon D Sunstone Salmon Douglas Fir Meadowlark
7:00-9:00 pm	Portland Spirit Tour & Dinner (for purchase)	Depart from Hotel Lobby

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# Daily Schedule

## Tuesday, August 20

7:20-8:10 am	Keynote Session—I	Eastside
7:20-8:10 am	Keynote Session—II	Mt. Hood
7:20-8:10 am	Keynote Session—III	Salon A
7:30 am-5:00 pm	Registration	Hotel Lower Level Registration Desk
8:20-10:00 am	Parallel Technical Sessions 3 <ul style="list-style-type: none"> <li>• Computational Multi-Fluid Dynamics—III</li> <li>• Benchmark Study of the Accident at the Fukushima Phase 2—III</li> <li>• Computational Fluid Dynamics—III</li> <li>• Computational Thermal-Hydraulics: General—II</li> <li>• Fundamental Thermal-Hydraulics: Experiments—III</li> <li>• Thermal Hydraulics in Advanced Reactors: General—III</li> <li>• Thermal Hydraulics in Lead-Cooled and Lead-Bismuth-Cooled Fast Reactors—III</li> <li>• Boiling and Condensation Fundamentals—III</li> <li>• Celebrating the Life and Legacy of Professor Raj Sehgal—Panel</li> <li>• Operation and Safety of Existing Reactors: General—III</li> <li>• Verification and Validation: General—III</li> <li>• CHF and Post CHF Heat Transfer, Flooding and CCFL—III</li> </ul>	Columbia Eastside Pearl Mt. Hood Salon A Salon B Salon C Salon D Sunstone Salmon Douglas Fir Meadowlark
9:00 am-5:00 pm	NURETH EXPO	Salon G-I
10:00-10:15 am	Coffee Break	
10:20 am-12:00 pm	Parallel Technical Sessions 4 <ul style="list-style-type: none"> <li>• Computational Multi-Fluid Dynamics—IV</li> <li>• Benchmark Study of the Accident at the Fukushima Phase 2—IV</li> <li>• Computational Fluid Dynamics—IV</li> <li>• Computational Thermal Hydraulics: General—III</li> <li>• Fundamental Thermal Hydraulics: Experiments—IV</li> <li>• Thermal Hydraulics in Lead-Cooled and Lead-Bismuth-Cooled Fast Reactors—IV</li> <li>• Boiling and Condensation Fundamentals—IV</li> <li>• Severe Accidents: General—I</li> <li>• NPP Transient and Accident Analysis—I</li> <li>• The Future of Multiphase Flow Modeling—Panel</li> <li>• Computational Fluid Dynamics V&amp;V—I</li> </ul>	Columbia Eastside Pearl Mt. Hood Salon A Salon C Salon D Sunstone Salmon Douglas Fir Meadowlark
11:00 am-3:00 pm	Spouse/Guest Tour: Portland Japanese Garden and Portland Rose Garden Visit	Depart from Hotel Lobby
12:00-1:20 pm	Lunch (no-host event)	
1:20-2:10 pm	Keynote Session—IV	Pearl
1:20-2:10 pm	Keynote Session—V	Mt. Hood
1:20-2:10 pm	Keynote Session—VI	Salon A
1:20-2:10 pm	Keynote Session—VII	Salon D
2:20-4:00 pm	Parallel Technical Sessions 5 <ul style="list-style-type: none"> <li>• Computational Multi-Fluid Dynamics—V</li> <li>• Thermal Hydraulics of TREAT—I</li> <li>• Computational Fluid Dynamics—V</li> <li>• Computational Thermal Hydraulics: General—IV</li> <li>• Fundamental Thermal Hydraulics: Experiments—V</li> <li>• Thermal Hydraulics in Sodium-Cooled Fast Reactors: Severe Accident Analysis</li> <li>• Thermal Hydraulics in Lead-Cooled and Lead-Bismuth-Cooled Fast Reactors—V</li> <li>• Boiling and Condensation Fundamentals—V</li> <li>• Severe Accidents: General—II</li> <li>• NPP Transient and Accident Analysis—II</li> <li>• Experiments and Data Bases for Assessment and Validation—I</li> <li>• Computational Fluid Dynamics V&amp;V—II</li> </ul>	Columbia Eastside Pearl Mt. Hood Salon A Salon B Salon C Salon D Sunstone Salmon Douglas Fir Meadowlark
4:00-4:20 pm	Coffee Break	
4:20-6:00 pm	Parallel Technical Sessions 6 <ul style="list-style-type: none"> <li>• Computational Multi-Fluid Dynamics—VI</li> <li>• Thermal Hydraulics of TREAT—II</li> <li>• Computational Fluid Dynamics—VI</li> <li>• Fundamental Thermal-Hydraulics: Experiments—VI</li> <li>• Thermal Hydraulics in Sodium-Cooled Fast Reactors: Steady Analysis—I</li> <li>• Thermal Hydraulics in Salt-Cooled High-Temperature Reactors—I</li> <li>• Severe Accidents: General—III</li> <li>• NPP Transient and Accident Analysis—III</li> <li>• Experiments and Data Bases for Assessment and Validation—II</li> <li>• Computational Fluid Dynamics V&amp;V—III</li> <li>• Verification and Validation: General—IV</li> </ul>	Columbia Eastside Pearl Salon A Salon B Salon C Sunstone Salmon Douglas Fir Meadowlark Salon D
<b>8</b> 6:00-9:00 pm	Exhibit Reception	Salon E & F

# Daily Schedule

## Wednesday, August 21

7:20-8:10 am	Keynote Session—VIII	Columbia
7:20-8:10 am	Keynote Session—IX	Mt. Hood
7:30 am-5:00 pm	Registration	Hotel Lower Level Registration Desk
8:20-10:00 am	Technical Sessions 7 <ul style="list-style-type: none"> <li>• Computational Multi-Fluid Dynamics—VII</li> <li>• Thermal Hydraulics of Space Applications</li> <li>• Computational Fluid Dynamics—VII</li> <li>• Computational Thermal Hydraulics: General—V</li> <li>• Natural Circulation, Passive Safety Systems and Related Phenomena—I</li> <li>• Thermal Hydraulics in Sodium-Cooled Fast Reactors: Steady Analysis—II</li> <li>• Thermal Hydraulics in Supercritical Water Reactors</li> <li>• Experimental Measurement Techniques and Flow Visualization—I</li> <li>• Severe Accidents: General—IV</li> <li>• Modeling and Experiments of Severe Accidents—I</li> <li>• Experiments and Data Bases for Assessment and Validation—III</li> <li>• Computational Fluid Dynamics V&amp;V—IV</li> </ul>	Columbia Eastside Pearl Mt. Hood Salon A Salon B Salon C Salon D Sunstone Salmon Douglas Fir Meadowlark Salon G-I
9:00 am-12:00 pm	NURETH EXPO	
10:00-10:20 am	Coffee Break	
10:00 am-5:00 pm	Spouse/Guest Tour: Pinot Patrol Wine Tour	Depart from Hotel Lobby
10:20 am-12:00 pm	Technical Sessions 8 <ul style="list-style-type: none"> <li>• Computational Multi-Fluid Dynamics—VIII</li> <li>• Subchannel Fluid Dynamics and Heat Transfer—I</li> <li>• Computational Fluid Dynamics—VIII</li> <li>• Computational Thermal Hydraulics: General—VI</li> <li>• Natural Circulation, Passive Safety Systems and Related Phenomena—II</li> <li>• Thermal Hydraulics in Sodium-Cooled Fast Reactors: Steady Analysis—III</li> <li>• Thermal Hydraulics in Salt-Cooled High-Temperature Reactors—II</li> <li>• Experimental Measurement Techniques and Flow Visualization—II</li> <li>• Fuel Coolant Interaction, Modeling and Experiments—I</li> <li>• Modeling and Experiments of Severe Accidents—II</li> <li>• Experiments and Data Bases for Assessment and Validation—IV</li> <li>• Plant System Code Analysis and Development—I</li> </ul>	Columbia Eastside Pearl Mt. Hood Salon A Salon B Salon C Salon D Sunstone Salmon Douglas Fir Meadowlark
12:00-1:20 pm	Lunch (no-host)	
1:20-2:10 pm	Keynote Session—XI	Mt. Hood
1:20-2:10 pm	Keynote Session—XII	Salon A
1:20-2:10 pm	Keynote Session—XIII	Salon D
2:20-4:00 pm	Technical Sessions 9 <ul style="list-style-type: none"> <li>• Thermal Hydraulics in Small Modular Reactors and Micro Reactors—I</li> <li>• Subchannel Fluid Dynamics and Heat Transfer—II</li> <li>• Core Thermal Hydraulics and Subchannel Analysis—I</li> <li>• Hydrogen and Fission Product Behavior</li> <li>• Natural Circulation, Passive Safety Systems and Related Phenomena—III</li> <li>• Thermal Hydraulics in Sodium-Cooled Fast Reactors: Transient Analysis—I</li> <li>• Thermal Hydraulics in Salt-Cooled High-Temperature Reactors—III</li> <li>• Experimental Measurement Techniques and Flow Visualization—III</li> <li>• Fuel Coolant Interaction, Modeling and Experiments—II</li> <li>• Plant System Code Validation—I</li> <li>• Plant System Code Analysis and Development—II</li> </ul>	Columbia Eastside Pearl Mt. Hood Salon A Salon B Salon C Salon D SunStone Douglas Fir Meadowlark
4:00-4:20 pm	Coffee Break	
4:20-6:00 pm	Technical Sessions 10 <ul style="list-style-type: none"> <li>• Multiscale Multiphysics Applications in Thermal Hydraulics—I</li> <li>• Subchannel Fluid Dynamics and Heat Transfer—III</li> <li>• Core Thermal Hydraulics and Subchannel Analysis—II</li> <li>• Accuracy and Uncertainty Analysis—I</li> <li>• Fundamental Thermal Hydraulics: General—I</li> <li>• Thermal Hydraulics in Sodium-Cooled Fast Reactors: Transient Analysis—II</li> <li>• Thermal Hydraulics in Salt-Cooled High-Temperature Reactors—IV</li> <li>• Experimental Measurement Techniques and Flow Visualization—IV</li> <li>• Fuel Coolant Interaction, Modeling and Experiments—III</li> <li>• Modeling and Experiments of Severe Accidents—III</li> <li>• Plant System Code Validation—II</li> <li>• Fluid-Structure Interactions—I</li> </ul>	Columbia Eastside Pearl Mt. Hood Salon A Salon B Salon C Salon D Sunstone Salmon Douglas Fir Meadowlark
7:00-9:00 pm	Banquet at Oregon Museum of Science & Industry	Depart from Hotel Lobby

# Daily Schedule

## Thursday, August 22

7:20-8:10 am	Keynote Session—XIV	Salon C
7:20-8:10 am	Keynote Session—XV	Salmon
7:30 am-12:00 pm	Registration	Hotel Lower Level Registration Desk
8:20-10:00 am	Technical Sessions 11 <ul style="list-style-type: none"> <li>• Multiscale Multiphysics Applications in Thermal Hydraulics—II</li> <li>• Two-Phase Flow and Heat Transfer Fundamentals—I</li> <li>• Accuracy and Uncertainty Analysis—II</li> <li>• Fundamental Thermal Hydraulics: General—II</li> <li>• Thermal Hydraulics in Sodium-Cooled Fast Reactors: Transient Analysis—III</li> <li>• Thermal Hydraulics in Small Modular Reactors and Micro Reactors—II</li> <li>• Experimental Measurement Techniques and Flow Visualization—V</li> <li>• Natural Convection and Mixing Phenomena, Modeling and Experiments—I</li> <li>• Modeling and Experiments of Severe Accidents—IV</li> <li>• Plant System Code Validation—III</li> <li>• Fluid-Structure Interactions—II</li> </ul>	Columbia Eastside Mt. Hood Salon A Salon B Salon C Salon D Sunstone Salmon Douglas Fir Meadowlark
10:00-10:20 am	Coffee Break	
10:20 am-12:00 pm	Technical Sessions 12 <ul style="list-style-type: none"> <li>• Multiscale Multiphysics Applications in Thermal Hydraulics—III</li> <li>• Two-Phase Flow and Heat Transfer Fundamentals—II</li> <li>• Core Thermal Hydraulics and Subchannel Analysis—III</li> <li>• Accuracy and Uncertainty Analysis—III</li> <li>• Fundamental Thermal Hydraulics: General—III</li> <li>• Thermal Hydraulics in High-Temperature Gas-Cooled Reactors—I</li> <li>• Thermal Hydraulics in Small Modular Reactors and Micro Reactors—III</li> <li>• Experimental Measurement Techniques and Flow Visualization—VI</li> <li>• Natural Convection and Mixing Phenomena, Modeling and Experiments—II</li> <li>• Plant System Code Validation—IV</li> <li>• Fluid-Structure Interactions—III</li> </ul>	Columbia Eastside Pearl Mt. Hood Salon A Salon B Salon C Salon D Sunstone Douglas Fir Meadowlark
12:00-1:20 pm	Lunch (no-host)	
1:20-2:10 pm	Keynote Session—XVI	Columbia
1:20-2:10 pm	Keynote Session—XVII	Mt. Hood
2:20-4:00 pm	Technical Sessions 13 <ul style="list-style-type: none"> <li>• Multiscale Multiphysics Applications in Thermal Hydraulics—IV</li> <li>• Two-Phase Flow and Heat Transfer Fundamentals—III</li> <li>• Containment Analysis—I</li> <li>• Accuracy and Uncertainty Analysis—IV</li> <li>• Multifield Two-Phase Flow Modeling—I</li> <li>• Thermal Hydraulics in High-Temperature Gas-Cooled Reactors—II</li> <li>• Experimental Measurement Techniques and Flow Visualization—VII</li> <li>• Advanced Design Features for Severe Accidents Mitigation—I</li> <li>• Debris Bed Cooling</li> <li>• Boiling and Condensation Heat Transfer—I</li> <li>• Thermal Hydraulics of Fluoride Salt-Cooled High-Temperature Reactors</li> </ul>	Columbia Eastside Pearl Mt. Hood Salon A Salon B Salon D Sunstone Salmon Douglas Fir Meadowlark
4:00-4:20 pm	Coffee Break	
4:20-6:00 pm	Technical Sessions 14 <ul style="list-style-type: none"> <li>• Containment Analysis—II</li> <li>• Multifield Two-Phase Flow Modeling—II</li> <li>• Thermal Hydraulics in High-Temperature Gas-Cooled Reactors—III</li> <li>• Thermal Hydraulics in Small Modular Reactors and Micro Reactors—IV</li> <li>• Advanced Design Features for Severe Accidents Mitigation—II</li> <li>• Boiling and Condensation Heat Transfer—II</li> <li>• Plant System Code Analysis and Development—III</li> </ul>	Pearl Salon A Salon B Salon C Sunstone Douglas Fir Meadowlark
6:00-6:30 pm	Closing Ceremony	Salon E-F

# Daily Schedule

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Friday, August 23

8:00 am-5:00 pm

8:00 am-5:00 pm

8:00 am - 5:00 pm

Technical Tour

Workshop: GOTHIC—Overview of Capabilities, Current Status and Example Applications

Workshop: Turbulence Modeling in Nuclear Energy Systems

Depart from Hotel Lobby



**#ANSMeeting**

# General Information

## MEETING INFORMATION

The Cascades region, reflecting a joint Oregon/Washington organization committee, is pleased to submit a proposal to host the 18th International Topical Meeting on Nuclear Reactor Thermal Hydraulics (NURETH-18) in Portland, Oregon, USA during the summer of 2019. This proposal is a joint effort of numerous Thermal Hydraulics Division (THD) members with the American Nuclear Society (ANS) Eastern Washington Section as the proposed local section sponsor.

Support and encouragement has been provided to this proposal preparation by several organizations that are actively involved with thermal-hydraulics research and application in the Pacific Northwest. These organizations all have a strong regional presence and are anticipated to be key contributors to the organization and funding of the meeting:

- NuScale Power LLC
- Oregon State University, School of Nuclear Science and Engineering
- TerraPower LLC
- Numerical Applications Division of Zachry Nuclear Engineering

## REGISTRATION HOURS

**Location:** Hotel Lower Level at the Registration Desk

Sunday	3:00 pm-6:00 pm
Monday	7:30 am-5:00 pm
Tuesday	7:30 am-5:00 pm
Wednesday	7:30 am-5:00 pm
Thursday	7:30 am-12:00 pm

## NURETH EXPO

**Location:** Salon G-I

Monday	9:00 am-5:00 pm
Tuesday	9:00 am-5:00 pm
Wednesday	9:00 am – 12:00 pm

Visit Salon G-I room on the Lower Level from 9:00 am-5:00 pm on Monday and Tuesday and 9:00 am-12:00 pm on Wednesday to see the latest work and products from related industry vendors and organizations. Participating companies of the NURETH18 exhibition include Idaho National Laboratory, Kairos Power, Oregon State University, and Oak Ridge National Laboratory

## HOTEL INFORMATION

### Portland Marriott Downtown Waterfront

1401 SW Naito Parkway, Portland, OR 87201

With a great downtown location in the heart of city life, The Portland Marriott Downtown Waterfront features a serene location on the Willamette River near over 60 breweries. Venture to the Oregon Convention Center, Oregon Zoo and Keller Auditorium. Soak in the vibrant local culture, and then unwind at our modern rooms and suites.

Reserve your room at the group date of \$209 plus tax. We also have a limited number of government per diem rooms available. Proper government issued identification will be required at check-in. The current government per diem is \$184 plus tax.

To reserve your room go to [RESERVE HERE](#) The Group Rate is available until July 26, 2019. After this rooms may still be available at the Hotel's prevailing rate.

Reservations may also be made by calling 1-877-901-6632. Please refer to the American Nuclear Society (ANS) Nureth-18 Meeting, August 16th-24th, 2019.

The hotel offers complimentary Guestroom Wireless Internet

Valet parking – \$44.00 per car, per night

# General Information

## ABOUT ANS

### Mission

ANS provides its members with opportunities for professional development. It also serves the nuclear community by creating a forum for sharing information and advancements in technology, and by engaging the public and policymakers through communication outreach.

### Statement on Diversity

The American Nuclear Society (ANS) is committed, in principle and in practice, to creating a diverse and welcoming environment for everyone interested in nuclear science and technology. Diversity means creating an environment – both in ANS and in the profession – in which all members are valued equitably for their skills and abilities and respected equally for their unique perspectives and experiences. Diverse backgrounds foster unique contributions and capabilities, and so creation of an inclusive Society ultimately leads to a more creative, effective, and technically respected Society.

ANS believes that everyone deserves opportunities for learning, networking, leadership, training, recognition, volunteering in Society activities, and all the other benefits that involvement in the Society brings, regardless of age, color, creed, disability, ethnicity, gender identity and expression, marital status, military service status, national origin, parental status, physical appearance, race, religion, sex, or sexual orientation. The selection of a member to serve in ANS's volunteer leadership structure shall be based solely on the member's ability, interest and commitment to serve. In particular, ANS encourages members at each level of the Society and in each Professional Division and Technical Group to make special efforts to recruit underrepresented minorities and women to ensure that they are adequately represented in the Society.

### Respectful Behavior Policy (Abbreviated)

The open exchange of ideas, freedom of thought and expression, and productive scientific debate are central to the mission of the American Nuclear Society (ANS). These require an open and diverse environment that is built on dignity and mutual respect for all participants and ANS staff members, and is free of bias and intimidation.

ANS is dedicated to providing a safe, welcoming, and productive experience for everyone participating in Society events and other Society activities regardless of age, color, creed, disability, ethnicity, gender identity and expression, marital status, military service status, national origin, parental status, physical appearance, race, religion, sex, or sexual orientation. Creation of a safe and welcoming environment is a shared responsibility held by all participants. Therefore, ANS will not tolerate harassment of or by participants (including ANS volunteer leaders and staff members) in any form. Disciplinary action for participants found to have violated this principle may include reprimand, expulsion from an event or activity with or without a refund, temporary or permanent exclusion from all ANS events and activities, suspension or expulsion from volunteer leadership positions or groups, and/or suspension or expulsion from Society membership, as appropriate.

***If you or someone else experiences harassment, regardless of how you otherwise choose to initially handle the situation,*** you are encouraged to report the situation to ANS. It is possible that the behavior you experienced is part of a larger pattern of repeated harassment. Please alert ANS to behavior you feel to be harassment regardless of the offender's identity or standing in the Society.

The designated contact for reports at Nureth18 is Wade Marcum. He can be reached at [wade.marcum@oregonstate.edu](mailto:wade.marcum@oregonstate.edu), or you can leave a message at the ANS Registration Desk for him to contact you directly.

The complete Respectful Behavior Policy can be found at [www.ans.org/about/rbp](http://www.ans.org/about/rbp). If you have questions about the policy, please contact ANS Executive Director Robert C. Fine at 708-579-8200 or [rfine@ans.org](mailto:rfine@ans.org).

## ANS CODE OF ETHICS

### Preamble

Recognizing the profound importance of nuclear science and technology in affecting the quality of life throughout the world, members of the American Nuclear Society (ANS) are committed to the highest ethical and professional conduct.

### Fundamental Principle

ANS members as professionals are dedicated to improving the understanding of nuclear science and technology, appropriate applications, and potential consequences of their use.

To that end, ANS members uphold and advance the integrity and honor of their professions by using their knowledge and skill for the enhancement of human welfare and the environment; being honest and impartial; serving with fidelity the public, their employers, and their clients; and striving to continuously improve the competence and prestige of their various professions.

ANS members shall subscribe to the following practices of professional conduct:

### Principles of Professional Conduct

1. We hold paramount the safety, health, and welfare of the public and fellow workers, work to protect the environment, and strive to comply with the principles of sustainable development in the performance of our professional duties.
2. We will formally advise our employers, clients, or any appropriate authority and, if warranted, consider further disclosure, if and when we perceive that pursuit of our professional duties might have adverse consequences for the present or future public and fellow worker health and safety or the environment.
3. We act in accordance with all applicable laws and these Practices, lend support to others who strive to do likewise, and report violations to appropriate authorities.
4. We perform only those services that we are qualified by training or experience to perform, and provide full disclosure of our qualifications.
5. We present all data and claims, with their bases, truthfully, and are honest and truthful in all aspects of our professional activities. We issue public statements and make presentations on professional matters in an objective and truthful manner.
6. We continue our professional development and maintain an ethical commitment throughout our careers, encourage similar actions by our colleagues, and provide opportunities for the professional and ethical training of those persons under our supervision.
7. We act in a professional and ethical manner towards each employer or client and act as faithful agents or trustees, disclosing nothing of a proprietary nature concerning the business affairs or technical processes of any present or former client or employer without specific consent, unless necessary to abide by other provisions of this Code or applicable laws.
8. We disclose to affected parties, known or potential conflicts of interest or other circumstances, which might influence, or appear to influence, our judgment or impair the fairness or quality of our performance.
9. We treat all persons fairly.
10. We build our professional reputation on the merit of our services, do not compete unfairly with others, and avoid injuring others, their property, reputation, or employment.
11. We reject bribery and coercion in all their forms.
12. We accept responsibility for our actions; are open to and acknowledge criticism of our work; offer honest criticism of the work of others; properly credit the contributions of others; and do not accept credit for work not our own.

# Honors and Awards Program

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## NURETH-18 HONORS AND AWARDS PROGRAM

The NURETH-18 awards program recognizes those papers of exceptional quality. It is comprised of two types of awards—Best Paper Awards and Young Professional Awards. The evaluation for all awards was based solely on the quality of the submitted manuscripts.

### BEST PAPER AWARDS

All papers submitted to NURETH-18 were peer-reviewed by some of world's foremost experts in nuclear thermal-hydraulics, with an average of 2.5 reviews per paper. As part of each review, reviewers were asked to score each paper based on four criteria (Originality, Correctness and Completeness, Presentation, and Overall Impression). The scores were averaged among multiple reviews.

The ten papers with the highest review scores for each track were submitted to the track chairs. Track chairs were asked to nominate three papers from the list of top ten papers in each track. For special topics, the Honors and Awards Committee completed the nomination of the three papers. The Honors and Awards Committee reviewed the 21 nominated papers and selected six to receive the "Best Paper Award". Winners will be announced at the conference banquet on Wednesday, August 21.

### YOUNG PROFESSIONAL AWARDS

In addition to the Best Paper Awards, the NURETH-18 Honors and Awards Committee will select three papers for young professional awards.

In order for a paper to be eligible for the competition, the first author needs to be a young professional according to the definition of ANS (36 years old or younger OR 5 years or less from graduation). Graduate students are eligible. Authors were also required to opt- in at paper submittal. Full-length papers were peer-reviewed with the same criteria as any other submitted paper and published in the NURETH-18 Proceedings.

The ten eligible papers across all tracks that during the review process yielded the highest scores were submitted to the Honors and Awards committee for evaluation. The Honors and Awards Committee reviewed the ten papers and selected three to receive the "Young Professional Award". Winners will be announced at the conference banquet on Wednesday, August 21.

## NURETH-18 HONORS AND AWARDS COMMITTEE

Below is the composition of the Honors and Awards Committee:

<b>Chair:</b>	Elia Merzari ( <i>ANL, Chair</i> )
<b>Members at large:</b>	Annalisa Manera ( <i>University of Michigan</i> ) Matteo Bucci ( <i>MIT</i> ) Katrien Van Tichelen ( <i>SCK-CEN</i> ) Philippe Planquart ( <i>VKI</i> ) Si Young Lee ( <i>Sandia National Laboratory</i> ) John Luxat ( <i>McMaster University</i> )



## MONDAY, AUGUST 19

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### Opening Plenary—I

**Location:** Salon E-F **Time:** 9:00-10:30 am

**Chair:** Jose Reyes (*NuScale*)

**Speakers:**

Joy Rempe (*Principal, Rempe and Associates, LLC*)

Yassin Hassan (*Professor, Texas A&M University Royce E. Wisenbaker '39 Chair in Engineering, Texas A&M, Editor-in-chief of Nuclear and Design Journal*)

Hisashi Ninokata (*Professor, Dipartimento di Energia, Politecnico di Milano*)

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### Opening Plenary—II

**Location:** Salon E-F **Time:** 10:50 am-12:00 pm

**Chair:** Jose Reyes (*NuScale*)

**Speakers:**

Jonathan Witter (*Chief Engineer, BWXT Advanced Technology Programs*)

Desari V. Rao (*Program Director, Civilian Nuclear Programs/ Science Program Office, Los Alamos National Laboratory*)

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### Portland Spirit Tour & Dinner

**Time:** 7:00-9:00 pm

Shuttle busses will be available for transit from the hotel lobby starting at 6:30 pm to take guests to the Portland Dock to board the Portland Spirit Cruise boat. Dinner and drinks will be provided to participants while experiencing the beautiful Columbia River. Upon conclusion of the riverboat tour and dinner guests will be transported via shuttle bus back to the conference hotel.

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## TUESDAY, AUGUST 20

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### Keynote Session—I

**Session Organizer and Chair:** Marco Pellegrini (*IAE*)

**Location:** Eastside **Time:** 7:20-8:10 am

**7:20 am:** Findings on Fukushima Daiichi NPP Severe Accident and Implication to SA Code Validation, Shinya Mizokami (*Tokyo Electric Power Co.*), invited

### Keynote Session—II

**Session Organizer and Chair:** Yassin Hassan (*TAMU*)

**Location:** Mt. Hood **Time:** 7:20-8:10 am

**7:20 am:** Best Practices for CFD Grade Experiments and Recent Developments in High-Resolution Measurement Techniques, Annalisa Manera, Victor Petrov (*Univ of Michigan*), invited

### Keynote Session—III

**Session Organizer and Chair:** Mathieu Martin (*TerraPower*)

**Location:** Salon A **Time:** 7:20-8:10 am

Liquid Metal Thermal Hydraulics: State-of-the-Art and Future Perspectives, F. Roelofs (*NRG*), invited

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### Spouse Tour: Portland Japanese Garden and Portland Rose Garden Visit

**Group 1 Time:** 11:00 am-2:00 pm **Group 2 Time:** 12:00-3:00 pm **Location:** Depart from Hotel Lobby

Experience the Japanese Garden, a living classroom that offers tremendous opportunities for experiential learning along with a Cultural Village that allows visitors to immerse themselves in Japanese culture. Take a short walk and find yourself at the Portland Rose Garden. Portland's International Rose Test Garden is the oldest official continuously operated public rose test garden in the United States and will be in full bloom. Ticket to the Japanese Garden and transportation is included. Rose Garden is free and lunch is on your own (suggested to eat before leaving).

# Plenary, Special Sessions & Events

## TUESDAY, AUGUST 20 CONTINUED

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### Keynote Session—IV

**Session Organizer and Chair:** Brian Woods (*OSU*)  
**Location:** Pearl **Time:** 1:20-2:10 pm

**1:20 pm:** Scaling Analysis of Thermal-Hydraulic Integral Systems: Insights from Practical Applications and Recent Advancements, C. Frepoli (*FPoliSolutions LLC*)

### Keynote Session—V

**Session Organizer and Chair:** Piyush Sabharwall (*INL*)  
**Location:** Mt. Hood **Time:** 1:20-2:10 pm

**1:20 pm:** Toward Exascale: Large Eddy Simulation and Direct Numerical Simulation of Nuclear Reactor Flows with the Spectral Element Method, Elia Merzari (*ANL*), invited

### Keynote Session—VI

**Session Organizer and Chair:** Jeff Luitjens (*NuScale*)  
**Location:** Salon A **Time:** 1:20-2:10 pm

**1:20 pm:** Separate-Effect Experiments and Modeling for Two-Phase Flow Under Geometric Restrictions, Seungjin Kim, Ran Kong (*Purdue Univ*), invited

### Keynote Session—VII

**Session Organizer and Chair:** Ferry Roelofs (*NRG*)  
**Location:** Salon D **Time:** 1:20-2:10 pm

**1:20 pm:** Development of a Fast Reactor and Related Thermal Hydraulics Studies in Japan, Hiroyuki Ohshima, Hideki Kamide (*JAEA*), invited

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### Exhibit Reception

**Location:** Salon E & F **Time:** 6:00-9:00 pm

Dinner will be held in the Conference hotel with a showcase of the exhibit booths and participants. Three options are made available for dinner for all participants including a vegetarian option.

## WEDNESDAY, AUGUST 21

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### Keynote Session—VIII

**Session Organizer and Chair:** Jinyong Feng (*MIT*)  
**Location:** Columbia **Time:** 7:20-8:10 am

**7:20 am:** Departure from Nucleate Boiling (*DNB*) Simulations Base on an Interface Tracking Method, Y. Sato, B. Niceno (*PSI*), B. L. Smith (*Goldsmith Transactions*), invited

### Keynote Session—IX

**Session Organizer and Chair:** Bao-Wen Yang (*Xi'an Jiaotong Univ*)  
**Location:** Mt. Hood **Time:** 7:20-8:10 am

**7:20 am:** Multi-Physics for Nuclear Energy Applications Using a Cohesive Computational Framework, R. Martineau, D. Andrs, R. Carlsen, D. Gaston, J. Hansel, F. Kong, A. Lindsay, C. Permann, A. Slaughter (*INL*), E. Merzari, Rui Hu (*ANL*), A. Novak, R. Slaybaugh (*Univ of California, Berkeley*), invited

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### Spouse Tour: Pinot Patrol Wine Tour

**Location:** Depart from Hotel Lobby **Time:** 10:00 am-5:30 pm

Savor award-winning Pinot Noir, Pinot Gris, Chardonnay and Riesling while your designated driver guides you through the rolling hills of the beautiful Willamette Valley. Visits to at least three wineries and your tasting fees, box lunch and expert wine tour guide are included.

## WEDNESDAY, AUGUST 21 CONTINUED

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### Keynote Session—XI

**Session Organizer and Chair:** Wade Marcum (*OSU*)

**Location:** Mt. Hood **Time:** 1:20-2:10 pm

**1:20 am:** Severe Accident Phenomena: A Comparison Between NuScale, Other Advanced LWRs, and Existing LWRs, Scott J. Weber, Etienne M. Mullin (*NuScale Power, LLC*)

### Keynote Session—XII

**Session Organizer and Chair:** Guillaume Mignot (*OSU*)

**Location:** Salon A **Time:** 1:20-2:10 pm

**1:20 pm:** Multiscale and Multiphysics Simulation of Sodium Fast Reactors: From Model Development to Safety Demonstration, Antoine Gerschenfeld (*CEA*), invited

### Keynote Session—XIII

**Session Organizer and Chair:** Brian Woods (*Oregon State University*)

**Location:** Salon D **Time:** 1:20-2:10 pm

**1:20 pm:** Molecular Tagging Velocimetry: Pushing the Limits of Velocimetry, P. M. Bardet, C. Fort, M. A. Andre (*George Washington Univ*), invited

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### Banquet at OMSI

**Location:** Oregon Museum of Science & Industry **Time:** 7:00-9:00 pm

The banquet will take place at the Oregon Museum of Science & Industry, located on the east side of the Willamette River in Downtown Portland. Guests will have a chance to view the Museum's exhibits while enjoying an evening of dinner with colleagues and friends. Shuttle busses will be available for transit from the hotel lobby starting at 6:30 pm to take guests to the OMSI. Upon conclusion of the event guests will be transported via shuttle bus back to the conference hotel.

## THURSDAY, AUGUST 22

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### Keynote Session—XIV

**Session Organizer and Chair:** Azat Galimov (*NuScale*)

**Location:** Salon C **Time:** 7:20-8:10 am

**7:20 am:** Smaller and Safer: How Micro-Reactors Can Redefine Nuclear, Ken Canavan, Yasir Arafat, Ryan Blinn (*Westinghouse*), invited

### Keynote Session—XV

**Session Organizer and Chair:** Fulvio Mascari (*ENEA*)

**Location:** Salmon **Time:** 7:20-8:10 am

**7:20 am:** Challenges in Containment Thermal Hydraulics, E. Studer, D. Abdo, S. Benteboula, G. Bernard-Michel, B. Cariteau, N. Coulon, F. Dabbene, Ph. Debese, S. Koudriakov, C. Ledier, J.-P. Magnaud, O. Norvez, J.-L. Widloecher, A. Beccantini, S. Gounand, J. Brinster (*CEA*), invited

### Keynote Session—XVI

**Session Organizer and Chair:** Brian Jackson (*Kairos Power*)

**Location:** Columbia **Time:** 1:20-2:10 pm

**1:20 pm:** Multi-Scale and Multi-Physics Nuclear Reactor Simulation for the Next Generation LWR Safety Analysis, Han Young Yoon, Ik Kyu Park, Jae Ryong Lee, Yunje Cho, Seung-Jun Lee (*KAERI*), Hyoung Kyu Cho (*Seoul Natl Univ*), Jae June Jeong (*Pusaj National Univ*), invited

### Keynote Session—XVII

**Session Organizer and Chair:** Izabela Gutowska (*OSU*)

**Location:** Mt. Hood **Time:** 1:20-2:10 pm

**1:20 pm:** Kairos Power Thermal Hydraulics Research and Development, Edward Blandford, Kyle Brumback, Lambert Fick, Craig Gerardi, Brandon Haugh, Elizabeth Hillstrom, Kevin Johnson, Per F. Peterson, Floren Rubio, Fatih S. Sarikurt, Sonat Sen, Haihua Zhao, Nicolas Zweibaum (*Kairos Power*), invited

# Plenary, Special Sessions & Events

## THURSDAY, AUGUST 22 CONTINUED

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### Closing Ceremony

**Location:** Salon E-F **Time:** 6:00 pm - 6:30 pm

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## FRIDAY, AUGUST 23

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### Technical Tour

**Location:** Depart from Hotel Lobby **Time:** 8:00 am-5:00 pm

A single, day-long technical tour has been arranged to transport registrants from the hotel to see world-class facilities located at both NuScale Power and Oregon State University. All registrants will depart from the same location (Hotel Lobby) at the same time (8:00 am) as a part of this tour experience.

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### Workshops

The three workshops listed below are offered. You must be registered for the NURETH-18 conference and have registered for the specific workshop to attend. Lunch is not included in these workshops.

#### Workshop: Turbulence Modeling in Nuclear Energy Systems

**Instructors:** Elia Merzari, Sofiane Benhamadouche, Yassin Hassan

**Time:** 8:00 am-5:00 pm

A presentation of phenomenological limitations and difficulties along with applications and approaches to modeling nuclear energy systems will be delivered.

#### Workshop: GOTHIC – Overview of Capabilities, Current Status & Example Applications

**Workshop Lead:** Jeff Lane *Senior Consultant, Zachry Nuclear*

**Time:** 8:00 am-5:00 pm

A general overview of the GOTHIC software and capabilities will be delivered along with highlights of unique features and capabilities. Insight on current developments to the code will be discussed and approaches to utilization of GOTHIC will be discussed.

## MONDAY, AUGUST 19

### TECHNICAL SESSIONS - 1:30 PM

#### Computational Multi-Fluid Dynamics—I

**Session Organizer:** Igor A. Bolotnov (*NCSU*), **Cochairs:** Dirk Lucas (*HZDR*), Jun Fang (*ANL*)

**Location:** Columbia **Time:** 1:30-3:10 pm

**1:30 pm:** A Multi-Scale Approach Simulating Generic Pool Boiling, T. Höhne, D. Lucas (*HZDR*)

**1:55 pm:** Numerical Simulations of Turbulent Rayleigh-Bénard Convection with a Free Surface, W. A. Hay (*Université Catholique de Louvain*), V. Deledicque (*Bel V*), M. V. Papalexandris (*Université Catholique de Louvain*)

**2:20 pm:** Towards Best Practice Guidelines for Euler-Euler Simulations of Poly-Disperse Bubbly Flows, D. Lucas, Y. Liao, R. Rzehak, E. Krepper (*HZDR*)

**2:45 pm:** Annular Flow Simulation Supported by Iterative In-Memory Mesh Adaptation, J. Fang (*ANL*), M. K. Purser (*Univ of Colorado Boulder*), C. Smith (*RPI*), R. Balakrishnan (*ANL*), I. A. Bolotnov (*NCSU*), K. E. Jansen (*Univ of Colorado Boulder*)

#### Benchmark Study of the Accident at the Fukushima Phase 2—I

**Session Organizer:** Marco Pellegrini (*IAE*), **Cochairs:** Randy Gauntt (*SNL*), Terttaliisa Lind (*PSI*)

**Location:** Eastside **Time:** 1:30-3:10 pm

**1:30 pm:** Comparative Analysis of Core Degradation Models Between ASTEC and MELCOR. Application to the Fukushima Daiichi Unit-1 Like Accident, P. Drai, C. Bouillet, H. Bonneville, V. Topin, L. Laborde, S. Belon (*IRSN*)

**1:55 pm:** Analysis for the Accident at Unit 1 of the Fukushima Daiichi NPS with THALES2/KICHE Code in BSAF2 Project, Hitoshi Tamaki, Jun Ishikawa, Tomoyuki Sugiyama, Yu Maruyama (*JAEA*)

**2:20 pm:** Simulation of the Fukushima Daiichi Unit 2 Severe Accident with MELCOR 2.1, A. C. Morreale (*CNL*)

**2:45 pm:** Analysis for the Accident at Unit 2 of the Fukushima Daiichi NPS with THALES2/KICHE Code in BSAF2 Project, Hitoshi Tamaki, Jun Ishikawa, Tomoyuki Sugiyama, Yu Maruyama (*JAEA*)

#### Computational Fluid Dynamics—I

**Session Organizer:** Jinyong Feng (*MIT*) **Cochairs:** Elia Merzari (*ANL*), Jinyong Feng (*MIT*)

**Location:** Pearl **Time:** 1:30-2:45 pm

**1:30 pm:** Predictive Study of Condensing Vapour Bubble in Subcooled Boiling Flow Using InterSection Marker Method, Syed Ahsan Sharif (*UNSW*), Mark Kai Ming Ho (*ANSTO*), Victoria Timchenko (*USW*), Guan Heng Yeoh (*USW/ANSTO*)

**1:55 pm:** Applying Tet-to-Hex Meshing Method to Complex Nuclear Reactor Geometries for Spectral Element Code, Haomin Yuan, Elia Merzari, Yiqi Yu, Aleksandr Obabko (*ANL*), Mustafa A. Yildiz, Gerrit Botha, Yassin A. Hassan (*Texas A&M*)

**2:20 pm:** Evaluation of Turbulence Modeling Approaches for the Prediction of Cross-Flow in a Helical Tube Bundle, Jinyong Feng, Michael Acton, Emilio Baglietto (*MIT*), Adam R. Kraus, Elia Merzari (*ANL*)

#### Celebrating the Legacies of Geoff Hewitt and George Yadigaroglu—Panel

**Session Organizers and Cochairs:** Michael Corradini (*Univ of Wisc*), Sanjoy Banerjee (*CUNY*), Yassin Hassan (*TAMU*)

**Location:** Mt. Hood **Time:** 1:30-3:10 pm

**1:30 pm:** Technical Contributions of Geoff Hewitt: A Remembrance, Sanjoy Banerjee (*CUNY*)

**2:00 pm:** Technical Contributions of George Yadigaroglu: A Remembrance, Djamel Lakehal (*ASCOMP*)

**Panelists:** Steve Bajorek (*NRC*)  
Dominique Bestion (*CEA*)  
Jacopo Buongiorno (*MIT*)  
Mike Corradini (*UW*)  
Yassin Hassan (*Texas A&M*)

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**MONDAY, AUGUST 19**  
TECHNICAL SESSIONS - 1:30 PM

**Fundamental Thermal Hydraulics: Experiments—I**

**Session Organizer:** Guanghui Su (*Xi'an Jiao Tong University*), Xiaodong Sun (*Univ of Mich*),

**Cochairs:** Suizheng Qiu (*Xi'an Jiaotong Univ*), Jun Wang (*Univ of Wisconsin, Madison*)

**Location:** Salon A **Time:** 1:30-3:10 pm

- 1:30 pm:** Particle Decontamination in a Single Bubble During Pool Scrubbing, K. Fujiwara, Y. Nakamura, A. Kaneko, Y. Abe (*Univ of Tsukuba*)
- 1:55 pm:** Heat Loss Assessment for CHF Test Sections, Michael S. Bradbury (*Information Systems Laboratory, Inc.*)
- 2:20 pm:** Observation of Air Bubble Characteristics by a Vertical Nozzle Under Pool Scrubbing Conditions, Jongwoong Yoon, Yong Hoon Jeong (*KAIST*)
- 2:45 pm:** Thermal-Hydraulic Modeling of Supersonic Steam Injector as a Passive Safety System, Shuichiro Miwa, Nozomu Akiyama (*Hokkaido Univ*)

**Thermal Hydraulics in Advanced Reactors: General—I**

**Session Organizers:** Ferry Roelofs (*NRG*), Maria Avramova (*NCSU*), **Cochairs:** Ferry Roelofs (*NRG*), Antoine Gerschenfeld (*CEA*)

**Location:** Salon B **Time:** 1:30-3:10 pm

- 1:30 pm:** Liquid Metal Thermal Hydraulics—Outcomes of the SESAME Project, F. Roelofs, A. Shams (*NRG*), A. Batta (*KIT*), V. Moreau (*CRS4*), I. Di Piazza (*ENEA*), A. Gerschenfeld (*CEA*), P. Planquart (*VKI*), M. Tarantino (*ENEA*)
- 1:55 pm:** A Collaborative Effort Towards the Accurate Prediction of Turbulent Flow and Heat Transfer in Low-Prandtl Number Fluids, A. Shams, F. Roelofs (*NRG*), I. Tiselj, J. Oder (*JSI*), Y. Bartosiewicz, M. Duponcheel (*UCL*), B. Niceno, W. Guo (*PSI*), E. Stalio, D. Angeli, A. Fregni (*UNIMORE*), S. Buckingham, L. K. Koloszar, A. V. Ortiz, P. Planquart (*VKI*), C. Narayanan, D. Lakehal (*ASCOMP AG*), K. van Tichelen (*SCK-CEN*), W. Jäger, T. Schaub (*KIT*)
- 2:20 pm:** Thermal Hydraulic Design of an Accelerator-Driven Subcritical System for Burning Minor Actinides, Adam Kraus, Yan Cao, Elia Merzari, Yousry Gohar (*ANL*)
- 2:45 pm:** PIV Measurements Inside a Wire-Wrapped Hexagonal Rod Bundle: From Experiments to Governing Equations, F. Bertocchi, M. Rohde, J. L. Kloosterman (*Delft Univ of Technol*)

**Thermal Hydraulics in Lead-Cooled and Lead-Bismuth-Cooled Fast Reactors—I**

**Session Organizer:** Ferry Roelofs (*NRG*), **Cochairs:** Jun Liao (*WEC*), Diego Castelliti (*SCK*)

**Location:** Salon C **Time:** 1:30-2:45 pm

- 1:30 pm:** Immortal Experimental Loop at JAEA—Post-Process and Validation, N. Watanabe, H. Obayashi, T. Sugawara, T. Sasa, K. Nishihara (*JAEA*), D. Castelliti (*SCK-CEN*)
- 1:55 pm:** Steady-State and Transient Experiments in Mock-Up of J-PARC LBE Spallation Target System Using Mockup Loop “IMMORTAL”, H. Obayashi, K. Yamaki, S. Kita, H. Yoshimoto, W. Tao, S. Saito, T. Sasa (*JAEA*)
- 2:20 pm:** The Importance of Phenomena Identification and Ranking Table in Lead Fast Reactor Development, Jun Liao, Richard F. Wright, Paolo Ferroni (*Westinghouse*), Tanju Sofu (*ANL*), Sung Jin Lee (*Fauske & Associates, LLC*)

## MONDAY, AUGUST 19

### TECHNICAL SESSIONS - 1:30 PM

#### Boiling and Condensation Fundamentals—I

**Session Organizer:** Byongjo Yun (*PNU*), **Cochairs:** Jae Jun Jeong (*PNU*), Seoungmin Oh (*GNFA*)

**Location:** Salon D **Time:** 1:30-3:10 pm

- 1:30 pm:** Coupled Calculation of Bubble Departure Diameter and Frequency from Mechanistic Principles for Nucleate Boiling Applications, Marco Colombo, Michael Fairweather (*Univ of Leeds*)
- 1:55 pm:** Temperature Distribution Measurement During Quenching of High-Temperature Wall with a Falling Liquid Film, Tomio Okawa, Keisuke Yamagata, Koji Enoki (*The Univ of Electro-Communications*)
- 2:20 pm:** Experimental Investigation of Subcooled Flow Boiling and CHF at High Pressure Using High-Resolution Diagnostics, A. Kossolapov, B. Phillips, M. Bucci (*MIT*)
- 2:45 pm:** Enhancement of Pressurized Subcooled Flow Boiling CHF with Nano-Engineered Surfaces, C. Wang, O. Akinsulire, G. Su, B. Phillips, M. Rahman, M. Bucci (*MIT*)

#### BEPU Analysis and Challenges in Licensing

**Session Organizer:** Brian Woods (*OSU*), **Cochairs:** Jinzhao Zhang (*Tractebel Engineering S.A.*)

**Location:** Sunstone **Time:** 1:30-3:10 pm

- 1:30 pm:** Uncertainty in Calculations by KWU-MIX of Condensation in the Cold Leg and Downcomer During Pressurized Thermal Shock, Richard R. Trewin (*Framatome GmbH*)
- 1:55 pm:** How to Bring Conservatism to a BEPU Analysis, Vincent Larget (*EdF*)
- 2:20 pm:** Uncertainty Assessment of LOCA Scenario for TRACE Model Based on TRAC-M Input of PWR Reactor, Pawel Domitr, Mateusz Malicki (*National Atomic Energy Agency PAA*), Lap-Yan Cheng (*BNL*)
- 2:45 pm:** Validation of a BEPU Methodology Through A Blind Benchmark Activity at the PKL Test Facility, J. Freixa, V. Martinez-Quiroga, M. Casamor, F. Reventós (*UPC*), R. Mendizabal (*CSN*)

#### Operation and Safety of Existing Reactors: General—I

**Session Organizer:** Jovica Riznic (*CNSC*), **Cochair:** Brian Woods (*OSU*)

**Location:** Salmon **Time:** 1:30-3:10 pm

- 1:30 pm:** Analysis and Implementation of Design Extension Conditions at Czech NPPs and Contribution (*DEC*) at Czech NPPS and Contribution of DEC to Enhancement of Defence-in-Depth, P. Kral (*UVV*)
- 1:55 pm:** An Artificial Intelligence-Guided Decision Support System for the Nuclear Power Plant Management, Botros Hanna, Tran Cao Son (*New Mexico State Univ*), Nam Dinh (*NCSU*)
- 2:20 pm:** VIKTORIA Experiments Investigating the Filtering System in the Sump of a PWR After a Loss of Coolant Accident—Part I : Physical/Chemical Effects on Strainer Head Loss Evolution, G. Repetto, B. Migot, J. F. Trigeol (*IRSN*), V. Soltész (*VUEZ as*)
- 2:45 pm:** Using Innovation to Deliver the Nuclear Promise at Exelon, B. Sarikaya, J. J. Tusar, D. S. Knepper, J. McHale, G. Inch, J. R. Massari (*Exelon Generation*)

#### Verification and Validation: General—I

**Session Organizer:** Kim Kungdoo (*KAERI*), **Cochairs:** Byoung Jae Kim (*Chungman Natl Univ*), Jean-Marie Le Corre (*Westinghouse*)

**Location:** Douglas Fir **Time:** 1:30-2:45 pm

- 1:30 pm:** A Frequency Response Approach to Model Validation for the Compact Integral Effects Test Facility in Transform, Dane De Wet, Per F. Peterson, James C. Kendrick, Christopher Poresky (*Univ of California, Berkeley*), M. Scott Greenwood (*ORNL*)
- 1:55 pm:** BWR Fuel Bundle Lift Force Measurements, Modeling and Validation, F. Waldemarsson, J.-M. Le Corre, S.-Ö. Lindahl, U. C. Bergmann, Y. Le Moigne (*Westinghouse Electric Sweden AB*)
- 2:20 pm:** Analysis of the Accuracy of Residual Heat Removal in Gen-IV Reactors, Jorge Yanez, Andreas Class (*KIT*)

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**MONDAY, AUGUST 19**  
TECHNICAL SESSIONS - 1:30 PM

**CHF and Post CHF Heat Transfer, Flooding and CCFL—I**

**Session Organizer:** Josh Kaizer (*NRC*), **Chair:** Juliana Duarte (*Virginia Tech*)

**Location:** Meadowlark **Time:** 1:30-2:45 pm

**1:30 pm:** Rod Bundle Post-CHF Heat Transfer Analysis at BWR Prototypical Conditions—Part 2: Heat Transfer Coefficient, J. P. Duarte (*Virginia Tech*), P. Yarsky T. Zaki (*NRC*)

**1:55 pm:** Development of CHF Prediction Method Based on the Film Flow Model with Nucleate Boiling Entrainment, Yuki Narushima, Kenichi Katono (*Hitachi*)

**2:20 pm:** Countercurrent Flows in Vertical Pipes Under Flooding at a Square Top End, Michio Murase, Koji Mishida, Toshiya Takaki (*Inst of Nuclear Safety System, Inc.*), Raito Goda, Takeyuki Shimamura, Akio Tomiyama (*Kobe Univ*)

**MONDAY, AUGUST 19**  
TECHNICAL SESSIONS - 3:30 PM

**Benchmark Study of the Accident at the Fukushima Phase 2—II**

**Session Organizer:** Marco Pellegrini (*Institute of Applied Energy*), **Cochairs:** Joy Rempe (*Rempe & Associates*), Martin Sonnenkalb (*GRS*)

**Location:** Eastside **Time:** 3:30-5:10 pm

**3:30 pm:** Sandia National Laboratories' Contribution to the OECD/NEA BSAF Phase II Project, N. Andrews, C. Facett, N. Bixler, D. Clayton, R. Gauntt (*SNL*)

**3:55 pm:** Analysis of Fission Product Transport in Unit 3 of Fukushima Daiichi, L. Fernandez Moguel, T. Lind (*PSI*), A. Rydl (*INSET s.r.o.*)

**4:20 pm:** Three Weeks Analysis of the Fukushima Daiichi Unit 3 NPP by the SAMPSON Code: Contribution to the BSAF-2 Project, M. Pellegrini, M. Naitoh (*IAE*)

**4:45 pm:** Analysis for the Accident at Unit 3 of the Fukushima Daiichi NPS with THALES2/KICHE Code in BSAF2 Project, Jun Ishikawa, Hitoshi Tamaki, Tomoyuki Sugiyama, Yu Maruyama (*JAEA*)

**Computational Multi-Fluid Dynamics—II**

**Session Organizer:** Igor A. Bolotnov (*NCSU*), **Cochairs:** Thomas Hoehne (*HZDR*), Nadish Saini (*NCSU*)

**Location:** Columbia **Time:** 3:30-5:35 pm

**3:30 pm:** Computational Experiments to Characterize Bubble Formation and Movement in Waste Glass Foam Layer, Donna P. Guillen, Alexander W. Abboud (*INL*), Richard Pokorny (*UCT Prague*)

**3:55 pm:** Towards a Two-Phase Flow All-Regime Model for Simulating Transitions from Dispersed to Stratified Regimes, E. V. Kuidjo Kuidjo, M; G. Rodio (*CEA*), R. Abgrall (*Univ of Zürich*), P. Sagaut (*Aix-Marseille Univ*)

**4:20 pm:** Interface Tracking Simulations of Bubble Population Effects in PWR Subchannels, Joseph J. Cambareri, Igor A. Bolotnov (*NCSU*)

**4:45 pm:** Interface Tracking Simulations of Droplet Interaction with Spacer Grids Under DFFB Conditions, Nadish Saini, Igor A. Bolotnov (*NCSU*)

**5:10 pm:** Assessment of MIT Momentum Closure Relations to Developing, Bubbly Flow Regimes, Brian Casel, Emilio Baglietto (*MIT*)

**Computational Fluid Dynamics—II**

**Session Organizer:** Jinyong Feng (*MIT*), **Cochairs:** Philippe Bardet (*George Washington University*), Jianping Long (*XJTU*)

**Location:** Pearl **Time:** 3:30-4:20 pm

**3:30 pm:** Importance of Conjugate Heat Transfer Modeling in Transient CFD Simulations, Angel Papukchiev (*GRS*), Dmitry Grishchenko, Pavel Kudinov (*KTH*)

**3:55 pm:** CFD Simulation of a Steam Generator U-Bend Region with Anti-Vibration Bars for the Investigation of Local Flow Behavior, D. Vivaldi (*IRSN*)



## MONDAY, AUGUST 19

### TECHNICAL SESSIONS - 3:30 PM

#### Computational Thermal Hydraulics: General—I

**Session Organizer:** Mathieu Martin (*TerraPower*), **Cochairs:** Elia Merzari (*Penn State*), Mathieu Martin (*TerraPower*)

**Location:** Mt. Hood **Time:** 3:30-4:45 pm

**3:30 pm:** A Reduced Order Model Study for Single-Phase Natural Circulation Reactor Stability, Yousef M. Farawila (*Farawila et al., Inc.*)

**3:55 pm:** Thermal Hydraulic CFD Validation for Liquid Metal Cooled 19-Pin Hexagonal Wire Wrapped Rod Bundle, A. Batta, A. Class (*KIT*)

**4:20 pm:** Study on the Two-Phase Flow in Simulated LWR Fuel Bundle by CFD Code, Ayako Ono, Susumu Yamashita, Takayuki Suzuki, Hiroyuki Yoshida (*JAEA*)

#### Fundamental Thermal Hydraulics: Experiments—II

**Session Organizer:** Guanghui Su (*Xi'an Jiao Tong Univ*), Xiaodong Sun (*Univ of Mich*),

**Cochairs:** Suizheng Qiu (*XJTU*), Jun Liao (*Westinghouse*)

**Location:** Salon A **Time:** 3:30-5:35 pm

**3:30 pm:** Thermal Stratification Analysis in a Pool-Type Geometry, James Schneider, Mark Anderson (*Univ of Wisconsin, Madison*), Emilio Baglietto, Liangyu Xu (*MIT*), Zeyun Wu, Sarah Morgan (*Virginia Commonwealth Univ*), Matthew Bucknor, Matthew Weathered (*ANL*), Sama Bilbao y Leon (*OECD NEA*)

**3:55 pm:** Experimental Study of Thermal-Hydraulic Performance of a Printed Circuit Heat Exchanger, Keyong Cheng (*CAS/Univ of Michigan*), Xiulan Huai, Jiangfeng Guo (*CAS*), Xiaodong Sun (*Univ of Michigan*)

**4:20 pm:** Effect of Indirect Heating of Rod Bundle in Fuel Assembly Thermal Hydraulic Experiment on Local Heat Flux Measurement, Bin Han, Bao-Wen Yang (*Delta Energy Group/Xi'an Jiaotong Univ*), Cen Wei, Yudong Zha (*Xi'an Jiaotong Univ*)

**4:45 pm:** The Effect of Gas-Liquid Properties on Height of Disturbance Waves in a Vertical Annular Two Phase Flow, S. Mori (*Kyushu Univ*), H. Yoshida (*JAEA*)

**5:10 pm:** Experimental Investigation on CHF of Water Flowing in Upward Tube from Subcooled to High Qualities, Bing Yang, Minfu Zhao (*China Inst of Atomic Energy*)

#### Thermal Hydraulics in Advanced Reactors: General—II

**Session Organizers:** Ferry Roelofs (*NRG*), Maria Avramova (*NCSU*), **Chair:** Angel Papukchiev (*GRS*)

**Location:** Salon B **Time:** 3:30-5:10 pm

**3:30 pm:** The Prospect and Challenge of Nuclear Thermal-Hydraulic Safety Research, Ki-Yong Choi (*KAERI*)

**3:55 pm:** The U.S. Nuclear Regulatory Commission Approach to Modeling and Simulation of Advanced Non-LWRs: Preparing for the Next Renaissance, Stephen M. Bajorek (*NRC*), invited

**4:20 pm:** Power-Reactivity Feedback and Oscillations in NuScale Power Module, Yousef M. Farawila (*Farawila et al., Inc.*)

**4:45 pm:** Thermal-Hydraulic Stability of the NuScale Reactor Concept, Yousef M. Farawila (*Farawila et al., Inc.*), Donald R. Todd (*Farawila et al., Inc./PNNL*), Bryan R. Hayden, Taylor N. Coddington, Hengliang Shen (*NuScale Power, L.L.C.*)

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## MONDAY, AUGUST 19

### TECHNICAL SESSIONS - 3:30 PM

#### Thermal Hydraulics in Lead-Cooled and Lead-Bismuth-Cooled Fast Reactors—II

**Session Organizer:** Ferry Roelofs (*NRG*), **Co-chairs:** Ferry Roelofs (*NRG*), Katrien van Tichelen (*SCK*)  
**Location:** Salon C **Time:** 3:30-5:10 pm

**3:30 pm:** Heavy Liquid Metal Thermal Hydraulic Progress in the MYRTE Project, F. Roelofs (*NRG*), K. Van Tichelen (*SCK-CEN*)

**3:55 pm:** Inter-Wrapper Flow: LBE Experiments and Simulations, Julio Pacio, Markus Daubner, Thomas Wetzel (*KIT*), Heleen Uitslag-Doolaard, Akshat Mathur, Ferry Roelofs (*NRG*)

**4:20 pm:** Validation of the System Thermal Hydraulics Code Athlet for the Simulation of Transient Lead-Bismuth Eutectic Flows, Angel Aleksandrov (*GRS*), Clotaire Geffray (*CEA*), Dmitry Grishchenko, Pavel Kudinov (*KTH*)

**4:45 pm:** Investigation of the Turbulent Pr<sub>t</sub> Model and Segmentation Rule for LBE Turbulent Heat Transfer, Peiyong Li, Yu Hongxing, Li Meifu, Du Sijia, Yan Mingyu, Liu Yu, Zhu Dahuan, Zhang He (*Nuclear Power Inst of China*)

#### Boiling and Condensation Fundamentals—II

**Session Organizer:** Byongjo Yun (*PNU*), **Co-chairs:** Seungjin Kim (*Purdue Univ*), Sung Joong Kim (*Hanyang Univ*)  
**Location:** Salon D **Time:** 3:30-5:35 pm

**3:30 pm:** Experimental Investigation of Seismic Vibration on Subcooled Boiling Flow, Yang Zhao, Zhuoran Dang (*Purdue Univ*), Jingyu Du (*Purdue Univ/Tsinghua Univ*), Mamoru Ishii (*Purdue Univ*)

**3:55 pm:** Relaxing the Stiffness of Interfacial Friction in the Drift Flux Formulation of Two-Phase Flow, Yousef M. Farawila (*Farawila et al Inc.*), Daniel Tinkler (*Framatome*)

**4:20 pm:** Evaluation of Stratified Condensation Models for a Slightly Inclined Tube Using ATHLET Code, Yu Zhang (*Deggendorf Inst of Technol/Univ of Luxembourg*), Amirhosein Moonesi Shabestary (*HZDR/Dresden Univ of Technol*), André Bieberle (*HZDR*), Uwe Hampell (*HZDR/Dresden Univ of Technol*) Stephan Leyer (*Univ of Luxembourg*)

**4:45 pm:** High-Fidelity Simulations of Boiling, Akash Dhruv, Elias Balaras (*George Washington Univ*), Amir Riaz, Jungho Kim (*Univ of Maryland*)

**5:10 pm:** Investigation of Subcooled Flow Boiling and CHF on Unoxidized and Oxidized Zircaloy-4 Surfaces, Jee Hyun Seong, Chi Wang, Bren Phillips, Matteo Bucci (*MIT*)

#### Instabilities and Nonlinear Dynamics

**Session Organizer:** Brian Woods (*OSU*), **Chair:** Amir Ali (*UNM*)  
**Location:** Sunstone **Time:** 3:30-4:20 pm

**3:30 pm:** Preliminary Analysis of Measured Data from a Simulated BWR Fuel Assembly Undergoing Power and Flow Oscillations Representative of Anticipated Transient Without SCRAM Conditions, P. Yarsky, T. Zaki (*NRC*), J. P. Duarte (*VT*)

**3:55 pm:** The Effect of Reactor Control Systems on BWR Stability Using Unique Plant Data, Carl Adamsson (*Vattenfall Nuclear Fuel AB*), David Palko, Thomas Smed (*Forsmark Kraftgrupp AB*)

## MONDAY, AUGUST 19

### TECHNICAL SESSIONS - 3:30 PM

#### Operation and Safety of Existing Reactors: General—II

**Session Organizer:** Jovica Riznic (*CNSC*), **Chair:** Jae Jun Jeong (*PNU*)

**Location:** Salmon **Time:** 3:30-5:10 pm

**3:30 pm:** VIKTORIA Experiments Investigating the Filtering System in the Sump of a PWR After a Loss of Coolant Accident—Part II: Downstream Effects, G.Repetto, B. Migot, C. Heib (*IRSN*), V. Soltész (*VUEZ as*)

**3:55 pm:** A Methodology for Predicting the Fouling of Steam Generators and Its Impact on Their Performance, Thibaut Dupuy, Thomas Prusek, Fadila Oukacine (*EdF*), Marc Jaeger (*Univ of Aix-Marseille*), Marcel Lacroix (*Univ of Sherbrooke*)

**4:20 pm:** Modification of 37-Element Fuel Bundle for Recovering Thermal Margin, J. H. Park, J. Y. Jung (*KAERI*)

**4:45 pm:** Develop of Calculation-Analytical Justification of Possibility of Increasing the Thermal Power of Reactor for Unit 4 of Rivne NPP to 101.5% Nnom. (up to 3045 MW), Oleksandr Mykhailenko, Oleksandr Mazurok, Vadym Ivanov (*ESG Group*), Yuriy Hubenya (*SD Rivne NPP*)

#### Verification and Validation: General—II

**Session Organizer:** Kim Kungdoo (*Korea Atomic Energy Research Inst.*), **Cochairs:** Ik Kyu Park (*Korea Atomic Energy Research Inst.*), Linyu Lin (*NCSU*)

**Location:** Douglas Fir **Time:** 3:30-5:10 pm

**3:30 pm:** Advanced Studies and Statistical Treatment for Sodium-Cooled Fast Reactor PIN Failures During Unprotected Transient Overpower Accident, N. Marie (*CEA*), K. Herbreteau, A. Marrel, F. Bertrand (*CEA*)

**3:55 pm:** Benchmarking of RAMONA5-FA to Oskarshamn-2 Instability Event, Daniel R. Tinkler, Cameron D. Myers (*Framatome*), Yousef M. Farawila (*Farawila et al Inc.*)

**4:20 pm:** Assessment of Smoothed Particle Hydrodynamics Methods for Simulating the External-Flooding Scenario, L. Lin, Nam Dinh (*NCSU*), S. Prescott, H. Bao (*INL*), N. Montanari, R. Sampath (*Centroid Lab*)

**4:45 pm:** Uncertainty and Sensitivity Analysis of PSBT with ATHAS Subchannel Code, Peichao Zhai, Bo Zhang, Jianqiang Shan (*Xi'an Jiaotong Univ*)

#### CHF and Post CHF Heat Transfer, Flooding and CCFL—II

**Session Organizer:** Josh Kaizer (*NRC*), **Cochairs:** Yong Hoon Jeong (*KAIST*), Juliana Duarte (*VT*)

**Location:** Meadowlark **Time:** 3:30-4:45 pm

**3:30 pm:** Rod Bundle Post-CHF Heat Transfer Analysis at BWR Prototypical Conditions—Part 1: Inverse Heat Transfer, J. P. Duarte (*Virginia Tech*), P. Yarsky, T. Zaki (*NRC*), M. L. Corradini (*Univ of Wisconsin, Madison*)

**3:55 pm:** Steady-State Flow CHFs with Various Tube Materials, Soon Kyu Lee (*Univ of New Mexico*), Nicholas R. Brown (*Univ of Tennessee, Knoxville*), Kurt A. Terrani (*ORNL*), Youho Lee (*Seoul National Univ*)

**4:20 pm:** Initial Entrained Fraction at Onset of Annular Flow, Henryk Anglart (*KTH*)

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**TUESDAY, AUGUST 20**  
**TECHNICAL SESSIONS - 8:20 AM**

**Computational Multi-Fluid Dynamics—III**

**Session Organizer:** Igor A. Bolotnov (*NCSU*), **Cochairs:** Dirk Lucas (*HZDR*), Joseph Cambareri (*NCSU*)  
**Location:** Columbia **Time:** 8:20-9:10 am

**8:20 am:** On Numerical Simulation of Flashing Flows, Yixiang Liao, Dirk Lucas (*HZDR*)

**8:45 am:** Preliminary Development of a Coarse-Mesh Sodium Boiling Model for OpenFOAM Based Mult-Physics Solvers, Stefan Radman, Carlo Fiorina, Andreas Pautz (*EPFL*)

**Benchmark Study of the Accident at the Fukushima Phase 2—III**

**Session Organizer:** Marco Pellegrini (*IAE*), **Cochairs:** Dave Luxat (*SNL*), Mizokami Shinya (*TEPCO*)  
**Location:** Eastside **Time:** 8:20-10:00 am

**8:20 am:** Overview and Outcomes of the OECD/NEA Benchmark Study of the Accident at the Fukushima Daiichi NPS (BSAF) Phase II—Results of Severe Accident Analyses for Unit 1, L. E. Herranz (*CIEMAT*), Marco Pellegrini (*IAE*), T. Lind (*PSI*), M. Sonnenkalb (*GRS*), L. Godin-Jacqmin (*CEA*), C. López (*CIEMET*), K. Dolganov (*IBRAE*), F. Cousin (*IRSN*), H. Tamaki (*JAEA*), T. W. Kim (*KAERI*), H. Hoshi (*NRA*), N. Andrews (*SNL*), T. Sevon (*VTT*)

**8:45 am:** Overview and Outcomes of the OECD/NEA Benchmark Study of the Accident at the Fukushima Daiichi NPS (BSAF) Phase 2—Results of Severe Accident Analyses for Unit 2, M. Sonnenkalb (*GRS*), M. Pellegrini (*IAE*), L. E. Herranz (*CIEMAT*), T. Lind (*PSI*), A. C. Morreale (*CNL*), J. Kanda (*CRIEPI*), H. Tamaki (*JAEA*), S. I. Kim (*KAERI*), F. Cousin (*IRSN*), L. Fernandez Moguel (*CIEMAT*), N. Andrew (*SNL*), T. Sevon (*VTT*)

**9:10 am:** Overview and Outcomes of the OECD/NEA Benchmark Study of the Accident at the Fukushima Daiichi NPS (BSAF) Phase 2—Results of Severe Accident Analyses for Unit 3, T. Lind (*PSI*), M. Pellegrini (*IAE*), L. E. Herranz (*CIEMAT*), M. Sonnenkalb (*GRS*), Y. Nishi (*CRIEPI*), H. Tamaki (*JAEA*), F. Cousin (*IRSN*), L. Fernandez-Moguel (*PSI*), N. Andrews (*SNL*), T. Sevon (*VTT*)

**9:35 am:** Main Findings, Remaining Uncertainties and Lessons Learned from the OECD/NEA BSAF Project, M. Pellegrini (*IAE*), L. E. Herranz (*CIEMAT*), M. Sonnenkalb (*GRS*), T. Lind (*PSI*), Y. Maruyama (*JAEA*), R. Gauntt, N. Bixler (*SNL*), A. Morreale (*CNL*), K. Dolganov (*IBRAE*), T. Sevon (*VTT*), D. Jacquemain (*IRSN*), J. H. Song (*KAERI*), H. Hoshi (*NRA*), Y. Nishi (*CRIEPI*), S. Mizokami (*TEPCO*)

**Computational Fluid Dynamics—III**

**Session Organizer:** Jinyong Feng (*MIT*), **Cochairs:** Jinyong Feng (*MIT*), Donna Guillen (*INL*)  
**Location:** Pearl **Time:** 8:20-10:00 am

**8:20 am:** Direct Numerical Simulations of Low-Prandtl Turbulent Heat Transfer in Planar Impinging Jets, M. Duponcheel, Y. Bartosiewicz (*Universite Catholique de Louvain*)

**8:45 am:** A Parameterized Proper Orthogonal Decomposition Approach for Reduced Order Models, T. P. Grunloh, L. Calian (*Univ of Illinois*), S. Natesh, A. Patel, T. Wilson (*Illinois Rocstar LLC*)

**9:10 am:** CFD Simulation of Condensation Heat Transfer in Horizontal Tubes, Khalid Khasawneh, Yong Hoon Jeong (*KAIST*)

**9:35 am:** Numerical Simulation on Fuel Assembly Deformation Induced by Flow Redistribution with Code SATURNE, T. Xu, J. X. Han, J. Min (*EDF China Center*), M.-C. Gauffre, R. Deneffe (*EDF*)

## TUESDAY, AUGUST 20

### TECHNICAL SESSIONS - 8:20 AM

#### Computational Thermal-Hydraulics: General—II

**Session Organizer:** Mathieu Martin (*TerraPower*), **Cochairs:** Bin Han (*Xi'an Jiaotong Univ*), Guojun Hu (*ANL*)

**Location:** Mt. Hood **Time:** 8:20-10:00 am

**8:20 am:** Les Investigation of Prandtl Number Effects over a Backward Facing Step and Consequences in Terms of Best Practice Guidelines for RANS, S. Buckingham, L. Koloszar, A. Villa Ortiz (*von Karman Inst for Fluid Dynamics*), Y. Bartosiewicz, G. Winckelmans (*UCLouvain*)

**8:45 am:** Numerical Simulation on LMR Molten-Core Centralized Sloshing Behaviors with Single/Multi-Phase Smoothed Particle Hydrodynamics Based on Novel Density Formulation, Young Beom Jo, Eung Soo Kim (*Seoul Natl Univ*)

**9:10 am:** A 3D Model to Solve U-Tube Steam Generator Secondary Side Thermal Hydraulics with Coupled Primary-to-Secondary Side Heat Transfer, D. Vivaldi (*IRSN*)

**9:35 am:** Development and Implementation of a 1-D FEM Compressible Flow Module in TRICORDER—A MOOSE-Based Multi-Physics Code, L. B. Carasik, V. Patel, S. Judd, P. Venneri (*UNSC*)

#### Fundamental Thermal-Hydraulics: Experiments—III

**Session Organizers:** Guanghui Su (*Xi'an Jiao Tong Univ*), Xiaodong Sun (*Univ of Mich*),

**Cochairs:** Caleb Brooks (*Univ of Illinois*), Nesrin O. Cetiner (*ORNL*)

**Location:** Salon A **Time:** 8:20-10:00 am

**8:20 am:** Experimental Study of Gas-Liquid Two-Phase Flow Behavior with Steam Condensation During Pool Scrubbing, Yuki Nakamura, Kota Fujiwara, Akiko Kaneko, Yutaka Abe (*Univ of Tsukuba*)

**8:45 am:** A New Dataset with Local Measurement and Visualization of Subcooled Boiling in an Internally Heated Annulus Channel, Joseph L. Bottini (*Univ of Illinois*), Longxiang Zhu (*Univ of Illinois*), Zhiee Jhia Ooi, Taiyang Zhang, Caleb S. Brooks (*Univ of Illinois*)

**9:10 am:** Relative Motion Between Phases in Horizontal Gas Dispersed Flow, Ran Kong (*Purdue Univ*), Jiawei Bian (*Purdue Univ*), Qingzi Zhu, Mamoru Ishii, Seungjin Kim (*Purdue Univ*)

**9:35 am:** Experimental Study of Liquid Entrainment in ADS-4 Branch Tube with Double-End Inlets of Air-Water, Liu Wang (*Xi'an Jiaotong Univ*), Lifang Liu (*State Power Investment Corp. Research Inst*), Ning Wang (*Xi'an Jiaotong Univ*), Qionghua Sun (*State Power Investment Corp. Research Inst*), Kui Zhang (*Xi'an Jiaotong Univ*), Xiaoliang Fu (*State Power Investment Corp. Research Inst*), Wenxi Tian (*Xi'an Jiaotong Univ*), Bo Dong (*State Power Investment Corp. Research Inst*), Suizheng Qiu, G. H. Su (*Xi'an Jiaotong Univ*)

#### Thermal Hydraulics in Advanced Reactors: General—III

**Session Organizers:** Ferry Roelofs (*NRG*), Maria Avramova (*NCSU*), **Cochairs:** Steve Bajorek (*NRC*), Ki Yong Choi (*KAERI*)

**Location:** Salon B **Time:** 8:20-10:00 am

**8:20 am:** Printed Circuit Heat Pipe Heat Exchanger for Passive Containment Cooling System, Hae-Yong Jeong (*Sejong Univ*), In-Sik Ra (*Energy Hub*)

**8:45 am:** PANAS- Project: Heat Transfer Model Development for Passive Safety Systems, Stephan Leyer (*Deggendorf Inst of Technol/Univ of Luxembourg*), Uwe Hampel (*HDZR/Dresden Univ of Technol*), Christoph Schuster, Wolfgang Lippmann (*Dresden Univ of Technol*), Markus Walther (*Framatome GmbH*), Kai Kosowski (*PreussenElektra GmbH*)

**9:10 am:** System Thermal-Hydraulics During SBO with a Passive Safety Feature of Hybrid SIT, Seok Cho, Byoung-Uhn Bae, Jae-Bong Lee, Yu-Sun Park, Jong-Rok Kim, Kyoung-Ho Kang (*KAERI*)

**9:35 am:** BEPU of MSLB LOCA on a Generation III Reactor Based on RELAP5/SCDAP 3.4, Ye Yang, Jun Yang, Chengcheng Deng (*Huazhong Univ*), Mamaru Ishii (*Purdue Univ*)

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**TUESDAY, AUGUST 20**  
**TECHNICAL SESSIONS - 8:20 AM**

**Thermal Hydraulics in Lead-Cooled and Lead-Bismuth-Cooled Fast Reactors—III**

**Session Organizer:** Ferry Roelofs (*NRG*), **Cochairs:** Graham Kennedy (*SCK*), Alessandro Del Nevo (*ENEA*)  
**Location:** Salon C **Time:** 8:20-9:10 am

**8:20 am:** Fouling Effect of Lead Oxide Crystallization on Heat Transfer in LBE, Yong-Hoon Shin, Kristof Gladinez, Jun Lim, Alessandro Marino, Kris Rosseel, Alexander Aerts, Katrien Van Tichelen (*SCK-CEN*)

**8:45 am:** Development of a Numerical Framework to Model Flow Accelerated Corrosion in a Lead Loop, Khaled Talaat, Rubel Das, Brian Romero, Cemal Cakez, Osman Anderoglu, Sang Lee (*Univ of New Mexico*), Youho Lee (*Seoul Natl Univ*), Heng Ban (*Univ of Pittsburgh*), Keith Woloshun, Seung Jun Kim, Dasari Rao, Cetin Unal (*LANL*)

**Boiling and Condensation Fundamentals—III**

**Session Organizer:** Byongjo Yun (*Pusan National Univ*), **Cochairs:** Hyoung Kyu Cho (*Seoul National Univ, SNU*), Marco Colombo (*Univ of Leeds*)

**Location:** Salon D **Time:** 8:20-10:00 am

**8:20 am:** Image Analysis of Bubbling Mode Condensation Oscillations in Horizontal Sparger, Elina Hujala, Vesa Tanskanen, Giteshkumar Patel, Juhani Hyvärinen (*Lappeenranta-Lahti Univ of Technol*)

**8:45 am:** A Potential Solution for Boiling Crisis, Prem Bikkina, Sushobhan Pradhan (*Oklahoma State Univ*)

**9:10 am:** Critical Heat Flux in Vertical Annulus Under Zero Flow Conditions with Radial Heat Losses, Lior Nahon (*NRCN/Ben-Gurion Univ*), Tali Bar-Kohany (*NRCN/Tel Aviv Univ*), Evgeny Rabinovich (*NRCN*), Yosef Aharon (*NRCN/Ben Gurion Univ*)

**9:35 am:** Current Capability of Interfacial Area Transport Equation in Subcooled Boiling, Longxiang Zhu (*Univ of Illinois/Xi'an Jiaotong Univ*), Zhiee Jhia Ooi, Caleb S. Brooks (*Univ of Illinois*)

**Celebrating the Life and Legacy of Professor Raj Sehgal—Panel**

**Session Organizers and Cochairs:** Jong Kim (*KAIST*), Nam Dinh (*NCSU*)

**Location:** Sunstone **Time:** 8:20-10:00 am

**Panelists:** Ravinder Sehgal (*SFSU*)  
Chul-Hwa Song (*KAERI*)  
Vijay Dhir (*UCLA*)  
Jong Kim (*KAIST*)  
Yassin Hassan (*Texas A&M*)  
Hisashi Ninokata (*Politecnico di Milano*)  
Weiman Ma (*KTH*)  
Nam Dinh (*NCSU*)

**Operation and Safety of Existing Reactors: General—III**

**Session Organizer:** Jovica Riznic (*CNSC*), **Cochairs:** Dan LaBrier (*ISU*), Amir Ali (*UNM*)

**Location:** Salmon **Time:** 8:20-10:00 am

**8:20 am:** Integral Effect Tests in Visualization Basis 3D Printed Test Facility for Improved Applicability of Innovative Technologies, Kyung Mo Kim, In Cheol Bang (*UNIST*)

**8:45 am:** Development of Operation Strategy and Recovery Guideline During Extended Station Blackout for OPR1000 and APR1400, Chang Gyun Lee, Jae Min Park, Ho Bin Yim, Chan Eok Park, Gyu Cheon Lee (*KEPCO E&C*)

**9:10 am:** Thermal-Hydraulic Calculations and Development of Boundary Conditions for Assessing the Technical Condition and Life Time Extension of Primary Main Equipment for Reactor Facility KHNPP-1, Oleksandr Mykhailenko, Oleksandr Mazurok, Vadym Ivanov (*ESG Group*)

**9:35 am:** Feasibility Study of TES Integrated Nuclear Power Plant, Ju Yeon Lee, Jeong-Ik Lee (*KAIST*)

## TUESDAY, AUGUST 20

### TECHNICAL SESSIONS - 8:20 AM

#### Verification and Validation: General—III

**Session Organizer:** Kim Kungdoo (*KAERI*), **Cochairs:** Richard Schultz (*ISU*), Linyu Lin (*NCSU*)

**Location:** Douglas Fir **Time:** 8:20-9:35 am

**8:20 am:** Two-Fluid Equation Considering Time-Dependent Change of Fluid Volume, Jong Hyuk Lee, Kyung Doo Kim (*KAERI*), Byoung Jae Kim (*Chungnam National Univ*)

**8:45 am:** Establishment of Guideline for Credibility Assessment of Nuclear Simulations in the Atomic Energy Society of Japan, Masaaki Tanaka (*JAEA*), Yoshiro Kudo (*CRIEPI*), Kotaro Nakada (*Toshiba Energy Systems and Solutions Corp.*), Seiichi Koshizuka (*Univ of Tokyo*)

**9:10 am:** Development of a One-Dimensional Model for a Closed Thermosiphon for Cooling a Spent-Fuel Pool, Richard R. Trewin (*Framatome GmbH*)

#### CHF and Post CHF Heat Transfer, Flooding and CCFL—III

**Session Organizer:** Josh Kaizer (*NRC*), **Cochairs:** Piyush Sabharwall (*INL*), Jean-Marie Le Corre (*Westinghouse*)

**Location:** Meadowlark **Time:** 8:20-10:00 am

**8:20 am:** Development of Nuscale Critical Flux Correlations, A. Galimov (*NuScale Power LLC*), M. Bradbury (*Information Systems Laboratories, Inc.*)

**8:45 am:** Modeling and Validation of a Post-Dryout Heat Transfer Model for Three-Field Sub-Channel Analysis, J.-M. Le Corre (*Westinghouse Electric Sweden AB*)

**9:10 am:** Experimental Research of Critical Heat Fluxes on 37-Rod Bundles with Various Types of Grids-Intensifiers, D. Oleksyuk, D. Kireeva, L. Kobzar (*NRC "Kurchatov Inst"*)

**9:35 am:** Validation of Cathare 3D Module on LSTF Core, Raphaël Pr ea (*CEA*)

### TECHNICAL SESSIONS - 10:20 AM

#### Computational Multi-Fluid Dynamics—IV

**Session Organizer:** Igor A. Bolotnov (*NCSU*), **Cochairs:** Marco Colombo (*Univ of Leeds*), Ed Koman

**Location:** Columbia **Time:** 10:20 am-12:00 pm

**10:20 am:** High-Fidelity Simulation of a Taylor Bubble in Co-Current Turbulent Flow, B. Mikuz (*NRG/ Jozef Stefan Inst*), E. M. A. Frederix (*NRG*), I. Tiselj (*Jozef Stefan Inst*), E. M. J. Komen (*NRG*)

**10:45 am:** Benchmarking of CFD Modelling Closures for Two-Phase Turbulent Bubbly Flows, Marco Colombo (*Univ of Leeds*), Roland Rzehak (*HZDR*), Michael Fairweather (*Univ of Leeds*), Yixiang Liao, Dirk Lucas (*HZDR*)

**11:10 am:** CFD Simulations of Direct-Contact Condensation of Horizontal Vapor Jets, T. P ttikangas, J. Peltola, V. Hovi (*VTT Technical Research Centre of Finland Ltd*), M. Puustinen, A. R s nen, E. Kotro (*Lappeenranta-Lahti Univ of Technol*)

**11:35 am:** An Eulerian-Eulerian CFD Approach to Simulate the Thermohydraulics of Pipes; Channels or Rod Bundles: from Onset of Nucleate Boiling to CHF, Wei Ding (*HZDR/TU Dresden*), Eckhard Krepper (*HZDR*), Uwe Hampel (*HZDR/TU Dresden*)

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**TUESDAY, AUGUST 20**  
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**Benchmark Study of the Accident at the Fukushima Phase 2—IV**

**Session Organizer:** Marco Pellegrini (*IAE*), **Cochairs:** Marco Pellegrini (*IAE*), Didier Jaquermain (*IRSN*)  
**Location:** Eastside **Time:** 10:20 am-12:00 pm

**10:20 am:** Uncertainty Analysis of Corium Relocation to the Lower Plenum Using Results from the OECD/NEA BSAF Phase II Project, Lucas I. Albright, Nathan Andrews, Larry Humphries, Randall O. Gauntt (*SNL*), Tatjana Jevremovic (*Univ of Utah*)

**10:45 am:** Reconstruction of the Fukushima Source Term from Nearby Radiological Measurements, Martin Sogalla, Martin Sonnenkalb, Sebastian Band, Cornelia Richter (*GRS*)

**11:10 am:** Analyses of Fission Products Behaviour and Environmental Releases During the Fukushima-Daiichi Accident by Direct and Inverse Approach at IRSN, Frédéric Cousin, Hervé Bonneville Charlaïne Bouillet, Damien Didier, Didier Jacquemain (*IRSN*)

**11:35 am:** Outline of the OECD/NEA/ARC-F Project, Toru Nakatsuka, Toshikatsu Maeda, Tomoyuki Sugiyama, Yu Maruyama (*JAEA*)

**Computational Fluid Dynamics—IV**

**Session Organizer:** Jinyong Feng (*MIT*), **Cochairs:** Bao-Wen Yang (*XJTU*), Matthew Zimmer (*NCSU*)  
**Location:** Pearl **Time:** 10:20 am-11:35 am

**10:20 am:** A Novel Coarse-Grid Sub-Channel CFD for Nuclear Thermal Hydraulics, B. Liu, S. He (*Univ of Sheffield*), C. Moulinec (*Science and Technology Facilities Council*), J. Uribe (*EDF Energy R&D UK Center*)

**10:45 am:** CFD Studies of Effect of Fuel Channel/Stringer Eccentricity in the Core of an Advanced Gas-Cooled Reactor, Jundi He, Shuisheng He (*Univ of Sheffield*), Bing Xu (*EDF Energy*)

**11:10 am:** CFD Analysis on Mixing Vane Grid Performance in a 5x5 Rod Bundle, Bin Han, Bao-Wen Yang (*Delta Energy Group/Ji'an Jiaotong Univ*), Cen Wei, Yudong Zha (*Xi'an Jiaotong Univ*)

**Computational Thermal Hydraulics: General—III**

**Session Organizer:** Mathieu Martin (*TerraPower*), **Cochairs:** Sofiane Benhamadouche (*EdF*), Thomas Hoehne (*HZDR*)

**Location:** Mt. Hood **Time:** 10:20 am-12:00 pm

**10:20 am:** Reynolds-Averaged Turbulence Modeling Using Deep Learning with Local Flow Features, Chih-Wei Chang (*Emory Univ*), Jun Fang (*ANL*), Nam T. Dinh (*NCSU*)

**10:45 am:** Numerical Simulation of Nonlinear Bubble Phenomena in Subcooled Boiling in a Channel, Jyoti Bhati, Swapan Paruya, J. Naik, L. G. Mayur, B. Das (*NIT Durgapur*), Subhramaniam Pushpavanam (*ITT Madras*)

**11:10 am:** CFD-DEM Analysis of Realistically Heated Pebble Bed Geometry, Robert Mardus-Hall, Guan Heng Yeoh (*Univ of New South Wales*), Mark Ho (*ANSTO*)

**11:35 am:** Hypothetical Accident Analyses on the Conceptual NIST Reactor with a Split Core Using RELAP5-3D, Tao Liu, Zeyun Wu (*Virginia Commonwealth Univ*)

**Fundamental Thermal Hydraulics: Experiments—IV**

**Session Organizers:** Guanghui Su (*Xi'an Jiao Tong Univ*), Xiaodong Sun (*Univ of Mich*), **Cochairs:** Xiaodong Sun (*Univ of Mich*), Liangming Pan (*CQU*)

**Location:** Salon A **Time:** 10:20 am-12:00 pm

**10:20 am:** Investigation of Liquid Film Behavior in Upper Reactor Vessel Downcomer with Electrical Conductance Sensor Based on Flexible Printed Circuit Board, Chi-Jin Choi, Hyoung Kyu Cho (*Seoul Natl Univ*)

**10:45 am:** That Dam Quality, Jeff Fluckiger, Daren Jensen (*INL*)

**11:10 am:** Experiments on Helium-3 Negative Reactivity Insertion -HENRI- Prototype, G. Mignot, A. Warren, S. Balderrama, W. Marcum (*OSU*), N.Woolstenhulme (*INL*)

**11:35 am:** Research Progress of Fission Gas Separation Technology Applied in Thorium Molten Salt Reactor, Junlian Yin, Tingting Zhang, Yalan Qian, Dezhong Wang (*Shanghai Jiao Tong Univ*)



## TUESDAY, AUGUST 20

### TECHNICAL SESSIONS - 10:20 AM

#### Thermal Hydraulics in Lead-Cooled and Lead-Bismuth-Cooled Fast Reactors—IV

**Session Organizer:** Ferry Roelofs (*NRG*), **Cochairs:** Angel Papukchiev (*GRS*), Jun Liao (*WEC*)

**Location:** Salon C **Time:** 10:20 am-12:00 pm

**10:20 am:** Results on Thermal Hydraulic Experiments in the LBE-Cooled Scaled Pool Facility E-SCAPE in Support of the Myrrha Design and Licensing, Katrien Van Tichelen, Fabio Mirelli (*SCK-CEN*)

**10:45 am:** LBE-Cooled Scaled Pool Facility E-SCAPE: Results and Applications for Code Validation, D. Castelliti, K. Van Tichelen, F. Mirelli (*SCK-CEN*)

**11:10 am:** Validation of CFD Analyses Against Pool Experiments E-SCAPE, D. C. Visser, F. Roelofs (*NRG*), F. Mirelli, K. Van Tichelen (*SCK-CEN*)

**11:35 am:** Numerical Simulation of Loss-of-Flow Transient in the MYRRHA Reactor, L. Koloszar, Ph. Planquart (*Karman Inst for Fluid Dynamics*), K Van Tichelen, S. Keijers (*SCK-CEN*)

#### Boiling and Condensation Fundamentals—IV

**Session Organizer:** Byongjo Yun (*PNU*), **Cochairs:** Matteo Bucci (*MIT*), Yong Hoon Jeong (*Kaist*)

**Location:** Salon D **Time:** 10:20 am-12:00 pm

**10:20 am:** A Preliminary Study On Biphilic Surface for Enhanced Pool Boiling Performance, Do Yeong Lim, In Cheol Bang (*UNIST*)

**10:45 am:** Modelling Path of the Heterogeneous Spontaneous Nucleation—A New Driven Mechanism of Power Transient CHF, Yikuan Yan, Emory Brown, Wade Marcum (*OSU*)

**11:10 am:** An Experimental Study of Steam Condensation with the Presence of Air Under Free Convection Condition, Jinhoon Kang, Byongjo Yun (*Pusan National Univ*), Sang-Gyu Lim, Jong Cheon (*KHNP Central Research Inst*)

**11:35 am:** Boiling Heat Transfer Enhancement with Extremely High Thermal Effusivity of Phase Change Material, Ji Yong Kim, In Cheol Bang (*UNIST*)

#### Severe Accidents: General—I

**Session Organizer:** Fulvio Mascari (*ENEA*), **Cochairs:** Jinzhao Zhang (*Tractebel Engineering S.A.*), Guillaume Mignot (*OSU*)

**Location:** Sunstone **Time:** 10:20 am-12:00 pm

**10:20 am:** EDF MAAP5.04 LOCA Transient Simulations Improvements, Jeremy Bittan (*EdF*)

**10:45 am:** Uncertainty Analysis of Severe Accident in the Spent Fuel Pool, V. Vileiniskis, A. Kaliatka, E. Ušpuras (*Lithuanian Energy Inst*), D. Merrouche (*CRNB*)

**11:10 am:** Uncertainty Analysis of Vessel Failure Mode and Melt Release in Station Blackout Scenario in Nordic BWR Using MELCOR Code, Sergey Galushin, Pavel Kudinov (*KTH*)

**11:35 am:** The Effect of Severe Accident Scenarios on In-Vessel Debris Relocation in Nordic BWRs, Sergey Galushin, Pavel Kudinov (*KTH*)

#### NPP Transient and Accident Analysis—I

**Session Organizer:** Dan LaBrier (*ISU*), **Cochairs:** Jae Jun Jeong (*PNU*), Stephen Louria (*OSU*)

**Location:** Salmon **Time:** 10:20 am-12:00 pm

**10:20 am:** Status of TRACE Model Development and Validation at NPP Gösgen in Switzerland, Davide Papini, Rainer Kaulbarsch, Jens-Uwe Klügel (*Nuclear Power Plant Gösgen-Däniken AG*), Evgeni Borisov, Kaliopa Mancheva (*GCR Ltd*)

**10:45 am:** Applicability of the TRACE Model of NPP Gösgen to Safety Analyses of BDBA Sequences, Davide Papini, Rainer Kaulbarsch, Jens-Uwe Klügel (*Nuclear Power Plant Gösgen-Däniken AG*), Evgeni Borisov, Kaliopa Mancheva (*GCR Ltd.*)

**11:10 am:** Thermal-Hydraulic Calculations for Technical Condition and Lifetime Extension Assessment of SUNPP-3 Reactor, Oleksandr Mazurok, Oleksandr Mihaylenko (*ESG*), Volodymyr Kravchenko (*Odessa National Polytechnic Univ*)

**11:35 am:** Determination of Representative Validation Scenarios for Emergency Operating Guidelines, Qingming Yang (*China Nuclear Power Eng Co., Ltd.*), Minfeng Chen (*China Zhongyuan Eng Corp.*), Jun Wang (*China Nuclear Power Eng Co., Ltd*)

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**TUESDAY, AUGUST 20**  
TECHNICAL SESSIONS - 10:20 AM

**The Future of Multiphase Flow Modeling—Panel**

**Session Organizers and Chairs:** Jinyong Feng (*MIT*), Dillon Shaver (*ANL*)

**Location:** Douglas Fir **Time:** 10:20 am-12:00 pm

Progress in the field of multiphase flow modeling has been driven by the issues encountered in nuclear engineering. With recent developments in the field placing an emphasis on advanced reactor design and high fidelity simulation capabilities, the complexity of reactor multiphase thermal-hydraulics remains a daunting hurdle as scientists and engineers move towards more physics-based approaches. This panel seeks to explore the current state-of-the-art in multiphase flow modeling and provide insight into its future. Panelists will discuss relevant topics including, but not limited to: the role of multiphase in advanced reactors, recent developments in boiling modeling, data-driven approaches for multiphase modeling, the role of high-fidelity simulation, and current efforts in verification and validation.

**Panelists:** Michael Podowski (*RPI*)  
Adrian Tentner (*ANL*)  
Henryk Anglart (*KTH*)  
Chul-Hwa Song (*KAERI*)

**Computational Fluid Dynamics V&V—I**

**Session Organizers:** Lane Carasik (*VCU*), Barton Smith (*USU*), **Cochairs:** Brian Jackson (*Kairos Power*), Aleksandr Obabko (*ANL*)

**Location:** Meadowlark **Time:** 10:20-11:35 am

**10:20 am:** Validation of Numerical Particle Tracking Inside a HLM Reactor with Measurements in a Water Model, Ph. Planquart, C. Spaccapaniccia, S. Buckingham (*von Karman Inst*), K. Van Tichelen (*SCK-CEN*)

**10:45 am:** Validation NEK5000 for 37- and 61-Pin Wire-Wrap Geometries with Conjugate Heat Transfer, Aleksandr Obabko, Elia Merzari (*ANL*), Landon Brockmeyer (*Texas A&M*), Paul Fischer (*ANL/Univ of Illinois*), Tanju Sofu (*ANL*), Brian Jackson, Michael Steer (*TerraPower*), Rodolfo Vaghetto, Yassin A. Hassan (*Texas A&M*)

**11:10 am:** CFD Verification and Validation of Wire-Wrapped Pin Assemblies, Mathieu Martin, Daniel Leonard, R. Brian Jackson, K. Michael Steer (*TerraPower*)

TECHNICAL SESSIONS - 2:20 PM

**Computational Multi-Fluid Dynamics—V**

**Session Organizer:** Igor A. Bolotnov (*NCSU*), **Cochairs:** Yang Liu (*ANL*), Ling Zou (*ANL*)

**Location:** Columbia **Time:** 2:20-3:35 pm

**2:20 pm:** Development and Multi-Level Validation of a Mechanistic Heat Flux Partitioning Model for Boiling Heat Transfer, Ravikishore Kommajosyula, Etienne Demarly, Emilio Baglietto (*MIT*)

**2:45 pm:** Numerical Simulation of Film Boiling on a Horizontal Surface in Oscillating System, Young Seock An, Byeongjae Jae Kim, Nam Kyu Ryu (*Chungnam National Univ*)

**3:10 pm:** On Development and Validation of Subcooled Nucleate Boiling Models for OpenFOAM Foundation Release, J. Peltola, T. Pättikangas (*VTT Technical Research Centre of Finland Ltd*), W. Bainbridge (*CFD Direct Ltd*), R. Lehnigk, F. Schlegel (*HZDR*)

## TUESDAY, AUGUST 20

### TECHNICAL SESSIONS - 2:20 PM

#### Thermal Hydraulics of TREAT—I

**Session Organizer:** Colby Jensen (*INL*), **Co-chairs:** Colby Jensen (*INL*), Brad Heath (*INL*)

**Location:** Eastside **Time:** 2:20-4:00 pm

**2:20 pm:** Design and CFD Modeling of the Gas Injection System for the Out-of-Pile HENRI Facility, S. Balderrama Prieto, G. Mignot, W. Marcum (*OSU*), N. Woolstenhulme (*INL*)

**2:45 pm:** Study of Transient CHF and Post-CHF Flow Boiling, Soon Kyu Lee (*Univ of New Mexico*), Nicholas R. Brown (*Univ of Tennessee, -Knoxville*), Kurt A. Terrani (*ORNL*), Colby B. Jensen (*INL*), Heng Ban (*Univ of Pittsburgh*), Youho Lee (*Seoul National Univ*)

**3:10 pm:** A Systematic Approach to Inform Experiment Design Through Modern Modeling and Simulation Methods, A. Epiney, C. Rabiti, C. Davis (*INL*)

**3:35 pm:** Sensitivity Studies of Heater Rod Design for Transient Critical Heat Flux Experiments In TREAT, Richard O. Hernandez (*Penn State*), Charles P. Folsom, Nicolas E. Woolstenhulme, Colby B. Jensen (*INL*), Jacob P. Gorton, Nicholas R. Brown (*Univ of Tennessee, Knoxville*)

#### Computational Fluid Dynamics—V

**Session Organizer:** Jinyong Feng (*MIT*), **Co-chairs:** Rui Hu (*ANL*), Yiqi Yu (*ANL*)

**Location:** Pearl **Time:** 2:20-3:10 pm

**2:20 pm:** Comparison of Computational Fluid Dynamics and Subchannel Numerical Solutions of Fuel Assemblies Characterised by Bowing, R. Puragliesi, R. Mukin, I. Clifford, H. Ferroukhi (*PSI*), M. Seidl (*PreussenElektra GmbH*)

**2:45 pm:** Development of a Data-Driven Turbulence Model for 3D Thermal Stratification Simulation During Reactor Transients, Yangmo Zhu, Nam Dinh (*NCSU*), Rui Hu, Adam Kraus (*ANL*)

#### Computational Thermal Hydraulics: General—IV

**Session Organizer:** Mathieu Martin (*TerraPower*), **Co-chairs:** Dirk Lucas (*HZDR*), Dominique Bestion (*CEA*)

**Location:** Mt. Hood **Time:** 2:20-4:00 pm

**2:20 pm:** Development and Assessment of Adjoint Sensitivity Analysis Method for Transient Two-Phase Flow Simulations, G. Hu (*ANL/Univ of Illinois*), T. Kozlowski (*Univ of Illinois*)

**2:45 pm:** Comparison of the 3D Nodal Integral Method for Arbitrary Hexahedral Elements and Spectral Element Method, Ibrahim Jarrah, Rizwan- Uddin (*Univ of Illinois*)

**3:10 pm:** Critical Flow Prediction by System Codes—Recent Analyses Made Within the FONESYS Network, M. Lanfredini (*GRNSPG-UNUPI*), D. Bestion (*Consultant*), F. D'Auria, N. Aksan (*GRNSPG-UNUPI*), P. Fillion (*CEA*), P. Gaillard (*Framatome*), J. Heo (*KAERI*), I. Karppinen (*VTT*), K. D. Kim (*KAERI*), J. Kurki, L. Lifang, A. Shen (*SPICRI*), J.-L. Vacher (*EdF*), D. Wang (*CNL*)

**3:35 pm:** Simulation and Analysis of the Sodium-Cooled Fast Reactor Steam Generator, Zenan Che, Peng Du, Bo Zhang, Pan Wu, Li Ge, Jianqiang Shan, Junli Gou (*Xi'an Jiaotong Univ*)

#### Fundamental Thermal Hydraulics: Experiments—V

**Session Organizers:** Guanghui Su (*Xi'an Jiao Tong Univ*), Xiaodong Sun (*Univ of Mich*),

**Co-chairs:** Dillon Shaver (*ANL*), Yong Hoon Jeong (*Kaist*)

**Location:** Salon A **Time:** 2:20-4:00 pm

**2:20 pm:** Experimental Study of the Evaporation Rate of a Heated Water Pool Using Infrared Thermography, J. Martin, B. Migot (*IRSN*)

**2:45 pm:** Quenching Experiment of Cr-Alloy Accident Tolerant Cladding Under Low and High Subcooling Conditions, Wang Kee In, Kwan-Geun Lee (*KAERI*)

**3:10 pm:** Velocity- and Scalar-Field Measurements of Turbulent Buoyant Jets in a Two-Layer Stratified Environment, Sunming Qin, Victor Petrov, Annalisa Manera (*Univ of Michigan*)

**3:35 pm:** Intelligent Identification System for Boiling Dynamics from Acoustic Emission Signal Using Machine Learning Technique, Seok Bin Seo, Do Yeong, Lim, In Cheol Bang (*UNIST*)

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**TUESDAY, AUGUST 20**  
**TECHNICAL SESSIONS - 2:20 PM**

**Thermal Hydraulics in Sodium-Cooled Fast Reactors: Severe Accident Analysis**

**Session Organizer:** Brian Jackson (*Kairos Power*), **Cochairs:** Dong-Wook Jerng (*Chung-Ang Univ*), Marine Anderhuber (*CEA*)

**Location:** Salon B **Time:** 2:20-3:35 pm

**2:20 pm:** Prospects for a CEA and ROSATOM/IPPE Collaborative Program on Na Boiling for GEN IV SFRs Safety: Rationale and Thermal-Hydraulic Preparatory Work, M. Anderhuber, A. Gerschenfeld, Y. Gorsse, N. Alpy C. Latge, J. Perez-Manes (*CEA*), Yu. Kuzina, A. Sorokin, I. Berensky, A. Volkov, Yu. Chernukhina, K. Raskach (*IPPE*)

**2:45 pm:** Comparison of Margins of Sodium Bulk Boiling and Reactor Vessel Creep Under RVACS Operation by Micro-Integral Effect Test, Minhoo Lee, In Cheol Bang (*UNIST*), Dong-Wook Jerng (*Chung-Ang Univ*)

**3:10 pm:** Fragmentation Behavior and Heat Transfer During Molten Aluminum-Liquid Sodium Interaction, Liang Hu, Kui Ge, Yapei Zhang, G. H. Su, Wenxi Tian, Suizheng Qiu (*Xi'an Jiaotong Univ*)

**Thermal Hydraulics in Lead-Cooled and Lead-Bismuth-Cooled Fast Reactors—V**

**Session Organizer:** Ferry Roelofs (*NRG*) **Cochairs:** Diego Castelliti (*SCK*), Adam Kraus (*ANL*)

**Location:** Salon C **Time:** 2:20-4:00 pm

**2:20 pm:** Calculation Tool for Heat Exchanger Tube Rupture in Pool-Type Reactors, D. Castelliti (*SCK-CEN*), G. Lomonaco (*GeNERG – DIME/TEC*)

**2:45 pm:** Experimental Campaign in Support of the Safety Studies of the STGR in LFR, Alessandro Del Nevo, Marcia Eboli (*ENEA*), Alessio Pesetti, Nicola Forgiione (*Univ of Pisa*)

**3:10 pm:** Characterization of Leak Detection in HLM System Using LIFUS5/MOD3 Facility, Marica Eboli, Alessandro Del Nevo (*ENEA*), Nicola Forgiione (*Univ of Pisa*), Fabio Giannetti (*Sapienza Univ of Rome*), Daniele Mazzi (*SRS S.r.l.*), Marco Ramacciotti (*ISE S.r.l.*)

**3:35 pm:** Numerical Analysis of the Axial Lead-Bismuth Pump Performance Base on the Different Rotation Speed, Kailin Wang, Liangxing Li, Wei Xie, Shuangbao Zhang (*Xi'an Jiaotong Univ*)

**Boiling and Condensation Fundamentals—V**

**Session Organizer:** Byongjo Yun (*PNU*), **Cochairs:** Ki Yong Choi (*KAERI*), Tomio Okawa (*The Univ of Electro-Communications*)

**Location:** Salon D **Time:** 2:20-4:00 pm

**2:20 pm:** Infrared Study of Flow Boiling and CHF on Prototypical Surfaces with Nuclear Fuel Cladding Morphology, Guan-Yu Su, Chi Wang, Jee Hyun Seong, Artyom Kossolapov, Bren Phillips, Matteo Bucci (*MIT*)

**2:45 pm:** Enhancement of Condensation Heat Transfer by Hydrophobic and Nano Porous Surface, Taeseok Kim, Yun Sik Cho, Sung Joong Kim (*Hanyang Univ*), Jaemin Lee, Wonjoon Choi (*Korea Univ*)

**3:10 pm:** Dependence of Nanoscale Roughness on Wicking-Based CHF Enhancement for Fresh and Oxidized Cr-Coated Surfaces, Namgook Kim, Hong Hyun Son, Sung Joong Kim (*Hanyang Univ*)

**3:35 pm:** Direct Contact Condensation Induced Transition from Oscillatory Bubble to Stratified Flow, Dingding Liang, Lu Tao, (*Beijing Univ of Chemical Technol*)

## TUESDAY, AUGUST 20

### TECHNICAL SESSIONS - 2:20 PM

#### Severe Accidents: General—II

**Session Organizer:** Etienne Studer (*CEA*), **Chair:** Peter Pandazis (*GRS*)

**Location:** Sunstone **Time:** 2:20-4:00 pm

**2:20 pm:** Simplified Thermohydraulic Criteria for a Comparison of the Accidental Behaviour of Gen-IV Nuclear Reactors and of PWRs, F. Bertrand, N. Marie, A. Bachrata, J. B. Droin, X. Manchon (*CEA*)

**2:45 pm:** Analyses with MELCOR Code of an Unmitigated SBO Scenario with In Vessel Retention Strategy Applied to a Generic PWR 900 MWe, F. Mascari, S. Ederli (*ENEA*)

**3:10 pm:** Pressurized Environments and Effect of Silica Gel Amount on Depressurization Inside the Containment, Dong Hoon Kam, Yong Hoon Jeong (*KAIST*)

**3:35 pm:** Development of Risk Oriented Accident Analysis Methodology (ROAAM+) for Assessment of Ex-Vessel Severe Accident Management Effectiveness, P. Kudinov, S. Galushin, D. Grishchenko (*KTH*), S. Yakush (*IPMech RAS*)

#### NPP Transient and Accident Analysis—II

**Session Organizer:** Dan LaBrier (*ISU*), **Chair:** Dan LaBrier (*ISU*)

**Location:** Salmon **Time:** 2:20-3:35 pm

**2:20 pm:** Screening Analysis for Pressurized Thermal Shock (PTS) Transient Scenarios, R. Mukin, I. Clifford, O. Costa Garrido, D. F. Mora, M. Niffenegger, B. Niceno, H. Ferroukhi (*PSI*)

**2:45 pm:** RELAP5-3D Simulation of Complex Flow Patterns Both In Core and Inside the Reactor Upper Plenum to Assess the Performance of Reactor Coolant Temperature Sensors Located at the Core Outlet and In-Core Elevation, Alex Matev (*BEL V*)

**3:10 pm:** Thermal Analysis for the Spent Fuel Pool Integrated with the Reactor Cavity of the Chinshan Plant Using GOTHIC, Yen-Shu Chen, Lin, Li-Ying Huang, Ansheng, Yng-Ruey Yuann (*INER*)

#### Experiments and Data Bases for Assessment and Validation—I

**Session Organizer:** Richard Schultz (*ISU*), **Cochairs:** Hyoung Kyu Cho (*Seoul Natl Univ*), Victor Petrov (*Univ of Mich*)

**Location:** Douglas Fir **Time:** 2:20-4:00 pm

**2:20 pm:** Experimental Study of an Adiabatic Two-Phase Flow in a Simulated PWR Spent Fuel Bundle, G. Brilliant, J. Martin, B. Fourné (*IRSN*)

**2:45 pm:** Containment Spray Experiments in MISTRA Facility for Heat and Mass Transfer Model Validation in Superheated Atmosphere, C. Ghitiu, E. Demay (*EdF SA*), E. Studer, D. Abdo, P. Debesse, B. Cariteau, G. Bernard-Michel, F. Dabbene (*CEA*)

**3:10 pm:** Experimental Investigations on the Heat Transfer Characteristics of Supercritical CO<sub>2</sub> in a Single Circular Tube with Direct Electrical Heating, Konstantinos Theologou, Rainer Mertz, Jörg Starflinger (*Univ of Stuttgart*)

**3:35 pm:** Experimental Investigation of Heat Transfer Characteristics in Tubes to Cool CO<sub>2</sub> Near the Critical Point in Horizontal Flow Orientation, Andreas Wahl, Rainer Mertz, Jörg Starflinger (*Univ of Stuttgart*)

#### Computational Fluid Dynamics V&V—II

**Session Organizers:** Lane Carasik (*VCU*), Barton Smith (*USU*), **Cochairs:** Mike Acton (*MIT*), Yang Liu (*Virg Tech U*)

**Location:** Meadowlark **Time:** 2:20-4:00 pm

**2:20 pm:** Validation of CFD Application Scheme on the Critical Heat Flux Phenomena in Rod Bundle Channel with Spacer Grids, Xiaomeng Dong, Zhijian Zhang, Zhaofei Tian, Guangliang Chen (*Harbin Eng Univ*)

**2:45 pm:** CFD Modeling and Sensitivity Analysis of Ex-Vessel Core Melt Process, Pavel Zacha, Vaclav Zenezny (*CTU in Prague, FME*)

**3:10 pm:** RANS Simulations of Turbulent Round Jets in the Presence of Density Difference and Comparison with High-Resolution Experimental Data, Jiaxin Mao, Sunming Qin, Victor Petrov, Annalisa Manera (*Univ of Michigan*)

**3:35 pm:** Development and Validation of a Conjugate Heat Transfer Model for the Two-Phase CFD Code NEK-2P, Prasad Vegendla, Adrian Tentner, Dillon Shaver, Aleks Obabko, Elia Merzari (*ANL*)

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**TUESDAY, AUGUST 20**  
**TECHNICAL SESSIONS - 4:20 PM**

**Computational Multi-Fluid Dynamics—VI**

**Session Organizer:** Igor A. Bolotnov (*NCSU*), **Co-chairs:** Robert Brewster (*Westinghouse*), Yoshiteru Komuro (*MHI*)

**Location:** Columbia **Time:** 4:20-5:35 pm

**4:20 pm:** Analysis of Wall Nucleation Modeling for Flow Boiling in Fluent, Longcong Wang, Caleb S. Brooks (*Univ of Illinois*)

**4:45 pm:** Development of Thermal Hydraulic Simulation Method for Two-Phase Flow in Steam Generators, Yoshiteru Komuro, Atsushi Kodama, Ling Cheng, Yoshiyuki Kondo, Seinosuke Azuma, Hideyuki Morita, Koichi Tanimoto, Ryoichi Kawakami, Toshifumi Nariai (*MHI*), Yoshito Nishikawa (*The Kansai Electric Power Co., Inc.*), Takashi Hibiki (*Purdue Univ*)

**5:10 pm:** A Subcooled Boiling Model Developed for Narrow Rectangular Channels Based on the CFD Method, Linfeng Li, Mingjun Wang, Dalin Zhang, Wenxi Tian, G. S. Su, Suizheng Qiu (*Xi'an Jiaotong Univ*)

**Thermal Hydraulics of TREAT—II**

**Session Organizer:** Colby Jensen (*INL*), **Co-chairs:** Aaron Epiney (*INL*), Colby Jensen (*INL*)

**Location:** Eastside **Time:** 4:20-6:00 pm

**4:20 pm:** Experimental Design for Transient in-Pile Boiling Studies at the TREAT Facility, Colby Jensen, Nicolas Woolstenhulme, Charles Folsom, David Kamerman, Austin Fleming, Daniel Wachs (*INL*)

**4:45 pm:** Thermal Design of the TREAT Facility, Bradley Heath, Colby Jensen (*INL*)

**5:10 pm:** Visual Inspection to Monitor / Detect Boiling, Colby B. Jensen (*INL*), Kevin Terrill, Alberto Cardenas, Richard Christensen (*Univ of Idaho*)

**5:35 pm:** Comparison of Integration Methods of STAR-CCM+ and RELAP5-3D for Application to Sodium Based on TREAT Experiments, Cole Blakely (*INL*)

**Computational Fluid Dynamics—VI**

**Session Organizer:** Jinyong Feng (*MIT*), **Co-chairs:** Junsoo Yoo (*INL*), Jun Wang (*Univ of Wisconsin, Madison*)

**Location:** Pearl **Time:** 4:20-5:35 pm

**4:20 pm:** Optimization of Heat Transfer Rate Around Cylindrical PCM Containers in Energy Storage Coupled with Nuclear Power Plant, Ahmed K. Alkaabi, Yacine Addad, Saeed A. Alameri (*Khalifa Univ*)

**4:45 pm:** A Parametric CFD Boiling Study Using State-of-the-Art Two-Phase and Boiling Closure Models, Junsoo Yoo (*INL*), Emilio Baglietto (*MIT*)

**5:10 pm:** Accuracy Analysis of Near Wall Thermal Hydraulics Modeling of Molten Salt Reactors, M. Tano (*LPSC*), Pablo Rubiolo (*Univ of Grenoble-Alpes*), Jean Ragusa (*Texas A&M*)

**Fundamental Thermal-Hydraulics: Experiments—VI**

**Session Organizer:** Guanghui Su (*Xi'an Jiao Tong Univ*), Xiaodong Sun (*Univ of Mich*),

**Co-chairs:** Wang Kee In (*KAERI*), Jongwoong Yoon (*Kaist*)

**Location:** Salon A **Time:** 4:20-5:35 pm

**4:20 pm:** An Advanced Ultrasonic Waveguide Concept for Spatially Distributed Monitoring of In-Core Temperatures, N. O. Cetiner, S. M. Cetiner, M. J. Roberts, V. K. Varma, G. Muralidharan, T. R. Muth, R. A. Montgomery (*ORNL*)

**4:45 pm:** Experimental Investigation on the Double-Hole Steam Jets Condensation Characteristics, Yuhao Zhang, Yonglong Yuan, (*NCEPU*), Lifang Liu, Xiaoliang Fu (*SPIC/National Energy Key Laboratory of Nuclear Power Software*), Li Feng (*NCEPU*), Zhongyi Wang (*SPIC/National Energy Key Laboratory of Nuclear Power Software*), Daogang Lu (*NCEPU*)

**5:10 pm:** Experimental Study on Single-Phase Flow Resistance Characteristics of Rectangular Channels with Lateral Non-Uniform Heating, Rulei Sun, D. L. Zhang, Jiancheng Zhou, Gongle Song, Wenxi Tian, Suizheng Qiu, G. H. Su (*Xi'an Jiaotong Univ*)

## TUESDAY, AUGUST 20

### TECHNICAL SESSIONS - 4:20 PM

#### Thermal Hydraulics in Sodium-Cooled Fast Reactors: Steady Analysis—I

**Session Organizer:** Brian Jackson (*Kairos Power*), **Cochairs:** Mathieu Martin (*TerraPower*), Xiaoxue Huang (*Univ of Sheffield*)

**Location:** Salon B **Time:** 4:20-5:35 pm

**4:20 pm:** Development of a Serpentine Tube Type Steam Generator with an Intermediate Heat Transfer Fluid for Prevention of SWR, Hyungmo Kim, Jung Yoon, Jaehyuk Eoh (*KAERI*), Namhyeong Kim, Moo-Hwan Kim (*POSTECH*), Dong Eok Kim (*CAU*)

**4:45 pm:** Natural Convection of a Droplet-Laden Flow in a Cylindrical Enclosure Above a Hot Sodium Pool, Xiaoxue Huang, Shuisheng He (*Univ of Sheffield*)

**5:10 pm:** Experimental and Numerical Investigation for Geometrical Effect on the Flow Characteristics for Plate-Throttle Entry Tube of Fast Reactor Fuel Assembly, Haiqi Qin, Daogang Lu, Cong Wang, Dawen Zhong, Yu Wang, Siyu Lyu (*NCEPU*)

#### Thermal Hydraulics in Salt-Cooled High-Temperature Reactors—I

**Session Organizers:** Izabela Gutowska (*OSU*), Piyush Sabharwall (*INL*), Maria Avramova (*NCSU*),

**Cochairs:** Xiaodong Sun (*UofM*), Kyle Brumback (*Kairos Power*)

**Location:** Salon C **Time:** 4:20-5:35 pm

**4:20 pm:** Design of a Direct Reactor Auxiliary Cooling System (DRACS) Considering Tritium Management for Advanced High-Temperature Reactor (*AHTR*), Sheng Zhang, Hsun-Chia Lin, Keyong Cheng, Xiaodong Sun (*Univ of Michigan*)

**4:45 pm:** Advancing Radiative Heat Transfer Modeling in High-Temperature Liquid-Salts, C. Coyle, E. Baglietto, C. Forsberg (*MIT*)

**5:10 pm:** Assessment on the Practicality of Off-the-Shelf Valves for Use in Molten Salt, T. K. Howard, David Holcomb, Kevin Robb (*ORNL*)

#### Severe Accidents: General—III

**Session Organizer:** Fulvio Mascari (*ENEA*), **Cochairs:** Jiri Duspiva (*UJV*), Etienne Studer (*CEA*)

**Location:** Sunstone **Time:** 4:20-5:10 pm

**4:20 pm:** Assessment of Severe Accident Management by Multiple Mitigation Actions Using Monte Carlo Sampling, Wonjn Choi, Nam Kyung Kim, Joongoo Jeon, Sung Joong Kim (*Hanyang Univ*)

**4:45 pm:** Effect of Water Radiolysis on the Heat Pipe Under Gamma Ray Irradiation for Fukushima Daiichi Decommissioning Use, Yao Zhang, Takayuki Saimu, Shunichi Suzuki, Koji Okamoto (*Univ of Tokyo*)

#### NPP Transient and Accident Analysis—III

**Session Organizer:** Dan LaBrier (*ISU*), **Chair:** Brian Woods (*OSU*)

**Location:** Salmon **Time:** 4:20-5:35 pm

**4:20 pm:** PMSYS: Plant Management System as a Part of Swiss Simulation Platform, K. Nikitin, I. Clifford, H. Ferroukhi (*PSI*)

**4:45 pm:** Risk-Informed Safety Analysis for Accident Tolerant Fuels, C. Parisi, Z. Ma, D. Mandelli, N. Anderson, H. Zhang (*INL*)

**5:10 pm:** Transient Analysis of a Detailed Thermal-Hydraulic Model of a VVER-1000 Core with the System Code ATHLET, Y. Périn, R. Henry, K. Velkov (*GRS*), S. P. Nikonov (*Mephy*)

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**TUESDAY, AUGUST 20**  
**TECHNICAL SESSIONS - 4:20 PM**

**Experiments and Data Bases for Assessment and Validation—II**

**Session Organizer:** Richard Schultz (*ISU*), **Cochairs:** Seok Cho (*Korea Atomic Energy Research Inst.*), Annalisa Manera (*Univ of Mich*)

**Location:** Douglas Fir **Time:** 4:20-5:35 pm

**4:20 pm:** CATHARE 3D Modeling Capability of a Small-Scale Pool Test Rig Experiments A. Bousbia Salah (*Bel V*), J. Martin (*IRSN*)

**4:45 pm:** Investigation of Drag and Virtual Mass Coefficients for Rising Ellipsoidal Bubbles, Alexander Dueñas, Isaiah Wieland, Wade Marcum, Qiao Wu (*OSU*)

**5:10 pm:** Methodology for Experimental Identification of Mixing Characteristics in the Primary System of PWR, D.-J. Euh (*KAERI/Univ of Science and Technol*), K. H. Kim, W. M. Park, H. S. Choi, Y. J. Youn (*KAERI*) S. S. Lee, S. K. Lim, H. D. Lee (*Korea Hydro & Nuclear Power Co.*), T. S. Kwon (*KAERI*)

**Computational Fluid Dynamics V&V—III**

**Session Organizers:** Lane Carasik (*VCU*), Barton Smith (*USU*), **Cochairs:** Hyoung Kyu Cho (*Seoul Natl Univ*), Lane Carasik (*VCU*)

**Location:** Meadowlark **Time:** 4:20-5:35 pm

**4:20 pm:** Assessment, Implementation, Validation, and Verification of Interfacial Closures in Multiphase Flows for the CFD Codes FLUENT and CFX, Gustavo Montoya, Jay Sanyal (*ANSYS, Inc.*), Markus Braun (*ANSYS Germany GmbH*)

**4:45 pm:** The Evaluation of AP1000® Plant Cold Leg Thermal Stratification During PRHR HX Natural Circulation Test, Hong Xu, Natalie M. Rodgers Richard F. Wright, John W. Boufford, (*Westinghouse*)

**5:10 pm:** Validation of Condensation Models for Hydrogen Distribution Evaluation Using CFD, Noriaki Hamada, Masataka Hidaka (*Hitachi, Ltd.*), Tadashi Fujii, Takeshi Yamada (*Hitachi-GE, Ltd*)

**Verification and Validation: General—IV**

**Session Organizer:** Kim Kungdoo (*KAERI*), **Cochairs:** Richard Schultz (*ISU*)

**Location:** Salon D **Time:** 4:20-5:10 pm

**4:20 pm:** Development of a Systematic Approach for Quantification of Thermal-Hydraulic Code Model Input Uncertainty, Jean Baccou (*IRSN*), Jinzhao Zhang (*Tractebel Engineering S.A.*), Philippe Fillion, Guillaume Damblin (*CEA*), Alessandro Petruzzi (*NINE*), Rafael Mendizábal (*CSN*), Francese Reventos (*UPC*), Tomasz Skorek (*GRS*), Mathieu Couplet, Bertrand Looss (*EdF R&D*), Deong-Yeon Oh (*KINS*), Takeshi Takeda (*Nuclear Regulation Authority*), Nils Sandberg (*OECD NEA*)

**4:45 pm:** Nuscale Safety Analysis Code and Design Validation Test Program, Matt Kizerian, Bradyn Wuth, Cristhian Galvez Velit, Maggie Wang, Robert Houser (*NuScale Power*)



## WEDNESDAY, AUGUST 21

### TECHNICAL SESSIONS - 8:20 AM

#### Computational Multi-Fluid Dynamics—VII

**Session Organizer:** Igor A. Bolotnov (*NCSU*), **Cochairs:** Nadish Saini (*NCSU*), Yangmo Zhu (*NCSU*)  
**Location:** Columbia **Time:** 8:20-10:00 am

- 8:20 am:** Nucleate Boiling Simulation Using Interface Tracking Method, Mengnan Li, Igor Bolotnov (*NCSU*)
- 8:45 am:** CFD Prediction of Ultra-High Critical Heat Flux for Subcooled Water Flow Boiling in a Vertical Tube, Kai Wang, Nejdet Erkan, Koji Okamoto (*Univ of Tokyo*)
- 9:10 am:** Numerical Study on the Dynamics of Bubble in Divergence of Venturi Tube, Yuchen Song, Junlian Yin, Dezhong Wang, Kangbei Cai (*Shanghai Jiao Tong Univ*)
- 9:35 am:** Improving the Understanding of Subgrid-Scale Deposition for Implementation in M-CFD Applications, G. Agostinelli, E. Baglietto (*MIT*)

#### Computational Fluid Dynamics—VII

**Session Organizer:** Jinyong Feng (*MIT*), **Cochairs:** Bin Han (*XJTU*), Jinyong Feng (*MIT*)  
**Location:** Pearl **Time:** 8:20-10:00 am

- 8:20 am:** A CFD Study on the Hydrodynamics for Tandem Plate Configurations Under Turbulent Flow, Wade Marcum, Jonathan Gjemso (*OSU*)
- 8:45 am:** CFD Analysis of the Fluid Flow, Heat Transfer and Cladding Oxidation in a PWR Fuel Bundle, Dong-Yuan Sheng (*Westinghouse Electric Sweden AB/KTH*), Marcus Seidl (*PreussenElektra GmbH*), Zhouqi Du (*Technical Univ Munich*)
- 9:10 am:** Framatome's Unified Single-Phase CFD Methodology for Fuel Design and Analysis, A. Hatman, S. Lydzinski, L. Charlot, G. Bache (*Framatome*), B. Farges (*Framatome SAS*), J. Dumond, M. Rehm, K. Vogel (*Framatome GmbH*)
- 9:35 am:** Thermal Analysis for eVinciTM Micro Reactor, Hong Xu, Jurie J. Van Wyk, Richard F. Wright (*Westinghouse*)

#### Computational Thermal Hydraulics: General—V

**Session Organizer:** Mathieu Martin (*TerraPower*), **Cochairs:** Guojun Hu (*ANL*), Bin Han (*Xi'an Jiaotong Univ*)  
**Location:** Mt. Hood **Time:** 8:20-10:00 am

- 8:20 am:** Numerical Simulation of Penetration Flow into T-Junction Branch Lines, Y. Utanohara, K. Miyoshi, M. Kamaya (*Inst of Nuclear Safety System, Inc.*)
- 8:45 am:** Statistical Emulator Models for Scalar Mixing in Reactor Safety Analysis, A. Gairola (*Kansas State Univ*), W. Guo, B. Niceno (*PSI*), H. Bindra (*Kansas State Univ*)
- 9:10 am:** Universal Digital Nuclear Reactor System (UNDREAS), Chirayu Batra, Vladimir Kriventsev (*IAEA*)
- 9:35 am:** Numerical Investigation of the Transient Flow with Alternating Diagonal Flow Direction in Wall Bounded Inline Tube Bundles, Weikai Gao, Xiaowei Li, Xinxin Wu (*Tsinghua Univ*)

#### Natural Circulation, Passive Safety Systems and Related Phenomena—I

**Session Organizer:** Yuquan Li (*State Power Investment Central Research Inst*), **Cochairs:** Jun Yang (*HUST*), Mark Lanza (*PNNL*)

**Location:** Salon A **Time:** 8:20-9:35 am

- 8:20 am:** Transient Local Thermal Hydraulics Data for Two-Phase Flow Instability in Natural Circulation, Taiyang Zhang, Zhiee Jhia Ooi, Caleb S. Brooks (*Univ of Illinois*)
- 8:45 am:** Natural Circulation of Sodium, Lead, LBE, Helium and Molten Salt Cartridge Closed Loops, S. A. Balderrama Prieto (*OSU*), P. Sabharwall (*INL*), M. Farmer (*ANL*)
- 9:10 am:** Propagation of Stratified Density Fronts in the HiRJet Facility, Daniel Nunez, Victor Petrov, Annalisa Manera (*Univ of Michigan*)

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**WEDNESDAY, AUGUST 21**  
**TECHNICAL SESSIONS - 8:20 AM**

**Thermal Hydraulics in Sodium-Cooled Fast Reactors: Steady Analysis—II**

**Session Organizer:** Brian Jackson (*Kairos Power*), **Cochairs:** Saya Lee (*TAMU*), Mathieu Martin (*TerraPower*)

**Location:** Salon B **Time:** 8:20-10:00 am

- 8:20 am:** Development of a Polyhedral Staggered Mesh Scheme Application to Subchannel and CFD SFR Thermal Hydraulics, Antoine Gerschenfeld, Yannick Gorsse, Gauthier Fauchet (*CEA*)
- 8:45 am:** Visualization of Flow Inside Reactor Vessel Using 1/5-Down Scaled Model of Prototype Gen-IV Sodium Cooled Fast Reactor, Woo Shik Kim, Yong Seok Choi, Dong-Jin Euh (*KAERI*)
- 9:10 am:** Study on Multi-Dimensional Core Cooling Behavior of Sodium Cooled Fast Reactors Under DRACS Operating Condition, T. Ezure, T. Onojima, M. Tanaka, J. Kobayashi, A. Kurihara (*JAEA*), Y. Kameyama (*NDD Cooperation*)
- 9:35 am:** Experimental Study on Heat Dissipation of Spent Fuel Assembly of Sodium Fast Reactor During Defueling, Zenghui Wu, Jinbiao Xiong, Xiang Chen (*Shanghai Jiao Tong Univ*)

**Thermal Hydraulics in Supercritical Water Reactors**

**Session Organizer:** Xu Cheng (*KIT*), **Cochairs:** Jinbiao Xiong (*Shanghai Jiao Tong Univ*), S. Z. Qiu (*Xi'an Jiao Tong Univ*)

**Location:** Salon C **Time:** 8:20-9:35 am

- 8:20 am:** Heat Transfer Deterioration and Enhancement in the Thermal Entry Length of Laminar Supercritical Water Channel Flow, R. Barney (*Univ of California, Davis*), R. Nourgaliev (*LLNL*), J. P. Delplanque (*Univ of California, Davis*), R. McCallen (*LLNL*)
- 8:45 am:** The Preliminary Safety Analysis of a s-CO<sub>2</sub> Brayton Cycle Cooled Reactor System, Chun Tian Gao, Pan Wu, Jianqiang Shan (*Xi'an Jiao Tong Univ*)
- 9:10 am:** A Study in the Effect of External Vertical Acceleration on the Uniformly Heated Channel with Supercritical Water, Jin-Der Lee, Shao-Wen Chen (*Natl Tsing Hua Univ*)

**Experimental Measurement Techniques and Flow Visualization—I**

**Session Organizers:** Philippe Bardet (*George Washington Univ*), Xiaodong Sun (*Univ of Mich*)  
**Cochairs:** Jean-Marie Le Corre (*Westinghouse in Sweden*), Jun Wang (*Univ of Wisconsin, Madison*)

**Location:** Salon D **Time:** 8:20-9:35 am

- 8:20 am:** PIV Refinement Using Optical Flow for High Resolution Flow Measurement: Development and Preliminary Validations, Jee Hyun Seong (*MIT*), Min Seop Song, Eung Soo Kim (*Seoul Natl Univ*), Daniel Nunez, Annalisa Manera (*Univ of Michigan*)
- 8:45 am:** Accelerating Infrared Boiling Heat Transfer Studies with Online Machine Learning Capabilities, M. Ravichandran, M. Bucci (*MIT*)
- 9:10 am:** Experimental Investigation of Bubble Nucleation, Growth and Departure Using Synchronized IR Thermometry, Two-Color LIF and PIV, Gustavo M. Aguiar (*MIT*), Victor Volgaropoulos, Omar K. Matar, Christos N. Markides (*Imperial College London*), Matteo Bucci (*MIT*)

**Severe Accidents: General—IV**

**Session Organizer:** Fulvio Mascari (*ENEA*), **Cochairs:** Terttaliisa Lind (*PSI*), Guillaume Mignot (*OSU*)

**Location:** Sunstone **Time:** 8:20-9:10 am

- 8:20 am:** Scaling Analysis on the Coolability of Fuel Rods and Debris Beds with Seawater, Zayed Ahmed, Hitesh Bindra, Steven Eckels (*Kansas State Univ*)
- 8:45 am:** How Much Was Hydrogen Gas Burned in the 1F3 Explosion, Wison Luangdilok (*Fauske & Associates, LLC*)

## WEDNESDAY, AUGUST 21

### TECHNICAL SESSIONS - 8:20 AM

#### Modeling and Experiments of Severe Accidents—I

**Session Organizer:** Guillaume Mignot (*OSU*), **Cochairs:** Nathan Andrews (*SNL*), Sung Joong Kim (*Hanyang Univ*)

**Location:** Salmon **Time:** 8:20-10:00 am

- 8:20 am:** Void Fraction Distribution in a Header-Feeder Test Facility Under a Simulated Loss-of-Coolant Accident, Étienne M. Lessard, Jun Yang (*CNL*)
- 8:45 am:** An Analytical Model of Plume/Droplet Interactions for the Assessment of Spent-Fuel-Pool Spray Cooling Effectiveness, J. Martin (*IRSN*), N. Tsukamoto (*NSR*)
- 9:10 am:** Experimental and Numerical Research on Melting Behavior Mechanism of Fuel Rod Using MPS-CV Method, Wenxi Tian, Yonglin Li, Tangtao Feng, Ronghua Chen, Suizheng Qiu, G. H. Su (*Xi'an Jiao Tong Univ*)
- 9:35 am:** Experimental Investigation of Debris Bed Relocation Behavior by Bottom Gas-Injection, Chunming Teng, Bin Zhang, Jianqiang Shan, Yang Liu (*Xi'an Jiaotong Univ*)

#### Experiments and Data Bases for Assessment and Validation—III

**Session Organizer:** Richard Schultz (*ISU*), **Chair:** Victor Petrov (*Univ of Mich*)

**Location:** Douglas Fir **Time:** 8:20-9:35 am

- 8:20 am:** Numerical and Experimental Investigation of the Water Flow Through PWR Spacer Grids at the Brazilian Nuclear Technology Development Center, H. F. P. Castro (*UFMG*), G. A. M. Vidal, T. A. S. Vieira, V. V. A. Silva, D. A. M. Campolina, G. P. Barros (*CDTN*), M. A. F. Veloso (*UFMG*), A. A. dos Santos (*CDTN*)
- 8:45 am:** Validation of Risk-Informed Safety Margin Characterization for Flooding of Nuclear Power Plants, M. André, P. Bardet (*George Washington Univ*), R. Sampath, N. Montanari (*Centroid Lab*), L. Lin (*NCSU*), S. Prescott, E. Ryan (*INL*)
- 9:10 am:** High-Resolution High-Speed Void Fraction Measurements in Helical Tubes Using X-Ray Radiography, David Breitenmoser (*Univ of Michigan/ETHZ*), Annalisa Manera (*Univ of Michigan*), Horst Prasser (*ETHZ*), Victor Petrov (*Univ of Michigan*)

#### Computational Fluid Dynamics V&V—IV

**Session Organizers:** Lane Carasik (*VCU*), Barton Smith (*USU*), **Cochairs:** Han Young Yoon (*KAERI*), Trevor Howard (*ORNL*)

**Location:** Meadowlark **Time:** 8:20-9:35 am

- 8:20 am:** CFD Validation of Buoyancy Driven Jet Spreading, Mixing and Wall Interaction, Graham Macpherson (*Frazer-Nash Consultancy*), Ryan Tunstall (*Rolls-Royce*)
- 8:45 am:** Uncertainty Quantification and Reduction for Multiphase-CFD Solvers: A Data-Driven Bayesian Approach Supported by High-Resolution Local Measurements, Yang Liu, Xiaodong Sun (*Univ of Michigan*), Yang Liu (*Virginia Tech*), Nam Dinh (*NCSU*)
- 9:10 am:** Verification and Validation of COMSOL for Heat Transfer in Thin Rectangular Channels Using NACA Test Results, T. K. Howard, P. Jain, E. Popov (*ORNL*)

#### Thermal Hydraulics of Space Applications

**Session Organizer:** Lane Carasik (*VCU*), **Cochairs:** Lane Carasik (*VCU*), Robert Martin (*BWXT*)

**Location:** Eastside **Time:** 8:20-9:35 am

- 8:20 am:** Modeling Gamma and Neutron Heating to a Liquid Hydrogen Tank for Nuclear Thermal Propulsion with RELAP5-3D, R. P. Martin (*BWX Technol*), J. A. Caffrey, M. G. Houts (*NASA*)
- 8:45 am:** Evaluation of a Desuperheating Spray Chamber for a Scaled Nuclear Thermal Propulsion Rocket Exhaust Capture System Test, R. P. Martin, J. L. Gustafson (*BWXT*), D. J. Coote (*NASA*)
- 9:10 am:** Numerical Investigations on the Turbulent Prandtl Number Models for Internal Forced Convection to Low-Pr Helium-Xenon Mixtures, Biao Zhou, Jun Sun, Yuliang Sun, Yu Ji (*Tsinghua Univ*)

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**WEDNESDAY, AUGUST 21**  
TECHNICAL SESSIONS - 10:20 AM

**Computational Multi-Fluid Dynamics—VIII**

**Session Organizer:** Igor A. Bolotnov (*NCSU*), **Cochairs:** Seung Jun Kim (*LANL*), Matthew Zimmer (*NCSU*)  
**Location:** Columbia **Time:** 10:20 am-12:00 pm

- 10:20 am:** Progress Toward Simulating Departure from Nucleate Boiling (DNB) at High Pressure Applications with Selected Wall Boiling Closures, Seung Jun Kim, Mario R. Naranjo, Russell C. Johns (*LANL*), Emilio Baglietto (*MIT*)
- 10:45 am:** Exploring Two-Phase Flow Regime Transition Mechanisms Using High Resolution Virtual Experiments, Matthew D. Zimmer, Igor A. Bolotnov (*NCSU*)
- 11:10 am:** Simulations of Particle Transport Inside Bubbles Using Coupled Interface and Lagrangian Tracking Approaches, Min Zhu (*Nanjing Univ of Science and Technology*), A. Dehbi Y. Sato, B. Niceno (*PSI*)
- 11:35 am:** Numerical Simulation Investigation on Two-Phase Flow Instabilities in Two-Parallel-Channel, Jianping Long (*Xi'an Jiaotong Univ*), Baowen Yang (*Xi'an Jiaotong Univ/Delta Energy Group*), Sipeng Wang (*Xi'an Jiaotong Univ*)

**Subchannel Fluid Dynamics and Heat Transfer—I**

**Session Organizer:** Philippe Fillion (*CEA*), **Cochairs:** Marco Lanfredini (*UNIFI*), Antoine Gerschenfeld (*CEA*)  
**Location:** Eastside **Time:** 10:20 am-11:35 am

- 10:20 am:** Application of the COBRAG Subchannel Code to Fuel Design, S. Oh, B. Hizoum, K. Kang, D. Miranda, J. Andersen, S. Bowman (*GE Hitachi Nuclear Energy*)
- 10:45 am:** Transient Subchannel Analysis of BWR Fuel Thermal Hydraulic Performance, B. Hizoum, D. Miranda, K. Kang, S. Oh, J. Andersen, S. Bowman (*GE Hitachi Nuclear Energy*)
- 11:10 am:** Experimental Thermal-Hydraulic Study of a Steam-Droplets Flow Inside a Vertical Pipe—Application to LOCA in PWR Reactor, J. D. Peña Carrillo, A. V. S. Oliveira, T. Glantz (*IRSN*), M. Gradeck, Al. Labergue, (*Univ of Lorraine*)

**Computational Fluid Dynamics—VIII**

**Session Organizer:** Jinyong Feng (*MIT*), **Cochairs:** Subash Sharma (*Purdue Univ*), Yixiang Liao (*HZDR*)  
**Location:** Pearl **Time:** 10:20-12:00 pm

- 10:20 am:** Hybrid Nodal Integral -Finite Element Method (NI-FEM) for 2D, Time-Dependent Burgers' Equation in Arbitrary Geometries, Sundar Namala, Rizwan-Uddin (*Univ of Illinois*)
- 10:45 am:** Application of Computational Fluid Dynamics (CFD) Codes For Nuclear Power Plant Design, M. Krause (*IAEA*), B. Smith (*Goldsmith Transactions*), T. Hoehne (*HZDR*), W. K. In (*KAERI*)
- 11:10 am:** Density Wave Instability Verification of CFD Two-Fluid Model, S. L. Sharma, M. A. Lopez de Bertodano (*Purdue Univ*), J. R. Buchanan (*NNL*)
- 11:35 am:** Modeling of Two-Phase Flows in Concrete Cracks with Neptune\_CFD, Stephane Mimouni (*EdF R&D*), Paul Baconnier (*ESPCI*), Germain Day (*EdF R&D*)

**Computational Thermal Hydraulics: General—VI**

**Session Organizer:** Mathieu Martin (*TerraPower*), **Chair:** Brian Jackson (*Kairos Power*)  
**Location:** Mt. Hood **Time:** 10:20 am-12:00 pm

- 10:20 am:** Remaining Issues in System Thermal Hydraulics How the Fonesys and CONUSAF Networks Can Help Find Solutions?, D. Bestion (*Consultant*), F. d'Auria (*Univ di PISA*), Y. Hassan (*Texas A&M*), N. Aksan (*Scientific Consultant*), M. Lanfredini (*Univ di PISA*), K. D. Kim (*KAERI*)
- 10:45 am:** A New Approach of Studying Transient Critical Heat Flux Using Computational Fluid Dynamics, T. Chen, Wade Marcum (*OSU*)
- 11:10 am:** A New Hypothesis of Transient Boiling Based on the CFD Simulation and Past Experimental Studies, T. Chen, W. Marcum (*OSU*)
- 11:35 am:** SPH Simulation on Single Bubble Behavior in Linear Shear Flow, Yelyn Ahn, Young Beom Jo, So Hyun Park, Jin Woo Kim, Eung Soo Kim (*Seoul Natl Univ*)

## WEDNESDAY, AUGUST 21

### TECHNICAL SESSIONS - 10:20 AM

#### Natural Circulation, Passive Safety Systems and Related Phenomena—II

**Session Organizer:** Yuquan Li (*State Power Investment Central Research Institute*),

**Chair:** Olu Omotowa (*TerraPower*)

**Location:** Salon A **Time:** 10:20-11:35 am

**10:20 am:** Improved Design of Spent Fuel Dry Storage Using Phase Change Heat Transfer of Hybrid Control Rod-Heat Pipe, Kyung Mo Kim, In Cheol Bang (*UNIST*)

**10:45 am:** Experimental Investigation on Atmospheric, Passive Spent Fuel Pool Cooling by Two-Phase Closed Thermosyphons, Claudia Grass, Rudi Kulenovic, Jörg Starflinger (*Univ of Stuttgart*)

**11:10 am:** Buoyancy-Driven Transformations in a Thermal Striping Flow Field, S. Lomperski, A. Obabko E. Merzari, (*ANL*)

#### Thermal Hydraulics in Sodium-Cooled Fast Reactors: Steady Analysis—III

**Session Organizer:** Brian Jackson (*Kairos Power*), **Cochairs:** Dan LaBrier (*ISU*), Thomas Fanning (*ANL*)

**Location:** Salon B **Time:** 10:20-11:35 am

**10:20 am:** Thermal Hydraulic Design of an In-Pile Experimental Loop for Fast Test Reactor Conditions, Anton Higgins, Dan LaBrier, Wade Marcum, Ben Lilley, Todd Palmer (*OSU*)

**10:45 am:** Computational Fluid Dynamics Assessment of Proposed Axial Reflector Designs for the Versatile Test Reactor Using Nek5000, D. R. Shaver, H. Yuan, F. Heidet (*ANL*)

**11:10 am:** Integrated Simulation Capabilities for Thermal Hydraulic Analysis of Test Vehicles in the Versatile Test Reactor, A. J. Brunett, T. Q. Hua, G. Hu, R. Hu, T. H. Fanning, G. Zhang (*ANL*)

#### Thermal Hydraulics in Salt-Cooled High-Temperature Reactors—II

**Session Organizers:** Izabela Gutowska (*OSU*), Piyush Sabharwal (*INL*), Maria Avramova (*NCSU*),

**Cochairs:** Caleb Brooks (*Univ of Illinois*), Glenn Roth (*Information Systems Lab*)

**Location:** Salon C **Time:** 10:20am-12:00 pm

**10:20 am:** Transient Analysis of an FHR Coupled to a Helium Brayton Power Cycle, Guolei Zhang (*Harbin Eng Univ*), Minghui Chen, Xiaodong Sun (*Univ of Michigan*)

**10:45 am:** Molten Salt Coolant Modeling In TRACE, Glenn Roth, Jay Spore (*Information Systems Laboratories*)

**11:10 am:** CFD Simulation of Xenon Removal by Helium Bubble Sparging in Molten Salt, Jiaqi Chen, Caleb S. Brooks (*Univ of Illinois*)

**11:35 am:** Flow Rates in a Natural Circulation FLiBe Loop, Karl Britsch, Mark Anderson, Kumar Sridharan (*Univ of Wisconsin, Madison*)

#### Experimental Measurement Techniques and Flow Visualization—II

**Session Organizers:** Philippe Bardet (*George Washington Univ*), Xiaodong Sun (*Univ of Mich*),

**Cochairs:** Xiaodong Sun (*U of Michigan*), Junlian Yin (*Shanghai Jiao Tong U, SJTU*)

**Location:** Salon D **Time:** 10:20 am-12:00 pm

**10:20 am:** Uncertainty Analysis of PIV Measurements for Liquid Velocity in Two-Phase Bubbly Flows, Yang Liu, Yalan Qian, Chengqi Wang, Xiaodong Sun (*Univ of Michigan*), Yang Liu (*Virginia Tech*)

**10:45 am:** Characterization of Liquid Jet Breakup for the Simulation of Accidental Sodium Leakage Scenarios in Sodium-Cooled Fast Reactors, Mira Sadek, Thierry Gilardi (*CEA*), Rudy Bazile (*IMFT*), Stéphane Mimouni, Lynda Porcheron (*EdF R&D*)

**11:10 am:** Important Issues in Validation of Computational Fluid Dynamics Codes Against CFD Grade Experimental Results, C. W. Hollingshead, A. Rashkovan (*NRCN*), A. Maunsell, M. Hodgins, D. R. Novog (*McMaster Univ*)

**11:35 am:** Preliminary Results on the Development of a Fast-Neutron Tomography System for Void Fraction Distribution Measurements, G. G. Patterson, D. R. Novog (*McMaster Univ*)

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**WEDNESDAY, AUGUST 21**  
TECHNICAL SESSIONS - 10:20 AM

**Fuel Coolant Interaction, Modeling and Experiments—I**

**Session Organizer:** Etienne Studer (*CEA*), **Cochairs:** Jeremy Bittan (*EDF*), Fulvio Mascari (*ENEA*)  
**Location:** Sunstone **Time:** 10:20 am-12:00 pm

- 10:20 am:** Ex-Vessel Fuel Coolant Interaction Experiment with the Geometry of an AP1000 Reactor, Giancarlo Albrecht, Leonhard Meyer (*KIT*), Rongjin Zhang (*SPICRI*)
- 10:45 am:** Premixed Layer Formation Modelling in Stratified Melt-Coolant Geometry, Janez Kokalj, (*Jozef Stefan Inst/Univerza v Ljubljani*) Matjaž Leskovar, Mitja Uršič (*Jozef Stefan Inst*)
- 11:10 am:** Risk of Containment Failure Due to Ex-Vessel Steam Explosion for Nordic BWRs, Dmitry Grishchenko, Sergey Galushin, Pavel Kudinov (*KTH*)
- 11:35 am:** Melt Droplet Fragmentation Behavior During Fuel-Coolant Interaction, Gen Li, Haobo Feng, Panpan Wen, Jun Zhang, Jinshi Wang, Junjie Yan (*Xi'an Jiaotong Univ*)

**Modeling and Experiments of Severe Accidents—II**

**Session Organizer:** Fulvio Mascari (*ENEA*), **Cochairs:** Marco Pellegrini (*IAE*), Jiri Duspiva (*UJV*)  
**Location:** Salmon **Time:** 10:20-11:35 am

- 10:20 am:** Dispersion of Surrogate LWR Fuel Experiments Under LOCA Conditions, G. D. Latimer, W. R. Marcum (*OSU*), W. F. Jones (*INL*)
- 10:45 am:** A Summary of Fission-Product Transport Phenomena During SGTR Severe Accidents, T. Lind (*PSI*), S. Campbell (*NRC*), L. E. Herranz (*CIEMAT*), M. Kissane (*OECD/NEA*), JinHo Song (*KAERI*)
- 11:10 am:** Simulation of In-Vessel Retention Scenarios in PWR with ATHLET-CD, P. Pandazis, S. Weber (*GRS*)

**Experiments and Data Bases for Assessment and Validation—IV**

**Session Organizer:** Richard Schultz (*ISU*), **Cochairs:** Byoung Uhn Bae (*Korea Atomic Energy Research Inst.*), Cesare Frepoli (*FPoliSolutions LLC*)

**Location:** Douglas Fir **Time:** 10:20-11:10 am

- 10:20 am:** Managing a Station Blackout (SBO) at the INKA Test Facility with Nothing but Passive Technology, Thomas Wagner, Thomas Mull (*Framatome GmbH*)
- 10:45 am:** Digitilization and Management of Thermal Hydraulic Legacy Data Using FPoliDON Platform, Cesare Frepoli (*FPoliSolutions LLC*)

**Plant System Code Analysis and Development—I**

**Session Organizer:** Mathieu Martin (*TerraPower*), **Cochairs:** Han Bao (*NCSU*)

**Location:** Meadowlark **Time:** 10:20 am-12:00 pm

- 10:20 am:** Application of Adjoint Based Node Optimization Method to Nuclear Thermal-Hydraulic System Analysis Code, Jae Jun Lee, Seongmin Son, Min-Gil Kim, Jeong Ik Lee (*KAIST*)
- 10:45 am:** Preliminary Tasks to Integrate CATHARE\_2 3D Reactor Vessel Module in Real-Time Simulators at EDF/DT, David Pialla, Marc Ludmann, Karine Vareille (*EdF*)
- 11:10 am:** A Rotodynamic Pump Seizure Transient Simulated Using the CATHARE-3 One-Dimensional Pump Model, L. Matteo, G. Mauger (*CEA*), P. Gyomlai (*Framatome*), A. Dazin (*LMFL*), N. Tauveron (*CEA*)
- 11:35 am:** Revisiting the PIRT and Scaling Analysis Within the Frame of 3D System Code Modelling, D. Bestion (*Consultant*), P. Fillion (*CEA*)

## WEDNESDAY, AUGUST 21

### TECHNICAL SESSIONS - 2:20 PM

#### Thermal Hydraulics in Small Modular Reactors and Micro Reactors—I

**Session Organizer:** Milorad Dzodzo (*Westinghouse*), **Cochairs:** Brian Wolf (*NuScale Power*), Milorad Dzodzo (*Westinghouse*)

**Location:** Columbia **Time:** 2:20-4:00 pm

**2:20 pm:** Overview of Thermal-Hydraulic Validation Tests with SMART-ITL to Support SMART Pre-Project Engineering, Hyun-Sik Park, Hwang Bae, Sung-Uk Ryu, Jin-Hwa Yang, Byong-Guk Jeon, Yoon-Gon Bang, Sung-Jae Yi (*KAERI*)

**2:45 pm:** Comparison of Two Different Sized Small Break LOCAs on the Passive Safety Injection Line with SMART-ITL, Jin Hwa Yang, Hwang Bae, Sung-Uk Ryu, Byong Guk Jeon, Sung-Jae Yi, Hyun-Sik Park (*KAERI*)

**3:10 pm:** Hot Spot Temperature Prediction for a Micro Modular High Temperature Gas-Cooled Reactor, Sung Nam Lee, Nam-il Tak, Chang Keun Jo (*KAERI*)

**3:35 pm:** Development of a SCDAP/RELAP5 Model for the Simulation of the Helical-Coiled Once-Through Steam Generators, Ziyi Xu, Maolong Liu, Yao Xiao, Hanyang Gu (*Shanghai Jiao Tong Univ*)

#### Subchannel Fluid Dynamics and Heat Transfer—II

**Session Organizer:** Philippe Fillion (*CEA*), **Cochairs:** Guillaume Bois (*CEA*), David Pialla (*EDF*)

**Location:** Eastside **Time:** 2:20-4:00 pm

**2:20 pm:** Flow Dynamic Behavior in Rod Bundles: An Experimental Assessment, O. C. A. Nalin, P. Lazo (*CNEA*), C. P. Marcel (*CONICET*), invited

**2:45 pm:** Effect of Part-Length Rods and Transient Flow for Different BWR Subchannel Geometries, Lukas Robers, Horst-Michael Prasser (*ETH Zürich*)

**3:10 pm:** Unsteady Pressure and Velocity Measurements in 5x5 Rods Bundle Using Grids with and Without Mixing Vanes, N.Turankok, F. Bazin, V. Biscay, T. Lohez, F. Moreno, S. Testanière, Lionel Rossi (*CEA*)

**3:35 pm:** Experimental Investigation of Power Transient Critical Heat Flux for Downward Flow in Narrow Rectangular Channel Used in Research Reactor, Hui Yung Kim, Jae Jun Jeong, Byong Jo Yun (*Pusan National Univ*)

#### Core Thermal Hydraulics and Subchannel Analysis—I

**Session Organizer:** David Aumiller (*BAPL*), **Cochairs:** David Aumiller (*BMPC*), Aiguo Liu (*Xi'an Jiaotong Univ*)

**Location:** Pearl **Time:** 2:20-3:35 pm

**2:20 pm:** A Three-Dimensional PWR LBLOCA Simulation Using the CUPID Code, Ik Kyu Park, Han Young Yoon, Seung Jun Lee, Yun Je Cho, Jae Ryong Lee (*KAERI*)

**2:45 pm:** Advanced Modelling Capabilities for Pin-Level Subchannel Analysis of PWR and VVER Reactors, Manuel Garcia, Uwe Imke, Diego Ferraro, Victor Sanchez-Espinoza, Luigi Mercatali (*KIT*)

**3:10 pm:** Chimney and Diverging Effects in Core PWR: Analysis and Experimental Characterization for Predictive Behaviour During Loss of Coolant Accident, Christophe Rabe, Raphaël Préa (*CEA*)

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## WEDNESDAY, AUGUST 21

### TECHNICAL SESSIONS - 2:20 PM

#### Hydrogen and Fission Product Behavior

**Session Organizer:** Etienne Studer (CEA), **Co-chairs:** Sung Joong Kim (Hanyang Univ), Davide Papini (Nuclear Power Plant Gösgen-Däniken AG)

**Location:** Mt. Hood **Time:** 2:20-4:00 pm

**2:20 pm:** CFD Analysis of Hydrogen Flame Acceleration with Burning Velocity Models, K. Motegi, N. Trianti, T. Matsumoto, T. Sugiyama, Y. Maruyama (JAEA)

**2:45 pm:** Numerical Investigation of the Effect of Buoyancy Forces on the Deflagration of Hydrogen in the THAI Facility, A. Attavino, L. Koloszar, P. Planquart (Von Karman Inst), M. Adorni (BelV), A. Parente (Université libre de Bruxelles)

**3:10 pm:** Development of a Radionuclide Release Module for an Integrated Source Term Analysis Tool for Liquid Metal Cooled Fast Reactors, T. Q. Hua (ANL), S. J. Lee (Fauske & Associates, LLC), J. Liao (Westinghouse), A. Moiseyev (ANL), P. Ferroni (Westinghouse), A. Karahan (ANL), C. Y. Paik (Fauske & Associates, LLC), A. M. Tentner, T. Sofu (ANL)

**3:35 pm:** Numerical Study of Lean Limit Hydrogen Flames Propagating Upward to Validate a Flammability Limit Model, Joongoo Jeon, Hoichul Jung, Yeon Soo Kim, Sung Joong Kim (Hanyang Univ)

#### Natural Circulation, Passive Safety Systems and Related Phenomena—III

**Session Organizer:** Yuquan Li (State Power Investment Central Research Institute), **Chair:** Mark Lanza (PNNL)

**Location:** Salon A **Time:** 2:20-3:35 pm

**2:20 pm:** Preliminary RELAP5 System Analysis of the Water-Based NSTF—Part 1: Model Development, Q. Lv, A. Kraus, R. Hu, M. Bucknor, D. Lisowski (ANL)

**2:45 pm:** Preliminary RELAP5 System Analysis of the Water-Based NSTF—Part 2: Parametric Study, Q. Lv, A. Kraus, R. Hu, M. Bucknor, D. Lisowski (ANL)

**3:10 pm:** Turbulent Natural Convective Condensation on the Underside of Inclined Surfaces for the AP1000® Plant Containment, Matthew M. Swartz, John Lojek, Richard F. Wright, Ryan T. Vanston (Westinghouse)

#### Thermal Hydraulics in Sodium-Cooled Fast Reactors: Transient Analysis—I

**Session Organizer:** Antoine Gerschenfeld (CEA), **Co-chairs:** Antoine Gerschenfeld (CEA), Adam Kraus (ANL)

**Location:** Salon B **Time:** 2:20-3:35 pm

**2:20 pm:** Onset of Natural Convection in a Sodium-Cooled Fast Reactor During a Station Black-Out: Blind Benchmark of Safety Assessment Using Multi-Scale Coupled Thermal Hydraulics Codes, Simon Li, Antoine Gerschenfeld (CEA), Olivier Bernard, Thomas Sageaux (Framatome)

**2:45 pm:** Modelling of the DIADemo Experiment with the CATHARE Code for ASTRID Gas Power Conversion System Studies, G. Mauger, M. Hochart, B. Grosjean, P. Teraud, B. Morassano (CEA)

**3:10 pm:** Oscillation Phenomenon Study for the Anti-Siphon Equipment in CFR600 Design, Yan Peng (China Inst of Atomic Energy)

#### Thermal Hydraulics in Salt-Cooled High-Temperature Reactors—III

**Session Organizers:** Izabela Gutowska (OSU), Piyush Sabharwall (INL), Maria Avramova (NCSU), **Co-chairs:** Rui Hu (ANL), Lambert Fick (Kairos Power)

**Location:** Salon C **Time:** 2:20-3:35 pm

**2:20 pm:** Validating System Analysis Module (SAM) Models Using Natural Circulation Experimental Data, Hsun-Chia Lin (Univ of Michigan), Rui Hu (ANL), Xiaodong Sun (Univ of Michigan)

**2:45 pm:** Modelling the Draining of a Molten Chloride Salt Reactor, Emily Lewis, Gregory Cartland-Glover, Stefano Rolfo, Charles Moulinec, David R. Emerson (STFC), Bruno Merk (Univ of Liverpool)

**3:10 pm:** Progress in the Thermal Hydraulic Modeling of the Molten Salt Fast Reactor, M. Tano, P. Rubiolo (Univ of Grenoble-Alpes), J. Ragusa (Texas A&M)

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## WEDNESDAY, AUGUST 21

### TECHNICAL SESSIONS - 2:20 PM

#### Experimental Measurement Techniques and Flow Visualization—III

**Session Organizers:** Philippe Bardet (*George Washington Univ*), Xiaodong Sun (*Univ of Mich*),

**Cochairs** Shuichiro Miwa (*Hokkaido U*), Jun Liao (*Westinghouse*)

**Location:** Salon D **Time:** 2:20-4:00 pm

**2:20 pm:** Measurements of Boiling Heat Transfer, Time-Averaged Void Fraction Distributions Using Neutron Radiography, Abir Muhammad. Boris Khaykovich, Jan Petrik, Artyom Kossolapov, Bren Phillips, Matteo Bucci (*MIT*)

**2:45 pm:** Automatic Detection of Bubble Footprints and Dry Spots in Infrared Boiling Heat Transfer Investigations Using Deep Convolution Neural Networks, Muhammad Abir (*MIT*), Shaikat M. Galib (*Missouri Univ Sci Technol*), Jee Hyun Seong, Matteo Bucci (*MIT*)

**3:10 pm:** Ultrasound Measurement of Upward Liquid Film Flow in Vertical Pipe, Yuki Wada, Akira Satou, Yasuteru Sibamoto, Taisuke Yonomoto (*JAEA*), Jun Sagawa (*Mito Electronic Solution*)

**3:35 pm:** High-Fidelity Velocity Measurements in a Totally Blocked Subchannel of a Wire-Wrapped 61-PIN Hexagonal Fuel Bundle, Lance L. A. White, Nolan Goth, Jake Pettyjohn, D. T. Nguyen, R. Vaghetto, Y. A. Hassan (*Texas A&M*)

#### Fuel Coolant Interaction, Modeling and Experiments—II

**Session Organizer:** Guillaume Mignot (*OSU*), **Chair:** Yu Maruyama (*JAEA*)

**Location:** Sunstone **Time:** 2:20-3:35 pm

**2:20 pm:** New Film Boiling Correlations for Drops and Fragments in Fuel Coolant Interaction Codes, E. Malmazet (*EdF*)

**2:45 pm:** Effects of Salinity in Coolant on Steam Explosion, Qiang Guo, Louis Manickam, Weimin Ma, Sevostian Behta (*KTH*)

**3:10 pm:** Validation of a Full Model for the Analysis of Ex-Vessel Steam Explosion in LWRs, Dmitry Grishchenko, Pavel Kudinov (*KTH*)

#### Plant System Code Validation—I

**Session Organizer:** Kent Welter (*NuScale*), **Cochairs:** Hengliang Shen (*NuScale Power*), Xu Wu (*NCSU*)

**Location:** Douglas Fir **Time:** 2:20-4:00 pm

**2:20 pm:** Predictability of System Codes for Void Fraction in Bundle, Yunseok Lee, Yeongjae Lee, Taewan Kim (*Incheon National Univ*)

**2:45 pm:** Benchmark Simulation of the Natural Convection Shutdown Heat Removal Test Facility Using SAM, B. Hollrah, R. Hu, M. Bucknor. D. Lisowski (*ANL*), Y. Hassan, R. Vaghetto (*Texas A&M*)

**3:10 pm:** Validation of S3K Against the Olkiluoto 2 Pump Trip Event May 8th 2018, Christian Jönsson, Gerardo Grandi (*Studsvik Scandpower*), Aarno Isotalo, Ville Hynönen (*Teollisuuden Voima Oyj*)

**3:35 pm:** Validation and Uncertainty Quantification for Two-Phase Natural Circulation Flows Using TRACE Code, K. Borowiec, T. Kozlowski, C. S. Brooks (*Univ of Illinois*)

#### Plant System Code Analysis and Development—II

**Session Organizer:** Mathieu Martin (*TerraPower*), **Cochairs:** Ivor Clifford (*PSI*), Francis Buschman (*Bettis Atomic Power Laboratory*)

**Location:** Meadowlark **Time:** 2:20-4:00 pm

**2:20 pm:** First Assessments of the Dynamic Gap Conductance Model in TRACE, I. Clifford, C. Cozzo, H. Ferroukhi (*PSI*)

**2:45 pm:** The New Critical Discharge Model for ATHLET, T. Skorek (*GRS*)

**3:10 pm:** An Enhanced Property File for RELAP5-3D, J. Luitjens, K. Schmidt, B. Wolf (*NuScale Power*)

**3:35 pm:** Development of a Thermal-Hydraulic Analysis Code for Helically Coiled Once Through Steam Generator, Jun Huang, Junli Gou, Jianqiang Shan (*Xi'an Jiaotong Univ*)

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**WEDNESDAY, AUGUST 21**  
TECHNICAL SESSIONS - 4:20 PM

**Multiscale Multiphysics Applications in Thermal Hydraulics—I**

**Session Organizer:** Bao-Wen Yang (*XJTU*), **Cochairs:** Michael Z. Podowski (*RPI*), Bin Han (*XJTU*)  
**Location:** Columbia **Time:** 4:20-5:10 pm

**4:20 pm:** A Three-Dimensional Multi-Physics Analysis of the Steam Line Break Accident of a PWR Using CUPID-RV/MASTER, Jae Ryong Lee, Ik Kyu Park, Seung Jun Lee, Yun Je Cho, Yong Hee Choi, Han Young Yoon (*KAERI*)

**4:45 pm:** Applicability of Gothic 8.3(QA) for Non-LWR Simulation, Aerosol Modeling and Hydrogen Management, J. W. Lane, T. L. George, S. W. Claybrook, J. A. Zankowski (*Zachry Nuclear Eng, Inc.*), T. Kindred (*EPRI*)

**Subchannel Fluid Dynamics and Heat Transfer—III**

**Session Organizer:** Philippe Fillion (*CEA*), **Cochairs:** Matteo Bucci (*MIT*), Philippe Fillion (*CEA*)  
**Location:** Eastside **Time:** 4:20-5:35 pm

**4:20 pm:** Critical Heat Flux Model for Vertical Annular Mist Flow Conditions in a Rod Bundle, José N. Reyes, Jr. (*NuScale Power*)

**4:45 pm:** A Criterion to Classify Void Fraction Profiles in Adiabatic Bubbly Flows Based on Averaged Flow Quantities for Use in Subchannel Codes, Ravikishore Kommajosyula (*MIT*), Guillaume Bois, Alan Burlot, Maria Giovanna Rodio, Benjamin Cariteau (*CEA*), Emilio Baglietto (*MIT*)

**5:10 pm:** Mapping Coherent Thermal Structures in a Rod Bundle, S. Lomperski, J. Licht (*ANL*)

**Core Thermal Hydraulics and Subchannel Analysis—II**

**Session Organizer:** David Aumiller (*BAPL*), **Cochairs:** Bao-Wen Yang (*XJTU*), Jean-Marie Le Corre (*Westinghouse*)  
**Location:** Pearl **Time:** 4:20-5:35 pm

**4:20 pm:** Investigations of Neutron Noise Induced by Transient Cross Flow in a PWR Reactor Core, Zhuoqi Du (*Technical Univ Munich*), Dong-Yuan Sheng (*Westinghouse Electric Sweden AB*), Marcus Seidl (*PreussenElektra GmbH*), Rafael Macián-Juan (*Technical Univ Munich*)

**4:45 pm:** On the Use of Small-Scale LES for Full-Length Heated Fuel Rod Simulations, Javier Martinez, Elia Merzari (*ANL*)

**5:10 pm:** Subchannel Analysis of Mixed Convection in a Rod Bundle, Ting Wu, Baowen Yang (*Xi'an Jiaotong Univ*)

**Accuracy and Uncertainty Analysis—I**

**Session Organizer:** Jinbiao Xiong (*SJTU*), **Cochairs:** Shanbin Shi (*RPI*), Jinbiao Xiong (*SJTU*)  
**Location:** Mt. Hood **Time:** 4:20-5:35 pm

**4:20 pm:** Addressing the Usage of CFD Within the CSAU Framework for Nuclear Reactor Safety Analysis Simulations, Michael Acton, Emilio Baglietto (*MIT*)

**4:45 pm:** Inverse Uncertainty Quantification by Hierarchical Bayesian Inference for TRACE Physical Model Parameters Based on BFBT Benchmark, Chen Wang (*Univ of Illinois*), Xu Wu (*MIT*), Tomasz Kozłowski (*Univ of Illinois*)

**5:10 pm:** A Study on Coupling Calculation Convergence Criterion Based on Uncertainty Analysis, Xiaolie Wang, Jianjun Wang, Zhiqiang Zhu (*Harbin Eng Univ*)

**Fundamental Thermal Hydraulics: General—I**

**Session Organizer:** Caleb Brooks (*Univ of Illinois*), **Cochairs:** Shuichiro Miwa (*Hokkaido U*), Caleb Brooks (*Univ of Illinois*)  
**Location:** Salon A **Time:** 4:20-5:10 pm

**4:20 pm:** About Phenomena Identification in a PIRT, D. Bestion (*Consultant*)

**4:45 pm:** Analytical Solution to a One-Dimensional Two-Region Heat Conduction Problem with Time Dependent Heat Input, Yikuan Yan, Emory Brown, Wade Marcum (*OSU*)

## WEDNESDAY, AUGUST 21

### TECHNICAL SESSIONS - 4:20 PM

#### Thermal Hydraulics in Sodium-Cooled Fast Reactors: Transient Analysis—II

**Session Organizer:** Antoine Gerschenfeld (*CEA*), **Cochairs:** Clotaire Geffray (*CEA*), Rizwan-Uddin (*Univ of Illinois*)

**Location:** Salon B **Time:** 4:20-5:35 pm

**4:20 pm:** Transient Analyses of the Versatile Test Reactor Using RELAP5-3D, C. Parisi, C. Davis, G. Youinou (*INL*)

**4:45 pm:** Modelling Thermal Stratification in Upper Plenum of Sodium Fast Reactor Using Systems Code SAS4A/SASSYS-1 and Using CFD, Sundar Namala, Rizwan-Uddin (*Univ of Illinois*), Tyler Sumner (*ANL*)

**5:10 pm:** Validation of the MATHYS Tool for the Design of Sodium-Cooled Fast Reactors Using PHENIX End-of-Life Test Data, Clotaire Geffray, Antoine Gerschenfeld, Yannick Gorsse (*CEA*)

#### Thermal Hydraulics in Salt-Cooled High-Temperature Reactors—IV

**Session Organizers:** Izabela Gutowska (*OSU*), Piyush Sabharwall (*INL*), Maria Avramova (*NCSU*),

**Cochairs:** Mark Anderson (*U of Wisc*), Haihua Zhao (*Kairos Power*)

**Location:** Salon C **Time:** 4:20-5:35 pm

**4:20 pm:** Molten Salt to Supercritical CO<sub>2</sub> Diffusion-Bonded Heat Exchanger Testing to Support Component Certification for Advanced Nuclear Power Systems, Shaun R. Aakre, Mark H. Anderson (*Univ of Wisconsin, Madison*)

**4:45 pm:** Triple Flow Heat Exchanger with Intermediate Oval Twisted Tube for FHRs, Amir Ali, Bryan Wallace, Edward D. Blandford (*Univ of New Mexico*)

**5:10 pm:** 3D Coupled Transient Simulation of a Fast Liquid Fuel Molten Salt Reactor Primary Loop Using GeN-Foam, Muhammad Altahhan, Sandesh Bhaskar, Paolo Balestra, Jason Hou, Maria Avramova (*NCSU*), Nicholas Smith (*Southern Co.*), Carlo Fiorina (*EPFL*)

#### Experimental Measurement Techniques and Flow Visualization—IV

**Session Organizers:** Philippe Bardet (*George Washington Univ*), Xiaodong Sun (*Univ of Mich*),

**Cochairs:** Selim Kuran (*NuScale*), Yang Liu (*U of Michigan*)

**Location:** Salon D **Time:** 4:20-5:35 pm

**4:20 pm:** Application of Strain Gages in a Highly Advective Environment for Measurement of Fluid-Structure Interactions, A. W. Weiss, W. R. Marcum (*OSU*), W. F. Jones, A. M. Phillips, T. V. Holschuh (*INL*), T. K. Howard (*ORNL*)

**4:45 pm:** An Approach to Instrumenting a Full-Scale 61-Pin Hexagonal Fuel Bundle for Flow-Induced Vibration Testing, C. A. Nixon, W. R. Marcum, A. W. Weiss (*OSU*), K. M. Steer, R. B. Jackson, M. G. Martin, C. Yeager (*TerraPower*)

**5:10 pm:** Flow Regime Identification in Two-Phase Flow Across Vertical Tube Bundles Using Optical Probes, Teng Wang, Qincheng Bi, Zhaohui Liu, Miao Gui (*Xi'an Jiaotong Univ*)

#### Fuel Coolant Interaction, Modeling and Experiments—III

**Session Organizer:** Sung Joong Kim (*Hanyang Univ*), **Chair:** Alessandro Del Nevo (*ENEA*)

**Location:** Sunstone **Time:** 4:20-6:00 pm

**4:20 pm:** Investigation on the Characteristics of Melt Jet Breakup in Water with Both Experiment and LBM Methods, Hui Cheng, Jiyun Zhao (*City Univ of Hong Kong*)

**4:45 pm:** Fuel-Coolant Interaction Modeling Supporting TREAT Experimental Analysis, R. Armstrong (*Univ of Wisconsin, Madison/INL*), H. Jo, M. L. Corradini (*Univ of Wisconsin, Madison*)

**5:10 pm:** Experimental Study on the Molten Materials Effect in Fuel-Coolant Interaction, Pengfei Liu, Longkun He, Bo Kuang (*Shanghai Jiao Tong Univ*)

**5:35 pm:** Parametric Studies on CHF Trends for a Downward Facing Curved Geometry Under a Flow Condition, Jun Yeong Jung, Dong Hoon Kam, Yong Hoon Jeong (*KAIST*), Hae Min Park (*KAERI*)

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## WEDNESDAY, AUGUST 21

### TECHNICAL SESSIONS - 4:20 PM

#### Modeling and Experiments of Severe Accidents—III

**Session Organizer:** Guillaume Mignot (*Oregon State University*), **Chair:** Didier Jacquemain (*IRSN*)  
**Location:** Salmon **Time:** 4:20-6:00 pm

**4:20 pm:** Developing Separate Effects Transient Test Experiments Using an Out-of-Pile Flowing Water Loop, Daniel P. LaBrier, Yikuan Yan, Emory Brown, Wade R. Marcum (*OSU*)

**4:45 pm:** Study on Fuel Damage Progression and Porosity in the SFD 1-4 Test, K. Nishida, N. Sano, T. Torige, T. Kusunoki, M. Murase (*Inst of Nuclear Safety System, Inc.*)

**5:10 pm:** Heat Transfer Model at Interface Between Molten Core and Concrete for Anisotropic Ablation, Kyoung M. Kang (*Univ of Wisconsin, Madison/GE Hitachi Nuclear*), Michael L. Corradini (*Univ of Wisconsin, Madison*), Mitchell T. Farmer (*ANL*)

**5:35 pm:** Inter-System Loss of Coolant Accident (ISLOCA) of APR1400 with Severe Accident Condition, Byeonghee Lee, Kwang Soon Ha (*KAERI*)

#### Plant System Code Validation—II

**Session Organizer:** Kent Welter (*NuScale*), **Cochairs:** Pravin Sawant (*NuScale Power*), Olu Omotowa (*TerraPower*)

**Location:** Douglas Fir **Time:** 4:20-6:00 pm

**4:20 pm:** H2020 MYRTE Circe-Hero Experimental Campaign: Post-Test Activity and Code Validation, D. Castelliti, T. Hamidouche (*SCK-CEN*), P. Lorusso (*Univ of Roma*), M. Tarantino (*ENEA*)

**4:45 pm:** MARS-KS Code Assessment on LOCA Test in Pressurized Water Loop Facility of PHWR, S. O. Yu, M. K. Cho, S. C. Song, K. L. Baek (*KINS*)

**5:10 pm:** Data Assimilation with Subchannel Analysis Code CTF on NUPEC BWR BFBT Test Matrix, Atsushi Ui, Yoshiro Kudo, Masahiro Furuya (*CRIEPI*)

**5:35 pm:** Horizontal Stratification and Its Application to PWR LOCA Analysis, Jun Liao (*Westinghouse*)

#### Fluid-Structure Interactions—I

**Session Organizer:** Afaque Shams (*NRG*), **Cochairs:** Afaque Shams (*NRG*), Angel Papukchiev (*Meadowlark*) **Time:** 4:20-5:35 pm

**4:20 pm:** Numerical Study of Flow-Induced Vibration of Nuclear Fuel Rods, D. De Santis, A. Shams (*NRG*)

**4:45 pm:** Numerical Simulations of the Turbulence-Induced Vibrations of a Wire-Wrapped Hexagonal Fuel Assembly, H. Dolfen, J. De Ridder (*Ghent Univ*), L. Brockmeyer, E. Merzari (*ANL*), G. Kennedy, K. Van Tichelen (*Belgian Nuclear Research Centre*), J. Degroote (*Ghent Univ*)

**5:10 pm:** Elastic Vibration Characteristics of Strips in Turbulent Water Flow, Botao Zhang, Yechen Zhu, Shengjie Gong, Hanyang Gu, Zhenqin Xiong (*Shanghai Jiao Tong Univ*)

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## THURSDAY, AUGUST 22

### TECHNICAL SESSIONS - 8:20 AM

#### Multiscale Multiphysics Applications in Thermal Hydraulics—II

**Session Organizer:** Bao-Wen Yang (*XJTU*), **Co-chairs:** Mathieu Martin (*TerraPower*), Davide Papini (*Nuclear Power Plant Gösgen-Däniken AG*)

**Location:** Columbia **Time:** 8:20-10:00 am

**8:20 am:** Fuel Assembly Bow Evaluations with Computed Hydraulic Forces, Robert A. Brewster, Yuriy Aleshin (*Westinghouse*)

**8:45 am:** Development, Verification and Validation of the Multi-Scale CATHARE—NEPTUNE\_CFD Coupling, Clotaire Geffray (*CEA*), Chai Koren (*EdF R&D*)

**9:10 am:** Multi-Scale Coupling of TRACE and TrioCFD Based on ICoCo, K. L. Zhang (*KIT*), X. L. Zhang (*KIT/USTC*), V. H. Sanchez Espinoza, R. Stieglitz (*KIT*)

**9:35 am:** Analyses of the Flow Mixing Phenomena in a Pressurized Water Reactor by 1d- and Coupled 1d-3d Simulations, H. V. Hristov, J. Herb, A. Papukchiev (*GRS*)

#### Two-Phase Flow and Heat Transfer Fundamentals—I

**Session Organizer:** Dillon Shaver (*ANL*), **Chair:** Jeff Luitjens (*NuScale*)

**Location:** Eastside **Time:** 8:20-10:00 am

**8:20 am:** Film Thickness and Disturbance Wave Structure of Upward Annular Flow, Guanyi Wang, Ke Tang, Mamoru Ishii (*Purdue Univ*)

**8:45 am:** Investigation of the Mechanisms Which Govern Bubble Geometry in the Spherical Cap Regime Through the Application of Particle Image Velocimetry, Isaiah Wieland, Alexander Dueñas, Wade Marcum, Qiao Wu (*OSU*)

**9:10 am:** Experimental Study of Flooding Phenomenon in Vertical Annular Smooth and Corrugated Channels, A. Biton (*NRCN/Ben-Gurion Univ of the Negev*), E. Rabinovich, R. Freud (*NRCN*), E. Gilad (*Ben-Gurion Univ of the Negev*)

**9:35 am:** Prediction of Annular Two-Phase Flow with Heat Transfer, Wenyuan Fan, Haipeng Li, Henryk Anglart (*KTH*)

#### Accuracy and Uncertainty Analysis—II

**Session Organizer:** Jinbiao Xiong (*SJTU*), **Co-chairs:** Yixiang Liao (*HZDR*), Maolong Liu (*SJTU*)

**Location:** Mt. Hood **Time:** 8:20-10:00 am

**8:20 am:** Analysis of Sensitivity and Uncertainty Quantification for Transient Simulation with the Emphasis on Changes in the Transient Structure, K. Borowiec, C. Pigg, T. Kozlowski (*Univ of Illinois*)

**8:45 am:** Uncertainty and Sensitivity Analysis of the PBF SFD Test 1-4 Using MAAP5 Code, Ikuo Kinoshita (*Inst of Nuclear Safety System, Inc*)

**9:10 am:** Sensitivity Analysis on the Critical Mass Flowrate Based on Sobol' Indices Through Replicated LHS, Lucia Sargentini, Guillaume Damblin (*CEA*)

**9:35 am:** A Best-Estimate-Plus-Uncertainty-Based Method for Design and Design Verification, R. P. Martin (*BWX Technol*)

#### Fundamental Thermal Hydraulics: General—II

**Session Organizer:** Caleb Brooks (*Univ of Illinois*), **Co-chairs:** Xu Wu (*MIT*), Juliana Duarte (*Virginia Tech*)

**Location:** Salon A **Time:** 8:20-9:10 am

**8:20 am:** Using Deep Learning for the Development of Critical Heat Flux Models for Pressurized Water Reactors, Otto Linsuain, Boyan D. Ivanov (*Westinghouse*)

**8:45 am:** A Correlation of the Water Film Thickness and Friction Factor for Supercritical/Subcritical Transition in a Hot-Leg Pipe Geometry, S. Al Issa, R. Macian-Juan (*Technical Univ Munich*)

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**THURSDAY, AUGUST 22**  
**TECHNICAL SESSIONS - 8:20 AM**

**Thermal Hydraulics in Sodium-Cooled Fast Reactors: Transient Analysis—III**

**Session Organizer:** Antoine Gerschenfeld (*CEA*), **Cochairs:** Hitesh Bindra (*KSU*), Simon Li (*CEA*)

**Location:** Salon B **Time:** 8:20-9:35 am

**8:20 am:** Application of Unstructured Mesh-Based Sodium-Water Reaction Analysis Code SERAPHIM, Akihiro Uchibori, Takashi Takata (*JAEA*), Yoshimi Shiina, Akira Watanabe (*NDD Corp.*)

**8:45 am:** Experimental Measurement of Liquid Metal Flow Fields in a Scaled SFR Upper Plenum, Brendan Ward, Broderick Sieh, Hitesh Bindra (*Kansas State Univ*)

**9:10 am:** Development of LMFBR System Analysis Code NUSOL-LMR and Analysis of the Transient Accidents in CEFR, Peng Du, Jianqiang Shan, Bo Zhang (*Xi'an Jiaotong Univ*)

**Thermal Hydraulics in Small Modular Reactors and Micro Reactors—II**

**Session Organizer:** Milorad Dzodzo (*Westinghouse*), **Cochairs:** Milorad Dzodzo (*Westinghouse*), Seth Cadell (*OSU*)

**Location:** Salon C **Time:** 8:20-10:00 am

**8:20 am:** Coupled Neutronics/Thermal Hydraulics Assessment of Graphite Moderated Molten Salt Reactors, A. Nalbandyan, E. B. Klinkby, B. Lauritzen (*DTU Nutech*), J. Groth Jensen, R. Steyn (*Seaborg Technologies*)

**8:45 am:** Experimental Study on the Steam Generator Performance of SMART-ITL Facility, Hwang Bae, Sung-Uk Ryu, Jin-Hwa Yang, Byong Guk Jeon, Yoon Gon Bang, Sung-Jae Yi, Hyun-Sik Park (*KAERI*)

**9:10 am:** Development of a Parametric Computational Fluid Dynamics Model to Estimate Passive Aerosol Decontamination, Rohan M. Biwalkar (*Pittsburgh Technical LLC/Carnegie Mellon Univ*), Satbir Singh, Nishant Sharma (*Carnegie Mellon Univ*), Sola M. Talabi (*Pittsburgh Technical LLC*)

**9:35 am:** Characterization of Containment Heat Transfer In Nuscale Power Small Modular Reactor (*SMR*), Pravin Sawant, Selim Kuran (*NuScale Power LLC*)

**Experimental Measurement Techniques and Flow Visualization—V**

**Session Organizers:** Philippe Bardet (*George Washington Univ*), Xiaodong Sun (*Univ of Mich*),

**Cochairs:** Jun Liao (*Westinghouse*), David Arcilesi (*U of Idaho*)

**Location:** Salon D **Time:** 8:20-10:00 am

**8:20 am:** Detailed Measurements of Void-Fraction Distribution in an Adiabatic Fuel Bundle Performed with High Resolution Gamm-Ray Tomography Imaging, Julio Diaz, Robert Adams, Victor Petrov, Annalisa Manera (*Univ of Michigan*)

**8:45 am:** Flow Structure in Dead-Ended, Coolant Loop Reactor Branch Lines Related to Thermal Fatigue Onset, J. R. Downing, V. Petrov, A. Manera (*Univ of Michigan*), invited

**9:10 am:** Modal Analysis of Parallel Rectangular Jets Interactions in the RCCS Separate-Effects Test Facility, Daniel Nunez, Benedikt Krohn, Victor Petrov, Annalisa Manera (*Univ of Michigan*)

**9:35 am:** Statistical Characterization of Gas-Liquid Flow in Swirl Vane Separator with Image Processing Technique, Li Liu (*Jiao Tong Univ/Ji'an Jiaotong Univ*), Bofeng Bai (*Xi'an Jiaotong Univ*)

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## THURSDAY, AUGUST 22

### TECHNICAL SESSIONS - 8:20 AM

#### Natural Convection and Mixing Phenomena, Modeling and Experiments—I

**Session Organizer:** Guillaume Mignot (*OSU*), **Cochairs:** Jeremy Bittan (*EDF*), Lucas Albright (*Univ of Utah*)

**Location:** Sunstone **Time:** 8:20-10:00 am

- 8:20 am:** CFD Prediction of Natural Convection During External Reactor Vessel Cooling, Marco Colombo, Michael Fairweather (*Univ of Leeds*)
- 8:45 am:** CFD Analysis of the CIGMA Experiments on the Heated Jet Injection into Containment Vessel with External Surface Cooling, A. Hamdani, S. Abe, M. Ishigaki, Y. Sibamoto, T. Yonomoto (*JAEA*)
- 9:10 am:** Analysis of Dynamic Natural Convection™ Cooling Combined with FLEX Mitigation During Station Blackout Events, Stephen M. Hess, Tom Elicson, Matthew Griffiths (*JENSEN HUGHES*), Brian Beley, Michael Torcaso, Greg Lazzaro (*NuVision Eng*), Aladar Csontos (*EPRI*)
- 9:35 am:** Analysis of Dynamic Natural Convection™ Cooling Combined with Accident Tolerant Fuel and FLEX Mitigation During Station Blackout Events, Stephen M. Hess, Tom Elicson, Matthew Griffiths (*JENSEN HUGHES*), Brian Beley, Michael Torcaso, Greg Lazzaro (*NuVision Eng*), Aladar Csontos (*EPRI*)

#### Modeling and Experiments of Severe Accidents—IV

**Session Organizer:** Yu Maruyama (*JAEA*), **Cochairs:** Fulvio Mascari (*ENEA*), Lucas Albright (*University of Utah*)

**Location:** Salmon **Time:** 8:20-10:25 am

- 8:20 am:** A Two Phase Mathematical Model to Describe the Dissolution of Corium Crust by Molten Steel, Shambhavi Nandan, Florian Fichot, Fabien Duval (*IRSN*)
- 8:45 am:** Experimental Studies on Two-Layer Corium Heat Transfer in Light Water Reactor Lower Head in LIVE2D Facility, X. Gaus-Liu, Th. Cron, B. Fluhrer (*KIT*)
- 9:10 am:** Computational Fluid Dynamics for In-Vessel Retention: Challenges and Achievements, A. Shams, D. Dovizio, K. Zwijzen (*NRG*), C. Le Guennic (*EDF R&D*), L. Saas, R. Le Tellier, M. Peybernes, B. Bigot (*CEA*), E. Skrzypek, M. Skrzypek (*NCBJ*), L. Vyskocil (*UJV Rez a. s.*), L. Carenini, F. Fichot (*IRSN*)
- 9:35 am:** MAAP5 Benchmarking to the TRACE Thermal Hydraulic Tool, Hu Luo, Matthew Griffiths (*JENSEN HUGHES*), Thomas Kindred, Richard Wachowiak (*EPRI*)
- 10:00 am:** MAA5-VVER Validation and IAEA5PE-3 Modeling, Tom Elicson, Hugh Luo (*JENSEN HUGHES*), Lajos Tarczal (*Paks Nuclear Plant*), Thomas Kindred, Richard Wachowiak (*EPRI*)

#### Plant System Code Validation—III

**Session Organizer:** Kent Welter (*NuScale*), **Cochairs:** Jaejun Jeong (*Pusan Natl Univ*), Pawel Domitr (*National Atomic Energy Agency PAA*)

**Location:** Douglas Fir **Time:** 8:20-9:35 am

- 8:20 am:** The Assessment of the Critical Flow Models of MELCOR2.2 and TRACE V5.0 Against MARVKEN Critical Flow Tests, Pawel Domitr (*National Atomic Energy Agency*), Piotr Darnowski (*Warsaw Univ of Technol*), Michal Spirzewski (*National Centre for Nuclear Research*)
- 8:45 am:** Test Result and MARS-KS Calculation with Uncertainty Propagation Analysis for Pressurizer Surgeline IBLOCA, Byoung-Uhn Bae, Jae-Bong Lee, Yu-Sun Park, Jong-Rok Kim, Seok Cho, Kyoung-Ho Kang (*KAERI*)
- 9:10 am:** Development and Assessment of the Thermal Hydraulic System Code ARSAC-K for Analysis of PWR LB LOCA, Mingjun Zhong, Dan Wu, Shuhua Ding, Wei Chen, Yaou Shen, Xiaowei Jiang, Jian Deng (*NPIC*)

#### Fluid-Structure Interactions—II

**Session Organizer:** Afaque Shams (*NRG*), **Cochairs:** Wade Marcum (*OSU*), Elia Merzari (*PSU*)

**Location:** Meadowlark **Time:** 8:20-9:35 am

- 8:20 am:** Review Paper on Water Film Characteristics, M. Moustafa, T. Ruifeng (*Harbin Eng Univ*)
- 8:45 am:** Assesment of High Performance Computing for Nuclear Reactor Thermal Hydraulics Applications, Adam Padee, Tomasz Kwiatkowski, Piotr Wasiuk, Tobiasz Jarosiewicz, Sławomir Potempski (*National Centre for Nuclear Research*), Afaque Shams (*NRG*)
- 9:10 am:** Dynamics of a Solitary Wire-Wrapped Pin in Axial Flow: A Theoretical Model, C. A. Nixon, W. R. Marcum (*OSU*)

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## THURSDAY, AUGUST 22

### TECHNICAL SESSIONS - 10:20 AM

#### Multiscale Multiphysics Applications in Thermal Hydraulics—III

**Session Organizer:** Bao-Wen Yang (*XJTU*), **Cochairs:** Bao-Wen Yang (*XJTU*), Zhiwei Zhou (*Tsinghua University*)

**Location:** Columbia **Time:** 10:20-11:35 am

**10:20 am:** Coupled APROS-CFD Simulation of Generic VVER-440 Loss of Feedwater Transient, T. Rämä, T. Toppila, J. Kättö (*Fortum Power and Heat*), V. Hovi, T. Pättikangas (*VTT Technical Research Centre of Finland Ltd*)

**10:45 am:** Thermal-Hydraulic Simulation of Advanced Gas-Cooled Reactors Steam Generators Using Coupled Porous CFD and 1D Two-Phase Flow Modelling, A. Toti, J. Uribe (*EDF Energy R&D*), M. Rabbitt, C. Sigournay, S. Pandit, P. Brown (*EDF Energy Nuclear Generation*)

**11:10 am:** Preliminary Application of the GeN-Foam Multiphysics Tool to the Analysis of the FFTF Sodium Fast Reactor: Coupling Thermal Hydraulics and Core Deformations, Carlo Fiorina, Stefan Radman (*EPFL*), Andreas Pautz (*PSI*)

#### Two-Phase Flow and Heat Transfer Fundamentals—II

**Session Organizer:** Dillon Shaver (*ANL*), **Cochairs:** Caleb Brooks (*U Illinois*), Ran Kong (*Purdue U*)

**Location:** Eastside **Time:** 10:20-11:35 am

**10:20 am:** A Study on Nanofluid Pool Boiling Critical Heat Flux Model, He Xiaoqiang, Yu Hongxing, Jiang Guangming (*NPIC*)

**10:45 am:** X-Ray Radiography for Two-Phase Mixture Level Fluctuation During Boil-Off in Rod Bundle for Wide Pressure Range, T. Arai, M. Furuya, H. Takiguchi, Y. Nishi, K. Shirakawa (*CRIEPI*)

**11:10 am:** Unexpected Heat Transfer Oscillations in Steady Annular Flow Detected by Synchronized Infrared and Liquid Film Sensor Measurements, G.-Y. Su, B. Phillips, J. Buongiorno (*MIT*), F. P. D'Aleo, R. M. Streich, H. M. Prasser (*ETH Zurich*), E. Al-Safran (*Kuwait Univ*)

#### Core Thermal Hydraulics and Subchannel Analysis—III

**Session Organizer:** David Aumiller (*BAPL*), **Cochairs:** Hisashi Ninokata (*Politecnico di Milano*), Sipeng Wang (*Xi'an Jiaotong Univ*)

**Location:** Pearl **Time:** 10:20 am-12:00 pm

**10:20 am:** CFD and Experiments for Wire-Wrapped Fuel Assemblies, F. Roelofs, H. Uitslag-Doolaard, B. Mikuz, D. Dovizio, D. De Santis, A. Shams (*NRG*), F. Bertocchi, M. Rohde (*TU Delft*), Kl. Van Tichelen, S. Keijers, G. Kennedy (*SCK-CEN*), A. Batta, J. Pacio (*KIT*), P. Planquart (*VKI*), A. Obabko (*ANL*), L. Brockmeyer (*ANL/TAMU*), Elia Merzari (*ANL*), R. Vaghetto, Y. Hassan (*TAMU*), D. Leonard, M. Martin, B. Jackson, M. Steer (*Terrapower*), M. Delchini, D. Pointer (*ORNL*)

**10:45 am:** A Review of CFD Approaches for Turbulent Mixing Model Development in Subchannel Code, Aiguo Liu, Bao-Wen Yang (*Delta Energy Group/Xi'an Jiaotong Univ*), Xianlin Zhu (*Xi'an Jiaotong Univ*)

**11:10 am:** A Review of Grid Induced Diversion Cross Flow Models in Subchannel Code and the Development, Aiguo Liu (*Delta Energy Group*), Bao-Wen Yang, (*Delta Energy Group/Xi'an Jiaotong Univ*), Xianlin Zhu (*Xi'an Jiaotong Univ*)

**11:35 am:** A Bundle CHF Mechanism Model and Its Preliminary Verification Under PWR Conditions, Yang Liu, Jianqiang Shan, Bo Zhang (*Xi'an Jiaotong Univ*), Wei Liu (*NPIC*)

#### Accuracy and Uncertainty Analysis—III

**Session Organizer:** Jinbiao Xiong (*SJTU*), **Cochairs:** Guanyu Su (*MIT*), Han Bao (*NCSU*)

**Location:** Mt. Hood **Time:** 10:20-11:10 am

**10:20 am:** Sensitivity Analysis of Minor Leaks in Light Water Reactor Environments, Lukasz Sokolowski (*Kiwa Inspecta Nuclear AB*)

**10:45 am:** Uncertainty Quantification of Thermal-Hydraulic CFD Simulation Using Hybrid Monte-Carlo and Polynomial-Chaos-Expansion Method, D. Gitelman (*NRCN/Technion*), M. Katz (*NRCN*), A. N. Shocron, I. Tsarfis, S. Frankel (*Technion*)

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## THURSDAY, AUGUST 22

### TECHNICAL SESSIONS - 10:20 AM

#### Fundamental Thermal Hydraulics: General—III

**Session Organizer:** Caleb Brooks (*Univ of Illinois*), **Cochairs:** Juliana Duarte (*Virginia Tech*), Xu Wu (*MIT*)  
**Location:** Salon A **Time:** 10:20-11:35 am

**10:20 am:** Experiment and Numerical Simulation of a Single Bubble Formation Under a Downward Face of Different Contact Angles, Kai Wang, Nejdet Erkan, Koji Okamoto (*Univ of Tokyo*)

**10:45 am:** Bayesian Calibration of Empirical Models Common in MELCOR and Other Nuclear Safety Codes, N. W. Porter, V. A. Mousseau (*SNL*)

**11:10 am:** Overview of Nuclear Reactor Thermal Hydraulic R&D in Xi'an Jiaotong University, G. H. Su, Ronghua Chen (*Xi'an Jiaotong Univ*)

#### Thermal Hydraulics in High-Temperature Gas-Cooled Reactors—I

**Session Organizers:** Rodolfo Vaghetto (*TAMU*), Lewis Lommers (*Framatome*), **Cochairs:** Lew Lommers (*Framatome*), Thien Nguyen (*TAMU*)

**Location:** Salon B **Time:** 10:20-11:10 am

**10:20 am:** Design of a Scaled Air Ingress Facility for VHTR Accident Analysis, Z. Welker, A. Manera, V. Petrov (*Univ of Michigan*)

**10:45 am:** Numerical Simulation on High Temperature Gas-Cooled Reactors on Less of Coolant Accident, Shuangbao Zhang, Liangxing Li, Wei Xie, Kailin Wang (*Xi'an Jiaotong Univ*)

#### Thermal Hydraulics in Small Modular Reactors and Micro Reactors—III

**Session Organizer:** Milorad Dzodzo (*Westinghouse*), **Cochairs:** Jun Liao (*Westinghouse*), Graham Macpherson (*Frazer-Nash Consultancy*)

**Location:** Salon C **Time:** 10:20-11:35 am

**10:20 am:** Development of Modeling Framework for High-Temperature Heat Pipes in Micro Reactors, Shanbin Shi (*RPI*), Yang Liu (*Virginia Tech*), Piyush Sabharwall (*INL*)

**10:45 am:** Significance of Modeling Specific Geometry in Post-Accident Nuclear Aerosol Transport, Rohan M. Biwalkar, Sola M. Talabi (*Pittsburgh Technical LLC*)

**11:10 am:** Phenomena Identification and Ranking Table for the eVinci™ Micro Reactor, Richard F. Wright, Andrew M. Dokmanovich (*Westinghouse*)

#### Experimental Measurement Techniques and Flow Visualization—VI

**Session Organizers:** Philippe Bardet (*George Washington Univ*), Xiaodong Sun (*Univ of Mich*), **Cochairs:** Yang Liu (*VT*), Ran Kong (*Purdue U*)

**Location:** Salon D **Time:** 10:20-11:35 am

**10:20 am:** POD Analysis of the Shell-Side Local Flow in a Five-Rod Helical Coil Steam Generator, Saya Lee, Marilyn Delgado, Yassin A. Hassan (*Texas A&M*)

**10:45 am:** Artificial Neural Network Method for Automatic Mask Generation for PIV: Applications in a 5x5 Rod Bundle with Mixing Vane Spacer Grids, Gabriel C. Q. Tomaz, Camila F. Matozinhos, Thien Nguyen, Yassin Hassan (*Texas A&M*)

**11:10 am:** High-Resolution Velocity Measurements in the Vicinity of a Customized Spacer Grid with Rod Bundle Using Matching Index of Refraction and Particle Image Velocimetry, Camila Freitas Matozinhos, Gabriel Caio Queiroz Tomaz, Mason Childs, Thien Nguyen, Yassin Hassan (*Texas A&M*), Andre A. Campagnole dos Santos (*Centro de Desenvolvimento da Tecnologia Nuclear*)

#### Natural Convection and Mixing Phenomena, Modeling and Experiments—II

**Session Organizer:** Etienne Studer (*CEA*), **Cochairs:** Alessandro Del Nevo (*ENEA*), Martin Sonnenkalb (*GRS*)  
**Location:** Sunstone **Time:** 10:20-11:35 am

**10:20 am:** Experiment on Density Stratification Behavior by Containment Venting Using CIGMA Facility, Masahiro Ishigaki, Satoshi Abe, Yasuteru Sibamoto, Taisuke Yonomoto (*JAEA*)

**10:45 am:** An Evaluation of External Reactor Vessel Cooling in SMART, Hyung Seok Kang, Donggun Son, Sang Mo An, Rae-Joon Park (*KAERI*)

**11:10 am:** Experimental Study of Natural Convection Heat Transfer Phenomena in a Two-Layer Corium Pools, Yukun Zhou, Yapei Zhang, Zhiyu Yu, Shihao Wu, Wenxi Tian, Suizheng Qiu, G. H. Su, Ronghua Chen, Simiao Tang (*Xi'an Jiaotong Univ*)

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## THURSDAY, AUGUST 22

### TECHNICAL SESSIONS - 10:20 AM

#### Plant System Code Validation—IV

**Session Organizer:** Kent Welter (*NuScale*), **Cochairs:** Kent Welter (*NuScale*), Seth Cadell (*OSU*)  
**Location:** Douglas Fir **Time:** 10:20-11:10 am

**10:20 am:** Verification of SAC-3D Based on EBR-II SHRT-45R Benchmark Data, Daogang Lu, Siyu Lyu, Danting Sui (*North China Electric Power Univ*)

**10:45 am:** Validation of a Drift-Flux Model Used in the CATHARE Code for Rod Bundle Geometry at Low Pressure and Low Liquid Flow Conditions, T. Lopez, L. Matteo (*CEA*), Dominique Bestion (*Consultant*)

#### Fluid-Structure Interactions—III

**Session Organizer:** Afaque Shams (*NRG*), **Cochairs:** Afaque Shams (*NRG*), Daniele Vivaldi (*IRSN*)  
**Location:** Meadowlark **Time:** 10:20-11:35 am

**10:20 am:** Time-Resolved Particle Image Velocimetry Between Two PWR Sub-Bundles, P. M. Bardet (*George Washington Univ*), F. Bazin, L. Longo, R. Capanna, G. Ricciardt (*CEA*)

**10:45 am:** Structural and FSI Modeling Approach in Accident Analysis for a Framatome BWR Fuel Design, B. Dressel, Sz.Kovacs (*Framatome GmbH*), invited

**11:10 am:** A Preliminary Study of Thermal Oscillations Induced by Dryout in Printed Circuit Steam Generator (*PCSG*), Jin Su Kwon, Jeong Ik Lee (*KAIST*), Sang Ji Kim (*KAERI*)

## Technical Sessions: Thursday August 22

### TECHNICAL SESSIONS - 2:20 PM

#### Multiscale Multiphysics Applications in Thermal Hydraulics—IV

**Session Organizer:** Bao-Wen Yang (*XJTU*), **Cochairs:** Marco Pellegrini (*IAE*), Xiaoying Zhang (*Sun Yat-Sen University*)  
**Location:** Columbia **Time:** 2:20-4:00 pm

**2:20 pm:** A Two-Phase Flow Model for Use in MAMBA; The CRUD Deposition Code, A. Huxford, V. Petrov, A. Manera (*Univ of Michigan*)

**2:45 pm:** A Data-Driven Approach to Scale Bridging in System Thermal-Hydraulic Simulation, Han Bao, Robert Youngblood, Hongbin Zhang (*INL*), Nam T. Dinh, Linyu Lin (*NCSU*), Jeffrey W. Lane (*Zachry Nuclear Eng Inc.*)

**3:10 pm:** Investigation of Scaling Distortions for NRELAP5 Model of NIST Facility Realized Using the Dynamical Systems Scaling Methodology, Stephen A. Heagy, Cesare Frepoli (*FPoliSolutions LLC*), Jose N. Reyes (*NuScale Power*)

**3:35 pm:** Hot Channel Factor Evaluation for Sodium-Cooled Fast Reactors with Multi-Physics SHARP Toolkit, Yiqi Yu, Emily R. Shemon, Taek K. Kim, Elia Merzari (*ANL*)

#### Two-Phase Flow and Heat Transfer Fundamentals—III

**Session Organizer:** Dillon Shaver (*ANL*), **Cochairs:** Jun Fang (*ANL*), Guillaume Bois (*CEA*)  
**Location:** Eastside **Time:** 2:20-3:35 pm

**2:20 pm:** Non-Intrusive Two-Phase Flow Regime Identification Method Using FIV and Machine Learning, Shuichiro Miwa, Shuhei Torisaki (*Hokkaido Univ*)

**2:45 pm:** A Novel Method for Predicting Power Transient CHF via the Heterogeneous Spontaneous Nucleation Trigger Mechanism, Emory Brown, Yikuan Yan, Wade Marcum (*OSU*)

**3:10 pm:** Experimental Characterization of Boiling Two-Phase Flow Structures Under BWR Core Operating Conditions, J.-M. Le Corre (*Westinghouse*)

## THURSDAY, AUGUST 22

### TECHNICAL SESSIONS - 2:20 PM

#### Containment Analysis—I

**Session Organizer:** Bao-Wen Yang (*XJTU*), **Co-chairs:** Sofiane Benhamadouche (*EDF*), Sanjeev Gupta (*Becker Technologies*)

**Location:** Pearl **Time:** 2:20-4:00 pm

**2:20 pm:** Modeling Approach of Flowing Condensate Coverage on Inclined Wall for Aerosol Wash Down, Fangnian Wang, Xu Cheng (*KIT*)

**2:45 pm:** CFD Analysis of SETH-2 Test Series Using CUPID Code, Daegwang Hong (*KINGS, KEPCO Nuclear Fuel*), Donghyun Cho (*KINGS, KEPCO E&C*), Sang Yong Lee (*KINGS*), Aya Diab (*KINGS, Ain Shams Univ*)

**3:10 pm:** Post-Test Calibration of the Effective Momentum Source (*EMS*) Model for Steam Injection Through Multi-Hole Spargers., Xicheng Wang (*KTH/Tsinghua Univ*), Ignacio Gallego Marcos, Dmitry Grishchenko, Pavel Kudinov (*KTH*)

**3:35 pm:** Pre-Test Analysis for HYMERES-2 PANDA Tests Series for Steam Injection into Pool Through Spargers, Xicheng Wang (*KTH/Tsinghua Univ*), Ignacio Gallego Marcos, Dmitry Grishchenko, Pavel Kudinov (*KTH*)

#### Accuracy and Uncertainty Analysis—IV

**Session Organizer:** Jinbiao Xiong (*SJTU*), **Co-chairs:** Ki-Yong Choi (*KAERI*), Mathieu Martin (*TerraPower*)

**Location:** Mt. Hood **Time:** 2:20-4:00 pm

**2:20 pm:** Quantification of Uncertainty in Pressure Loss Associated with Manufacturing Tolerances in Nuclear Fuel Assemblies, George Bache (*Framatome*), Klaus Vogel (*Framatome GmbH*), Benjamin Farges (*Framatome SAS*), Lise Charlot (*Framatome*)

**2:45 pm:** Uncertainty Quantification on SAM Simulations of EBR-II Loss-of-Flow Tests, Travis Mui (*Univ of Illinois/ANL*), Rui Hu, Guanheng Zhang (*ANL*)

**3:10 pm:** Comparison of Random and Deterministic Sampling Methods for Quantification of the Input Uncertainty in CFD, A. Cutrono Rakhimov, D. C. Visser, E. M. J. Komen (*NRG*)

**3:35 pm:** Model and Boundary Uncertainty Analysis of PWR LBLOCA Transient Event in RELAP5/ MOD3.3 Code, Chih-Chia Chiang, Hao-Chun Chang (*Natl Tsing Hua Univ*), Jong-Rong Wang, Chunkuan Shih (*Nuclear and New Energy Education and Research Foundation*), Shao-Wen Chen, Yu-Ming Feng (*Natl Tsing Hua Univ*)

#### Multifield Two-Phase Flow Modeling—I

**Session Organizer:** Caleb Brooks (*Univ of Illinois*), **Co-chairs:** Jean-Marie Le Corre (*Westinghouse*), Dillon Shaver (*ANL*)

**Location:** Salon A **Time:** 2:20-4:00 pm

**2:20 pm:** Four Field Flow Modeling of Forced Convective Boiling, T. D. Strayer, G. M. Burdick, R. W. Dacus, T. Gallaway, B. L. Magolan, B. M. Waite (*NNL*)

**2:45 pm:** Development of the CATHARE 3 Three-Field Model for Simulations in Large Diameter Horizontal Pipes, Philippe Fillion (*CEA*)

**3:10 pm:** Current Intergroup Mass Transfer Limitations in the Multi-Group Two-Fluid Model, Longxiang Zhu (*Univ of Illinois/Xi'an Jiaotong Univ*), Zhiee Jhia Ooi, Caleb S. Brooks (*Univ of Illinois*)

**3:35 pm:** Validation of Interfacial Area Concentration Approaches for Prediction of Gas-Dispersed Condensing Flows, Vineet Kumar, Caleb S. Brooks (*Univ of Illinois*)

#### Thermal Hydraulics in High-Temperature Gas-Cooled Reactors—II

**Session Organizers:** Rodolfo Vaghetto (*TAMU*), Lewis Lommers (*Framatome*), **Co-chairs:** Thien Nguyen (*TAMU*), Aaron Epiney (*INL*)

**Location:** Salon B **Time:** 2:20-3:35 pm

**2:20 pm:** Visualization Experiment for Convective Heat Transfer in a Rectangular Riser of Air-Cooled Reactor Cavity Cooling System, Sin-Yeob Kim, Goon-Cherl Park, Hyoung Kyu Cho (*Seoul Natl Univ*), Chan Soo Kim (*KAERI*), Goon-Cherl Park, Hyoung Kyu Cho (*Seoul Natl Univ*)

**2:45 pm:** Improvement of GAMMA+ for Turbulent Mixed Convection of Air in a Vertical Duct of Reactor Cavity Cooling System, Dong-Ho Shin, Sin-Yeob Kim, Goon-Cheryl Park, Hyoung Kyu Cho (*Seoul Natl Univ*), Chan Soo Kim (*KAERI*)

**3:10 pm:** CFD Assessment of LOFA Intra Core Natural Circulation in the High Temperature Test Facility, Izabela Gutowska, Brian G. Woods (*OSU*)

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## THURSDAY, AUGUST 22

### TECHNICAL SESSIONS - 2:20 PM

#### Experimental Measurement Techniques and Flow Visualization—VII

**Session Organizers:** Philippe Bardet (*George Washington Univ*), Xiaodong Sun (*Univ of Mich*),  
**Cochairs:** Jinbiao Xiong (*SJTU*), Shanbin Shi (*RPI*)  
**Location:** Salon D **Time:** 2:20-4:00 pm

**2:20 pm:** Simultaneous Measurements of Temperature and Velocity by Optical Methods in Mixing Jets, Mira Chitt, David Guenadou, Lionel Rossi (*CEA*)

**2:45 pm:** TDLAS Diagnostic for Investigation of Steam Ingress Accident in HTGRs, Michael C. Button, Philippe M. Bardet (*George Washington Univ*)

**3:10 pm:** Experimental Investigation on Turbulence Flow Downstream a Spacer Grid with Split-Type Mixing Vanes in a 5x5 Rod Bundle Using PIV, Wenhai Qu, Jinbiao Xiong, Xu Cheng (*Shanghai Jiao Tong Univ*)

**3:35 pm:** Development of Aqueous Molecular Tagging Velocimetry to Measure Wall Shear Stress, C. Fort, M. A. André, P. M. Bardet (*George Washington Univ*)

#### Advanced Design Features for Severe Accidents Mitigation—I

**Session Organizer:** Sung Joong Kim (*Hanyang Univ*), **Cochairs:** Nathan Andrews (*SNL*), Fulvio Mascari (*ENEA*)  
**Location:** Sunstone **Time:** 2:20-3:35 pm

**2:20 pm:** MAAP5 Passive Containment Cooling System Model for Korean Advanced Power Reactor Plus, Byung Jo Kim, Jeongseong Lee, Kyubok Lee (*KEPCO E&C*), Paul McMinn, Chan Y. Paik (*Fauske & Associates, LLC*), Thomas Kindred (*EPRI*)

**2:45 pm:** Mapping Emergency Cooling Water Spray System Test Results to the AP1000® PWR Spent Fuel Pool Physical Layout, Mathew M. Swartz (*Westinghouse*)

**3:10 pm:** Performance Analysis of External Drywell Cooling on BWR Mark II Drywell Head During a Short-Term Station Blackout Scenario by MELCOR, Miao Gui, Jun Wang, Ryan Dailey, Michael L. Corradini (*Univ of Wisconsin, Madison*)

#### Debris Bed Cooling

**Session Organizer:** Fulvio Mascari (*ENEA*), **Cochairs:** Peter Pandazis (*GRS*), Etienne Studer (*CEA*)  
**Location:** Salmon **Time:** 2:20-4:00 pm

**2:20 pm:** Two-Phase Flow Structure in a Particle Bed Packed in a Confined Channel, Daisuke Ito, Tatsuya Kurisaki, Kei Ito, Yasushi Saito (*Kyoto Univ*), Yuya Imaizumi, Ken-ichi Matsuba, Kenji Kamiyama (*JAEA*)

**2:45 pm:** MELCOR and ASTEC Validation on Prelude Test, J. Duspiva, M. Kotouč (*UJV Rez*)

**3:10 pm:** Analytical Transient Two-Phase Model for Dry-Superheated Debris Bed Under Top Flooding Conditions, Alejandro Villarreal Larrauri, Renaud Meignen (*IRSN*), Michel Gradeck, Nicolas Rimbart (*LEMTA CNRS, Univ of Lorraine*)

**3:35 pm:** Development of Surrogate Model for Debris Bed Coolability Analysis, Yangli Chen, Weimin Ma (*KTH*)

#### Boiling and Condensation Heat Transfer—I

**Session Organizer:** Fumio Inada (*CRIEPI*), **Cochairs:** Junsoo Yoo (*INL*), Koji Nishida (*INSS*)  
**Location:** Douglas Fir **Time:** 2:20-3:35 pm

**2:20 pm:** Assessment of Empirical Models and Uncertainty and Sensitivity Study of a High-Velocity Steam Condensation Experiment with TRACE, W. Jaeger, W. Hering (*KIT*)

**2:45 pm:** Condensation Heat Transfer of the Steam-Air Mixture on Bundle Heat Exchanger of PCCS (*Passive Containment Cooling System*), Byoung-Uhn Bae, Seok Kim, Yu-Sun Park, Kyoung-Ho Kang (*KAERI*)

**3:10 pm:** Study of the Thermal-Hydraulic Behaviors of an Open-Loop PCCS, Xianmao Wang (*China Nuclear Power Technol Research Inst*), Jun Wang (*Univ of Wisconsin, Madison*), Suizheng Qiu (*Xi'an Jiaotong Univ*)

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## THURSDAY, AUGUST 22

### TECHNICAL SESSIONS - 2:20 PM

#### Thermal Hydraulics of Fluoride Salt-Cooled High-Temperature Reactors

**Session Organizer:** Edward Blandford (*Kairos Power*), **Co-chairs:** Lambert Fick (*Kairos*), Kyle Brumback (*Kairos Power*)

**Location:** Meadowlark **Time:** 2:20-4:00 pm

- 2:20 pm:** Development of a Component-Based Scaling Methodology for Fluoride-Salt-Cooled High-Temperature Reactors, Ishak Johnson, Per Peterson (*Univ of California, Berkeley*)
- 2:45 pm:** Numerical Verification of the Kairos Power Systems Code KP-SAM, Lambert H. Fick, Haihua Zhao (*Kairos Power*)
- 3:10 pm:** Scaling Methodology for Integral Effects Tests in Support of Fluoride-Salt-Cooled, High-Temperature Reactor Technology, Nicolas Zweibaum, Edward Blandford, Craig Gerardi, Per Peterson (*Kairos Power*)
- 3:35 pm:** Overview of Kairos Power Systems Code KP-SAM Development, Haihua Zhao, Lambert Fick, Justin Herter, Brandon Haugh (*Kairos Power*)

### TECHNICAL SESSIONS - 4:20 PM

#### Containment Analysis—II

**Session Organizer:** Bao-Wen Yang (*XJTU*), **Co-chairs:** Sanjeev Gupta (*Becker Technologies*), Zhiwei Zhou (*Tsinghua University*)

**Location:** Pearl **Time:** 4:20-5:35 pm

- 4:20 pm:** A Mechanistic Spray Model for Lumped Parameter Reactor Containment Modeling, D. Bestion (*Consultant*), T. Lopez (*CEA*)
- 4:45 pm:** Development and First Validation of the Tailored CFD Solver ‘ContainmentFoam’ for Analysis of Containment Atmosphere Mixing, S. Kelm, M. Kampili (*FzJ*), G. Vijaya Kumar (*FzJ/ Indian Inst of Technol Madras*), Kinshiro Sakamoto (*FzJ/Fukui Univ*), X. Liu, C. Druska, A. Kuhr (*FzJ*), K. Arul Prakash (*Indian Inst of Technol Madras*), H.-J. Allelein (*FzJ*)
- 5:10 pm:** Improvement of Physical Modeling for Coupled Heat and Mass Transfer in a Square Cavity with Condensation in the Presence of Non-Condensable Gas, Nan Jiang, Etienne Studer (*DEN/STMF, CEA, Université Paris-Saclay*), Bérengère Podvin (*LIMSI, CNRS, Université Paris-Saclay*)

#### Plant System Code Analysis and Development—III

**Session Organizer:** Mathieu Martin (*TerraPower*), **Co-chairs:** Matthew Zimmer (*NCSU*), Olu Omotowa (*TerraPower*)

**Location:** Meadowlark **Time:** 4:20-5:10 pm

- 4:20 pm:** Mesh Sensitivity Analysis of 1-D Nuclear System Analysis Code with Higher-Order Numerical Scheme, Wonwoong Lee, Jae Jun Lee, Sung Gil Shin, Jeong Ik Lee (*KAIST*)
- 4:45 pm:** Comparisons of Friction Models Implemented in U.S. TRACE and Korean MARS-KS System TH Codes, Sung Gil Shin, Jeong Ik Lee (*KAIST*)

#### Multifield Two-Phase Flow Modeling—II

**Session Organizer:** Caleb Brooks (*Univ of Illinois*), **Chair:** Subash Sharma (*Purdue University*)

**Location:** Salon A **Time:** 4:20-5:35 pm

- 4:20 pm:** Development of a Droplet Entrainment Correlation for a Vertical Upward Annular-Mist Flow, Jee Min Yoo, Kum Ho Han, Jae Jun Jeong (*Pusan National Univ*), Han Young Yoon (*KAERI*)
- 4:45 pm:** Study on Evaluation Method for Entrained Gas Flow Rate by Free Surface Vortex, Kei Ito, Daisuke Ito, Yasushi Saito (*Kyoto Univ*), Toshiki Ezure, Kentarou Matsushita, Masaaki Tanaka (*JAEA*), Yasutomo Imai (*NDD Corp.*)
- 5:10 pm:** Validation of the Interfacial Area Transport Equation Coupled with the Void Transport Equation for Prediction of Flashing Flows, Zhi-ee Jhia Ooi, Vineet Kumar, Caleb S. Brooks (*Univ of Illinois*)

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**THURSDAY, AUGUST 22**  
**TECHNICAL SESSIONS - 4:20 PM**

**Thermal Hydraulics in High-Temperature Gas-Cooled Reactors—III**

**Session Organizers:** Rodolfo Vaghetto (*TAMU*), Lewis Lommers (*Framatome*), **Cochairs:** Lew Lommers (*Framatome*), Izabela Gutowska (*OSU*)

**Location:** Salon B **Time:** 4:20-5:35 pm

**4:20 pm:** Discrete Element Modeling of Conduction Cool Down in Pebble-Bed Reactors Under Loss of Forced Convection, Dan Gould (*General Atomics-ASI*), Mary Ross, Hitesh Bindra (*Kansas State Univ*)

**4:45 pm:** Velocimetry/Thermometry Data Fusion from DCC Tests in the HTTF, M. A. André, P. M. Bardet (*George Washington Univ*), S. R. Cadell, B. Woods (*OSU*)

**5:10 pm:** Standard Fuel Block Test to Validate Core Thermo-Fluid Analysis Code for Prismatic Gas-Cooled Reactor, Chan Soo Kim, Byung Ha Park, Eung Seon Kim (*KAERI*)

**Thermal Hydraulics in Small Modular Reactors and Micro Reactors—IV**

**Session Organizer:** Milorad Dzodzo (*Westinghouse*), **Cochairs:** Kent Welter (*NuScale*), Richard Wright (*Westinghouse*)

**Location:** Salon C **Time:** 4:20-5:35 pm

**4:20 pm:** LOCA-Type Scenario Simulation for NuScale-SMR with RELAP/SCDAPSIM/MOD3.4, Katarzyna Skolik (*AGH Univ of Science and Technology*), Anuj Trivedi, Marina Perez-Ferragut, Chris Allison (*Innovative Systems Software*)

**4:45 pm:** Validation of the Trace Code Against Small Modular Integral Reactor Natural Circulation Phenomena, F. Mascari (*ENEA*), B. G. Woods (*OSU*), K. Welter (*NuScale Power*), F. D'Auria (*Univ of Pisa*)

**5:10 pm:** Scaling Effects of Film Flow Regimes in SMR Integral Tests, Dongyoung Lee, Qiao Wu (*OSU*)

**Advanced Design Features for Severe Accidents Mitigation—II**

**Session Organizer:** Fulvio Mascari (*ENEA*), **Chair:** Etienne Studer (*CEA*)

**Location:** Sunstone **Time:** 4:20-5:10 pm

**4:20 pm:** Surface Characteristics of Accident Tolerant Fuels Cladding and Their Potential Impact in Critical Heat Flux, Rajnikant Umretiya, Daniel Ginestro, Sama Bilbao y Leon, Jessika Rojas (*Virginia Commonwealth Univ*), Barret Elward, Mark Anderson (*Univ of Wisconsin, Madison*), Raul B. Rebak (*GE Global Research*)

**4:45 pm:** A Study on Safety Margin of In-Vessel Melt Retention for VVER1000 Reactor, Long Manh Doan, Tran Chi Thanh (*Viet Nam Atomic Energy Inst*), Nguyen Van Thai (*Hanoi Univ of Science and Technology*)

**Boiling and Condensation Heat Transfer—II**

**Session Organizer:** Fumio Inada (*CRIEPI*), **Cochairs:** Atsushi Ui (*CRIEPI*), Wadim Jaeger (*KIT*)

**Location:** Douglas Fir **Time:** 4:20-5:10 pm

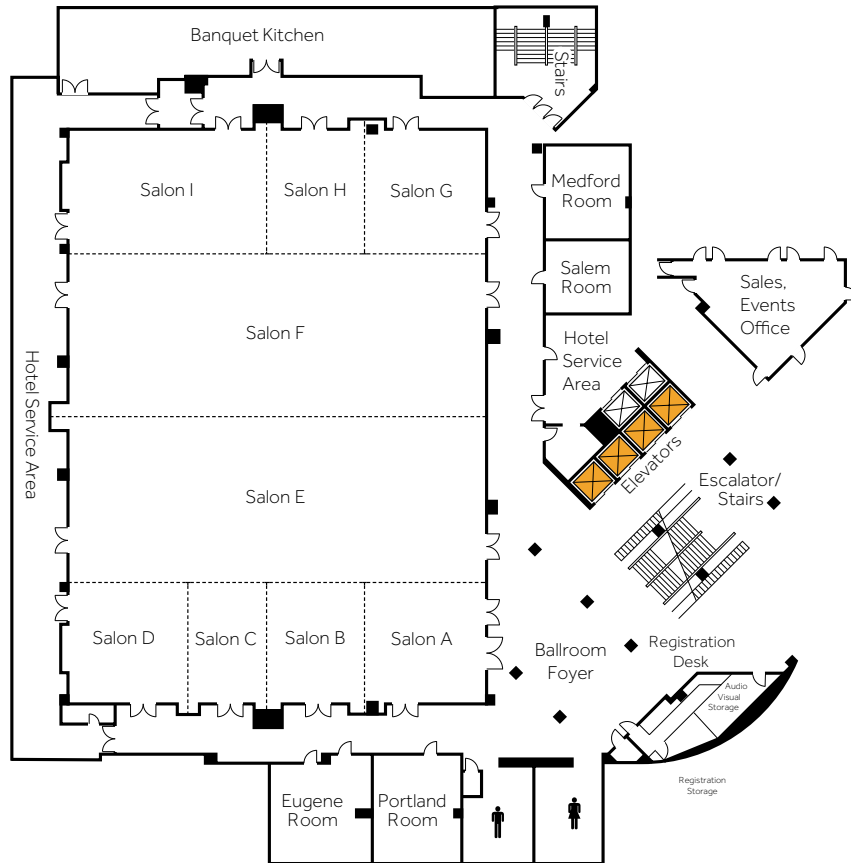
**4:20 pm:** Force Balance Model Assessment for Mechanistic Prediction of Sliding Bubble Velocity in Vertical Subcooled Boiling Flow, Junsoo Yoo (*INL*), Yassin A. Hassan (*Texas A&M*)

**4:45 pm:** TRACE High Pressure Condensation Model Validation Using KAIST Data, J. Thompson, P. Lien (*NRC*)

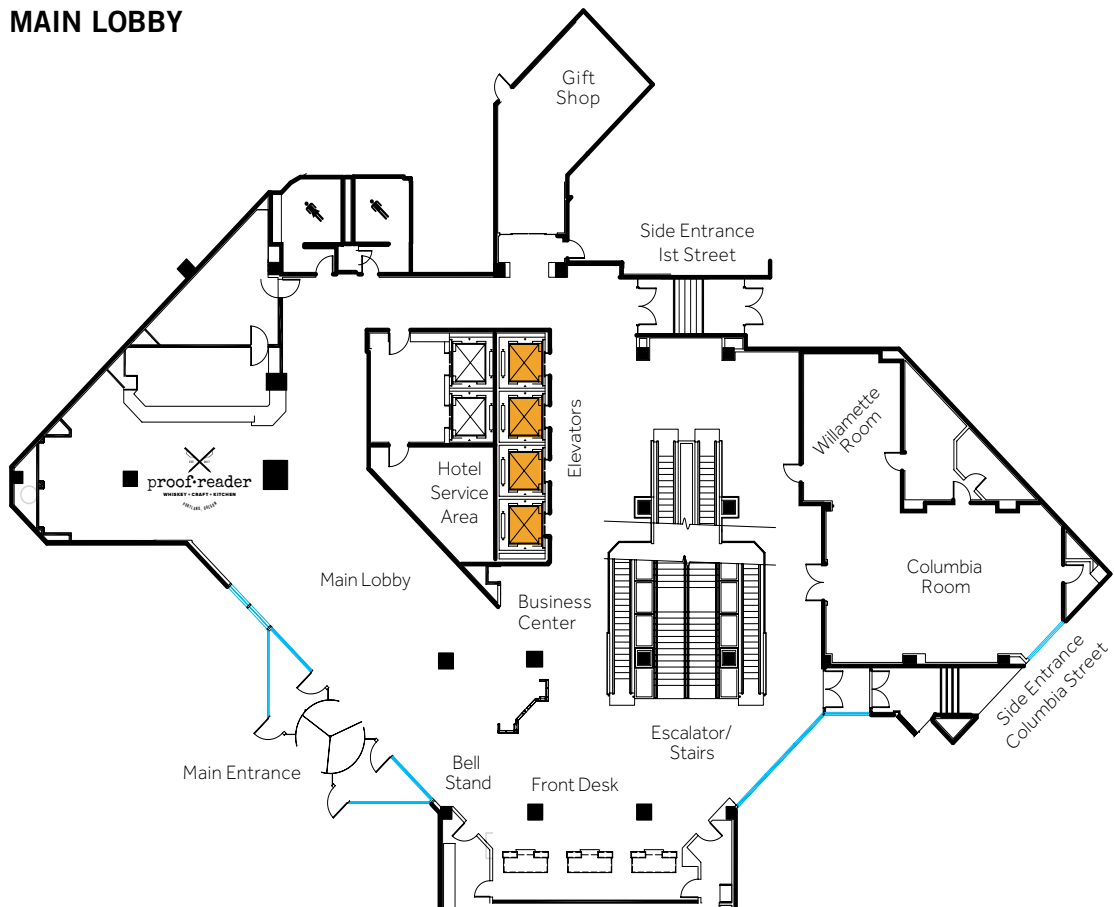
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# Hotel Floorplans

## LOWER LEVEL



## MAIN LOBBY



# Hotel Floorplans

## 2ND FLOOR

