

# **Transactions of the American Nuclear Society 2024**

ANS Annual Conference 2024

Transactions of the American Nuclear Society Volume 130

Las Vegas, Nevada, USA  
16 – 19 June 2024

Part 1 of 2

ISBN: 979-8-3313-0352-5

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2024) by American Nuclear Society  
All rights reserved.

Printed with permission by Curran Associates, Inc. (2024)

For permission requests, please contact American Nuclear Society  
at the address below.

American Nuclear Society  
555 North Kensington Avenue  
La Grange Park, Illinois 60526  
USA

Phone: (800) 323-3044  
(708) 352-6611  
Fax: (708) 352-0499

[www.ans.org](http://www.ans.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# Transactions of the American Nuclear Society Vol. 130

June 16–19, 2024  
Las Vegas, Nevada

**1 Opening Plenary**

**3 Tuesday Special Session: Our Friends the Isotopes**

---

**5 Executive Sessions**

**7 One-on-One Conversation with Dr. Katy Huff**

**8 Nuclear Waste: The Changing Opportunity**

**9 U.S. Nuclear Reactor Firsts**

**10 The Changing Tides of Nuclear**

**11 Accelerating Qualification of Materials for Nuclear Environments**

**12 Engaging with Non-Traditional Workforce Pipelines**

**13 Nuclear Communications on the Global Stage: COP and Beyond**

**14 Training Session for Prospective Nuclear Ambassadors**

---

**15 Education, Training & Workforce Development**

**17 Advanced Nuclear Reactor Deployment on University Campuses**

**19 Education, Training, and Workforce Development: General and Lightning Talks**

**20 Nuclear Science User Facilities (NSUF) Minority Serving Institutions (MSI) Relationship Development Workshop—J. Keith Jewell (INL), Jeffery Giglio (INL), Brenden Heidrich (INL)**

**22 Recent Case Study on NRC Rulemaking on Right-Sizing SMR Emergency-Zones—Sola Talabi (Pittsburgh Technical), Rohan Biwalkar (Pittsburgh Technical)**

**26 We get by with a Little Help from our Friends -- A Case Study of how to Bring on 350+ Coworkers in a Year—Adam Peck (Pacific Gas and Electric Co.), Justin Rogers (Pacific Gas and Electric Co.)**

**27 Importance of Hands-On Training Within the Nuclear Industry—Kelsey Amundson (LANL)**

**29 Integrating Socially Led Co-Design into Consent-Based Siting of Interim Storage Facilities**

**31 Training, Human Performance, and Workforce Development**

**32 Stochastic Projections of U.S. Nuclear Power Industry to Identify Workforce Needs—Saman Marandi (Univ. Maryland), Ziyue Liu (Univ. Maryland), Michelle T. Bensi (Univ. Maryland), Mohammad Modarres (Univ. Maryland)**

**36 Generation IV International Forum -- Knowledge Management and Knowledge Preservation: An Initiative from the Education and Training Working Group—Patricia Paviet (PNNL)**

**40 Development of an Online Graduate Certificate for Nuclear Safeguards and Security—Daniel LaBrier (Idaho State), Kathy Araújo (Boise State), Matthew Bernards (Univ. Idaho)**

**43 Leveraging Behavior Sciences in the Nuclear Industry to Improve Worker Performance—Amanda Lee Chamberlain Cobb (South Texas Project), Scott Anthony Grones (South Texas Project)**

## 45 Fuel Cycle & Waste Management

### 47 Consent-Based Siting: Current Status and Key Considerations for Advancement

### 49 Innovations for FCWMD Applications

50 Multi-Orientation Depth of Field Imaging with Cosmic-Ray Muons—*Jesus J. Valencia (Univ. New Mexico), J. Bacon (LANL), J. M. Durham (LANL), E. Guardincerri (LANL), A.A. Hecht (Univ. New Mexico), C.L. Morris (LANL), D. Poulson (LANL)*

53 Homogeneity Evaluation for Geopolymer Waste Form with Spent Ion-Exchange Resin—*Seoukyoung Oh (Pohang Univ. Science and Technology), Byoungkwan Kim (Pohang Univ. Science and Technology), Hyun-min Ma (Pohang Univ. Science and Technology), Wooyong Um (Pohang Univ. Science and Technology)*

56 Impact of Ba on the Immobilization of Selenate Ettringite in Metakaolin-Based Geopolymer Waste Form—*Hyun-min Ma (Pohang Univ. Science and Technology), Byoungkwan Kim (Pohang Univ. Science and Technology), Seoukyoung Oh (Pohang Univ. Science and Technology), Wooyong Um (Pohang Univ. Science and Technology)*

59 On Demand HCl Production for Chlorination of U from Dissociated NH<sub>4</sub>Cl Through the Catalytic Removal of Ammonia Vapor—*Collin Andersen (Univ. Utah), Krista Carlson (Univ. Nevada, Reno), Michael Simpson (Univ. Utah)*

### 63 Waste Management Approaches and Facility Siting Considerations

64 Thematic Shifts in Discussion and Questions About Consent-Based Siting—*Matthew D. Sweitzer (Sandia), Danielle N. Sanchez (Sandia), Alisa Rogers (Sandia), Thushara Gunda (Sandia), Lauren Drakopoulos (Sandia), Tara LaForce (Sandia)*

68 An Historical Review of DOE's Attempt to Site a Monitored Retrievable Storage Facility in Oak Ridge, Tennessee, Between 1985 and 1987—*Paul Cantonwine (ORNL), Bruce Bevard (ORNL)*

72 Sociotechnical Systems Analysis to Identify Best Practices for Facility Siting—*Lauren Drakopoulos (Sandia), Carmen Mendez (Sandia), Gretchen Gano (Sandia), Bruce Bevard (ORNL)*

76 Dual-Track Approach: Sustainable Solution for Radioactive Waste Disposal—*Hamdi Alalaween (ORNL), Sean Tyson (U.S. Dept. of Energy)*

80 Consent Based Siting for Spent Nuclear Fuel – The Common Ground Consortium Focus on Research and Public Conversations—*R. A. Borrelli (Univ. Idaho), Kathleen Araujo (Boise State), Cassie Koerner (Boise State), Denia Djokic (Univ. Michigan)*

## 85 So You Want to Recycle in the U.S.?

### 87 ARPA-E ONWARDS and CURIE Project Updates: I

88 Computational Modeling of Induction Heating of Stainless Steel Surrogates for Uranium Metal-Based Fuel Rods for Development of a Zone Refining Process—*Hayden Hansen (Univ. Utah), Jon Dromey (Univ. Utah), Ethan Rose (Univ. Utah), Tae-Sic Yoo (INL), Michael Simpson (Univ. Utah)*

92 A Reprocessing Facility Optimization Tool for Fuel Life-Cycle Management and Advanced Reactor Fuel Supply—*Kevin Kelly (EPRI), Dan Moneghan (EPRI)*

96 Towards Scale-Up of Group Actinide Co-Crystallizations and Investigating Tc-99 Behavior—*Jeffrey D. Einkauf (ORNL), Jennifer M. Pyles (Univ. Alabama, Birmingham), Luke Sadergaski (ORNL), Laetitia Delmau (ORNL), Bruce A. Moyer (ORNL), Jonathan D. Burns (Univ. Alabama, Birmingham)*

98 Dissolution of ZrCl<sub>4</sub> in Eutectic LiCl-KCl for Chlorination of Metal Oxides—*Courtney Eckley (Univ. Utah), Michael F. Simpson (Univ. Utah)*

100 Investigation of Selective Galvanic Reduction of MgCl<sub>2</sub> from LiCl-KCl Eutectic Salt—*Forest M. Felling (Univ. Utah), Michael Simpson (Univ. Utah)*

### 103 ARPA-E ONWARDS and CURIE Project Updates: II

104 Reference Shale Host Rock Properties and Chemistries for Deep Borehole Disposal Performance Modeling—*Ethan Bates (Deep Isolation), John Grimsich (Deep Isolation), Stefan Finsterle (Finsterle GeoConsulting), LianGe Zheng (Berkeley Lab), Mikey Hannon (Carbon Solutions), Jesse Sloane (Deep Isolation)*

107 Advanced Reactor Waste Forms: State of Knowledge and Future Directions—*Jeffrey McLachlan (Berkeley Lab), Rebecca Abergel (Univ. California, Berkeley)*

111 MgO Waste Form Irradiation Damage and Stability—*Eric C. O'Quinn (Univ. Tennessee, Knoxville), David J. Sprouster (Stony Brook Univ.), Maik K. Lang (Univ. Tennessee, Knoxville), Jason R. Trelewicz (Stony Brook Univ.)*

115 Probabilistic Digital Twin and Distributed Ledger Technology Based Safeguards Solution for Aqueous Nuclear Reprocessing Facilities—*Scott Evans (GE Vernova Advanced Research Center), John Carbone (GE Aerospace Advanced Research Center), Chris Reynolds (GE Vernova Advanced Research Center)*

119 Economic Model Development for Deep Borehole Repositories—*Matt Waples (Deep Isolation), Vaibhav Sharma (Deep Isolation), Ethan Bates (Deep Isolation), Jesse Sloane (Deep Isolation)*

- 123 Technical Advances for Interim Storage, Disposal, and Nuclear Waste Repositories**
- 124 Evaluation of HLW-Repository Under Multiple Earthquake Occurrences: (1) Risk Distribution—*Karyoung Choi (Kyung-Hee Univ.), Kibeom Son (Kyung-Hee Univ.), Gyunyoung Heo (Kyung-Hee Univ.)*
- 128 Evaluation of HLW-Repository Under Multiple Earthquake Occurrences: (2) Peak Risk Probability—*Minseok Kim (Kyung-Hee Univ.), Karyoung Choi (Kyung-Hee Univ.), Gyunyoung Heo (Kyung-Hee Univ.)*
- 131 Thermal Expansion of Uranium Mononitride—*Natalie S. Yaw (Washington State), Emma C. Kindall (Washington State), Arjen van Veelen (LANL), Malin C. Dixon Wilkins (Washington State), Sam Karcher (Washington State), Bryn Merrill (Washington State), Graham King (Canadian Light Source), John S. McCloy (Washington State), Joshua T. White (LANL), Xiaofeng Guo (Washington State)*
- 134 Impact of LWR Assembly Structural Features on Cladding Burst Behavior Under LOCA Conditions—*Daniel Schappel (ORNL), Nathan Capps (ORNL)*
- 138 The Philosophy Behind Consent Based Siting Efforts with NC State—*Robert B. Hayes (NCSU), Melody G. Polk (NCSU)*
- 139 Progress Towards Chloride-Based Volatility Separations for Recovery of Uranium from Used Nuclear Fuel—*Aaron Unger (TerraPower), Katie McBride (TerraPower), SeungMin Lee (TerraPower), Pradeep Perera (TerraPower), Sayandeep Chatterjee (TerraPower), Perry Motsegood (TerraPower)*
- 141 UNF as a Viable Fuel for Next Generation Electricity Production**
- 143 AI/ML, Modeling, Design, and Simulation Approaches for FCWMD Applications**
- 144 AI/ML-Assisted Design of Phosphate Glass and Ceramic Nuclear Waste Forms—*Jincheng Du (Univ. North Texas), Vinay I. Hegde (Citrine Informatics), James Saal (Citrine Informatics), Brian Riley (PNNL), John Vienna (PNNL)*
- 148 Machine Learning to Enable Pyro-Processing Safeguards—*Christopher Reynolds (GE Vernova Advanced Research Center), Subhrajit RoyChowdhury (GE Vernova Advanced Research Center), Scott Evans (GE Vernova Advanced Research Center)*
- 151 CYCLUS Toolkit Enhancements to Simulate Nuclear Material Buying Patterns—*Kathryn Mummah (Univ. Wisconsin, Madison), Paul P.H. Wilson (Univ. Wisconsin, Madison)*
- 155 Conceptual Design of Equipment and Operations for Treatment of Fermi-1 Blanket Material—*B.D. Preussner (INL), S.D. Herrmann (INL), R.C. Campbell (INL), M.R. Meengs (INL)*
- 159 Commutable, Adaptive Process for the Treatment of UNF Radioactive Exhaust (CAPTURE)—*Sven Bader (Orano Federal Services)*
- 161 Sustainability in Advanced Fuel Cycles**
- 163 Fuel Cycle Considerations of Advanced Reactors**
- 164 Research Process on Tritium Behavior in HTGR—*Zhou Ziling (Tsinghua Univ.), Feng Xie (Tsinghua Univ.)*
- 168 Uncertainty Quantification for Pebble Bed Reactor Fuels Burnup Credit—*Jonathan Wing (Univ. Tennessee, Knoxville), G. Ivan Maldonado (Univ. Tennessee, Knoxville), Gordon M. Petersen (INL), Robert A. Joseph (INL)*
- 172 Sustainability of Innovative Nuclear Energy Systems Using INPRO Methodology—*Carolynn Scherer (IAEA), Nilormi Das (IAEA), Sera Jeon (IAEA), Gaye Sayin (IAEA)*
- 176 A New Uranium-Plutonium Breed and Burn Fuel Cycle—*Neal Mann (Neal Mann and Assoc.), Mihai G.M. Pop (Areva College of Experts (Retired))*
- 180 Development of Cs Pollucite Ceramic Waste Form and Evaluation of Long-Term Chemical Durability—*Ga-Yeong Kim (Chungnam National Univ.), Ki-Rak Lee (KAERI), Jung-Hoon Choi (KAERI), Jae Hwan Yang (Chungnam National Univ.), Hwan-Seo Park (KAERI)*
- 181 Influences of Iodine Separation and Capture in the Context of NO<sub>2</sub>-Based Voloxidation—*Katherine R. Johnson (ORNL), Allison T. Greaney (ORNL), Kathryn M. Peruski (ORNL), Chase Cobble (ORNL), Matthew Vick (ORNL), Joanna McFarlane (ORNL)*
- 183 UNF/SNF Monitoring, Storage and Transportation Advances**
- 184 RAMT-PSA® -- An Emerging Tool for Radioactive Material Transportation Probabilistic Safety Assessment to Support Decision-Making—*Manorma Kumar (Technical Univ. Catalonia), Guillem Cortes-Rossell (Technical Univ. Catalonia)*
- 188 Development of a Functions and Requirements Document for a SNF Transportation Package Performance Demonstration—*Laura Hay (PNNL), Steven Maheras (PNNL), Miriam Juckett (PNNL), Harold Adkins Jr. (PNNL), Erica Bickford (U.S. Dept. of Energy), Gerard Jackson (U.S. Dept. of Energy), Douglas Ammerman (Sandia), Kevin J. Connolly (ORNL)*
- 192 Process Intensification for Recovery of Uranium from Spent Fuel Using DEHiBA—*Gregg J. Lumetta (PNNL), Gabriel B. Hall (PNNL), Nathan P. Bessen (PNNL), Daria Boglajenko (PNNL), Amy L. Speelman (PNNL)*
- 196 Isotope Recovery from UNF Recycling and Transmutation—*Ross Radel (SHINE Technologies), Tracy Radel (SHINE Technologies), Yana Karslyan (SHINE Technologies)*

## 201 Fusion Energy

---

### 203 Fusion: General

- 204 Development, Validation and Application of a Mathematical Model for Inertial Fusion Energy Using OpenFOAM—*Eric Cervi (Politecnico di Milano), Antonio Cammi (Politecnico di Milano)*
- 208 VERTEX Closures: Towards Data-Driven 3D MHD Turbulence Models for Fusion Blanket Simulations—*Arpan Sircar (ORNL), Katarzyna Borowiec (ORNL), Vittorio Badalassi (ORNL)*
- 212 Helium Flow Simulations of Heat Transfer Enhancement Structures for Blanket First Wall Cooling—*Yuqiao Fan (ORNL), Cody S. Wiggins (ORNL)*
- 216 Development of OpenMC Reduced Ordered Models to Evaluate Solid Breeder Concepts—*Yogendra S. Panchal (Univ. Tennessee, Knoxville), Marina Rizk (Univ. Tennessee, Knoxville), Nicholas Brown (Univ. Tennessee, Knoxville), G. Ivan Maldonado (Univ. Tennessee, Knoxville)*

## 221 Human Factors, Instrumentation & Controls

---

### 223 Emerging Topics in Artificial Intelligence and Machine Learning: I

- 224 Exploring Quantitative and Qualitative Machine Learning Methods for Predicting Neutron Flux Values from a Simulated Molten Salt Reactor—*Konstantinos Vasili (Purdue Univ.), Seda Yilmaz (Purdue Univ.), Matthew M. Niichel (Purdue Univ.), Jonah Lau (Purdue Univ.), Shripad Revankar (Purdue Univ.), Lefteri Tsoukalas (Purdue Univ.), Stylianos Chatzidakis (Purdue Univ.)*
- 228 Preliminary Analysis of Passive Safety System Operation Through Temperature-Data-Based Machine Learning Modeling—*Hyoung Suk Yu (KAIST), Yong Hoon Jeong (KAIST)*
- 230 Classification Modeling of Nuclear Power Plant Outage Severities—*Michael Castillo (Oregon State), Andrew Klein (Oregon State)*
- 234 Integrating LLMs for Explainable Fault Diagnosis in Complex Systems—*Akshay J. Dave (ANL), Tat Nghia Nguyen (ANL), Richard B. Vilim (ANL)*
- 238 Condition-Based Calibration of Pressure Transmitters Implemented at Vogtle Nuclear Station—*H.M. Hashemian (Analysis and Measurement Services Corp.), G.W. Morton (Analysis and Measurement Services Corp.), B.D. Shumaker (Analysis and Measurement Services Corp.)*

### 239 Remote Operation of Advanced Reactors: What Actions are Needed Today to Prepare for Tomorrow?

### 241 Emerging Topics in Artificial Intelligence and Machine Learning: II

- 242 Developing a Machine Learning Benchmark Using Real-Time Data from the PUR-1 Reactor for Nuclear Applications—*William Richards (Purdue Univ.), Zachery Dahm (Purdue Univ.), Oliver Buss (Nuclear Energy Agency), Catalina Anghel (Canadian Nuclear Laboratory), Kamal Moravej (Canadian National Laboratory), Xingang Zhao (ORNL), Basma Foad (McMaster Univ.), Upendra Rohatgi (Brookhaven), Gregory Delipei (NCSU), Xu Wu (NCSU), Stylianos Chatzidakis (Purdue Univ.)*
- 246 ContextGPT: Predictive Monitoring of Nuclear Power Plant with Contextually-Informed Situational Understanding—*Raisa Bentay Hossain (Univ. Illinois, Urbana-Champaign), Farid Ahmed (Univ. Illinois, Urbana-Champaign), Jahangir Alam (Southern Illinois Univ.), Sajedul Talukder (Southern Illinois Univ.), Syed Bahauddin Alam (Univ. Illinois, Urbana-Champaign)*
- 250 Development of AI-Based Decision-Making Support Technology to Prevent Human Error in Nuclear Power Plant—*Seo Ryong Koo (KAERI), Young Ho Chae (KAERI)*
- 254 Enhancing the Cybersecurity of Advanced Nuclear Power Plants Through Generative AI and Large Language Models—*Raisa Bentay Hossain (Univ. Illinois, Urbana-Champaign), Ismail Hossain (Southern Illinois Univ.), Sajedul Talukder (Southern Illinois Univ.), Syed Bahauddin Alam (Univ. Illinois, Urbana-Champaign)*
- 258 Adaptive Machine Learning-Based Threat Intelligence in Nuclear Facilities (AML-TIN): A Framework for Enhanced Cybersecurity in Nuclear Computing Environments—*Alaa M. Alotaibi (Southern Illinois Univ.), Farid Ahmed (Univ. Illinois, Urbana-Champaign), Sai Puppala (Southern Illinois Univ.), Sajedul Talukder (Southern Illinois Univ.), Syed Bahauddin Alam (Univ. Illinois, Urbana-Champaign)*
- 261 Innovations in Advanced Cybersecurity Technologies for Safety Systems Within NPPs
- 263 Digital Twins and Their Applications
- 264 ML-Based Real-Time Monitoring Method for Nuclear Systems—*Kazuma Kobayashi (Univ. Illinois, Urbana-Champaign), Syed Alam (Univ. Illinois, Urbana-Champaign)*
- 267 Modeling for a Digital Twin-Based Remote Operation System Framework—*Kaeley Stevens (INL), Joseph Oncken (INL), Izabela Gutowska (Oregon State)*



- 271 Natural Language Processing for Predictive Maintenance in Nuclear Power Plant: Digital Twin Context—*Raisa Bentay Hossain (Univ. Illinois, Urbana-Champaign), Sajedul Talukder (Southern Illinois Univ.), Syed Bahauddin Alam (Univ. Illinois, Urbana-Champaign)*
- 274 Digital Twin Approach for Prognostic and Health Management of Nuclear Reactor Pressure Vessels—*Raisa Bentay Hossain (Univ. Illinois, Urbana-Champaign), Kazuma Kobayashi (Univ. Illinois, Urbana-Champaign), Syed Bahauddin Alam (Univ. Illinois, Urbana-Champaign)*
- 278 Approach for Inferring Full-Scope Human Reliability Data Based on Simplified Simulator Data—*Jooyoung Park (INL), Taewon Yang (Chosun Univ.), Ronald Boring (INL), Jonghyun Kim (Chosun Univ.)*
- 282 Developing a 3D NPP Digital Twin for Robotic Inspection and Maintenance Simulation—*Himanshu Vairagade (Georgia Tech), Youndo Do (Georgia Tech), Hoojon Son (Georgia Tech), Jackson Stahl (Georgia Tech), Sungmin Kim (Georgia Tech), Fan Zhang (Georgia Tech)*
- 283 Cybersecurity in Wireless Technologies, Digital I&C, Digital Twins, and Human Factors: I**
- 284 Control System Targeted Malicious Codes Detection Through Configuration Management—*Poe il Park (Korea Institute of Nuclear Non-Proliferation and Control), Kookheui Kwon (Korea Institute of Nuclear Non-Proliferation and Control)*
- 288 A Dataset to Support Cybersecurity Research for Non-Safety Controller of APR1400—*Taejin Kim (KAERI), Young-Jun Lee (KAERI), Inhye Hahm (KAERI)*
- 291 Cyber-Attack Scenario Development for Radiation Detection Systems—*Cheng-Shao Chiang (Georgia Tech), Johan Gouws (Georgia Tech), Sharmistha Mukhopadhyay (Georgia Tech), Fan Zhang (Georgia Tech)*
- 295 Enhancing OT Security in Advanced Reactors: Microsegmentation and Zero-Trust Strategies Against Emerging Cyber Threats—*Kazuma Kobayashi (Univ. Illinois, Urbana-Champaign), Md Jahangir Alam (Southern Illinois Univ.), Sajedul Talukder (Southern Illinois Univ.), Syed Bahauddin Alam (Univ. Illinois, Urbana-Champaign)*
- 299 Design of Defensive Cyber Security Architectures Using Event Trees—*Lee T. MacCarone (Sandia), Andrew S. Hahn (Sandia), Michael T. Rowland (Sandia)*
- 303 Application of International Technical Standards for Human Factors Verification and Validation in Advanced Nuclear Systems—*Sa-Kil Kim (KAERI), Young-Do Koo (KAERI)*
- 307 Cybersecurity in Wireless Technologies, Digital I&C, Digital Twins, and Human Factors: II**
- 308 Simulation Based Analytical Approaches to Cyber Risk Mitigation in Advanced Nuclear Reactors—*Andrew Hahn (Sandia), Lee MacCarone (Sandia), Mike Rowland (Sandia)*
- 312 Requirement for Security Verification and Supply Chain Control of Digital Commercial Off-the-Shelf for Cybersecurity of Nuclear Facilities—*Seunghoon Park (Korea Institute of Nuclear Nonproliferation and Control), Kookheui Kwon (Korea Institute of Nuclear Nonproliferation and Control), Poe il Park (Korea Institute of Nuclear Nonproliferation and Control)*
- 315 Diagnostics Using Nuclear Plant Cyber Attack Analysis Toolkit—*Japan K. Patel (Univ. Michigan), Athi Varuttamaseni (Brookhaven), Robert W. Youngblood III (INL), John C. Lee (Univ. Michigan)*
- 319 An Online FDI Detection Scheme Based on Noise Analysis for Nuclear Signals—*Konstantinos Gkouliaras (Purdue Univ.), Vasileios Theos (Purdue Univ.), Zachery Dahm (Purdue Univ.), William Richards (Purdue Univ.), Konstantinos Vasili (Purdue Univ.), Stylianos Chatzidakis (Purdue Univ.)*
- 323 Pilot Business Case Analysis for Digital Infrastructure Modernization Deployment—*Paul J. Hunton (INL), Sean Lawrie (Lumerra Corp.)*
- 327 Online Monitoring, Diagnostics, and Prognostics**
- 328 Development of a Proof-of-Concept Technique for Particle Deposition Removal Using High-Power Ultrasound—*Hongbin Sun (ORNL), Thien Duy Nguyen (ORNL)*
- 332 Lessons Learned from Validating a Software-Trained AI Model with Hardware Data—*Hee-Jae Lee (Chosun Univ.), Younhee Choi (Chosun Univ.), Jihoon Park (Chosun Univ.), Sangwon Oh (Chosun Univ.), Eunse Ahn (Chosun Univ.), Daeil Lee (KAERI), Man Gyun Na (Chosun Univ.), Jonghyun Kim (Chosun Univ.)*
- 336 A Wireless Method for Leak Detection of Insulation Piping—*Tae-Jin Park (KAERI), Jai-Wan Cho (KAERI), Jae-Cheol Lee (KAERI), Doyeob Yeo (KAERI), You-Rak Choi (KAERI)*
- 338 Modeling and Simulation Activities for the Westinghouse In-Rod Wireless Sensor Program—*E. Tatti (Westinghouse Electric Co.), A. Mofidi (Westinghouse Electric Co.), J. Carvajal (Westinghouse Electric Co.), S. Stafford (Westinghouse Electric Co.), J. Arndt (Westinghouse Electric Co.), P. Sirianni (Westinghouse Electric Co.), N. Arlia (Westinghouse Electric Co.)*
- 342 Benchmarking of Different Inverse Point Kinetics Implementations for an Autocorrected Reactimeter Algorithm—*Paul A. Ferney (INL), Mark D. DeHart (INL)*

**347 Digital Twin Approach for Effective Prognostic and Health Managements for Nuclear Systems**

**349 Advances in Sensors and Instrumentation: I**

- 350 Measuring Flow Rates and Compositions in Salt Reactors with Gamma Spectroscopy—*Charles Forsberg (MIT), Dave Carpenter (MIT), Seth Dayawansa (Univ. Texas, Austin), Kevin T. Clarno (Univ. Texas, Austin)*
- 354 A Compact and Robust Semiconductor Neutron Detector Alternative for Subsurface Exploration—*Shikha Prasad (SLB)*
- 357 Laser-Spectroscopy Testbed Design for Impurity Monitoring in Sodium-Cooled Fast Reactors—*M. Ortiz (Univ. Michigan), E. Kent (ANL), J. Craparo (Energy Research Co.), R. De Saro (Energy Research Co.), I. Jovanovic (Univ. Michigan), M. Burger (Univ. Michigan)*
- 359 Drift for Optical Fiber-Based Gamma Thermometer—*Thomas E. Blue (Ohio State), Anthony Birri (ORNL), Christian M. Petrie (ORNL)*
- 362 Cherenkov-Based Neutron Detector Design and Development for Advanced Reactors—*Jacob Strong (Univ. Utah), Jesse Snow (Univ. Utah), Edward Cazalas (Univ. Utah)*

**365 Isotopes & Radiation**

---

**367 Radiation Effects in Materials and Advanced Sensors**

- 368 Testing and Evaluation of Field-Programmable Gate Arrays for Applications in High Radiation Environment—*Marlin Keller (Ohio State), Lei Raymond Cao (Ohio State), Praneeth Kandlakunta (Ohio State)*
- 372 Towards an Open-Source Hybrid Monte-Carlo Framework for Fast Response Modeling of NaI(Tl) and HPGe Detectors—*Matthew Niichel (Purdue Univ.), Stylianos Chatzidakis (Purdue Univ.)*
- 376 Analysis of Radioactive Zn-65 Contamination Using 3D Position Sensitive CdZnTe Detectors—*Valerie E. Nwadeyi (SRNL)*
- 377 Metal Oxide Infused Conformal Coatings for Shielding Satellite Electronics—*Robert B. Hayes (NCSU), Patrick J. Hartwell (NCSU)*

**379 Advances in Radiation Detectors**

- 380 Developing and Optimizing a Low-Cost Heat Pipe Thermoelectric Cloud Chamber—*Nathan Tollett (Purdue Univ.), Stylianos Chatzidakis (Purdue Univ.)*

- 384 A Low-Cost Method for the Detection of Sub-picocurie per cc Concentrations of Ar-41 in Air—*True Miller (Purdue Univ.), Ryan Smith (Purdue Univ.), Brian Jowers (Purdue Univ.), Stylianos Chatzidakis (Purdue Univ.), Seungjin Kim (Purdue Univ.)*

**387 Isotopes and Radiation: General**

- 388 Harnessing the Unique Properties of Berkelium in its Separation from other *f*-Elements and Fission Products—*Miting Du (ORNL), Punam Thakur (ORNL)*
- 392 Californium Feedstock Study to Support the Californium-252 Supply Program at Oak Ridge National Laboratory—*Grace M. Power (ORNL)*
- 395 Mass Spectrometry Analysis of Lithium in FLiBe—*Sean R. Scott (PNNL), Johnny Williams (Kairos Power), Sara Mastromarino (Kairos Power)*
- 398 Empirical Bounding Analysis and User Recommendations for a Neutron Multiplicity Detector—*J. Hutchinson (LANL), T. Cutler (LANL), D. Dinwiddie (LANL), K. Kazkaz (LANL), S. Kiff (LANL), G. McKenzie (LANL), H. Kistler (LANL), M. Nelson (LANL), E. Sorensen (LANL), K. Stults (LANL), N. Thompson (LANL), J. Walker (LANL)*

**403 Mathematics & Computation**

---

**405 Current Issues in Computational Methods—Roundtable: Challenges in Time-Dependent Neutron Transport Problems**

**407 Transport Methods**

- 408 Analysis of Hybrid MC/Deterministic Methods for Transport Problems Based on Low-Order Equations Discretized by Finite Volume Schemes—*Vincent N. Novellino (NCSU), Dmitriy Y. Anistratov (NCSU)*
- 412 Reduced Order Modeling of Thermal Radiation Diffusion via Modified Shifted Operator Inference—*Simon Butson (Oregon State), Todd S. Palmer (Oregon State)*
- 415 IMC Detector Modeling with Modified Radiography Tallies—*Alex P. Robinson (LLNL), Taylor E. Grubbs (NCSU), Patrick S. Brantley (LLNL)*
- 419 A Linear, Exponential-Discontinuous Scheme for Discrete-Ordinates Calculations in Slab Geometry—*Jeremy A. Roberts (Kansas State)*
- 423 An Alternative to Stride-Based RNG for Monte Carlo Transport—*Braxton S. Cuneo (Seattle Univ.), Ilham Variansyah (Oregon State)*



#### 427 Computational Methods and Mathematical Modeling

- 428 Development of Verification Methodology for Thermo-Mechanical Solver of MERCURY Fuel Performance Code—*Dong-hwa Lee (KAERI), Sung-Uk Lee (KAERI), Hyochan Kim (KAERI)*
- 432 Influence of Variance Reduction Techniques on the Wrong Results Obtained from Monte Carlo Radiation Transport Simulations when Random Number Stride is Exceeded—*Arief Rahman Hakim (Ulsan Nat'l Institute Science and Technology), Wooil Lee (Ulsan Nat'l Institute Science and Technology), Douglas A. Fynan (Ulsan Nat'l Institute Science and Technology)*
- 436 FMI-Based Multi-Fidelity and Multi-Scale Simulations of a Nuclear Reactor—*Thomas Guilbaud (École Polytechnique Fédérale de Lausanne), Carlo Fiorina (TAMU), Alessandro Scolaro (École Polytechnique Fédérale de Lausanne), Andreas Pautz (École Polytechnique Fédérale de Lausanne)*
- 440 Wrong Results when Random Number Stride is Exceeded in Monte Carlo Radiation Transport: Reanalysis of Legacy Stride Exceedance Study—*Arief Rahman Hakim (Ulsan Nat'l Institute Science and Technology), Douglas A. Fynan (Ulsan Nat'l Institute Science and Technology)*
- 444 Uncertainty Estimation by Correlated Sampling for the Neutronics Analysis of Sodium-Cooled Fast Reactors by the iDTMC Methodology—*Sunjoon Yoon (KAIST), Inyup Kim (KAIST), Taesuk Oh (KAIST), Yonghee Kim (KAIST)*

#### 449 Uncertainty Quantification, Sensitivity Analysis, and Machine Learning

- 450 Uncertainty Analysis on the Pump Flow Transient Phenomena in the Molten Salt Reactor Experiment—*Mohamed H. Elhareef (Virginia Commonwealth Univ.), Zeyun Wu (Virginia Commonwealth Univ.)*
- 454 The Effect of the State-of-Knowledge Correlation in PSA Depending on the Type of Uncertainty Distributions—*Gyun Seob Song (Chung-Ang Univ.), Man Cheol Kim (Chung-Ang Univ.)*
- 456 Optimization and Analysis of LSTM-Based Surrogate Modeling of Metallic Nuclear Fuels—*James Daniell (Missouri Univ. Science and Technology), Kazuma Kobayashi (Univ. Illinois, Urbana-Champaign), Syed Bahauddin Alam (Univ. Illinois, Urbana-Champaign), Ayodeji Alajo (Missouri Univ. Science and Technology)*
- 460 Predicting Heat Release Rates of Electrical Enclosures Using Machine Learning—*Elvan Sahin (Virginia Tech), Brian Y. Lattimer (Virginia Tech), Juliana P. Duarte (Univ. Wisconsin, Madison)*

#### 465 Mathematics and Computation: General

- 466 A Study on Simplified Energy and Geometry-Based MC for Recurring Equivalence to Continuous Energy MC—*Inhyung Kim (Univ. California, Berkeley), Massimiliano Fratoni (Univ. California, Berkeley)*
- 470 Investigation of Doppler Broadening Methods Within the Shift Monte Carlo Radiation Transport Code—*Amanda M. Bachmann (ANL), Seth R. Johnson (ORNL), Shane W.D. Hart (ORNL), Elliott D. Biondo (ORNL), Thomas M. Evans (ORNL)*
- 474 Exploratory Data Analysis of Long-Term Meteorological Data at a DOE Site for Nuclear Safety—*Xiao-Ying Yu (ORNL)*
- 479 Implementation and Verification of Element-Wise Density and Temperature Specifications in MCNP6 Unstructured Mesh Simulations—*Pablo A. Vaquer (LANL), Michael E. Rising (LANL), Joel A. Kulesza (LANL), Colin A. Weaver (LANL)*
- 483 New and Improved Capabilities in SCALE's Monte Carlo Code Shift—*Tara Pandya (ORNL), Tarek Ghaddar (ORNL), Matthew Jessee (ORNL), Rike Bostelmann (ORNL), Steven Hamilton (ORNL), Seth Johnson (ORNL)*
- 484 Evolutionary Algorithm Fitting of X-Ray Fluorescence Data for Elemental Analysis—*Jason Clifford (ANL), Alexander Heifetz (ANL), Madis Michor (Univ. Illinois, Chicago), Mark Schlossman (Univ. Illinois, Chicago)*

---

#### 485 Materials Science & Technology

##### 487 In-Pile Testing of Nuclear Fuels and Materials

- 488 Refining Absorber Shroud Geometry to Maximize Power Output and Reduce Power Peaking in ATF Test Train—*Matilda Åberg Lindell (INL), Brian Durtschi (INL), David Kamerman (INL), Travis Labossiere-Hickman (INL)*
- 492 Fuel Safety Testing for Modern Fuel Research Programs at TREAT—*Colby Jensen (INL), Nicolas Woolstenhulme (INL), Jason Schulthess (INL), David Kamerman (INL), Daniel Wachs (INL)*
- 493 Dynamic System Scaling/Similarity Analysis of Accelerated Irradiation Testing of Uranium Dioxide Fuel—*Ian T. Ferguson (Oregon State), Tianyi Chen (Oregon State), Ramon K. Yoshiura (INL), Charles P. Folsom (INL), Daniel M. Wachs (INL)*
- 496 In Situ Cladding Surface Temperature Measurements During Simulated LOCA Transients—*Daniel C. Sweeney (ORNL), Mackenzie J. Ridley (ORNL), Samuel B. Bell (ORNL), Nathan A. Capps (ORNL)*

499 Impact of Stoichiometry and Radiation in Mesoscale Models of  $UO_2$  Densification—Brandon Battas (Univ. Florida), Michael R. Tonks (Univ. Florida), Michael Cooper (LANL)

### 501 Nuclear Fuels: I

502 Informing Bubble Evolution and Pulverization in  $UO_2$  with Lower Length Scale Simulations—M.W.D. Cooper (LANL), C. Matthews (LANL), D.A. Andersson (LANL)

503 Investigating the Dependence of Fracture Criteria on Microstructure in  $UO_2$  Using Atomic-Scale Simulations—Conor Galvin (LANL), David Andersson (LANL), Michael Cooper (LANL)

504 Diffusional Creep in  $UO_2$  Investigated by Atomic Scale Simulations—David Andersson (LANL), Conor Galvin (LANL), William Neilson (LANL), Pieterjan Robbe (Sandia), Michael Cooper (LANL)

505 Improved Simulation of  $UO_2$  Fuel Creep Deformation in LWR Fuel Elements—R.T. Sweet (INL), J.A. Hirschhorn (INL), C.O.T. Galvin (LANL), S.R. Novascone (INL)

509 The Effect of Porosity and Chemical Composition of Fuel Corrosion Product Deposit on its Thermal Conductivity—Hee-Sang Shim (KAERI), Hye Min Park (Defense Agency for Technology and Quality), Sang Yeob Lim (KAERI), Soon-Hyeok Jeon (KAERI), Do Haeng Hur (KAERI)

### 513 Nuclear Fuels: II

514 Current Status of Regulatory Fuel Research Progress in Korea—Yongsik Yang (KAERI), JangSoo Oh (KAERI), Jaeyong Kim (KAERI), Changhwan Shin (KAERI), Ju Yeop Park (Korea Institute of Nuclear Safety), Taewan Kim (Incheon Nat'l Univ.)

516 Quantitative Insights into the Fluidization of Surrogate Particle Fuel Forms—Bryan Conry (ORNL), Ryan Heldt (ORNL), Eddie Lopez-Honorato (ORNL), Elvis Dominguez-Ontiveros (ORNL), Tyler Gerczak (ORNL)

517 Incorporating a Risk-Informed, Performance-Based Process into Nuclear Fuel and Materials Development for Advanced Reactors—Sai Zhang (INL), Zhegang Ma (INL), Peng Xu (INL)

521 Numerical Analysis of Fluidized Bed Chemical Vapor Deposition of Pyrolytic Carbon for Tristructural-Isotropic (TRISO) Fuel Particles—Flavio Dal Forno Chuahy (ORNL), Oluwafemi Oyediji (ORNL), Eddie Lopez-Honorato (ORNL), Charles Finney (ORNL)

525 Development of TRISO Particle Fuel Performance Analysis Code TRIPLE—Jongho Park (Seoul Nat'l Univ.), Youho Lee (Seoul Nat'l Univ.)

528 Thermophysical Properties of a (U,Zr)C Solid Solution Fuel for Nuclear Thermal Propulsion—J. Schaeperkoetter (LANL), S. Widgeon Paisner (LANL), D. Byler (LANL), A. Gonzales (LANL), J. White (LANL), B. Taylor (Marshall Space Flight Center), J. Rosales (Marshall Space Flight Center), K. McClellan (LANL), E. Kardoulaki (LANL)

### 529 Accelerated Testing, Qualification, and Regulatory Acceptance of Fuels and Materials

530 Fuels and Materials Irradiation Testing Needs, Recent Progress, and Future Opportunities—Christian M. Petrie (ORNL), Richard H. Howard (ORNL), David Carpenter (MIT), Nicolas Woolstenhulme (INL)

531 Perspectives to Promote the Regulatory Acceptance of Combined Neutron, Ion, and Modeled Irradiation Data for Material Degradation in Nuclear Reactors—Stephen Taller (ORNL), Andrea Jokisaari (INL), Yiren Chen (ANL), Wei-Ying Chen (ANL), Rongjie Song (INL)

532 Parallel Irradiation Testing to Support Accelerated Down-Selection of Advanced Fuels—G.L. Beausoleil II (INL), Nic Woolstenhulme (INL), L. Capriotti (INL), S. Patnaik (INL), A. Nelson (ORNL), C. Petrie (ORNL), P. Doyle (ORNL), Jason Harp (ORNL)

533 High Impact Fuel Irradiation Testing Strategies Through International Frameworks—G.L. Beausoleil II (INL), D. Wachs (INL), C. Jensen (INL), D. Kamerman (INL), S. Holcombe (Lightbridge Corp.), M. Bales (Nuclear Energy Agency)

### 535 Nuclear Fuels: III

536 Accelerated Fuel Concept Screening via Neutronics and Thermal Hydraulics Modeling—Jacob P. Gorton (ORNL), Christian M. Petrie (ORNL), Nathan A. Capps (ORNL), Andrew T. Nelson (ORNL)

537 Effect of Threshold Parameter for Fuel Fragment Mobility on Fuel Relocation Model in FRAPTRAN—JangSoo Oh (KAERI), YongSik Yang (KAERI), Ju Yeop Park (Korea Institute of Nuclear Safety)

539 Historical, Contemporary, and Future Perspectives on Fuel Qualification—Mitch Mika (Univ. Florida), Assel Aitkaliyeva (Univ. Florida)

540 GIFT-1.0, Advanced Fuel Performance Code for LWR: Development and Multi-Physics Code Coupling Status—Kyuseok Shim (Seoul Nat'l Univ.), Youho Lee (Seoul Nat'l Univ.)

- 544 Mechanistic Fuel Performance Modeling of Uranium Nitride—*Jason Rizk (LANL), Michael Cooper (LANL), Pierre-Clement Simon (INL), Anton Schneider (LANL), Anders David Andersson (LANL), Stephen Novascone (INL), Christopher Matthews (LANL)*
- 545 Accelerating Fuels and Materials Research: I**
- 546 The Challenge of Innovation in Nuclear Fuel Development and Qualification—*Daniel Wachs (INL)*
- 549 Fission Accelerated Steady-State Post Irradiation Examinations of U-10Zr Metallic Fuel—*S. Patnaik (INL), G.L. Beausoleil II (INL), Alexander L. Swearingen (INL), Jacob A. Hirschhorn (INL), L. Capriotti (INL)*
- 551 Pre-Transient Characterization of Historic EBR-II Pins for Transient Testing—*Allison Probert (Univ. Florida), Jason Schulthess (INL), Luca Capriotti (INL), Assel Aitkaliyeva (Univ. Florida)*
- 552 Preparation of the Fast Modular Reactor Accelerated Fuel Testing—*Hangbok Choi (General Atomics Electromagnetic Systems), Oscar Gutierrez (General Atomics Electromagnetic Systems), John Bolin (General Atomics Electromagnetic Systems)*
- 553 Accelerating Fuels and Materials Research: II**
- 554 Integrated Approach to Post-Irradiation Examination of Nuclear Materials at Idaho National Laboratory—*Fabiola Cappia (INL), Daniel Murray (INL), Brandon Miller (INL), Grace Burke (INL), Jian Gan (INL), Aaron Craft (INL), Colin Judge (INL)*
- 555 In-situ TEM Observation of Dislocation Evolution in UN in Support of Accelerated Fuel Qualification—*E. Kardoulaki (LANL), M. Kosmidou (LANL), A. Terrabras (LANL), W. Chen (ANL), J. Rizk (LANL), T. Matthews (LANL), J. White (LANL)*
- 557 Void Surface Diffusion in  $\gamma$ -U-10Mo—*Gyuchul Park (ANL), Benjamin Beeler (NCSU), Bei Ye (ANL)*
- 558 Effect of Grain Structure and Zr Interdiffusion Layer on Gas Bubble Structure in Monolithic UMo Fuels—*Shenyang Hu (PNNL), Zirui Mao (PNNL), Benjamin Beeler (NCSU)*
- 559 Fuels and Materials for Fast Reactors**
- 560 Assessment of Local Thermal Conductivity and Microstructure of Ultra-Low Burnup U-20 wt% Pu- 10 wt% Zr Alloy—*Cynthia Adkins (INL), Ethan Hisle (INL), Daniele Salvato (INL), Assel Aitkaliyeva (Univ. Florida), Tiankai Yao (INL)*
- 561 Comparison of Porosity Distribution in U-Zr and U-Pu-Zr—*Mary Severt (Univ. Florida), Mitch Mika (Univ. Florida), Luca Capriotti (INL), Tiankai Yao (INL), Fei Xu (INL), Karen Wright (INL), Assel Aitkaliyeva (Univ. Florida)*
- 562 Advances in Metallic Fuel Database Development and Data Qualification—*Kun Mo (ANL), Aaron Oaks (ANL), Yinbin Miao (ANL), Dandan Zhang (ANL), Jason L. Schulthess (INL), Douglas L. Porter (INL), Abdellatif Yacout (ANL)*
- 566 Pulsed Neutron Characterization of Irradiated Fuels at LANSCE—*S.C. Vogel (LANL), James R. Angell (INL), T. Balke (Purdue Univ.), C.A. Bouman (Purdue Univ.), F. Cappia (INL), D.T. Carver (LANL), L. Capriotti (INL), A.E. Craft (INL), J. Harp (ORNL), P. Hoseman (Univ. California, Berkeley), E.J. Larson (LANL), A.M. Long (LANL), A.S. Losko (Technical Univ. Munich), K.J. McClellan (LANL), B.E. Wohlberg (LANL)*
- 567 Integral Experimental Investigations of Radioisotope Evaporation in Molten Lead for the Mechanistic Source Term Evaluation of Lead-Cooled Fast Reactor—*Malak Bani-Melhem (Univ. New Mexico), Michael Trombetta (Univ. New Mexico), Shuprio Ghosh (Univ. New Mexico), Jared Justice (Univ. New Mexico), Sung J. Lee (Fauske & Assoc.), Michael Epstein (Fauske & Assoc.), Emre Tatli (Westinghouse Electric Co.), Paolo Ferroni (Westinghouse Electric Co.), Osman Anderoglu (Univ. New Mexico)*
- 571 Accident Tolerant Fuels**
- 572 Assessment of DBA Limits of Coated ATF with Various Zirconium-Based Alloys and Coating Thickness with Steam Oxidation and Partial Zr-Cr Eutectic Melting—*SungHoon Joung (Seoul Nat'l Univ.), Youho Lee (Seoul Nat'l Univ.)*
- 576 Comparison of Thermal Response and Integrity of Cold Spray Cr-Coated and Uncoated ZIRLO Cladding Under the Multiple Quenching Tests—*WooHyun Jung (Univ. Wisconsin, Madison), Cole Dunbar (Univ. Wisconsin, Madison), Nicholas Fox (Univ. Wisconsin, Madison), Thomas Demo (Univ. Wisconsin, Madison), Robert Armstrong (Univ. Wisconsin, Madison), Kumar Sridharan (Univ. Wisconsin, Madison), Michael Corradini (Univ. Wisconsin, Madison), Hwasung Yeom (Univ. Wisconsin, Madison)*
- 580 High-Temperature Oxidation of Cr-Coated Zirconium Alloy: Effects of Cr Thickness and Heating Rate—*M. Steinbrueck (Karlsruhe Institute for Technology), M. Grosse (Karlsruhe Institute for Technology), D. Kim (Karlsruhe Institute for Technology), I. Lee (Karlsruhe Institute for Technology), U. Stegmaier (Karlsruhe Institute for Technology), C. Tang (Karlsruhe Institute for Technology)*
- 583 Ballooning, Post-Burst Oxidation and FFRD Investigation of Cr Coated ATF Cladding Using i-LOCA—*Hyunwoo Yook (Seoul Nat'l Univ.), SungHoon Joung (Seoul Nat'l Univ.), Youho Lee (Seoul Nat'l Univ.)*

- 586 Corrosion of FeCrAl in Low Temperature Steam and Operating Conditions—*Logan Joyce (Purdue Univ.), Peng Wang (Univ. Michigan), Rajnikant Umretiya (General Electric Research), Haozheng Qu (General Electric Research), Yi Xie (Purdue Univ.)*
- 589 Anomalous Heat and Isotopes in Low-Energy Nuclear Reaction Research and General**
- 590 Material Analysis of Anomalous Heat Experiments Using Hydrogen-Filled Nanometallic Composites—*Yasuhiro Iwamura (Tohoku Univ.), Takehiko Itoh (Tohoku Univ.), Shinobu Yamauchi (Clean Planet), Tomonori Takahashi (Clean Planet)*
- 594 Low Energy Nuclear Reactions in Highly Driven Light Water Electrolysis: From Circumstantial Evidence to Unambiguous Nuclear Signatures—*Ankit Kumar (Indian Institute of Technology Kanpur), Raviraj Nehra (Indian Institute of Technology Kanpur), Raj Ganesh Pala (Indian Institute of Technology Kanpur), K.P. Rajeev (Indian Institute of Technology Kanpur)*
- 596 Peculiar Phenomena Observed in Low-Energy Nuclear Reactors—*Bin-Juine Huang (Nat'l Taiwan Normal Univ.), Yu-Hsiang Pan (Advanced Thermal Devices), Po-Hsien Wu (Advanced Thermal Devices), Jong-Fu Yeh (Advanced Thermal Devices), Ming-Li Tso (Advanced Thermal Devices), Ying-Hung Liu (Advanced Thermal Devices), Litu Wu (Advanced Thermal Devices), Ching-Kang Huang (Advanced Thermal Devices), I-Fee Chen (Advanced Thermal Devices), Che-Hao Lin (Advanced Thermal Devices), T.R. Tseng (Mastek Technologies), Fang-Wei Kang (Mastek Technologies), Tan-Feng Tsai (Mastek Technologies), Kuan-Che Lan (Nat'l Tsing Hua Univ.), Yi-Tung Chen (Univ. Nevada, Las Vegas), Mou-Yung Liao (Nat'l Taiwan Univ.), Li Xu (Nat'l Taiwan Univ.), Sih-Li Chen (Nat'l Taiwan Univ.), Robert William Greenyer (Martin Fleischmann Memorial Project)*
- 600 Linear Flow Network Analysis of Resonator in Low-Energy Nuclear Reactor—*Mou-Yung Liao (Nat'l Taiwan Univ.), Bin-Juine Huang (Nat'l Taiwan Univ.), Li Xu (Nat'l Taiwan Univ.), Sih-Li Chen (Nat'l Taiwan Univ.), Yu-Hsiang Pan (Advanced Thermal Devices), Kuan-Che Lan (Nat'l Tsing Hua Univ.), Yi-Tung Chen (Univ. Nevada, Las Vegas)*
- 603 Hot Hydrogen Testing of Uranium Nitride Cermet for Nuclear Thermal Propulsion—*Benjamin Larson (Brigham Young Univ.), Jhonathan Rosales (NASA Marshall Space Flight Center), Brian Taylor (NASA Marshall Space Flight Center), Jason Reynolds (NASA Marshall Space Flight Center), Nathan Jerred (INL), Jamelle Williams (NASA Marshall Space Flight Center), Arne Croell (Univ. Alabama, Huntsville), Martin Volz (NASA Marshall Space Flight Center)*
- 609 Accelerating Fuels and Materials Research: III**
- 610 Designing Novel Metallic Fuels Systems Using Multi-Principal Element Alloys—*G.L. Beausoleil II (INL), J. Zelina (INL), T. Yao (INL), N. Woolstenhulme (INL), J. Zillenger (INL), B. Curnutt (INL), L. Hawkins (INL), A. Weiss (National Institute of Standards and Technology)*
- 611 Diffusion of Fission Product Lanthanides in HCP Zirconium via Vacancy-Mediated Transport—*Shehab Shousha (NCSU), Benjamin Beeler (NCSU), Larry Aagesen (INL), Boone Beausoleil (INL), Maria Okuniewski (Purdue Univ.)*
- 612 Hydrided Zircaloy-4 Cladding Failure Criteria During Reactivity-Initiated Accidents—*Katheren R.B. Nantes (Penn State), Miaomiao Jin (Penn State), Arthur T. Motta (Penn State)*
- 615 Multilayer Approach for Developing Ultra-Thin FCCI Barrier Coating—*Sumit Bhattacharya (ANL), Abdellatif M. Yacout (ANL)*
- 617 Irradiation Testing and Characterization Facilities: I and Lightning Talks**
- 618 Shielded Irradiation Facility Design for use in the High Flux Isotope Reactor—*Richard Howard (ORNL), Abby Till (ORNL), Zain Karriem (ORNL)*
- 619 Current Status of the AMIS Ion Irradiation Facility at Argonne—*Peter Mouche (ANL), Laura Jamison (ANL), Brahim Mustapha (ANL), Yinbin Miao (ANL), William Limestall (ANL), Abdellatif Yacout (ANL)*
- 620 Investigation of Gamma/Heavy Ion Irradiated Materials and Nuclear Graphite Studies by Use of Positron Annihilation—*Jagoda Urban-Klaehn (INL), Tianyi Chen (Oregon State), Jacy K. Conrad (INL), Arvin Cunningham (INL), Anne Gaffney (INL), Spencer Doran (Oregon State), Di Chen (INL), Milad Ghayoor (Oregon State), Somayeh Pasebani (Oregon State)*
- 624 Neutron PIE: Accelerating Post-Irradiation Examination with Advanced Neutron Imaging for Next-Gen. Nuclear Reactor Materials—*Alexander M. Long (LANL), Sven C. Vogel (LANL)*
- 625 Microstructural Properties of Laser Welded 304 Austenitic Steel in Underwater Environment—*Danbi Song (Korea Institute of Machinery and Materials), Sujin Lee (Korea Institute of Machinery and Materials), Jungsoo Choi (Korea Institute of Machinery and Materials), Induck Park (Korea Institute of Machinery and Materials)*
- 626 Application of CVD and CVI Techniques to Deposit ZrC Coatings on Complex Geometries—*Ryan Heldt (ORNL), Eddie Lopez-Honorato (ORNL), Tyler Gerczak (ORNL), Peter Doyle (ORNL), Grant Helmreich (ORNL), Katherine Montoya (ORNL), Dylan Richardson (ORNL)*



## 627 Actinide Science

- 628 Raman Investigation of MoF<sub>6</sub> Hydrolysis: A Non-Radiological Surrogate for UF<sub>6</sub> Hydrolysis—*Brandon T. Yost (SRNL), Louis Mcnamara (SRNL), Nicholas Groden (SRNL)*
- 629 Structural Transformations in Uranothorite Under Pressure—*Shinhyo Bang (Washington State), Andrew Strzelecki (LANL), Jason L. Baker (LANL), Nicolas Dacheux (ICSM), Hongwu Xu (LANL), Xiaofeng Guo (Washington State)*
- 633 Generation III <sup>238</sup>Pu Production Target Hydraulic Characterization—*Nick Russell (ORNL), Nolan Goth (ORNL), Richard Howard (ORNL), Jim Nash (ORNL)*
- 637 A Method Comparison for Releasing Trapped Radionuclides from Solid Matrices—*B.R. Hackett (PNNL), A.M. Whitehill (PNNL), E.K. Mace (PNNL)*

## 639 Irradiation Testing and Characterization Facilities: II

- 640 Applications of High Energy Heavy Ion Irradiation for Nuclear Fuels and Materials Accelerated Testing—*Abdellatif Yacout (ANL), Bei Ye (ANL), Kun Mo (ANL), Yinbin Miao (ANL), Sumit Bhattacharya (ANL), Laura Jamison (ANL), Peter Mouche (ANL)*
- 641 Post-Irradiation Analysis of Accelerator-Based High Energy Xe Ion Irradiation of U-10Mo—*Matthew J. Jasica (ANL), Peter A. Mouche (ANL), Laura M. Jamison (ANL), Abdellatif M. Yacout (ANL)*
- 642 In-Situ Ion Irradiation of a Spent UO<sub>2</sub> Fuel—*Sadman Sakib (NCSU), Yunyuan Lu (NCSU), Cameron B. Howard (INL), Chao Jiang (INL), Sudipta Biswas (INL), Dewen Yushu (INL), Jatuporn Burns (INL), Wei-Yeng Chen (ANL), Lingfeng He (NCSU)*
- 644 Highly Porous Resolidified Tungsten Microstructures Under Fusion-like High Heat Flux and Focused Ion Beam—*Minsuk Seo (LLNL), A. Leigh Winfrey (State Univ. New York Maritime College)*
- 647 Characterization of the Structural Changes of ZrB<sub>2</sub> Ceramics Under Heavy Ion Irradiation—*Narrie Loftus (Missouri Univ. Science and Technology), Joseph Graham (Missouri Univ. Science and Technology)*

## 649 Accelerating Development of Fuels and Materials for Molten Salt Reactors: I

- 650 Thermophysical Characterization of Molten Salt Reactor Fuels Through Experimentation and Semi-Empirical Modeling—*Anthony Birri (ORNL), Nicholas Termini (ORNL), Shane Henderson (ORNL), N. Dianne Bull Ezell (ORNL)*

- 651 Advancing Thermal Conductivity Measurement and Modeling for Molten Salts in Gen IV Nuclear Reactors—*Jacob Numbers (Brigham Young Univ.), Tyler Hamm (Brigham Young Univ.), Ryan Ruth (Brigham Young Univ.), Hunter Pitchford (Brigham Young Univ.), McKay Sumsion (Brigham Young Univ.), Noah Petersen (Brigham Young Univ.), Ben Wright (Brigham Young Univ.), Brian Merritt (Brigham Young Univ.), Crewse Petersen (Brigham Young Univ.), Max Colton (Brigham Young Univ.), Spencer Larson (Brigham Young Univ.), David Allred (Brigham Young Univ.), Anthony Birri (ORNL), Troy Munro (Brigham Young Univ.)*
- 652 Assessing Impurity Activity in 2LiF-BeF<sub>2</sub> Using a Transpiration Method—*Ryan C. Gallagher (Kairos Power), Jake Quincey (Kairos Power), Jacob W. McMurray (Kairos Power), Augustus Merwin (Kairos Power)*

## 653 Accelerating Development of Fuels and Materials for Molten Salt Reactors: II

- 654 Modeling Detector Response of the Massachusetts Institute of Technology Molten Salt Irradiation Flow Loop—*Seth Dayawansa (Univ. Texas, Austin), Kevin T. Clarno (Univ. Texas, Austin), Charles Forsberg (MIT), David Carpenter (MIT)*
- 657 A Hydrodynamic Model for Rotating Cylinder Electrodes in Molten Salts—*Ranon Fuller (Brigham Young Univ.), Devin Rappleye (Brigham Young Univ.)*
- 659 To Be or Not to Be: Identifying Non-Beryllium-Containing FLiBe Surrogates for Fusion and Fission—*L. Vergari (Univ. Illinois, Urbana-Champaign), Olivia Hunsberger (Univ. Illinois, Urbana-Champaign), G.S. Rakib (Univ. Illinois, Urbana-Champaign)*
- 660 Resilient Corrosion Barrier Coating to Protect Structural Components in Molten Salt Nuclear Reactors—*Sumit Bhattacharya (ANL), Yinbin Miao (ANL), Abdellatif Yacout (ANL)*

## 661 Environmental Degradation of Materials: I

- 662 The Assessment Component Materials Integrity of Secondary System in Long Term Atmospheric Environment—*Hyuk-Chul Kwon (Korea Hydro and Nuclear Power Co.), Cho-Rong Kim (Korea Hydro and Nuclear Power Co.), Kyu-Min Song (Korea Hydro and Nuclear Power Co.)*
- 664 Microstructure and Corrosion Behavior of Deformed Alloy 690 SG Tube in Secondary Side Crevice Environment—*Soon-Hyeok Jeon (KAERI), Ji-Young Han (KAERI), Hee-Sang Shim (KAERI), Sung-Woo Kim (KAERI)*
- 666 Characterization of Deformation Mechanisms of Irradiated Inconel 718 Using In-Situ SEM-EBSD Analysis—*Soyoung Kang (ORNL), Tim Lach (ORNL), David McClintock (ORNL), Maxim Gussev (ORNL)*

- 667 Recent Developments in the use of Mini-CT Specimens for Fracture Toughness Characterization of RPV Materials—*Mikhail A. Sokolov (ORNL)*
- 670 Electrical Cable Design and Selection in Advanced Reactor Environments—*Patrick Ward (Analysis and Measurement Services Corp.), Codi Ferree (Analysis and Measurement Services Corp.), Trevor Toll (Analysis and Measurement Services Corp.)*
- 675 Additive/Advanced Manufacturing: I**
- 676 Low-Pressure and Fluidized-Bed Chemical Vapor Deposition of PyC and ZrC for Space Nuclear Propulsion—*Eddie Lopez-Honorato (ORNL), Tyler J. Gerczak (ORNL), Ryan Heldt (ORNL), Grant W. Helmreich (ORNL), Katherine Montoya (ORNL), Peter Doyle (ORNL), William F. Cureton (ORNL), John D. Hunn (ORNL)*
- 679 Progress Toward In Situ Tempered, Additively Manufactured Ferritic-Martensitic Steels—*C.R. Lear (LANL), T.J. Lienert (Optomec), S.A. Maloy (PNNL)*
- 682 Counterfeit Prevention Using Thermal Imaging for Binder-Jet Printed Parts—*James Oti (Univ. Pittsburgh), Ryan Wassel (Univ. Pittsburgh), Jung-Kun Lee (Univ. Pittsburgh), Nikhil Bajaj (Univ. Pittsburgh)*
- 686 Development of a Hastelloy N-Based ODS Alloy Through Laser Powder-Bed Fusion (LPBF) Additive Manufacturing (AM)—*Ertugrul Demir (NCSU), Fedi Fehri (NCSU), Matt DeJong (NCSU), Sourabh Saptarshi (NCSU), Tim Horn (NCSU), Djamel Kaoumi (NCSU)*
- 687 Environmental Degradation of Materials: II**
- 688 Discovering Electrochemical Mechanisms for Moisture Induced Molten Salt Corrosion—*Yongfeng Zhang (Univ. Wisconsin, Madison), Anton Schneider (LANL), Ximeng Wang (Univ. Wisconsin, Madison), David Andersson (LANL)*
- 689 Miniaturized Testing Technique for Fracture Toughness Evaluation of Irradiated Materials—*T.S. Byun (ORNL), David A. Collins (ORNL), Sunday C. Aduloju (ORNL), Ben E. Garrison (ORNL), Annabelle G. Le Coq (ORNL), Kory D. Linton (ORNL)*
- 690 Correlating Damage with Acoustic Emission in Creeping 316 Stainless Steels—*Muhammad Khan (Univ. Illinois, Chicago), Chenxi Xu (Univ. Illinois, Chicago), Javier Obregon (Univ. Illinois, Chicago), Derek Kultgen (ANL), Alexander Heifetz (ANL), Didem Ozevin (Univ. Illinois, Chicago), Matthew Daly (Univ. Illinois, Chicago)*
- 692 Effect of Al Addition on the Microstructure and Radiation Response of Equiatomic CrFeMnNi and CrFeCuNi Alloys—*Saikumaran Ayyappan (NCSU), Kara Krogh (NCSU), Geoffrey Beausoleil (INL), Djamel Kaoumi (NCSU)*
- 693 Additive/Advanced Manufacturing: II and Machine Learning in Nuclear Materials**
- 694 Will Compositionally Complex Carbide Ceramics be Enabling Materials for Nuclear Energy Applications?—*Bai Cui (Univ. Nebraska, Lincoln), Fei Wang (Univ. Nebraska, Lincoln), Lanh Trinh (Univ. Nebraska, Lincoln), Kaustubh Bawane (INL), Zilong Hua (INL), Linu Malakka (INL), Lingfeng He (NCSU), Khalid Hattar (Univ. Tennessee, Knoxville), Luke Wadle (Univ. Nebraska, Lincoln), Yongfeng Lu (Univ. Nebraska, Lincoln)*
- 695 Simultaneous Corrosion/Irradiation Testing in Liquid Lead-Bismuth Eutectic (LBE) for FeCrAlY and FeNiCrAlNb Alloys—*Ertugrul Demir (NCSU), Saikumaran Ayyappan (NCSU), Weiyue Zhou (MIT), Michael P. Short (MIT), Djamel Kaoumi (NCSU)*
- 696 Creep Analysis of Passive Metallic Structures in Nuclear Reactors with Machine Learning—*Ugur Cotel (Purdue Univ.), Gabrielle Carrel (ANL), Lefteri H. Tsoukalas (Purdue Univ.), Alexander Heifetz (ANL)*
- 700 Fine-Tuned Machine Learning Interatomic Potentials for Predicting Radiation Damage Tolerance in V-Cr-Ti Alloys—*Myles G. Stapelberg (MIT), James Damewood (MIT), James Xu (MIT), Dennis Whyte (MIT), Michael P. Short (MIT)*
- 705 Accelerating Structural Material Development**
- 706 Irradiation and Corrosion Testing of Laser Powder Bed Fusion-Manufactured Materials in the Advanced Manufacturing and Materials Technologies Program—*Andrea M. Jokisaari (INL)*
- 707 On the Applicability of Miniature High-Throughput Scoping Specimens to Prototypic Laser Powder Bed Fusion 316HSS Component Geometries—*Caleb Massey (ORNL), Holden Hyer (ORNL), Amy Godfrey (ORNL), Josh Kendall (ORNL), Sebastien Dreypondt (ORNL), Amir Ziabari (ORNL)*
- 708 Effect of Heat Treatment on Microstructure and Mechanical Property of 316L Stainless Steel Produced by Laser Powder Bed Fusion—*Rongjie Song (INL), Michael Moorehead (INL), Xinchang Zhang (INL), Dewen Yushu (INL), Jia-Hong Ke (INL)*



709 Microstructural and Mechanical Property Heterogeneity as a Function of Processing Parameters and Post-Build Heat Treatment for Laser Powder Bed Fusion 316H Stainless Steel—*Geeta Kumari (ORNL), Selda Nayir (ORNL), Amy Godfrey (ORNL), David Collins (ORNL), Josh Kendall (ORNL), Chase Joslin (ORNL), Ryan Duncan (ORNL), Andres Marquez Rossy (ORNL), Amir Ziabari (ORNL), Peeyush Nandwana (ORNL), Caleb Massey (ORNL)*

## 711 Nuclear Criticality Safety

---

### 713 Sharing of Good Industry Practices and/or Lessons Learned in NCS

### 715 Innovation in Nuclear Criticality Safety

716 The PARADIGM Project: An Integral Experiment Optimized to Reduce Plutonium Intermediate Energy Nuclear Data Uncertainties—*T. Cutler (LANL), K. Amundson (LANL), P. Brain (LANL), M. Devlin (LANL), N. Gibson (LANL), J. Hutchinson (LANL), N. Kleedtke (LANL), R. Little (LANL), D. Neudecker (LANL), E. Williamson (LANL)*

720 Criticality Safety Support for Deactivated Facilities at Savannah River Site—*Tracy E. Stover (Savannah River Nuclear Solutions), David Lehner (Savannah River Nuclear Solutions)*

724 Nuclear Criticality Safety Considerations for Hydraulic Elevator Systems—*Adam Walker (Y-12 Nat'l Security Complex), Joshua Schwartz (Y-12 Nat'l Security Complex)*

727 Equivalency Factors and Mixed Isotope Subcritical Limits in H-Canyon—*R.M. Rice (Savannah River Nuclear Solutions), T.E. Stover (Savannah River Nuclear Solutions), N.P. Devine (Savannah River Nuclear Solutions), D. Randle (Savannah River Nuclear Solutions)*

### 731 Nuclear Criticality Safety: General I

732 How to Safely Build a Criticality Experiment with 100-plus Kilograms of Weapons-Grade Plutonium—*J. Hutchinson (LANL), T. Cutler (LANL), M. Grosskopf (LANL), D. Hayes (LANL), I. Michaud (LANL), T. Smith (LANL), N. Thompson (LANL), N. Wynne (LANL)*

736 Criticality Safety Calculations for Inadvertent PuF<sub>6</sub> Formation—*Brindley Wade (TAMU), Tracy E. Stover (Savannah River Nuclear Solutions)*

739 Nuclear Criticality Safety Co-Analyst Guide—*Zachary Jaczesko (Y-12 National Security Complex)*

742 On Estimating Uncertainty in Integral Benchmarks due to Inconsistencies in Geometrical Measurements—*Kathryn Worrell (Univ. Tennessee, Knoxville), Vladimir Sobes (Univ. Tennessee, Knoxville), William Marshall (ORNL)*

745 Zirconium Sludge Criticality Calculations in Large Process Tanks—*Brindley Wade (TAMU), Nathan Devine (Savannah River Nuclear Solutions)*

### 749 Nuclear Data Needs for Nuclear Criticality Safety and Advanced Reactor Concepts: I

750 Current Overview of Neutron Moderator Thermal Scattering Kernels for HALEU-Fueled Advanced Reactors—*Iyad I. Al-Qasir (ORNL), K. Lisa Reed (ORNL), W.J. Marshall (ORNL), Mathieu N. Dupont (ORNL), Chris W. Chapman (ORNL), Donny Hartanto (ORNL), Walid A. Metwally (ORNL), William A. Wieselquist (ORNL)*

754 Nuclear Data Sensitivity/Uncertainty Studies of Tantalum-Reflected Systems—*J. Hutchinson (LANL), R. Bulso (LANL), T. Cutler (LANL), N. Kleedtke (LANL), R. Little (LANL), I. Michaud (LANL), M. Rising (LANL)*

758 Data Assimilation Using Deterministic Sampling Method to Selectively Reduce Uncertainty due to Thermal Neutron Scattering Law for Light Water—*Yoshinari Harada (Nagoya Univ.), Hibiki Yamaguchi (Nagoya Univ.), Tomohiro Endo (Nagoya Univ.), Akio Yamamoto (Nagoya Univ.), Kenichi Tada (Japan Atomic Energy Agency)*

763 Neutronics Study of HTR-10: Impact of Graphite Porosity Representation in ENDF/B-VIII.1 TSLs—*Kemal Ramic (ORNL), Iyad Al-Qasir (ORNL), Friederike Bostelmann (ORNL), Chris W. Chapman (ORNL), Anne Campbell (ORNL), Kyle B. Grammer (ORNL), Zain Karriem (ORNL), Jose Ignacio Marquez Damian (European Spallation Source ERIC), Mark Baird (ORNL), Dorothea Wiarda (ORNL), Luke Daemen (ORNL), Eric Novak (ORNL), Jesse Brown (ORNL), Goran Arbanas (ORNL), Luiz Leal (ORNL), Germina Ilas (ORNL), William A. Wieselquist (ORNL)*

767 Cross-Section Sensitivity Studies on Sodium-Cooled Fast Neutron Reactor Isotopes—*A.C. Hellinger (PNNL), C.E. Goodson (PNNL), S.M. Lyons (PNNL)*

### 769 ANS-8 Standards Forum

### 771 Nuclear Data Needs for Nuclear Criticality Safety and Advanced Reactor Concepts: II

772 Nuclear Data Needs for MCFR Reactors—*T. Cisneros (TerraPower), M. Wargon (TerraPower)*

- 776 Design of Pre-Moderated Pulsed-Neutron Die-Away Experiments to Validate the Thermal Scattering Law of Beryllium—*Rida Rahman (Univ. Tennessee, Knoxville), Daniel Siefman (Univ. California, Berkeley), Ruby Araj (LLNL), Catherine Percher (LLNL), Vladimir Sobes (Univ. Tennessee, Knoxville)*
- 780 Bayesian Inference Re-estimation of  $9\text{Be}(\alpha, n)$  Cross Sections by Using Neutron Spectra Measurements—*Sylvain Bertholon (CEA), Anis Ben-Yelles (CEA), David Bernard (CEA)*
- 784 Review of Available Critical Experiments and Critical Experiments Facilities to Perform High-Assay Low-Enriched Uranium Fuel Transport Validation for Advanced Reactor Deployment—*M.N. Dupont (ORNL), K.L. Reed Fassino (ORNL), W.J. Marshall (ORNL), W.A. Metwally (ORNL), W.A. Wieselquist (ORNL)*
- 788 A Methodology for Validating the Evolution of Start-up Neutron Sources—*Anis Ben-Yelles (CEA)*
- 789 Nuclear Criticality Safety: General II**
- 790 Flattop-HEU Benchmark Reevaluation Summary—*Kristin Stolte (LANL), Theresa Cutler (LANL)*
- 794 Effect of Decay Time on Criticality Safety Analyses for High-Burnup and Extended Enrichment Fuels—*A.M. Shaw (ORNL), W.A. Metwally (ORNL), M.N. Dupont (ORNL), W.J. Marshall (ORNL), C. Celik (ORNL), V. Karriem (ORNL), A. Lang (ORNL), K.L. Reed (ORNL)*
- 798 A Resolved Resonance Evaluation for  $51\text{V}$  with Resonance Parameter Covariance—*Luiz Leal (ORNL), Goran Arbanas (ORNL), Nicolas Leclaire (IRSN), Klaus Guber (ORNL), Peter Schillebeeckx (EC, JRC-Geel), Stefan Kopecky (EC, JRC-Geel), Carlos Paradela (EC, JRC-Geel), Ettore Marcello Mafucci (Univ. degli Studi di Torino)*
- 802 HALEU (LEU+) Commercial LWR Fuel Fabrication at 8 wt. %  $^{235}\text{U}$ —*Lon E. Paulson (GE Hitachi Nuclear Energy), James F. DeGolyer (GE Hitachi Nuclear Energy), Brian K. Stone (GE Hitachi Nuclear Energy), David A. Eghbali (GE Hitachi Nuclear Energy), James E. Banfield (GE Hitachi Nuclear Energy), Joshua W. Thomas (GE Hitachi Nuclear Energy), Charles R. Priest (GE Hitachi Nuclear Energy), Ethan T. Reisker (GE Hitachi Nuclear Energy), Maddison C. Barber (GE Hitachi Nuclear Energy)*
- 806 Conducting MUSiC Modeling Studies—*W.J. Marshall (ORNL), M.T. Brandt (U.S. Naval Academy), L.M. Mulig (U.S. Naval Academy), T.M. Greene (ORNL), S.R. Blair (U.S. Naval Academy), A.M. Shaw (ORNL)*
- 811 Integration of NCS into Facility Maintenance**
- 813 Nuclear Criticality Safety: General III**
- 814 Impact of Increased Monte Carlo Parameters on Sensitivity Calculations with SCALE—*Travis M. Greene (ORNL), Kursat Bekar (ORNL)*
- 818 Jemima Plate Characterization—*J. Lamproe (LANL), K. Amundson (LANL), T. Cutler (LANL), K. Stolte (LANL)*
- 822 Investigating a Potential Hafnium Bias in SCALE—*T.M. Greene (ORNL), W.J. Marshall (ORNL), M.T. Brandt (U.S. Naval Academy), L.M. Mulig (U.S. Naval Academy), S.R. Blair (U.S. Naval Academy), A.M. Shaw (ORNL)*
- 826 Chlorine Worth Study and Nuclear Data—*Nicholas W. Thompson (LANL), Theresa Cutler (LANL), Kelsey Amundson (LANL), Jeffrey A. Favorite (LANL), Travis Grove (LANL), Jesson Hutchinson (LANL), Noah Kleedtke (LANL)*
- 830 ANS-8 Nuclear Criticality Safety Standards -- Are they Risk Informed, Performance Based?—*Douglas G. Bowen (ORNL)*
- 833 Nuclear Installations Safety**
- 
- 835 Nuclear Installations Safety: General I**
- 836 Aircraft Accident Analysis Using FAA Flight Track Data—*Mark Joseph (Navarro Research & Engineering), William Studniarz (Project Enhancement Corp.), Luis Jovel (Project Enhancement Corp.), Nancy Fujikado (LANL)*
- 840 Causality Extraction from Nuclear Licensee Event Reports Using a Hybrid Framework—*Shahidur Rahoman Sohag (Univ. Idaho), Sai Zhang (INL), Min Xian (Univ. Idaho), Shoukun Sun (Univ. Idaho), Fei Xu (INL), Zhegang Ma (INL)*
- 844 Postulating Transient Events for Molten Chloride Fast Reactors (MCFRs) with Application for Integrated Energy Systems (IESs)—*Emily V. Meilus (Univ. Tennessee, Knoxville), Nicholas R. Brown (Univ. Tennessee, Knoxville)*
- 847 Safety Considerations for Advanced Material Irradiation at the Advanced Test Reactor—*Daniel K. Sluder (INL), R. Duane Ball (INL), Nate S. Oldham (INL), Jacob L. Westcott (INL)*
- 849 Determination of Highest Radiation Exposure Work in Korean Pressurized Water Reactors by the Dose Normalization—*Changju Song (Chosun Univ.), Tae Young Kong (Chosun Univ.), Seungho Jo (Chosun Univ.), Jaeok Park (Chosun Univ.)*

## 851 Nuclear Installations Safety: General II

- 852 Guidelines for Designing Radiological Environmental Monitoring Programs for Nuclear Facilities—*Teresa Eddy (Savannah River Nuclear Solutions), Brooke Stagich (SRNL), Mike Stewart (DOE Office of Public Radiation Protection)*
- 854 RASTEP -- A Tool for Nuclear Emergency Response and Decision Making—*Manorma Kumar (Vysus Group), Sergey Galushin (Vysus Group)*
- 857 Preliminary Parametric Study of Microreactor EPZ—*Erik Hisahara (Penn State), Christopher Balbier (Penn State), Saya Lee (Penn State), Rohan Biwalkar (Pittsburgh Technical), Sola Talabi (Pittsburgh Technical)*
- 861 Doctor -- A Tool for Calculating Nuclear Activity Concentrations and Doses to Workers and the Public, Supporting Consequence Analyses—*Manorma Kumar (Vysus Group), Joakim Klug (Vysus Group)*
- 865 Best Practices Associated with Community Engagement Panels—*Thomas Jones (Pacific Gas and Electric Co.)*

## 867 Nuclear Nonproliferation Policy

### 869 HALEU and Nonproliferation

- 871 Past, Present, and Future of the Atomic Museum—**Las Vegas**
- 873 Science, Engineering, and Technology Supporting Nuclear Nonproliferation Efforts
- 874 Radiation Source Localization Algorithm in the Pedestrian Radiation Portal Monitor—*JungHyun Bae (ORNL), Robert Bean (ORNL), Kunal Mondal (ORNL), Stefano Tognini (ORNL), Alex Enders (ORNL), Rose Montgomery (ORNL)*
- 878 Simulation Framework for Cosmic Ray Muon Impact on Radiation Portal Monitors—*Stefano C. Tognini (ORNL), JungHyun Bae (ORNL), Robert Bean (ORNL), Alex Enders (ORNL), Kunal Mondal (ORNL), Rose Montgomery (ORNL)*
- 882 Uranium Oxide Production Pathway Classification Using Quantified Particle Morphology—*Edward Goodell (Univ. Utah), Glenn Sjoden (Univ. Utah), Luther McDonald (Univ. Utah), Kari Sentz (LANL)*
- 886 Believe it or Not -- HALEU is the First Step—*Benjamin S. Jordan (American Centrifuge Operating), David C. O'Keefe (American Centrifuge Operating), Sean E. Oehlbert (Centrus Energy)*
- 890 Technology Down-Selection for a Successful and Responsible Nuclear Energy Future—*Ross Matzkin-Bridger (Nuclear Threat Initiative)*

## 893 Operations & Power

### 895 Operations and Power: General and Lightning Talks

- 896 Testing Gears and Bearings for Fuel Handling Machines in Sodium Fast Reactors—*Alex Grannan (ANL), Edward Kent (ANL), Sasan Bakhtiari (ANL), Thomas Elmer (ANL), H.T. Chien (ANL), Chris Grandy (ANL)*
- 900 Operation and Security Considerations for Heat Pipe Cooled Microreactors—*Ilyas Yilgor (INL), Piyush Sabharwall (INL), Scott Ferrara (INL)*
- 904 Study of Parametric Fluctuations in Integral Reactor Configuration—*Hui-Yu Hsieh (TAMU), Pavel Tsvetkov (TAMU)*
- 908 Feasibility of Remote Monitoring of Microreactors Using Satellites and Leveraging Transfer Learning and Pre-trained Models—*Hui-Yu Hsieh (TAMU), Thabit Abuqudaira (TAMU), Pavel Tsvetkov (TAMU), Piyush Sabharwall (INL)*
- 912 100-30-100 Load Following Concept for a Typical PWR System with Increased Enrichment Fuel—*Isabelle O. Lindsay (Univ. Tennessee, Knoxville), Jamie B. Coble (Univ. Tennessee, Knoxville), Nicholas R. Brown (Univ. Tennessee, Knoxville)*
- 916 Mutual Gains from Diablo Canyon Extended Operations: Exploring the Nexus Between State Energy Needs, Federal Interests, the Commercial Nuclear Industry, and a Utility—*Tyson Smith (Pacific Gas and Electric Co.)*
- 917 Recent Advances in General Atomics Fast Modular Reactor Conceptual Design—*Hangbok Choi (General Atomics Electromagnetic Systems), John Bolin (General Atomics Electromagnetic Systems)*
- 919 Nuclear Energy Markets, Financing, Economics, and Policy
- 920 Q-Learning Empowered Economic Dispatch for Nuclear-Driven Integrated Energy Systems—*Athanasios Ioannis Arvanitidis (Univ. Texas, San Antonio), Miltiadis Alamaniotis (Univ. Texas, San Antonio)*
- 924 Quantifying Investment Risk: Analysis of the Purchase Decision of a Nuclear Power Plant—*Ryan Spangler (INL), Jason Hansen (INL), Erna Gevondyan (ANL), T.K. Kim (ANL)*
- 928 Cost Savings Through Power Controlled Critical Heat Flux Margin—*Assil Halimi (MIT), Koroush Shirvan (MIT)*
- 932 Using an Energy Justice Framework to Improve Regulatory Policy—*Gale E. Hauck (ORNL), Steven A. Arndt (ORNL)*

**937 Opportunities and Technical Characteristics of Power Upgrades for Existing Fleet**

**939 The Role of Civil Engineering in the Accelerated and Scaled Deployment of Nuclear**

---

**941 Radiation Protection & Shielding**

**943 Second Target Station Development at SNS and Accelerator Facilities**

944 Status of the Neutronics Design of the Second Target Station Project at the ORNL's Spallation Neutron Source—*Igor Remec (ORNL), Kristel Khoos (ORNL), Tucker McClanahan (ORNL), Ahmad Ibrahim (ORNL), Thomas Miller (ORNL), Kumar Mohindroo (ORNL), Vitaly Pronskikh (ORNL), Wouter de Wet (ORNL), Lukas Zavorka (ORNL)*

948 Simulation Studies of Prompt Dose Distribution in the Second Target Station Downstream Utilities Area—*Vitaly Pronskikh (ORNL), Thomas Miller (ORNL), Kumar Mohindroo (ORNL), Igor Remec (ORNL)*

951 Dose Rate Analyses of Accelerator Tunnel Shield Wall and Labyrinth—*Wouter de Wet (ORNL), Kumar Mohindroo (ORNL)*

955 Residual Dose Rates Analyses from Vent Lines Shield Block on the Target Cart at Spallation Neutron Source—*I.I. Popova (ORNL), F.X. Gallmeier (ORNL)*

959 Monte Carlo Graphical User Interface for Accelerator Applications—*Randolph Schwarz (PNNL), Mark Murphy (PNNL), David Wootan (PNNL)*

**961 SUSTAIN: Strategic Training of Adaptable and Integrated Nuclear Workforce**

**963 Computational Tools for Radiation Protection and Shielding**

964 MCNP6 Evaluation of Exposure Dose Rates from a <sup>252</sup>Cf-Based Neutron Irradiator for NAA—*Livia Fernandes Barros (MIT), Jiankai Yu (MIT), Michael Philip Short (MIT), Tolga Durak (MIT), Edward Lamere (MIT), Mitchell S. Galanek (MIT), Akmal Safarov (Samarkand State Univ.), Haruko M. Wainwright (MIT)*

968 Improvements on Oktavian Modeling with MCNP6.3—*Micky Dzur (LANL), Jerawan Armstrong (LANL), Chelsea D'Angelo (LANL)*

972 Automated Vector Analysis Using Particle Swarm Optimization—*John C. Stooksbury (Bechtel)*

976 Solution Grown Hybrid Halide Perovskite Single Crystals for Photon Detectors—*Kaleb Ayalew (Univ. Nevada, Las Vegas), Shea Tonkinson (Univ. New Mexico), Alexandria Ragsdale (Univ. New Mexico), Maya Narayanan Kutty (Univ. New Mexico), Ganesh Balakrishnan (Univ. New Mexico), Adam Hecht (Univ. New Mexico), Jaeyun Moon (Univ. Nevada, Las Vegas), Alexander Barzilov (Univ. Nevada, Las Vegas)*

980 Tempest™: A Monte Carlo Code for Radiation Transport with Combined Native CAD and CSG Geometries—*Carl Hughes (Orthrus Software), Peter Taylor (Orthrus Software), Daniel Cork (Cerberus Nuclear)*

981 Integrating AI Assistant Technology into Cyclone™ for Simplified MCNP® Syntax Generation—*Daniel Cork (Cerberus Nuclear), John Billingsley (Cerberus Nuclear), Tu Nguyen (Cerberus Nuclear), Andrew Smith (Cerberus Nuclear), Peter Taylor (Orthrus Software)*

---

**983 Reactor Physics**

**985 Overview of MARVEL Readiness**

**987 Reactor Physics: General**

988 Uncertainty Quantification of Critical Boron Concentration in Tihange-2 Reactor Core Tracking Analysis Using CASMO5/SIMULATE5 with JENDL-5—*Shigeki Shiba (Nuclear Regulation Authority)*

992 Heat Deposition Analysis of Target Materials in the High Flux Isotope Reactor for HEU and LEU Cores—*K.M. Burg (ORNL), D. Chandler (ORNL), J.W. Bae (ORNL), D. Hartanto (ORNL), Y.E. Robert (ORNL), C.W. Sizemore (ORNL)*

996 Monte Carlo Evaluation of Delayed Neutron Parameters for CANDU Reactor—*Zack Demers (Ontario Tech Univ.), Eleodor Nichita (Ontario Tech Univ.)*

1001 Sensitivity Analysis of the SCALE/Polaris-PARCS Code Procedure for Watts Bar Unit 1 and Peach Bottom Unit 2—*Kang Seog Kim (ORNL), William Gurecky (ORNL), Matthew A. Jessee (ORNL), William A. Wieselquist (ORNL)*

1005 Understanding the Sampling Algorithm for Watt Spectrum—*Jilang Miao (Penn State), Miaomiao Jin (Penn State)*

### 1009 Reactor Physics of Advanced Reactors I

- 1010 Reactivity Feedback Effect Analysis by Multi-Layer Reflector Temperature for Molten Salt Reactor—*Jinyoung Lee (Hyundai Engineering and Construction), Seung Yop Paek (Hyundai Engineering and Construction), Jihwan Kim (Hyundai Engineering and Construction), Jongwoo Lee (Hyundai Engineering and Construction), Inwon Jo (Hyundai Engineering and Construction), Young O. Kim (Hyundai Engineering and Construction)*
- 1014 A Physics Study for an Innovative Long-Life Small Molten Salt Fast Reactor (MSFR) for Ship Propulsion—*Youngjune Lee (KAIST), Eunhyug Lee (KAIST), Yonghee Kim (KAIST)*
- 1018 Fuel Doppler Coefficient of Reactivity in Highly Enriched Uranium-Fueled MSRs—*Ondrej Chvala (Univ. Tennessee, Knoxville), Kyra Lawson (Univ. Tennessee, Knoxville), Kevin Clarno (Univ. Texas, Austin)*
- 1022 Fast Chloride MSR Coefficients of Reactivity—*Kyra Lawson (Univ. Tennessee, Knoxville), Nicholas R. Brown (Univ. Tennessee, Knoxville)*

### 1025 Reactor Analysis Methods

- 1026 Subgroup Resonance Self-Shielding Method with Two-Term Functionalization for VERA-MPACT—*Kang Seog Kim (ORNL), Mehdi Asgari (ORNL)*
- 1030 Dancoff-Based Wigner-Seitz Approximation for the Embedded Self-Shielding Method in SCALE/Polaris—*Kang Seog Kim (ORNL), Matthew A. Jessee (ORNL), Andrew M. Holcomb (ORNL), William A. Wieselquist (ORNL)*
- 1034 Uncertainty Propagation for the Fission Matrix Method for the Molten Salt Fast Reactor—*Maximiliano Dalinger (Penn State), Elia Merzari (Penn State), William Walters (Penn State), Saya Lee (Penn State)*
- 1038 Development of an Analytical Fixed Source Solver for the 1D Multigroup SN Equations—*Jilang Miao (Penn State), Miaomiao Jin (Penn State)*
- 1042 3DBF -- A Diffusion Theory Code for Fast Reactor Calculations—*Randolph Schwarz (PNNL), David Wootan (PNNL), Dion Sunderland (PNNL), Ron Omberg (PNNL)*

### 1043 Advances in Reactor Design Methods

- 1044 Loading Pattern Optimization with Deep Learning and Monte-Carlo Tree Search—*Rikuto Kasama (Nagoya Univ.), Akio Yamamoto (Nagoya Univ.), Tomohiro Endo (Nagoya Univ.)*
- 1048 Impact of ENDF/B-VIII.0 Library on BR2 Depletion Calculations for Irradiation Testing of Low-Enriched Uranium Silicide Dispersion Fuel—*Andrei Rykhlevskii (ANL), Aurelien Bergeron (ANL), Francesc Puig (ANL), Jeremy Licht (ANL), Silva Kalcheva (SCK-CEN), Geert Van den Branden (SCK-CEN)*

- 1052 Honeycomb, an Effective Web Tool to Visualize and Edit Lattices—*Thomas Guilbaud (École Polytechnique Fédérale de Lausanne)*
- 1054 Coarse Mesh Iteration Approach for Analytical 1D Multigroup SN Eigenvalue Problems—*Jilang Miao (Penn State), Miaomiao Jin (Penn State)*
- 1058 Legendre Expansion for Scattering Anisotropy in Analytical 1D Multigroup SN Equations—*Jilang Miao (Penn State), Miaomiao Jin (Penn State)*

### 1063 Reactor Physics of Advanced Reactors II

- 1064 Direct Multi-Group Cross-Sections via NJOY/ETEN for TRISO Fuel Compacts—*Taylor S. Kimball (Univ. Utah), Glenn E. Sjoden (Univ. Utah), Meng-Jen (Vince) Wang (Univ. Nevada, Las Vegas)*
- 1068 Exploring the Effect of the Number of Groups of Delayed Neutron Precursors in Reactor Dynamics Simulations of Molten Salt Reactors—*Thabit Abuqudaira (TAMU), Pavel Tsvetkov (TAMU), Piyush Sabharwall (INL)*
- 1072 A Note on Using Poisons to Improve MTC in Metal Hydride-Moderated Reactors—*Zuolong Zhu (Ohio State), Dean Wang (Ohio State)*
- 1076 Feasibility of Enhancing Neutron Moderation in Nuclear Thermal Propulsion Reactor by Using Synthetic Diamond—*Reem Alnuaimi (KAIST), Paolo Venneri (Ultra Safe Nuclear Corp.), Yonghee Kim (KAIST)*

### 1081 Research Reactors in Support of Advanced Reactors R&D

- 1082 Preliminary Design Scoping for MITR-III—*Sara Hauptman (MIT), Jacopo Buongiorno (MIT), Aaron Craft (INL), Koroush Shirvan (MIT), Lin-wen Hu (MIT), Gordon Kohse (MIT), Lance Snead (MIT), Benoit Forget (MIT)*
- 1086 Direct Energy Conversion from Complex-Structured NLTPs Using TRIGA Reactor Pulses—*Austin Lo (GenAlpha Nuclear Technologies), William Charlton (Univ. Texas, Austin)*
- 1090 Application of OpenFOAM to Research Reactor Modelling: Validation Against the TRIGA Mark II Reactor—*E. Cervi (Politecnico di Milano), K. Routsonis (Nuclear Research and Consultancy Group), V. Habiyaremye (Nuclear Research and Consultancy Group), F. Roelofs (Nuclear Research and Consultancy Group), Antonio Cammi (Politecnico di Milano)*
- 1094 Development and Validation of a Three-Dimensional Griffin Model of the Advanced Test Reactor—*Mark D. DeHart (INL), Khang H.N. Nguyen (NCSSU), Joshua T. Hanophy (INL), Yaqi Wang (INL)*



## 1099 Reactor Physics Design, Validation and Operational Experience

- 1100 Consideration of Design Based Uncertainties in TREAT Reactor Control Mechanisms During Steady-State Operation—*Ishita Trivedi (INL), Sebastian Schunert (INL), Mark DeHart (INL)*
- 1104 Benchmark Calculations for Turkey Point Unit 3 and Surry Unit 1 Using the SCALE/Polaris-PARCS Procedure—*Byoung-kyu Jeon (ORNL), Kang Seog Kim (ORNL), Andrew M. Ward (Univ. Michigan), Ugur Mertuyurek (ORNL), Matthew A. Jessee (ORNL), William A. Wieselquist (ORNL)*
- 1108 Sensitivity and Validation Studies of Plutonium-238 Production with Shift and ORIGEN—*D. Chandler (ORNL), D. Hartanto (ORNL), J.W. Bae (ORNL), K.M. Burg (ORNL), Y.E. Robert (ORNL)*
- 1112 Preliminary Neutronics Analysis of Mixed HEU-LEU Transition Cores for the Massachusetts Institute of Technology Reactor—*Kyle Anderson (ANL), Alberto Talamo (ANL), Tyler Sumner (ANL), Sero Yang (ANL), Walid Mohamed (ANL), Lin-wen Hu (MIT), Erik Wilson (ANL)*

---

## 1117 Robotics & Remote Systems

### 1119 Robotics in Hazardous Environments

### 1121 Advancement of Robots and Intelligent Machines for Nuclear Power Plants Inspection and Maintenance

---

## 1123 Thermal Hydraulics

### 1125 General Thermal Hydraulics: I

- 1126 Uncertainties for In-Reactor Testing of Tritium Loaded Getters with Temperature Control—*Mie Azuma (PNNL), Nathan Carstens (PNNL), Kevin Anderson (PNNL), Robert Gates (PNNL)*
- 1130 Preliminary Experimental and Numerical Studies of Light-Core Vortex Rings—*Thien Duy Nguyen (ORNL), Nolan Goth (ORNL), Pablo Moresco (ORNL), Vincent Jodoin (ORNL), Vivek Rao (ORNL)*
- 1134 Identification of Relevant Dimensionless Parameters Using Buckingham Pi Analysis of Helical Rifled Tubes—*Ryan P. McGuire (Virginia Commonwealth Univ.), Sierra Tutwiler (Virginia Commonwealth Univ.), James Vulcanoff (Virginia Commonwealth Univ.), Lane B. Carasik (Virginia Commonwealth Univ.)*

1138 Scaling Sensitivity Analysis of PUMA Bottom Drain Line Break Accident—*Xueyan Zhang (Huazhong Univ. Science and Technology), Jun Yang (Huazhong Univ. Science and Technology)*

1141 Correlation Models of Radioactive Particle Deposition in Ventilation Ducts in Nonreactor Nuclear Facilities—*Daniel Orea (ORNL), Thien Duy Nguyen (ORNL), William McCarter (ORNL), Scott Nelson (ORNL), Joanna McFarlane (ORNL)*

### 1145 CFD and System Code Validation for HTGR Applications Leveraging HTTF Data

### 1147 Computational Thermal Hydraulics

- 1148 Parametric Study of the CHF Occurrence During RIAs for High Burnup Fuels.—*Luiz C. Aldeia Machado (Penn State), Elia Merzari (Penn State), Lise Charlot (INL)*
- 1152 Development of Segregated Thermal-Hydraulics Solvers in MOOSE—*Peter German (INL), Alexander D. Lindsay (INL), Mauricio E. Tano (INL), Guillaume L. Giudicelli (INL), Ramiro O. Freire (INL), Sebastian Schunert (INL)*
- 1156 Numerical Evaluation of Effective Thermal Conductivity of PCM with Metal Foam Incorporating Buoyancy Effects for Thermal Energy Storage—*Janghun Han (Hanyang Univ.), Junsoo Yoo (INL), Sunming Qin (INL), Minseop Song (Hanyang Univ.)*
- 1160 A Eulerian Framework for Modeling and Simulation of Particle Transport During Fuel Dispersal—*Avinash Moharana (Rensselaer Polytechnic Institute), Shanbin Shi (Rensselaer Polytechnic Institute)*
- 1164 Simulation of Pebble Bed Conduction Cooldown Using LIGGGHTS DEM Software Package—*Andres Gomez (Purdue Univ.), John Matulis (Purdue Univ.), Hitesh Bindra (Purdue Univ.)*
- 1168 Preliminary Analysis of Fluid-Structure Interaction Behavior for MITR LEU Fuel Elements—*M. Sharabi (ANL), C. Bojanowski (ANL), W. Mohamed (ANL), G. Wang (ANL), M. Sitek (ANL), K. Anderson (ANL), L.-W. Hu (MIT), E. Wilson (ANL)*

### 1173 Enabling Thermal Hydraulics Technologies for Digital Twins

### 1175 Verification, Validation, and Uncertainty Quantification of Machine Learning Models

### 1177 Computational Fluid Dynamics

- 1178 High-Fidelity Simulations of the Flow Instability in an Eccentric Annular Channel—*Carolina S.B. Dutra (Penn State), Tri Nguyen (Penn State), Elia Merzari (Penn State)*
- 1182 Update on HFIR Data Informed RANS Turbulence Modeling—*Emilian Popov (ORNL), Nicholas Mecham (NCSU)*



- 1187 Preliminary Computational Fluid Dynamics Analysis on Helical Cruciform Metal Fuel Subchannels for Enhanced Reactor Performance—*Hyeonggi Moon (Hanyang Univ.), Minseop Song (Hanyang Univ.)*
- 1191 VERTEX-CFD: A Multiphysics Solver—*Marc-Olivier Delchini (ORNL), Kellis C. Kincaid (ORNL), Doug Stefanski (ORNL), Ryan Glasby (ORNL), Franklin Curtis (ORNL)*
- 1195 Simulations of the Effects of Gap Width on Flow and Heat Transfer Characteristics for Twisted Tape Inserts—*Sierra A. Tutwiler (Virginia Commonwealth Univ.), Lane B. Carasik (Virginia Commonwealth Univ.)*
- 1199 Preliminary LES of Cross Flow in the GOKSTAD Experimental Tube Bundle—*Trevor C. Franklin (Virginia Commonwealth Univ.), Lane B. Carasik (Virginia Commonwealth Univ.)*
- 1203 Computational Two-Phase Flow**
- 1204 Simulations of Two-Phase Boiling Flow in a 5x5 Rod Bundle with Spacer Grids Under PWR Conditions—*Prasad Vegendla (ANL), Adrian Tentner (ANL)*
- 1208 Thermal-Hydraulic Analysis of the INL Boiling Water Reactor Test Facility Using RELAP5-3D©—*Andrew Prince (Oregon State), Izabela Gutowska (Oregon State), Wade Marcum (Oregon State), Nate Oldham (INL), Jason Barney (INL), Kendall Horman (INL), Brian Durtschi (INL), Joshua Graves (ORNL)*
- 1212 Modeling of Two-Phase Oscillatory Transient in a Large Scale RCCS with RELAP5-3D—*Zhiee Jhia Ooi (ANL), Qiuping Lv (ANL), Matthew Jasica (ANL), Rui Hu (ANL), Darius Lisowski (ANL)*
- 1216 Evaluating MARS-KS Code Performance for Predicting Density Wave Oscillation in Helical Tubes—*Seunghwan Oh (KAIST), Doh Hyeon Kim (KAIST), Jeong Ik Lee (KAIST)*
- 1220 ATF Pool Boiling CHF Predictions Using ML—*Bruno Pinheiro Serrao (Univ. Wisconsin, Madison), Eliot Ciuperca (Univ. Wisconsin, Madison), Juliana Pacheco Duarte (Univ. Wisconsin, Madison)*
- 1225 Experimental Thermal Hydraulics**
- 1226 Slug Bubbles in a Seawater Loop During Natural Circulation Oscillation—*Howard Y.K. Li (City Univ. Hong Kong), Gong Chen (City Univ. Hong Kong), Chin Pan (City Univ. Hong Kong)*
- 1230 A Test Facility for Experimental Investigation of Nucleate Boiling on an Inclined Surface—*Caleb Thompson (Penn State), Michael Riley (Penn State)*
- 1234 Parametric Study of Quenching Behavior of 316L Stainless Steel and ZIRLO Tubes in Simulated LOCA Reflood Conditions—*Nicolas Fox (Univ. Wisconsin, Madison), WooHyun Jung (Univ. Wisconsin, Madison), Cole Dunbar (Univ. Wisconsin, Madison), Thomas Demo (Univ. Wisconsin, Madison), Kumar Sridharan (Univ. Wisconsin, Madison), Michael Corradini (Univ. Wisconsin, Madison), Hwasung Yeom (Pohang Univ. Science and Technology)*
- 1238 High Temperature Fiber Optic Temperature Sensor Performance—*Chris Balbier (Penn State), Scout Bucks (Penn State), Saya Lee (Penn State)*
- 1243 Experimental Two-Phase Flow**
- 1244 Droplets Measurement with High-Speed Camera and Defocusing Method—*Ayden Cohn (Virginia Tech), Yang Liu (Virginia Tech), Shanbin Shi (Rensselaer Polytechnic Institute), Eymon Lan (Rensselaer Polytechnic Institute)*
- 1248 Drag Coefficient Characterization for Single Bubbles in Water—*Harold Valle Reyes (Univ. Puerto Rico, Mayagüez), Silvina Cancelos Mancini (Univ. Puerto Rico, Mayagüez)*
- 1252 Experimental Analysis of Air-Water Two-Phase Bubbly Flow Across a Vertical U-Bend—*Zhengting Quan (Purdue Univ.), Adam Dix (Purdue Univ.), Alicja Stoppel (Purdue Univ.), Seungjin Kim (Purdue Univ.)*
- 1256 Investigation of Two-Phase Pressure Drop Across a Vertical U-Bend—*Zhengting Quan (Purdue Univ.), Alicja Stoppel (Purdue Univ.), Seungjin Kim (Purdue Univ.)*
- 1261 Advanced Reactor Thermal Hydraulics: I**
- 1262 Integration of a Clad Damage Propagation Model into PRONGHORN-SC for Fast Reactors—*Aydin Karahan (ANL)*
- 1266 Investigation of Core Inlet Flow Distribution for the Westinghouse Lead Fast Reactor—*E. Tatli (Westinghouse Electric Co.), T. Loebig (Westinghouse Electric Co.), C. Stansbury (Westinghouse Electric Co.), P. Ferroni (Westinghouse Electric Co.)*
- 1270 Simulating Radionuclide Retention Experiment in Liquid Sodium Pools Using MELCOR Code—*Gabriel Dengler-Jeanblanc (Univ. Wisconsin, Madison), WooHyun Jung (Univ. Wisconsin, Madison), Michael Corradini (Univ. Wisconsin, Madison), Benjamin Lindley (Univ. Wisconsin, Madison)*
- 1274 Towards a 3D Multi-Physics Model of MSRE—*Ferry Roelofs (Nuclear Research & Consultancy Group), Victor Habiyaemye (Nuclear Research & Consultancy Group), Akshat Mathur (Nuclear Research & Consultancy Group), Heleen Uitslag-Doolaard (Nuclear Research & Consultancy Group)*

1278 Neutronics and Thermal Hydraulics Analysis of the Molten Salt Fast Reactor—*Casey Emler (Penn State), Elia Merzari (Penn State), Saya Lee (Penn State), William Walters (Penn State)*

### 1283 General Thermal Hydraulics: II

1284 Design of a Heat Pipe-Cooled MicroReactor Heat Exchanger for Open Air Brayton Cycle Application—*Brent Hollrah (TAMU), Yassin Hassan (TAMU)*

1288 Machine Learning for Gas Void Fraction Prediction in Two-Phase Flow—*Farnam Pournia (Univ. Tennessee, Knoxville), Robert Salko (ORNL), Xingang Zhao (ORNL)*

1292 Sensor Location Selection in Proper Orthogonal Decomposition Based Reduced Order Models—*Lucas San Martin (Purdue Univ.), John Matulis (Purdue Univ.), Hitesh Bindra (Purdue Univ.)*

1297 Development and Application of Quantitative Methods for Mixed Uncertainty—*Peng Cuiting (Huazhong Univ. Science and Technology), Hu Mengyan (Huazhong Univ. Science and Technology), Xiong Qingwen (Nuclear Power Institute of China), Yang Jun (Huazhong Univ. Science and Technology)*

1302 Scaling of Advanced Passive SMR—*Jun Liao (Westinghouse Electric Co.), Megan Durse (Westinghouse Electric Co.), Richard F. Wright (Westinghouse Electric Co.)*

### 1303 Advanced Reactor Thermal Hydraulics: II

1304 Preliminary Multi-Physics Analysis for Fast-Spectrum Molten Salt Reactor with BeO Reflector Using GeN-Foam—*Wooseong Park (KAIST), Yong Hoon Jeong (KAIST)*

1308 Implementation of Radiation in Cardinal Single Pebble Model—*Michael Seneca (Penn State), Haomin Yuan (ANL), Luiz Aldeia (Penn State), David Reger (Penn State), Tri Nguyen (Penn State), Elia Merzari (Penn State)*

1312 Reviewing Assumptions of the High Temperature Test Facility 2D Ring Model—*Roberto E. Fairhurst-Agosta (ANL), Zhihe Jhia Ooi (ANL), Thanh Hua (ANL), Ling Zou (ANL), Rui Hu (ANL)*

1316 Sensitivity Analysis of Depressurized Loss of Forced Cooling of Gas-Cooled Fast Modular Reactor Using MELCOR—*Seung Kyo Jung (Univ. Wisconsin, Madison), Woo Hyun Jung (Univ. Wisconsin, Madison), Michael Corradini (Univ. Wisconsin, Madison), Ben Lindley (Univ. Wisconsin, Madison), John Bolin (Univ. Wisconsin, Madison), Hangbok Choi (Univ. Wisconsin, Madison)*

1320 Effect of Heat Transfer Coefficient on Time to Onset of Natural Circulation—*Meredith Eaheart (Univ. Michigan), Nathan See (ORNL)*

---

### 1325 Young Members Group

1327 Backgrounds and Byways: Exploring Non-Nuclear Pathways into the Nuclear Industry

1329 Strengthening U.S./International Relationships Through Nuclear Energy