

# 4<sup>th</sup> Annual Probabilistic Flood Hazard Assessment Workshop

April 30 - May 2, 2019

U.S. NRC Headquarters, Rockville, Maryland

On April 30 - May 2, 2019, the Nuclear Regulatory Commission's Office of Nuclear Regulatory Research (NRC/RES) will host the 4th Annual NRC Probabilistic Flood Hazard Assessment (PFHA) Research Workshop at NRC headquarters in Rockville, Maryland. Staff and contractors from NRC, Electric Power Research Institute (EPRI), federal agencies, industry, and other organizations involved in flood hazard assessment, flood risk assessment, and flood protection/mitigation research will provide information on recent results, current activities, and perspectives on future research directions. This three-day workshop is open to the public at no charge, but registration is required.

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## AGENDA: TUESDAY, APRIL 30, 2019

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09:00 – 09:10 Welcome & Logistics

### Session 1A: Introduction

Session Chair: *Meredith Carr, NRC/RES*

09:10 – 09:25	Introduction <i>Raymond Furstenau*</i> , Director, Office of Nuclear Regulatory Research	1A-1
09:25 – 09:45	NRC Flooding Research Program Overview <i>Joseph Kanney*</i> , <i>Meredith Carr</i> , <i>Tom Aird</i> , <i>Elena Yegorova</i> , <i>Mark Fuhrmann</i> & <i>Jacob Philip</i> , NRC/RES	1A-2
09:45 – 10:05	EPRI Flooding Research Program Overview <i>Marko Randelovic*</i> , Electric Power Research Institute (EPRI)	1A-3
10:05 – 10:20	Nuclear energy Agency Working Group on External Events (WGEV) Flooding Overview <i>John Nakoski*</i> , NRC/RES	1A-4
10:20 – 10:35	<b>BREAK</b>	

\* denotes presenter, ^ denotes remote presenter

## Session 1B: Coastal Flooding

Session Chair: *Joseph Kanney, NRC/RES*

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|---------------|---|------|
| 10:35 – 11:05 | KEYNOTE: NWS Storm Surge Ensemble Guidance<br><i>Arthur Taylor*, NWS</i>  | 1B-1 |
| 11:05 – 11:30 | Advancements in Probabilistic Storm Surge Models and Uncertainty Quantification Using Gaussian Process Metamodeling<br><i>Norberto C. Nadal-Caraballo*, Victor M. Gonzalez, Alexandros Taflanidis, U.S. Army Corps of Engineers (USACE) R&amp;D Center, Coastal and Hydraulics Laboratory</i> | 1B-2 |
| 11:30 – 11:55 | Probabilistic Flood Hazard Assessment Using the Joint Probability Method for Hurricane Storm Surge<br><i>Michael B. Salisbury^ (EPRI Contractor, tentative)</i>   | 1B-3 |
| 11:55 – 12:20 | Assessment of Epistemic Uncertainty for Probabilistic Storm Surge Hazard Assessment using a Logic Tree Approach<br><i>Bin Wang*, GZA</i>  | 1B-4 |
| 12:20 – 13:00 | Coastal Flooding Panel  | 1B-5 |
| 13:00 – 14:00 | <b>LUNCH</b>  |      |

## Session 1C: Precipitation

Session Chair: *Elena Yegorova, NRC/RES*

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|---------------|---|------|
| 14:00 – 14:30 | KEYNOTE: Satellite Precipitation Estimates, GPM, and Extremes<br><i>George J. Huffman*, NASA/GSFC</i>   | 1C-1 |
| 14:30 – 14:55 | Hurricane Harvey Highlights: Need to Assess the Adequacy of Probable Maximum Precipitation Estimation Methods<br><i>Shih-Chieh Kao, Scott T. DeNeale, David B. Watson, ORNL</i>   | 1C-2 |
| 14:55 – 15:20 | Current Use of Reanalysis in Flood Hazard Assessments<br><i>Jason Caldwell *, USACE, Galveston District</i>   | 1C-3 |
| 15:20 – 15:35 | <b>BREAK</b>  |      |
| 15:35 – 16:00 | Current Capabilities for Developing Watershed Precipitation-Frequency Relationships and Storm-Related Inputs for Stochastic Flood Modeling for Use in Risk-Informed Decision-Making<br><i>M.G. Schaefer*, MGS Engineering Consultants, Inc.</i> | 1C-4 |
| 16:00 – 16:25 | Factors Affecting the Development of Precipitation Areal Reduction Factors<br><i>Shih-Chieh Kao*, Scott DeNeale, ORNL</i>   | 1C-5 |
| 16:25 – 17:05 | Precipitation Panel Discussion  | 1C-6 |
| 17:05 – 17:20 | <b>Daily Wrap-up</b>  |      |

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**AGENDA: WEDNESDAY, MAY 1, 2019**

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08:20 – 08:30 Day 2 Welcome

**Session 2A: Riverine Flooding**

Session Chairs: *Meredith Carr and Mark Fuhrmann, NRC/RES*

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|---------------|--|------|
| 08:30 – 9:00  | KEYNOTE: Using HEC-WAT to evaluate watershed level systems based risk<br><i>Will Lehmann, Lea Adams, Chris Dunn, USACE, Institute for Water Resources, Hydrologic Engineering Center (HEC)</i>   | 2A-1 |
| 09:00 – 09:25 | Global Sensitivity Analyses Applied to Riverine Flood Modeling<br><i>Vincent Rebour and Claire-Marie Duluc, Institut de radioprotection et de sûreté nucléaire (IRSN) Radioprotection and Nuclear Safety Institute</i>   | 2A-2 |
| 09:25 – 09:50 | Detection and attribution of flood change across the United States<br><i>Stacey A. Archfield*, Water Mission Area, U.S. Geological Survey</i>  | 2A-3 |
| 09:50 – 10:15 | Bulletin 17C Flood Frequency and Extrapolations for Dams and Nuclear Facilities<br><i>J. England*, USACE, Risk Management Center</i>   | 2A-4 |
| 10:15 – 10:35 | <b>BREAK</b>   |      |
| 10:35 – 11:00 | Riverine Paleoflood Analyses in Risk-Informed Decision Making: Improving Hydrologic Loading Input for USACE Dam Safety Evaluations<br><i>Keith Kelson*, USACE, Sacramento Dam Safety Production Center; Justin Pearce, USACE, Risk Management Center; Brian Hall, USACE, Dam Safety Modification Mandatory Center of Expertise</i> | 2A-5 |
| 11:00 – 11:25 | Improving Flood Frequency Analysis with a Multi-Millennial Record of Extreme Floods on the Tennessee River near Chattanooga, TN<br><i>Tess Harden*, Jim O'Connor &amp; Mackenzie Keith, U.S. Geological Survey</i>   | 2A-6 |
| 11:25 – 12:05 | Riverine Flooding Panel Discussion   |      |
| 12:05 – 13:25 | <b>LUNCH</b>   |      |

# 4<sup>th</sup> Annual Probabilistic Flood Hazard Assessment Workshop

## Session 2B: Modeling Frameworks

Session Chair: *Thomas Nicholson, NRC/RES*

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|---------------|--|------|
| 13:25 – 13:50 | Structured Hazard Assessment Committee Process for Flooding (SHAC-F) for Probabilistic Flood Hazard Assessment<br><i>Rajiv Prasad<sup>^</sup> &amp; Phillip Meyer, Pacific Northwest National Laboratory; Kevin Coppersmith, Coppersmith Consulting</i>  | 2B-1 |
| 13:50– 14:15  | Overview of the TVA PFHA Calculation System<br><i>Shaun Carney*, RTI International, Water Resource Management Division</i>   | 2B-2 |
| 14:15 – 14:40 | Development of Risk-Informed safety margin characterization framework for flooding of nuclear power plants<br><i>M.A. Andre, George Washington University; E. Ryan, Idaho State University, Idaho National Laboratory; S. Prescott*, Idaho National Laboratory; N. Montanari, R. Sampath, Centroc Lab; L. Lin, A. Gupta, N. Dinh, North Carolina State University; P.M. Bardet, George Washington University</i> | 2B-3 |
| 14:40 – 15:20 | Modeling Frameworks Panel Discussion   | 2B-4 |
| 15:20 – 15:35 | Daily Wrap-up  |      |

15:35 – 16:50

## Session 2C: Poster Session

Session Chair: *Meredith Carr, NRC/RES*

18:00

## Group Dinner: TBD

## **AGENDA: THURSDAY, MAY 2, 2019**

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08:20 – 08:30 Day 3 Welcome

## Session 3A: Climate and Non-stationarity

Session Chair: *Elena Yegorova, NRC/RES*

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| 08:30 – 09:00 | KEYNOTE: Hydroclimatic Extremes Trends and Projections: A View from the Fourth National Climate Assessment<br><i>Kenneth Kunkel*, North Carolina State University</i> | 3A-1 |
| 09:00 – 09:25 | Regional Climate Change Projections: Potential Impacts to Nuclear Facilities<br><i>L. Ruby Leung* &amp; Rajiv Prasad, Pacific Northwest National Laboratory</i>       | 3A-2 |
| 09:25 – 09:50 | Role of Climate Change/Variability in the 2017 Atlantic Hurricane Season<br><i>Young-Kwon Lim*, GSFC/NASA</i>   | 3A-3 |
| 9:50 – 10:30  | Climate Panel Discussion  | 3A-4 |
| 10:30 – 10:50 | <b>BREAK</b>  |      |

## Session 3B: Flood Protection and Plant Response

Session Chair: *Thomas Aird, NRC/RES*

10:50 – 11:15	Qualitative Risk Ranking Process of External Flood Penetration Seals <i>Marko Randelovic*, EPRI</i>	3B-1
11:15– 11:40	Results of Performance of Flood-Rated Penetration Seals Tests <i>William (Mark) Cummings, Fisher Engineering, Inc. (formerly Fire Risk Management, Inc.)</i>	3B-2
11:40– 12:05	Modeling Overtopping Erosion Tests of Zoned Rockfill Embankments <i>Tony Wahl^, U.S. Bureau of Reclamation</i>	3B-3
12:05– 12:45	Flood Protection and Plant Response Panel Discussion	3B-4
12:45 – 13:45	<b>LUNCH</b>	

## Session 3C: Towards External Flooding PRA

Session Chair: *Joseph Kanney, NRC/RES*

13:45 – 14:10	External Flooding PRA Walkdown Guidance <i>Marko Randelovic*, EPRI, Andrew Miller*, Jensen Hughes (tentative)</i>	3C-1
14:10 – 14:35	Updates on the Revision and Expansion of the External Flooding PRA Standard <i>Michelle(Shelby) Bensi*, University of Maryland (tentative)</i>	3C-2
14:35 – 15:00	Update on ANS-2.8: Probabilistic Evaluation of External Flood Hazards for Nuclear Facilities <i>Ray Schneider, Westinghouse (tentative)</i>	3C-3
15:00 – 15:25	Qualitative PRA Insights from Operational Events of External Floods and Other Storm-Related Hazards <i>Nathan Siu, Ian Gifford*, Zeechung (Gary) Wang, Meredith Carr and Joseph Kanney, NRC/RES</i>	3C-4
15:25 – 16:05	Towards External Flooding PRA Discussion Panel	3C-5
16:05 – 16:25	Wrap-up Discussion	