International Topical Meeting on Probabilistic Safety Assessment and Analysis (PSA 2017)

Pittsburgh, Pennsylvania, USA
24 - 28 September 2017

Volume 1 of 2
# TABLE OF CONTENTS

## VOLUME 1

### EXTERNAL EVENTS ANALYSIS

- Effective Use of PRA Walkdown Information for Integrated External Hazard Risk Model Development ................................................................. 1
  Richard Anoba
- Determination of River Water Level Exceedance Frequency Curves .............................................................................................................. 6
  G. M. Schoen, R. C. Hausherr, A. Ramezanian
- NPP Control Room Habitability Assessment Due to an Accidental Toxic Release from an External Event Applying Probabilistic Approach. Part I: Atmospheric Dispersion ................................................................................. 14
  Antonio Gomez, Guillem Cortes, Alfredo de Bilas
- A PSA for External Events Endangering Water Intake from the River Danube at NPP Paks ............................................................................. 21
  Tamas Siklosy, Attila Bareith

### HIGH WINDS PSA-I

- Integrated Use of Modeling and Simulation in High Winds PRA ....................................................................................................................... 30
  Stephen M. Hess, Steven Prescott, Curtis Smith, Linyu Lin, Niam Dinh, Ramprasad Sampath, Niels Montanari
- Plant Walkdown Guidance to Support High Winds Probabilistic Risk Assessments ..................................................................................... 40
  Nicholas Lovelace, Kelly Wright, Leo Shumley, Hassan Charkas
- Excessive Risk Conservatism in High Wind PRA ........................................................................................................................................ 49
  Mohammad Hadi Hadavi
- Improved Tornado Missile Risk Analysis Using Nonlinear Finite Element Analysis of Nuclear Power Plant Structures .................................................................................................................. 59
  Claudia Navarro-Northrup, Robert T. Bocchiere, Virginia Phan, Jeffrey C. Sciaudone, Lawrence A. Twisdale

### SEISMIC PSA - 1

- Methodology of Treatment of Multiple Failure Initiating Events for Seismic PRA (1) Establishment of Analysis Methodology and Trial Analysis of Core Damage Frequency ........................................................................................................ 68
  Yuki Kameko, Tatayuta Kanishi, Ken Muramatsu, Hitoshi Muta
- Quantification of Plant-Level HCLPF Capacity in PSA-Based SMA ..................................................................................................................... 74
  Claudia Picoco, Tunc Aldemir, Valentin Rychkov
- Insights from the Application of the Hybrid Approach to Seismic Human Reliability Analysis at the Oconee Nuclear Station .................................................................................................................................. 84
  Erin P. Collins, Elizabeth Cook, Scott Hollingsworth, David Garland, Russell Childs, Paul J. Amico
- Methodology of Treatment of Multiple Failure Initiating Events for Seismic PRA (2) Success Criteria Analysis for Multiple Pipe Break Accidents of a PWR ............................................................................................................ 92
  Tatayuta Kanishi, Hitoshi Muta, Ken Muramatsu, Yuki Kameko

### DYNAMIC PSA - I

- Dynamic Event Tree Generation With RAVEN-MAAP5 Using Finite State Machine System Models .................................................................................. 100
  Claudia Picoco, Tunc Aldemir, Valentin Rychkov
- Local Fusion of an Ensemble of Semi-Supervised Self Organizing Maps for Post-Processing Accidental Scenarios ......................................................... 107
  Francesco Di Maio, Roberta Rossetti, Enrico Zio
- IDPSA Approach to Assess the Potential of a Thermally Induced Steam Generator Tube Rupture ...................................................................................... 117
  Martina Kloos, Joerg Peschke
- Dynamic Approach on Multi-Unit Probabilistic Risk Assessment Using Continuous Markov and Monte Carlo Method ................................................................................................................ 125
  Brian Cohn, Richard Denning, Tunc Aldemir, Jien Hur, Halil Sezen
- Surrogate Model Selection in RAVEN for Seismic Dynamic PRA/PSA .................................................................................................................. 132
  Brian Cohn, Richard Denning, Tunc Aldemir, Jien Hur, Halil Sezen

### MODELING AND SIMULATION - I

- Implementation of the RCP SHIELD Seal Model in the Comanche Peak PRA .................................................................................................... 140
  Nathan Larson, Daniel Tirsun, Aaron Moreno
- Coupling Smoothed-Particle Hydrodynamics and Torricelli’s Law-Based Hydraulic Models for Flooding Risk Analysis ................................................................. 146
  Niels Montanari, Ramprasad Sampath, John E. Wegljan, Robert J. Wolfgang, Donald A. Dubbe, Curtis L. Smith, Steven Prescott
- Convolution Correction Factor Adjustments on Static PRA Models for Event Assessment .................................................................................. 156
  James Knudsen, Ted Wold, Steven Prescott, Curtis Smith, John A. Schroeder
Accidents, Near Misses, and Probabilistic Analysis: On the Use of CCDPs in Enterprise Risk Monitoring and Management ............................................................................................................................................................................ 163
Nathan Situ, Kevin Coyne, John Nakoski, Christopher Hunter

Global Importance Measure Methodology for Integrated Probabilistic Risk Assessment ............................................................................................................................................................................................................. 173
Tatsuya Sakurahara, Zahra Mohaghegh, Seyed Reisani, Ernest Kee

SEISMIC PSA - II

Richard Quittmeye, Miloš Bavec, Igor Riznar, Ali Fatehi, Jose E. Blanco, Paul C. Rizzo, Mojca Planinc

Correlation of Equipment Failures in Seismic PRAs ................................................................................................................................. 192
Robert W. Drsek, Sean A. McGhee, Lawrence A. Mangan, K. Raymond Fine, Eddie M. Guerra

An Original Approach to Derive Seismic Frailty Curves—Application to a PWR Main Steam Line ............................................................. 197
Nadia Rahni, Christophe Clement, Georges Nahas, Julien Clement, Lionel Vivan, Yves Guiguena, Emmanuel Raimond, Thomas Chartier, Marine Marcilhac, Thierry Yalamas

Seismic PRA Frailty Sensitivity Studies ............................................................................................................................................................................................. 205
Lawrence A. Mangan, Robert Drsek, Sean McGhee, K. Raymond Fine, Eddie M. Guerra

Seismic Evaluation of Auxiliary Buildings and Effects of 3D Locational Dynamic Response in SPRA ........................................................................................................................................................................................................ 211
June Hur, Eric Althoff, Halil Sezen, Yune Alden, Richard Denning

FIRE PSA - I

Lessons Learned Applying NRC-Approved Methods for Incipient Detection Credit in Fire PRA ...................................................................................................................................................................................................... 219
Richard Sprengle, Sam T. Leeng, F. William Etzel, K. Raymond Fine, Brian J. Krystek

Statistical Characterization of the Time to Reach Peak Heat Release Rate for Nuclear Power Plant Electrical Enclosure Fires ............................................................................................................................................................................. 225
Raymond H. V. Gallucci

Raymond H. V. Gallucci, Brian Metzger

HIGH WINDS PSA - II

An Estimation Method for Tornado Missile Strike Probability Under Assumption of Statistically Isotropic Tornado Path Directions .................................................................................................................................................................................................... 241
Yuzuru Eguchi, Soichiro Sugimoto, Yasuo Hattori, Takahiro Murakami, Hiromaru Hikouchi

Comparison of Tornado Missile Fragilities Developed Using TORMIS and Simplified Methods ....................................................................................................................................................................................................... 247
J. C. Sciaudone, L. A. Twisdale, T. B. Dombrosky, M. B. Hardy

High Wind PRA Key Insights and Uncertainties .................................................................................................................................................................................................................. 255
Nicholas Lovelace, Matt Johnson, Lawrence A. Twisdale Jr.

LPSD

Phenomena Identification Ranking Techniques (PIRT) for Determination of Low Power Shutdown PRA Priorities ..................................................................................................................................................................................................... 260
Garri Coles, Steve Short

Low Power and Shutdown PSA for High Temperature Gas-Cooled Reactor ........................................................................................................................................................................................................... 270
Tao Liu, Jiejuan Tong, Jun Zhao

Is Green Good Enough? Managing Shutdown Risk in Generation III+ Nuclear Power Plants ........................................................................................................................................................................................................... 275
Aaron Moreno, Nathan Larson, Ken Kiper

SEISMIC PSA - III

Qualitative Approach to Grasp Whole Risk Profile of Multi-Unit Site ........................................................................................................................................................................................................ 279
Haruhira Nomura, Yoshiyuki Narumuya, Kensuke Toyoshima, Satoshi Shinzaki, Masayuaki Hijiya, Akira Yamaguchi

Probabilistic Seismic Hazard Analyses—An Industry Professional’s Perspective ........................................................................................................................................................................................................... 289
Lawrence Salomone

Seismic Frailty Evaluation of Reinforced Concrete Walls with Arbitrary Shapes in Plan ........................................................................................................................................................................................................ 294
Enrique Bazan, Yigit Isbiliroglu, Bradley Yagla

RISK AGGREGATION - I

Data-Mining Approach for Validation of PSA Models ........................................................................................................................................................................................................ 302
G. Loskouv, P. Hellström, C. Karlsson

WGRISK Site-Level PSA Project: Status Update and Preliminary Insights for the Risk Aggregation Focus Area ........................................................................................................................................................................................................... 307
Smain Yalaoui, Yolande Akl, Marina Roesvekamp, Daniel Hudson
A Hierarchical Tree-Based Decision Making Approach for Assessing the Trustworthiness of Risk Assessment Models
Tasneem Bani-Mustafa, Nicola Pedroni, Enrico Zio, Dominique Vasseur, Francois Beaudouin

FIRE PSA - II
Tatsuya Sakurahara, Zahra Mohaghegh, Seyed Reihani, Ernie Kee
High Energy Arc Faults (HEAF) and Their Impact on PRA for a Nuclear Power Plant—Latest International Operating Experience and Research Activities
Marina Roewekamp, Nicholas Melly, Mark Henry Salley
Development of Fire PRA Guide for Japanese NPPs
Tsuyoshi Uchida, Yoshiyuki Zama, Hirohito Takeuchi, Shingo Oda, Kakujiro Kadaya, Daniel Funk, Mardy Kasarian

RISK-INFORMED DECISION MAKING - I
Donald Dube, Gareth Parry, Stuart Lewis, Doug True, Fernando Ferrante, James Chapman
Probabilistic Risk Assessment Usage in Support of Plant Operations and Management
Mark T. Cursey, Suzanne M. Loyd, Christopher Pupek, Gregory T. Zucal
Probabilistic Risk Assessment and Knowledge Management at the U.S. Nuclear Regulatory Commission
Suzanne Dennis

ATF
Assessing the Business Case for Accident Tolerant Fuel
Stephen M. Hess, Jeff R. Gabor, Jennifer L. Uhle, Tom Ellicson, Garrett Geiger
Estimating the Benefits of Accident Tolerant Fuel (ATF)
Raymond Schneider, N. Reed Labarge, Hans Van De Berg, Martin Van Halteren, Zeses Karoutas, Edward Lahoda
Risk Implication of Using Accident Tolerant Fuels in LWRs
Koroush Shirvan, C. R. Grantom

DATA AND PARAMETER ESTIMATION - I
Nonparametric Empirical Bayes Estimation Through Deconvolution in Probabilistic Risk Analysis
Andrei V. Gribok, Vivek Agarwal, Vaibhav Yadav
Methodology for Modeling Manual Valve Plugging Failures in PRA
J. R. Soniker, N. M. Passmore
Bayes, Data and NUREG CR-6928 Caveats
Carroll Trull, Nathan Larson, Craig Navas

HRA - I
Reassessment of Operator Actions Claimed in the Sizewell B Living PSA
Christopher Eames, John Collins
Human Reliability Analysis in CAP1400 Nuclear Power Plant
Yongqing Qu, Jiadong He, Juntao Hu, Yucheng Zhao, Jie He
Statistical Approaches to Estimation of Nominal HEPs Using Simulation Data
Yochan Kim, Inkysan Park, Wondea Jung
Lessons Learned in Fire PRA Human Reliability Analysis
Pierre Macheret, Nicholas Lovelace

RISK AGGREGATION - II
Beyond Basic Events: Measuring the Importance of Hidden PRA Items of Interest
Andrew Miller, Gregory Zucal
Multi-Hazard Risk Aggregation in Support of Risk-Informed Decision Making
Robert Boyer, Eric Thornsbury, Stanley Levinson, Andrea Maioli
Further Development of a Framework for Addressing Site Integrated Risk
Adriana Sivori, Kenneth Kiper, Andrea Maioli, David Teolis
Multi-Unit Accident Effects on Safety Goal Quantitative Health Objectives: Insights from a Two-Unit Case Study
Involving Two Representative U.S. Nuclear Power Plant Sites
Daniel Hudson, Mohammad Modarres
DYNAMIC PSA - II

Timed-Fault Tree Generation from Dynamic Flowgraph Method ................................................................. 472
Chuanming Zeng, Lixuan Lu

The ADS-IDAC Dynamic Platform with Dynamically Linked System Fault Trees ........................................... 482
Mihai A. Diaconeasa, Ali Mosleh

Development of Integrated Site Risk Using the Multi-Unit Dynamic Probabilistic Risk Assessment (MU-DPRA) Methodology.................................................. 492
Matthew Dennis, Mohammad Modarres, Ali Mosleh

SEISMIC PSA - IV

Systems-Based Seismic Contact Chatter Analysis .......................................................................................... 502
Eric Jorgenson, Robert Miller, Parthasarathy Chandran

Analysis and Examination for Developing Fault Displacement PRA Methodology ........................................... 506
Katsumi Ebitani, Hideaki Tsutsumi, Ryosuke Haraguchi, Kunihiko Sato, Futoshi Tanaka, Daisuke Ochi, Yoshihito Mihara, Shinichi Yoshida

In-Cabinet Amplification Factor for Relay Fragility Analysis in Seismic PRAs .................................................. 514
Stephen J. Eder, Kenneth Whitmore

Evaluation of Interfluence Between Adjacent Units in Seismic PRA .................................................................. 519
Shuai Matsuoka, Hiroshi Abe, Manabu Watanabe, Yoshihiro Oyama

DATA AND PARAMETER ESTIMATION - II

Estimation of Manually Recoverable Fraction of Common Cause Failures of Motor Operated Valves .................. 527
Young G. Jo

Handling Room Cooling in PRA ................................................................................................................... 535
Carroll Trull, Daniel Tirsun

Expert Elicitation Process for ISLOCA Modeling – Process, Representative Results, and Lessons Learned .......... 541
Steve Short, William Ivans

Treatment of Expert Opinion Diversity in Bayesian Belief Network Model for Nuclear Digital I&C Safety
Software Reliability Assessment .................................................................................................................. 551

Analysis on the Important Indicators in Bayesian Belief Network Model for RPS Software Reliability Assessment ........................................................................... 559
Sang Hun Lee, Hyun Gook Kang, Tsong-Lun Chu, Ahti Varattamaseni, Meng Yue, Jae Hyun Cho

RISK-INFORMED DECISION MAKING - II

Exelon Economic Enterprise Risk Modeling of a BWR ................................................................................ 567
Donald Dube, Brian Albinson, Robert Wolfgang, Michael Saunders, Gregory Krueger

PRA Insights Relating to the Loss of Electrical Sources—A WGRISK Survey .................................................. 572
Jeanne-Marie Lamore, François Corenwinde, Gabriel Georgescu, Attila Bureth, Kevin Coyne, Per Hellström, Milan Patrik, Marina Roevekamp

Risk Methodology for Assessment of Fuel Debris Retrieval Options at the Fukushima Daiichi Nuclear Power Station .................................................................................................................................................. 579
William Ivans, Bruce Napier, Eva Mart, Michael Smith, Sandra Snyder, Masahiko Kikumi, Mari Mariann Uematsu

Risk Analysis Framework for Severe Accident Mitigation Strategy in Nordic BWR: An Approach to
Communication and Decision Making .................................................................................................................. 587
Sergey Galushkin, Dmitry Grishchenko, Pavel Kudinov

Enhancing Safety Associated with Post Fukushima Modifications: Role of Risk-Informed Decision Making .......... 595
Sunil D. Weerakkody, Michael Montecalvo, Matthew Humberstone

RISK-INFORMED APPLICATIONS I

Implementation of a Risk-Informed Surveillance Frequency Control Program for the NextEra Energy Nuclear Fleet .................................................................................................................................................. 601
Anil Jukla, Loren Heistand, Thomas Morgan

Integrating Risk and Engineering Skills for 10 CFR 50.69 System Categorization ............................................. 606
Brian Nolan, David Passehl

Lessons Learned from Development of the 10 CFR 50.69 LAR for Exelon Plants Using the NEI Efficiency Bulletin
17-09 Template ................................................................................................................................................ 610
David Passehl, Barry Sloane, Shannon Rafferty-Czincila, Eugene Kelly, Philip Tarpinian

Insights from Exelon 50.69 Passive Categorization Pilot at Limerick Generation Station .................................. 615
David Bulwell, Maricarmen Tresler, Barry Sloane

10 CFR 50.69 Generic Categorization Process Development ............................................................................... 620
David Teolis, Ryan Griffin, Kyle Hope, Ogden Sawyer, Ralph Checkal
SEISMIC PSA - V

Integrating Physical Degradation Modeling Within the Seismic Fragility Analysis of Nuclear Power Plant Equipment ........................................................................................................................................................................................................625
WeiTang, SaiZhang

Relay Chatter in Seismic PRAs
Andrea Maioli, Clarence Worrell, David Gerlits, Steven Satter, Andrew Masiusnas, Mark Etre

How to Find Synergy Between Different Teams in a Seismic PRA Project
ParthasarathyChandran, PatrickFussell, AdamBlood

An Effective and Efficient Methodology to Update the Seismic Fragilities of SSCs over Different Seismic Hazard Updates ........................................................................................................................................................................................................646
BennyJebunaRatnagaran, ParthasarathyChandran, AdamBlood

Recent Advances in Seismic Fragilities for SPRAs
GregoryS. Hardy, RobertP. Kassawara, JohnRichards

RISK AGGREGATION - III

Spatio-Temporal Probabilistic Methodology and Computational Platform for Common Cause Failure Modeling in Risk Analysis ........................................................................................................................................................................................................658
TatsuyaSakurahara, GrantSchumock, TadashiMurase, ZahraMohaghegh, SeyedRehmani, ErnieKee

Issues in Dependency Modeling in Multi-Unit Seismic PRA
TaotaoZhou, MohammadModarres, EnriqueLopezDrogue

HUMAN FACTORS MODELING IN MULTI-UNIT SEISMIC DATA

Optimizing Human Performance Through Systems Engineering: Lessons from the UK Defence Sector ........................................................................................................................................................................................................676
KellyDavies, ClareBorras

Functional Allocation to Balance the Requirements of Humans and Automation ........................................................................................................................................................................................................682
LesAinsworth

LEVEL 2 AND LEVEL 3 PSA - I

Protective Systems: An Application of Regulatory Guidance for ECCS Sump Performance ........................................................................................................................................................................................................693
HaBui, TatsuyaSakurahara, Wen-ChiCheng, TimothyCrook, RodolfoVaghetto, MartinWortman, ZahraMohaghegh, SeyedRehmani, ErnieKee, DominicMatloz, DavidJohnson, WesSchulz, FatmaYilmaz, VeraMoiseytsve

Full Risk-Informed Resolution of the GSI-191: Simulations of LOCA Scenarios Using RELAP5-3D and MELCOR ........................................................................................................................................................................................................703
RodolfoVaghetto, ErnieKee, TimothyCrook, YassinHassan

Modeling of SiC Cladding Behavior During Severe Accidents ........................................................................................................................................................................................................711
Wisonguangdiatlok, PengXu

HIGH WINDS PSA - III

Progressive Failure of Building Cladding in High Winds ........................................................................................................................................................................................................721
SudhanS. Banik, LawrenceA. Twisdale, Jr., Peter J. Vickery, ShubhrajQuayyum

Fragility Analysis of Extreme Wind and Wind-Driven Rainwater ........................................................................................................................................................................................................730
Peter J. Vickery, Lawrence A. Twisdale Jr., Abby Liu, Sudhan Banik, ArturMironenko, Michael S. Kilan Jr., NicholasLovelace

Non-Parametric Method for Wind Pressure Fragility Analysis ........................................................................................................................................................................................................739
LawrenceA. Twisdale Jr.

SEISMIC PSA - VI

SPRA Alternate Screening Method ........................................................................................................................................................................................................750
WeiWang, SaiZhang

Seismic PSA of WWER440 Type Reactors in Slovakia ........................................................................................................................................................................................................757
ZoltanKovacs, RobertSpenlinger

Updates to the EPRI Seismic-Induced Fire and Flood Methodology Resulting from Pilot Application ........................................................................................................................................................................................................765
PaulAmico, PierreMacheret, RobertKassawara

VOLUME 2
RISK AGGREGATION - IV

Treating Common-Cause Failures in Multi-Unit PRAs
Sai Zhang, Jiejian Tong, Jing Wu

Parametric Estimation of Multi-Unit Dependencies
Tao Tao Zhou, Mohammad Modarres

Exploring the Need for Standard Approaches to Addressing Risk Associated with Multi-Module Operation in Plants Using Small Modular Reactors
Mark A. Caruso

CONFIDENCE ANALYSIS AND MODELING

Interpretation of PSA Results Using Semantic Analysis of Minimal Cutsets
Gennadi Loskoutov, Per Hellström

Uncertainty and Sensitivity Analysis of LSTF Small Break LOCA Tests Using RELAP5 and RAVEN
Ikuo Kinoshita, Cristian Rabiti, Andrea Alfonsi

Simple Method to Account for the State of Knowledge Correlation
Michael Lloyd, Jason Hall, Ross Anderson, David Teolis

CONFIGURATION RISK MANAGEMENT

Lessons Learned in the Development of an At-Power Risk Monitor for the AP1000® Plant
Nathan Larson, Rachel Christian

The Instantaneous LOOP Frequency
Ross C. Anderson, Jason Hall, Michael Lloyd

Lessons Learned from Incorporating Temporary Equipment into the Palo Verde Configuration Risk Management Program Using NEI 16-06
Michael Wittas, Michael Powell

RISK-INFORMED APPLICATIONS - II

Luyen D. Nguyen, John T. Kitzmiller

Centralization of Surveillance Frequency Control Program for Enhanced Efficiency
Nicholas C. Szansowski, Jenna Barr

Global Sensitivity Analysis to Rank Parameters of Stress Corrosion Cracking in the Spatio-Temporal Probabilistic Model of Loss of Coolant Accident Frequencies
Wen-Chi Cheng, Chenghao Ding, Nicholas O'Shea, Tatsuya Sakurahara, Grant Schumock, Zahra Mohaghegh, Seyed Reihani, Ernie Kee

PSA STANDARDS AND PEER REVIEWS

Insights Into New 2017 Revision of ASME/ANS PRA Standard Part 5—Seismic
Eddie M. Guerra, Andrea Maioli, Stephen Eder, Annie M. Kammerer

The Use of Comprehensive In-Process Peer Reviews in Support of the UK ABWR PSA Generic Design Assessment
Dennis Hennenke, Jonathan Li, Glen Seeman, Cassandra Ruch, Thomas Morgan, Eric Jorgenson

PRA Peer Review Finding Closure via Independent Assessment
David Passehl, Paul Amico, Barry Sloane, Jeffrey Stone, Larry Naron

HRA - II

Approach to Human Reliability Analysis for High Winds Events
Erin P. Collins, Elizabeth Cook

Final Conclusions and Lessons Learned from Testing the Integrated Human Event Analysis System for Nuclear Power Plant Internal Events At-Power Application
Huafei Liao, Stephanie Morrow, Gareth Parry, Dennis Bley, Lawrence Criscione, Mary Presley

Lessons Learned in HRA Dependency Analysis
Joshua S. Beckton, Mark Wilk

How Representative Are Our Quantitative Data on Performance Shaping Factors
Les Ainsworth
**Level 2 and Level 3 PSA - II**

- Likelihood that Short Term Station Blackout Scenarios Lead to a Large and Early Release ............................................... 934
  Donald E. Vanover, Robert J. Wolfgang
- Insights from MELCOR Independent Confirmatory Analyses for New Reactor Design Certification ........................................ 941
  Jason Schapero, Shawn Campbell, Marie Pohida
- Advanced Containment Design to Enhance Passive Safety Through Phoretic Deposition Phenomena—Preliminary
  Findings from Empirical Studies ................................................................. 946
  Seda Talabi
- Spatio-Temporal Socio-Technical Risk Analysis Methodology: An Application in Emergency Response .......................... 949
  Ha Bui, Justin Pence, Zahra Mohaghegh, Seyed Reisani, Ernie Kee

**Non-Light Water Reactor Safety**

- Development of a Design-Stage PRA for the Xe-100 ........................................................................................................... 959
  Alexander J. Hunting, Karl N. Fleming
- Evaluating Risk Measures for Non-LWR PSA ..................................................................................................................... 969
  Jonathan Li, Jordan Hagaman, Dennis Henneke, Gary Miller, Glen Seeman
- Identification of Research and Development Needs for Non-LWR PSA ............................................................................. 975
  Jordan Hagaman, Dennis Henneke, Gary Miller, Jonathan Li, Matt Warner, Jim Young
- Preliminary Functional Safety Assessment for Molten Salt Fast Reactors in the Framework of the Samofar Project ................. 980
  Anna Chiara Uggetti, Delphine Gérardin, Andrea Carignano, Sandra Dulla, Elsa Merle, Daniel Heuer, Axel Laureau, Michel Allibert

**Flooding PSA - I**

- Nuclear Power Plant Flooding due to a Dam Failure: Teachings ........................................................................................... 990
  Christelle Weber, Anne Dutfoy, Coraline Gaucher
- Revision and Expansion of ASME/ANS External Flooding PRA Standard ........................................................................ 996
  Michelle Bensi, Ray Schneider, Artur Mironenko, Suzanne Loyd, Zhegang Ma
- Modeling of Flooding Flow Rates Through Floor Drain Networks Using Mathcad ........................................................... 1003
  Robert J. Wolfgang
- Development of Internal Flooding PSA for New Build UK Generic Design Assessment .................................................... 1008
  Richard Derrett-Smith, Yuki Ishiwatari

**HRA - III**

- Timeline Development for Main Room Abandonment Human Reliability Analysis due to Fire Conditions .................... 1016
  Kaydee Kohlhepp Gunter, Jeffrey Julius, Erin Collins, Paul Amico, Mary Presley, Ashley Lindeman, Susan E. Cooper, Tammie Rivera, Stacey Hendrickson, John Wheatall
- Dynamicizing the SPAR-H Method: A Simplified Approach to Computation-Based Human Reliability Analysis .............. 1024
  Ronald Boring, Martin Rasmussen, Curtis Smith, Diego Mandelli, Sarah Ewing
- Implementation of FLEX Operator Actions in PRA Models .................................................................................................. 1032
  Parthasarathy Chandran, David L. Moore, John Reddington
- Human Reliability Analysis for Implementation of Incipient Fire Detectors in Fire PRAs .................................................... 1036
  Susan E. Cooper, Amy D’Agostino, Gabriel Taylor, Nicholas Melly
- Developing Human Reliability Analysis Guidance for Main Control Room Abandonment Scenarios in Fire PRA:
  What’s Different About Command and Control .................................................................................................................. 1045
  Susan E. Cooper, Stacey Hendrickson, John Wheatall, Jeff Julius, Mary Presley, Erin Collins, Kaydee Kohlhepp Gunter, Paul Amico, Ashley Lindeman, Tammie Rivera

**Dynamic PSA - III**

- A Dynamic Assessment of an Interfacing System Loss of Coolant Accident ................................................................. 1052
  Zachary K. Jankovsky, Matthew R. Denman, Tunc Aldemir
Estimation of Failure On-Demand Probability and Malfunction Rate Values in Cyber-Physical Systems of Nuclear Power Plants
Wei Wang, Francesco Di Maio, Enrico Zio

Research on Vital Digital Assets for Nuclear Cyber Security
Kookheui Kwon, Hyundoo Kim, Siwon Kim

Improvement of Vital Area Identification Method
Woo Sik Jung

FIRE PSA - IV

Nicholas Lovelace, Dane Lovelace, Brett Long, Daniel Fark

Moving Forward with Developed Fire PRA Models—A Model Owner’s Perspective
Young G. Jo

Is Fire Modeling Getting Better?—A Comparison of Recent Fire Dynamics Simulator Versions for Result Trends
Jeffrey D. Miller

Predictive Model of the Degradation of Cable Insulation Subject to Radiation and Temperature
Yuan-Shang Chang

The “Incredible” Difficulty of Proving “Incredibility”—Example of Fire-Induced Multiple Spurious Operations
Raymond H. V. Gallucci

PASSIVE SYSTEM SAFETY AND RELIABILITY

Comparative Assessment of Passive and Active Systems for the Development of Advanced Reactors
Luciano Burgazzi

A Mechanistic Reliability Assessment of RVACS and Metal Fuel Inherent Reactivity Feedback
David Grubskas, Acacia J. Brunett, Stefano Passerini, Austin Grelle

Mission Definition for a Passive Reliability Assessment of SMART Passive Residual Heat Removal System
Douglas A. Fynan, Yong Hun Jung, Jin Hee Park

Passive System Reliability Analysis Using APSRA+ Methodology and Its Application to Passive Isolation Condenser System of an Advanced Reactor
A. Chandrakar, A. K. Nayak, Vinod Gopika

SAFETY CULTURE AND ORGANIZATIONAL FACTORS

Data-Theoretic Methodology and Computational Platform for the Quantification of Organizational Mechanisms in Probabilistic Risk Assessment
Justin Pence, Yicheng Sun, Xuefeng Zhu, Zahra Mohaghegh, Cheri Ostroff, Ernie Kee

Employee Well-Being Framework to Facilitate a Total Safety Culture Within a Nuclear Power Plant
N. J. F. van Loggerenberg, Hester Nienaber

FLOODING PSA - II

A Case Study of Simulation-Based Dynamic Analysis Approach for Modeling Plant Response to Flooding Events
Zhegang Ma, Curtis Smith, Steven Prescott

Monte Carlo Simulations for Probabilistic Flood Hazard Assessment
Ahmed "Jamie" A. Dababneh, Mark A. Schwartz

Lessons Learned in the Development and Characterization of an External Flood Hazard for a Plant Site with Multiple Upstream Dams
Raymond Schneider, Gary Douglas, Jay Fluehr, H. A. Hackerott

OTHER EXTERNAL HAZARDS PSA

Hazard Curve Evaluation for Forest Fire Smoke Effects on Air-Cooling Decay Heat Removal Systems
Yasushi Ohtani, Hidenaka Yamamoto

Screening Approach for Systematically Considering Hazards and Hazard Combinations in PRA for a Nuclear Power Plant Site
Marina Raevekamp, Silvio Sperbeck, Gerhard Gaenssmantel

Analysis of the Risk of Aircraft Crash Hazard
James C. Lin