OVERVIEW OF THE PSA2017 MEETING

Presentation at the Panel on PSA-2017 American Nuclear Society Winter Meeting, Washington DC, November 2, 2017

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COPYRIGHT © 2017, M. Modarres MUPRA Research Summary in PSA-2017

Plenary Lecture and Special Session

- Plenary Lecture "Safety Culture and the One Reactor At a Time Mindset"—Karl Fleming
- Special Session "MUPRA Advances, Issues, Impediments and Promise"

17 Papers Were Directly Related to MUPRA in Technical Sessions

Categories of MUPRA Papers

- Review
- Methodology
- External hazard (mainly seismic)



Panelists



- 1. Mohammad Modarres (Chair)
- 2. George Apostolakis
- 3. Karl Fleming
- 4. Robert Budnitz
- 5. Nathan Siu
- 6. Carlos Lorencez
- 7. Ovidiu Coman





COPYRIGHT © 2017, M. Modarres Key Developments Discussed

1. International Workshop on Multi-Unit Probabilistic Safety Assessment

Ottawa, Ontario, Canada, November 17–20, 2014. Sponsored by the Canadian Nuclear Safety Commission (CNSC).

- 2. IAEA Initiatives:
- I. Safety Reports Series SR 8.5: TECHNICAL APPROACH TO PROBABILISTIC SAFETY ASSESSMENT FOR MULTI-UNITS
- II. IAEA TECDOC Methodology for Multi-Unit Probabilistic Safety Assessment

3. International PRA efforts: IAEA Case Study, U.S., Canada, S. Korea, France



Some Discussion Points at The Panel

- MUPRA Risk Metrics needed to augment reactor-based risk metrics
- Acceptable Risk Aggregation methods for comparison to safety goals don't exist
- MUPRA identifying important Site Risk Contributors
- MUPRA insights enhance the implementation of DiD principles
- Better understanding of Inter-Unit Dependency modeling is needed (human, fragility, cascading events)
- Activities at NRC, IAEA and multiple countries and specially Canada is encouraging
- Industry hesitations in usefulness and potential ramifications of the MUPRA techniques were raised
- Organizational root causes of Multi-Unit events discussed



Review Papers

- **Summarized research on the development of MUPRA from NRC perspective.**
- [15] Exploring the Need for Standard Approaches to Addressing Risk Associated with Multi-Module Operation in Plants Using Small Modular Reactors, Mark A Caruso (*NRC*)
- **Presented the status and preliminary insights of Site-Level PSA Project in Canada.**
- [6] WGRISK Site-Level PSA Project: Status Update and Preliminary Insights for the Risk
 Aggregation Focus Area, Smain Yalaoui, Yolande Akl (*Canadian Nucl Safety* Commission), Marina Roewekamp (*GRS*), Daniel Hudson (*NRC*)
- **Presented the insights regarding the MUPRA analysis of LOOP**
- [11] PRA Insights Relating to the Loss of Electrical Sources A WGRISK Survey, Jeanne-Marie Lanore, François Corenwinder, Gabriel Georgescu (IRSN), Attila Bareith (NUBIKI Nucl Safety Research Inst), Kevin Coyne (NRC), Per Hellström (Swedish Radiation Safety Authority), Milan Patrik (ÚJV REZ), Marina Roewekamp (GRS)



Methodology – Static & Dynamic

Static

- Qualitative Approach to Grasp Whole Risk Profile of Multi-Unit Site, Haruhiro Nomura, Yoshiyuki Narumiya (*Kansai Electric Power Co.*), Kensuke Toyoshima, Satoshi Shinzaki, Masayuki Hijiya (*Nucl Engineering, LTD*), Akira Yamaguchi (*Univ of Tokyo*)
- Further Development of a Framework for Addressing Site Integrated Risk, Adriana Sivori, Kenneth Kiper, Andrea Maioli, David Teolis (*Westinghouse*)

Dynamic

- Dynamic Approach on Multi-Unit Probabilistic Risk Assessment Using Continuous Markov and Monte Carlo Method, Sunghyon Jang, Akira Yamaguchi *(Univ of Tokyo)*
- **Dynamic PRA of a Multi-Unit Plant**, D Mandelli, C Parisi, A Alfonsi, D Maljovec, S St Germain, R Boring, S Ewing, C Smith, C Rabiti *(INL)*
- Development of Integrated Site Risk Using the Multi-Unit Dynamic Probabilistic Risk
 Assessment (MU-DPRA) Methodology, Matthew Dennis, Mohammad Modarres (Univ of Maryland), Ali
 Mosleh (UCLA)



COPYRIGHT © 2017, M. Modarres Methodology – Treatment of Multi-Unit CCF

- **Showed importance of inter-unit CCF and the conservatism using simplified MGL**
- Treating Common-Cause Failures in Multi-Unit PRAs, Sai Zhang, Jiejuan Tong (*Tsinghua Univ*), Jing Wu (*Huaneng Shandong Shidao Bay Nucl Power Co*)
- Proposed to exclude the CCFs not importance to risk based on the Risk
 Achievement Worth (RAW)
- Further Development of a Framework for Addressing Site Integrated Risk, Adriana Sivori, Kenneth Kiper, Andrea Maioli, David Teolis (*Westinghouse*)
- **Extended** and showed the parametric approach and results to Multi-Unit events
- Parametric Estimation of Multi-Unit Dependencies, Taotao Zhou, Mohammad Modarres (Univ of Maryland)



Methodology – Safety Goal

- **Q** Reviewed effects of Multiple Releases on U.S. Safety Goals QHOs
- 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 (NRC), Mohammad Modarres (Univ of Maryland)



External Hazards

- **Considered seismic dependency when evaluating multiple seismic-induced pipe ruptures**
- Methodology of Treatments of Multiple Failure Initiating Events for Seismic PRA (1) Establishment of Analysis Methodology and Trial Analysis of Core Damage Frequency, Yuki Kameko, Tatsuya Kunishi, Ken Muramatsu, Hitoshi Muta (*Tokyo City Univ*)
- **Evaluate the success criteria for multiple seismic-induce initiating event of pipe ruptures**
- Methodology of Treatment of Multiple Failure Initiating Events for Seismic PRA (2) Success Criteria Analysis for Multiple Pipe Break Accidents of a PWR, Tatsuya Kunishi, Hitoshi Muta, Ken Muramatsu, Yuki Kameko (Tokyo City Univ)
- **Identification and screening of hazard combinations**
- Screening Approach for Systematically Considering Hazards and Hazard Combinations in PRA for a Nuclear Power Plant Site, Marina Roewekamp, Silvio Sperbeck, Gerhard Gaenssmantel (GRS)
- **D** Provided insights on treatment of seismic failures correlation
- Correlation of Equipment Failures in Seismic PRAs, Robert W Drsek, Sean A McGhee, Lawrence A Mangan, K Raymond Fine (*FirstEnergy*), Eddie M Guerra (*RIZZO Associates*).
- Highlighted some issues regarding approaches to current seismic dependency modeling
- Issues in Dependency Modeling in Multi-Unit Seismic PRA, Taotao Zhou, Mohammad Modarres (Univ of Maryland), Enrique López Droguett (Univ of Maryland, Univ of Chile)
- Showed effects of radiation from adjacent plant. Perfect correlations in intra- and inter-unit dependencies
- Evaluation of Interinfluence Between Adjacent Units in Seismic PRA, Shuhei Matsunaka, Hiroshi Abe (*Tepco Systems Corp, Inc.*), Manabu Watanabe, Yoshihiro Oyama (*TEPCO Holdings, Inc.*)



PSA2019

ANS 16th International Conference on Probabilistic Safety Assessment & Analysis - PSA 2019

- Follows PSA 2017 (September 24-28, Pittsburgh, PA) and PSAM 14 (September 16-21, 2018, UCLA - Los Angeles, CA)
- Scheduled for April 28 May 3, 2019
- Organized by Savannah River and Columbia Sections of ANS
- Nuclear Installations Safety Division (NISD) major biennial
- Expect ~300 attendees;~40% International participation
- Supported by AECOM, SRNS, SCANA, & Southern Company technical staff





PSA2019 (Cont.)

PSA 2019 Conference Theme

Role of Probabilistic Methods in Understanding Uncertainties and Improving the Safety & Security of Nuclear Facilities and Activities



PSA2019

Position	Name	Affiliation
General Chair	Kevin O'Kula	AECOM Technical Services
Technical Program Advisory Board Chair	Professor Mohammad Modarres	University of Maryland
Assistant Technical Program Chair	Bonnie Shapiro	SRS/Savannah River Nuclear Solutions
University/Student Coordinator	Professor Travis Knight	University of South Carolina
Early Career Coordinator	Maeley Brown	AECOM Technical Services
Finance Chair Assistant	Damon Bryson John Dewes	V.G. Summer, SCANA SRNL
Arrangements	Matt Wargon	SCANA
Publications	ANS Headquarters/Tracy Stover	SRS/Savannah River Nuclear Solutions
Registration/Website	ANS Headquarters/Tinh Tran	AECOM Technical Services
Publicity	Phil Cupp	Retiree, Southern Company
Exhibits Chair	Duane Twinning	SCANA
Workshops	Kevin O'Kula	AECOM Technical Services
Tours and Events	April 30, 2019-Charleston Harbor Tour: Carl Fields and Linda Wright; May 1, 2019, Vogtle New Build: Karen Fili/Mike McCracken/TJ Corder May 1, 2019 – HLW SRS: To be determined	Retirees, URS and DOE SR Southern Company



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