

PSAM 12

Probabilistic Safety Assessment and Management

22-27 June 2014 • Sheraton Waikiki, Honolulu, Hawaii, USA

O'ahu



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Foreword

Dear Colleagues,

It is our honor to welcome you to Honolulu, Hawaii, for the twelfth rendition of the Probabilistic Safety Assessment and Management (PSAM) Conference. We have spent many years coordinating this meeting, and we hope that you take the time to participate in the conference events that we have planned, and that you spend a few days around the conference to enjoy the location. We know that many of you have brought your families along, as have we, and we wanted to assure you your families are safe while you are attending the conference. ☺

The planning for PSAM Honolulu began back in 2007 (before PSAM 9 in Hong Kong), when we looked at several locations around the United States, included Arizona, California, Boston, and even considered locations in Oceania. We decided on Honolulu before the world economy issues struck in 2008 due to its ability to attract, what we hoped, were new comers to the organization. We saw an organizational demographic that was clearly aging, and clearly we needed to find the leaders of the future. We felt that an enticing and exotic location Hawaii would be the perfect location to do that, and well, because we wanted to come to Hawaii!

So after many years of planning, our conference will begin on Sunday, June 22 in the evening with a small registration event. This will give you the opportunity to get your conference materials before the big opening on Monday, June 23. Although we will have registration open every day, all day, hopefully we can alleviate the rush by passing out as many registration materials as possible on Sunday.

Starting each day of the regular conference, will be a plenary session. We plan on having a variety of speakers from nuclear (the Honorable Dr. George Apostolakis and Dr. Shunsuke Kondo), environmental (Dr. Heather Bell and Mr. Ray Shirkhodai), financial (Mr. John O'Donnell) and medical (Dr. Sandeep "Bobby" Reddy). We also have a long list of social events for you to participate. On Monday evening we are planning a welcome reception for everyone hosted by Lloyd's Register. On Tuesday we will have the conference luncheon, with another plenary-type session presented by Mr. Jerzy Grynblat and Mr. Steve "Woody" Epstein. Wednesday will have the conference dinner, or in this case a luau, at the fabulous Royal Hawaiian, which is next door to the Sheraton Waikiki. Lastly, we will close our conference on Friday, June 27, at noon with our customary ice cream social, which will have an authentic Hawaiian flavor to it.

On behalf of the International Association for Probabilistic Safety Assessment and Management Board of Directors, we wish you all an enjoyable learning experience at the conference, a memorable stay in the Hawaiian Islands, and a safe journey home.

Dr. Curtis Smith
Technical Program Chairs

Dr. Todd Paulos
General Chair

Acknowledgement

I now feel for everyone who has ever coordinated and organized a major conference. Glad this is almost over...

The task of organizing any large meeting, conference, or event (I guess this is why my wife still talks to this day about that wedding planning thing), requires not just organizational skills, time, and effort, but the ability to coerce your friends into donating their lives as well. I would like to thank so many people who made all of this possible, it is difficult to know where to begin, so let me start with our corporate sponsors.



These are the companies that have donated resources on different levels, but our major sponsor is Lloyd's Register. For this PSAM conference, they are not only hosting the Welcome Reception for everyone, but they provide additional support by sending a large contingent to Honolulu, offer publicity, moral support, advice, help, and on occasion, Jerzy will buy me lunch. I would like to thank them for being a major sponsor 11 events running. I hope I do not miss any sponsors as this is being written two months before the conference (an up to date list is on the website), but I would like to thank in no particular order, EPRI, Idaho National Laboratory, Isograph and the University of Southern California's National Center for Risk and Economic Analysis of Terrorism Events (CREATE). Additionally, we have the American Institute of Aeronautics and Astronautics and Star Alliance as sponsors.

On the people side, I truly appreciate the guidance of my General Vice Chair, Prof. Stephen Hora from USC. Steve has recently retired from USC, and I wish him well on the next stage of life: grand-parenting. On the technical program side, it is led by Dr. Curtis Smith from the Idaho National Laboratory. Our Assistant Technical Program Chairs are Mr. Steve Epstein from Lloyd's Register, Dr. Vinh Dang from the Paul Scherrer Institute, and Prof. Ted Steinberg from the Queensland University of Technology. Additionally, there are numerous people who helped serve on the Technical Program committee.

On a personal note, I would like to thank the Honorable George Apostolakis for many years as an advisor, mentor, friend, and motivator who shared this Hawaii dream with me from day one, and my wife, Cindy, who is tired of hearing about this conference excuse to avoid honey-dos.

None of this would have happened without the immense help from webmaster/registrar/general support/slash Hanna Shapira from Techno-Info Comprehensive Solutions. Hanna has been instrumental in many PSAMs and other conferences over the years, and we all value her guidance.

Lastly, I would like to thank each and every one of you for attending. We come from all over the world every two years to meet, exchange ideas, see old (I mean long time) friends, stir debates, and have an ice cream social. Until the next time, I wish all of you the best.



Delegates at PSAM 12

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Date: 21 June 2014

Welcome to PSAM 12

Dear Fellow Risk Professionals,

Lloyd's Register Consulting (LR Consulting, previously Scandpower) welcomes you to Honolulu! LR Consulting has been a long-time supporter of and participant in past PSAMs and is pleased to sponsor the Welcoming Reception at PSAM 12.

In recent years, nuclear safety has been focused on extreme external events, such as earthquakes and tsunamis – and with good reason. So maybe it is not pure coincidence that the PSAM 12 Conference is taking place in one of the seismically most dynamical areas of the world: the beautiful islands of Hawaii. Here we can experience dramatic forces of Mother Nature, including very active volcanoes.

In our efforts to improve safety, the international nuclear safety community has been busy analysing potential impacts of natural disasters. An important part of these studies is the so called stress-test, which has resulted in a re-evaluation of all current NPPs. Several issues have been raised, including further developments and improvements in PSA methods and software.

LR Consulting has not been idle during this period. We have supported several projects related to existing NPPs and also different R&D-activities. Our software department has developed new applications for RiskSpectrum[®] and also some completely new software tools. During PSAM we will share some of this experience to you.

Ever since the first PSAM conference, we have enjoyed the high quality of the presentations and also had the honour of giving a large number of presentations to our fellow risk professionals. PSAM 12 is no exception. We are looking forward to many interesting discussions and to jointly contribute to advancing the science of risk.

We would also like to encourage you to look ahead and make a note in your calendar: PSAM 13 in South Korea in 2016!

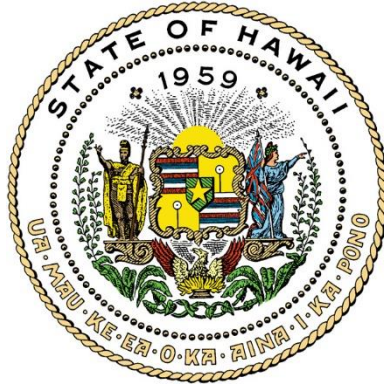
Again, a warm welcome!



Jerzy Grynblat
Nuclear Business Director

Working together for a safer world

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Special Message from Governor Neil Abercrombie Presented

In Recognition of the International Association for Probabilistic Safety Assessment and Management

June 22, 2014



On behalf of the people of the State of Hawai'i, I extend a special *aloha* to General Chair Dr. Todd Paulos, Program Committee Chair Dr. Curtis Smith, and all those attending the 12th biennial Probabilistic Safety Assessment and Management Conference at the Sheraton Waikiki.

As a truly international organization embracing the contributions of experts hailing from countries across the globe, it is fitting that you hold your 12th conference here on O'ahu, the island known as the "Gathering Place" and home to a unique natural splendor and rich cultural diversity that makes it a truly special destination. I wish you fair weather and memorable experiences in your time here.

I commend your organization for assembling hundreds of the world's foremost minds in risk and reliability assessment for a vigorous discussion and exchange of ideas, which I trust will result in a wealth of new knowledge and innovations. The fruits of this conference will assist governments, their constituencies, and the decisionmakers in businesses and other organizations worldwide in the safe and optimum use of resources.

Mahalo to those sharing their expertise this weekend. I wish you continued success in all future endeavors.

With warmest regards,

NEIL ABERCROMBIE

Governor, State of Hawai'i

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INTERNATIONAL
ASSOCIATION FOR
PSAM

Technical Program Committee

Technical Program Chair: Curtis Smith, INL USA
Assistant Technical Program Chairs: Steve Epstein, Lloyd's Register Japan
Vinh Dang, PSI Switzerland
Ted Steinberg, QUT Australia

We would like to thank the members of the PSAM 12 Technical Program Committee. These individuals helped to make PSAM 12 a success by reviewing abstracts, technical papers, organizing sessions, and providing technical leadership for the conference.

Technical Committee Members:

Roland Akselsson	Vyacheslav S. Kharchenko
S. Massoud (Mike) Azizi	James Knudsen
Tito Bonano	Zoltan Kovacs
Ronald Boring	Ping Li
Roger Boyer	Harry Liao
Mario Brito	Francois van Loggerenberg
Kaushik Chatterjee	Jerome Lonchamp
Vinh Dang	Soliman A. Mahmoud
Claver Diallo	Diego Mandelli
Nsimah Ekanem	Donovan Mathias
Steve Epstein	Zahra Mohaghegh
Fernando Ferrante	Thor Myklebust
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S. Tina Ghosh	Marina Roewekamp
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Seth Guikema	Ted Steinberg
Steve Hess	Kurt Vedros
Christopher J. Jablonowski	Smain Yalaoui
Moosung Jae	Robert Youngblood
Jeffrey Joe	Enrico Zio

Organizing Committee

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General Vice Chair: Prof. Stephen Hora, USC
Technical Program Chair: Curtis Smith, INL USA
Webmaster, Registration,
Support for Papers/Abstracts
Submission and Review: Hanna Shapira, TICS

General Information

Registration

Registration is required for all attendees and presenters. Badges are required for admission to all events.

Full Conference Registration Fee* includes: Technical sessions, morning & afternoon breaks (Monday through Thursday), and proceedings. Special Events included are Monday Welcome Reception, Tuesday Luncheon, Wednesday Luau, and Friday Ice Cream Social. (\$ 1,045.00)

1 Day Registration Fee includes: Morning & afternoon breaks and proceedings. (\$ 400.00)

Student Registration Fee includes: Technical sessions, morning & afternoon breaks, Tuesday Luncheon, and proceedings. Special events included are Monday Reception, Wednesday Luau, and Friday Ice Cream Social. (\$ 545)

Retiree Registration Fee includes: Same as full registration. (\$ 645)

Guests: No registration required. Participation in events requires tickets purchase.

EXTRA TICKETS (Included in Full Registration)

Monday Welcome Reception:	\$ 45
Tuesday Luncheon:	\$ 60
Wednesday Luau: Adult	\$ 120
Child 6 - 12	\$ 60
Child 5 & under	Free
Friday Ice Cream Social:	\$ 25

Conference Proceedings

Conference Proceedings, in CD-ROM format, are included with the program book. Please check the vinyl pocket inside the back cover of the program book.

Meeting Registration Desk

Sunday	2:00 PM - 5:30 PM
Monday	7:00 AM - 3:00 PM
Tuesday	7:30 AM - 3:00 PM
Wednesday	7:30 AM - 3:00 PM
Thursday	8:00 AM - Noon
Friday	8:00 AM - 9:00 AM

Guidelines for Speakers (Podium Presenters)

After the daily morning plenary session at PSA12, the conference will transition to six parallel sessions. Sessions are 90 minutes long – the minutes you have to present can be determined by: $\text{Time} = [90 / (\# \text{ papers in your session})] - 4$ minutes for questions

Do not rush through slides. Having unnecessary animation slows you down. Have no more than one or two slides for every two minutes: $\# \text{ Slides} = \text{Time} / 2$

The conference rooms will be equipped with a laptop computer, an LCD projector, laser pointer and a microphone. Microsoft Windows, MS Office (PowerPoint) 2010, and the latest Adobe Acrobat Reader (PDF reader) will be installed on the computers. Alternatively, speakers may bring their laptops and run the presentation from their computer. In either case, all presenters should make sure they are available ahead of time (see following paragraph) to discuss with the Chair their presentation place (e.g., first, second, etc.) and whether they will run the file from the session room PC or if they plan to use their own computer. Also, take advantage of the speaker breakfast the morning of your presentation to discuss with the session chair how you will run the presentation.

All presenters are to report to the Session Chair at the assigned room 10 minutes before the start of the session.

Your presentation needs to be loaded into the paper profile page in your account no later than 24 hours before your presentation. If you have having any difficulties with upload you may get help at the registration desk after 10:00 each day. You may load and test your presentation slides on the computer at the assigned room during the tea/coffee/lunch break before the session. It is highly encouraged to test the presentation (especially if you have animation) at the lobby area where one to two computers with the same settings as that in the session room will be provided.

A microphone will be available for the presentation, please make sure that you keep close to the microphone during your talk.

Extra Events

Sunday

Registration Event (Time and location TBD)

Monday

Welcome Reception, (hors d'oeuvres)
sponsored by Lloyd's Register
Helumoa Playground
7:00 - 9:00 PM

Tuesday

Lunch
Maui Room
12:00 Noon - 1:30 PM

Tuesday Evening

Explore the Island (free time on your own)

Wednesday

Conference Luau Dinner
Royal Hawaiian Hotel, Ocean Lawn
7:00-10:00 PM

Thursday Evening

Explore the Island (free time on your own)

Friday Noon

Ice Cream Social
Maui or Lanai room

Where Kids Eat Free

Keiki (children under 12) eat free with full paying adult in the following locations at Sheraton Waikiki:

Kai Market (breakfast and dinner)
RumFire (lunch only until 5:30pm)
Helumoa Pool (lunch only)



9:00 AM

Commissioner George Apostolakis U.S. NRC



Beware of the Assumptions: Decision Making and Statistics

Biography: The Honorable George Apostolakis was sworn in as a Commissioner of the U.S. Nuclear Regulatory Commission (NRC) on April 23, 2010, to a term ending on June 30, 2014.

Dr. Apostolakis has had a distinguished career as an engineer, professor and risk analyst. Before joining the NRC, he was the Korea Electric Power Corporation professor of Nuclear Science and Engineering and a professor of Engineering Systems at the Massachusetts Institute of Technology. He was also a member and former chairman of the statutory Advisory Committee on Reactor Safeguards of the NRC.

In 2007, Dr. Apostolakis was elected to the National Academy of Engineering for “innovations in the theory and practice of probabilistic risk assessment and risk management.” He has served as the Editor-in-Chief of the International Journal Reliability Engineering and System Safety and is the founder of the International Conferences on Probabilistic Safety Assessment and Management. He received the Tommy Thompson Award for his contributions to improvement of reactor safety in 1999 and the Arthur Holly Compton Award in Education in 2005 from the American Nuclear Society.

Dr. Apostolakis has published more than 120 papers in technical journals and has made numerous presentations at national and international conferences. His research interests include the use of Probabilistic Risk Assessment (PRA) in reactor design; uncertainty analysis; decision analysis; infrastructure security; risk-informed and performance-based regulation; human reliability; and risk management involving multiple stakeholders. He has edited or co-edited eight books and conference proceedings and has participated in many PRA courses and reviews.

Dr. Apostolakis received his diploma in electrical engineering from the National Technical University in Athens, Greece in 1969. He earned a master’s degree in engineering science from the California Institute of Technology in 1970 and a Ph.D. in engineering science and applied mathematics in 1973, both from the California Institute of Technology.

M01 Consequence Modeling and Management

Monday 6/23/2014 10:30 Honolulu

Chair: Ludivine Pascucci-Cahen, IRSN

4 Nuclear Refugees After Large Early Radioactive Releases

Ludivine Pascucci-Cahen
Institut de Radioprotection et de Sûreté Nucléaire, Fontenay-aux-Roses, France

73 Multidimensional Risk Evaluation: Assigning Priorities for Actions on a Natural Gas Pipeline

Mônica Frank Marsaro, Marcelo Hazin Alencar, Adiel Teixeira de Almeida, and Cristiano Alexandre Virginio Cavalcante
Universidade Federal de Pernambuco, UFPE, Recife, Brazil

100 Development of Accident Consequence Assessment Scheme using Accident Cost and Consideration of Decontamination Model

Kampanart Silva (a), Koji Okamoto (b), Yuki Ishiwatari (b,c) Shogo Takahara (d) and Jiraporn Promping (a)
a) Thailand Institute of Nuclear Technology, Nakhon Nayok, Thailand, b) The University of Tokyo, Tokyo, Japan, c) Hitachi-GE Nuclear Energy, Ltd., Ibaraki, Japan, d) Japan Atomic Energy Agency, Ibaraki, Japan

118 Safety of LPG Rail Transportation: Influence of Safety Barriers

V. Busini, M. Derudi, R. Rota
Politecnico di Milano, Department of Chemistry, Materials and Chemical Engineering "G. Natta", Piazza Leonardo da Vinci 32, 20133 Milano, Italy

169 Determination of Target Reliability Levels Based on Value to the Customer and Warranty Budgets

Michael Bartholdt, Volker Schweizer and Bernd Bertsche
University of Stuttgart, Stuttgart, Germany

M02 Digital I&C and Software Reliability I

Monday 6/23/2014 10:30 Kahuku

Chair: Hervé Brunelière, AREVA NP SAS

49 How to Integrate Correctly Hardware Common Cause Failures in Frequency Calculations?

Hervé Brunelière, Monica Rath, and Wenjie Qin
AREVA NP SAS, Paris La Défense, France

66 The Basic Idea of Quantitative Model of Reactor Protection System Considering Stochastic Process

Hitoshi Muta
Tokyo City University, Tokyo, Japan

119 A Quantitative Software Testing Method for Hardware and Software Integrated Systems in Safety Critical Applications

Hai Tang, Lixuan Lu
University of Ontario Institute of Technology, Oshawa, ON, Canada

123 OECD/NEA WGRISK task on failure modes taxonomy for digital I&C – DIGREL

Abdallah Amri (a), Stefan Authén (b), Herve Bruneliere (c), Gilles Deleuze (d), Gabriel Georgescu (e), Jan-Erik Holmberg (f), Man Cheol Kim (g), Keisuke Kondo (h), Ming Li (i), Ewgenij Piljugin (j), Wietske Postma (k), Jiri Sedlak (l), Carol Smidts (m), Jan Stiller (j), and Nguyen Thuy (d)
a) OECD/NEA, Paris, France, b) Risk Pilot AB, Stockholm, Sweden, c) AREVA, Paris, France, d) EDF R&D, Paris, France, e) Institut de Radioprotection et de Sûreté Nucléaire, Paris, France, f) Risk Pilot AB, Espoo Finland, g) Chung-Ang University, Seoul, Korea, h) Nuclear Regulation Authority, Japan, i) United States Nuclear Regulatory Commission, USA, j) Gesellschaft für Anlagen- und Reaktorsicherheit, Germany, k) Nuclear Research and consultancy Group, the Netherlands, l) ÚJV Řež, Husinec - Řež, Czech Republic, m) Ohio State University, USA

139 A Component-based Approach for Assessing Reliability of Compound Software

Monica Lind Kristiansen (a), Bent Natvig (b), and Harald Holone (c)
a) Department of Informatics, Østfold University College, Halden, Norway, b) Department of Mathematics, University of Oslo, Oslo, Norway, c) Department of Informatics, Østfold University College, Halden, Norway

M03 Enterprise Risk Management

Monday 6/23/2014 10:30 Oahu

Chair: David Johnson, ABS Consulting

161 Automated Evolutionary Restructuring of Workflows to Minimise Errors Via Stochastic Model Checking

Luke Thomas Herbert (a), Zaza Nadja Lee Hansen and Peter Jacobsen (b)
a) DTU Compute, Lyngby, Denmark, b) DTU Management, Lyngby, Denmark

384 Enterprise Risk and Opportunity Management for Nonprofit Organizations and Research Institutions

Allan Benjamin (a), Homayoon Dezfuli (b), Chris Everett (c), Julie Pollitt (d), Dev Sen (c)
a) Independent Consultant, Albuquerque, NM, USA, b) Office of Safety & Mission Assurance, NASA Headquarters, Washington, DC, USA, c) Information Systems Laboratories, Inc., Rockville, MD, USA, d) Independent Consultant, San Jose, CA, USA

589 Programmatic Assessment of RG-MOX Utilization Following Participation in the DOE Surplus Plutonium Disposition Program

David H. Johnson, Andrew A. Dykes (a), Andrew G. Sowder, and Albert J. Machiels (b)
a) ABSG Consulting, Irvine, CA, USA, b) Electric Power Research Institute (EPRI), Charlotte, NC, USA

358 A Jointly Optimization of Production, Delivery and Maintenance Planning for Multi-Warehouse/Multi-Delivery Problem

Hajej Zied, Turki Sadok, and Rezg Nidhal
LGIPM-University of Lorraine, Metz, France

135 Investigating the Role of Statistical Models in Water Distribution Asset Management: A Semi-structured Interview Approach

Vikram M. Rao, and Royce A. Francis
The George Washington University, Washington DC, USA

M04 Environmental Modeling

Monday 6/23/2014 10:30 Waialua

Chair: Stefan Hirschberg, Paul Scherrer Institut

189 Modeling of Pollutant Dispersion in Street Canyon by Means of CFD

Davide Meschinia, Valentina Busini (a), Sjoerd W. van Ratingen (b), Renato Rota (a)
a) Department of Chemistry, Materials and Chemical Engineering "G. Natta", Politecnico di Milano, Italy, b) TNO, Utrecht, Netherlands

221 Consideration on the Assessment of the Environmental Consequences and Impacts During Transport of Radioactive Materials (RAM)-A Safety Case

Gheorghe Vieru
AREN, Bucharest, ROMANIA

546 Health Effects of Technologies for Power Generation: Contributions from Normal Operation, Severe Accidents and Terrorist Threat

S. Hirschberg, C. Bauer, P. Burgherr (a), E. Cazzoli (b), T. Heck, M. Spada and K. Treyer (a)
a) Paul Scherrer Institute, Laboratory for Energy Systems Analysis, Villigen, Switzerland, b) Cazzoli Consulting, Villigen, Switzerland

249 Metal Remediation of Acid Mine Drainage Using a Hybrid System of Microalgae Reactor

Young-Tae Park, Hongkyun Lee, Hyun-Shik Yun, Jaeyoung Choi
Korea Institute of Science and Technology- Gangneung Institute, Gangneung, South Korea

M05 Fire Modeling and Simulation

Monday 6/23/2014 10:30 Waianae

Chair: Shahen Poghosyan, Nuclear and Radiation Safety Center, Armenia

155 Experiences from Developing and Implementing Shutdown Fire PRA at Forsmark NPP

Erik Cederhorn, Maria Frisk
Risk Pilot AB, Stockholm, Sweden

292 **Fire PSA and Insights**

F. Nicoleau, F. Corenwinder, G. Georgescu
Institute for Radiological Protection and Nuclear Safety (IRSN), Fontenay-Aux-Roses, France

354 **Complex Investigation of Fire PSA Dominant Scenario Related to Direct Flame Contact with Safety Related Pipes**

Shahen Poghosyan, Tsolak Malakyan, Gurgen Kanetsyan and Armen Amirjanyan
Nuclear and Radiation Safety Center, Yerevan, Armenia

386 **Fire Risks of Loviisa NPP During Shutdown States**

Sami Sirén, Ilkka Paavola, Kalle Jänkäälä
Fortum Power And Heat Oy, Espoo, Finland

M06 **Human Reliability Analysis I**

Monday 6/23/2014 10:30 Ewa

Chair: Jeffrey C. Joe, Idaho National Laboratory

7 **Modeling and Quantification of Team Performance in Human Reliability Analysis for Probabilistic Risk Assessment**

Jeffrey C. Joe and Ronald L. Boring
Idaho National Laboratory, Idaho Falls, USA

16 **Comparison of Task Loads between Usages of Computer-based Procedures in an Advanced Control Room**

Yochan Kim, Wondea Jung, and SeungHwan Kim
Korea Atomic Energy Research Institute, Daejeon, Republic of Korea

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Pengcheng Li (a), Li Zhang (a,b), Licao Dai, Jianjun Jiang, and Difan Luo (a)
a) Human Factor Institute, University of south China, Hengyang, People's Republic of China, b) Hunan Institute of Technology, Hengyang, People's Republic of China

136 **Study on Human Errors in DCS of a Nuclear Power Plant**

Licao Dai (a), Li Zhang (b), Pengcheng LI (a), Hong Hu (b) Yanhua Zou (b)
a) Human Factor Institute, University of South China, Hengyang, P.R.China, b) Hunan Institute of Technology, Hengyang, P.R.China China

167 **Experience Feedback from Fukushima towards Human Reliability Analysis for Level 2 Probabilistic Safety Assessments**

V. Fauchille, H. Bonneville, J.Y. Maguer
Institut de Radioprotection et de Sûreté Nucléaire, Fontenay-aux-Roses Cedex, FRANCE

M07 **Industrial Safety and Accident Analysis I**

Monday 6/23/2014 10:30 Kona

Chair: Thor Myklebust, SINTEF

8 **The Impacts of Supervisor Attributes and Supervision-Related Policies on Safety and Environmental Outcomes and Reporting Behavior**

Christopher J. Jablonowski (a), John J. Tolle (b)
a) Shell Exploration and Production Company, Houston, TX, U.S.A. b) Value Discovery LLC, Houston, TX, U.S.A.

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Thor Myklebust (a), Tor Stålhane (b), Geir Kjetil Hanssen, and Børge Haugset (a)
a) SINTEF ICT, b) IDI NTNU

125 **Bucket Wheel Excavators: Past to Present Experiences in Safety Operation**

Marek Młyńczak
Wrocław University of Technology, Wrocław, Poland

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Katarina Holla and Jozef Ristvej
University of Žilina, Žilina, Slovakia

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Siri Mariane Holen, Ingrid Bouwer Utne (a), and Ingunn Marie Holmen (b)
 a) Department of Marine Technology, NTNU, Trondheim, Norway, b) SINTEF Fisheries and Aquaculture, Trondheim, Norway

M11 Lifetime and Ageing

Monday 6/23/2014 1:30 Honolulu

Chair: Tunc Aldemir, The Ohio State University

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Peng Qin, Xiaoling Zhang, Liping He, Liangliang Ding
 School of Mechanics, Electronic, and Industrial Engineering, University of Electronic Science and Technology of China, Chengdu, China

279 **Development of a Dynamic, Plant Condition-Dependent Probabilistic Safety Assessment**

Radoslaw Lewandowski, Richard Denning, Tunc Aldemir and Jinsuo Zhang
 The Ohio State University, Columbus, Ohio, USA

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D. P. Blanchard (a) and R. W. Youngblood (b)
 a) Applied Reliability Engineering, Inc. (AREI), San Francisco, California USA, b) Idaho National Laboratory (INL), Idaho Falls, Idaho, USA

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Shahen Poghosyan and Armen Amirjanyan
 Nuclear and Radiation Safety Center, Yerevan, Armenia

448 **The Reliability Effects of Transient-Induced Degradation on the Performance of Large Power Transformers**

Brittany L. Guyer (a), Carl R. Grantom (b), and Michael W. Golay (a)
 a) Massachusetts Institute of Technology, Cambridge, MA, USA, b) CRG LLC, West Columbia, TX, USA

M12 Maintenance Modelling and Optimisation I

Monday 6/23/2014 1:30 Kahuku

Chair: Cristiano Cavalcante, UFPE - Universidade Federal de Pernambuco, Brasil

111 **Risk-Informed Simulation Optimization for Engineering Asset Management**

Jérôme Lonchamp, William Lair
 EDF R&D, Chatou, France

137 **A Usage-Informed Preventive Maintenance Policy to Optimize the Maintenance Free Operating Period for Multi-Component Systems**

Romain Lesobre (a,b), Keomany Bouvard (a), Christophe Bérenguer (b), Anne Barros (c), Vincent Cocquemot (d)
 a) Volvo Group Trucks Technology, Advanced Technology and Research, Saint Priest Cedex, France, b) Laboratoire Grenoble Image Parole Signal Automatique, Gipsa-Lab, Grenoble INP, UMR 5216 CNRS, Saint Martin d'Hères, France, c) Laboratoire de Modélisation et Sécurité des Systèmes, UTT, Institut Charles Delaunay, UMR 6279 CNRS, Troyes Cedex, France, d) Laboratoire d'Automatique, Génie Informatique et Signal, Université Lille1, UMR 8219 CNRS, Villeneuve d'Ascq Cedex, France

335 **Model of Improvement of Maintenance Policies for Electrical Substations**

Cristiano Cavalcante, Marcelo Alencar, Adiel Almeida, Ana Paula Costa, Rodrigo Ferreira (a), Maxwell Luna, Rogério Sá, Alison Ferreira and Adilson Vieira (b)
 a) UFPE - Universidade Federal de Pernambuco, Recife, Brazil, b) CELPE - Companhia Energética de Pernambuco, Recife, Brazil

359 **A Stochastic Production Planning Optimization for Multi Parallel Machine under Leasing Contract**

Medhioub Fatma, Hajej Zied, and Rezg Nidhal
 LGIPM-University of Lorraine, Metz, France

397 **Review of the Preventive Maintenance Requirements for the Safety Systems of the Mochovce NPP**

Zoltan Kovacs, Robert Spenlinger
 RELKO Ltd., Bratislava, Slovak Republic

M13 Occupational Safety and Management

Monday 6/23/2014 1:30 O'ahu

Chair: Thomas Wold, Norwegian University of Science and Technology

265 An Integrated Management for Occupational Safety and Health throughout the Plant-Lifecycle

Yukiyasu Shimada (a), Teiji Kitajima (b), Tetsuo Fuchino (c), and Kazuhiro Takeda (d)

a) National Institute of Occupational Safety and Health, Japan, Kiyose, Tokyo, Japan, b) Tokyo University of Agriculture and Technology, Koganei, Tokyo, Japan, c) Tokyo Institute of Technology, Meguro, Tokyo, Japan, d) Shizuoka University, Hamamatsu, Shizuoka, Japan

79 End User Involvement in the Development of Procedures and Safety Management Systems

Thomas Wold and Karin Laumann

Department of Psychology, Norwegian University of Science and Technology (NTNU), Trondheim, Norway.

370 Identifying Requirements for Effective Human-Automation Teamwork

Jeffrey C. Joe (a), John O'Hara (b), Heather D. Medema and Johanna H. Oxstrand (a)

a) Idaho National Laboratory, Idaho Falls, ID, USA, b) Brookhaven National Laboratory, Upton, NY, USA

127 Characterization of Resilience in Nuclear Power Plants

Florah Kamanja (a), and Kim Jonghyun (b)

a) Kenya Electricity Generating Company, Nairobi, Kenya, b) KEPCO International Nuclear Graduate School, Ulsan, South Korea

M14 Operational Experience and Data Analysis

Monday 6/23/2014 1:30 Waialua

Chair: Shawn St. Germain, Idaho National Laboratory

30 Recent Insights from the International Common Cause Failure Data Exchange (ICDE) Project

Albert Kreuser (a), Gunnar Johanson (b)

a) Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH, Cologne, GERMANY, b) ES konsult, Solna, SWEDEN

328 Internal Flooding According to EPRI Guidelines – Detailed Electrical Mapping at Ringhals

Per Nyström, Carl Sunde (a), and Cilla Andersson (b)

a) Risk Pilot, Gothenburg, Sweden, b) Ringhals AB, Varberg, Sweden

366 NRC Reactor Operating Experience Data

Shawn Walter St. Germain

Idaho National Laboratory, Idaho Falls, USA

368 Component Reliability in the T-Book – The New Approach

Anders Olsson, Erik Persson Sunde, and Magnus Gudmundsson

a) Lloyd's Register Consulting, Stockholm, Sweden, b) TUD Office, Vattenfall, Stockholm, Sweden

48 Trend Analysis of Input Data to Nordic PSA

Ostrovskii Dimitri (a), Lindahl Pär (b)

a) ÅF consulting, Gothenburg, Sweden, b) OKG AB, Oskarshamn, Sweden

M15 Phenomena Modeling

Monday 6/23/2014 1:30 PM Waianae

Chair: Nat Heatwole, University of Southern California

58 Preparation of Implementation Standard Concerning Severe Accident Management in Nuclear Power Plants

Shinya Kamata (a), Koji Okamoto (b), and Tomoyuki Sugiyama (c)

a) Japan Nuclear Safety Institute, Minato-ku, Tokyo, Japan, b) The University of Tokyo, Tokai-mura, Naka-gun, Ibaraki, Japan, c) Japan Atomic Energy Agency, Tokai-mura, Naka-gun, Ibaraki, Japan

62 EPRI Fukushima Technical Evaluation—Evaluation of Flammable Gas Leakage from Fukushima Daiichi Containments using the MAAP5 Computer Code

David L. Luxat, Donald A. Dube, Andrew S. Dercher (a), Richard Wachowiak, Rosa Yang (b), and Jeff R. Gabor (a)

a) ERIN Engineering and Research, Inc., West Chester, PA, USA, b) Electric Power Research Institute, Palo Alto, CA, USA

- 114 **Prediction of Complex Thermal-Hydraulic Phenomena Supplemented by Uncertainty Analysis with Advanced Multiscale Approaches for the TALL - 3D T01 Experiment**
 Angel Papukchiev (a), Marti Jeltsov (b), Clotaire Geffray (c), Kaspar Kööp, Pavel Kudinov (b), Rafael-Juan Macián (c) and Georg Lerchl (a)
 a) Gesellschaft fuer Anlagen- und Reaktorsicherheit (GRS) mbH, Garching n. Munich, Germany, b) KTH Royal Institute of Technology, Stockholm, Sweden, c) Technische Universitaet Muenchen (TUM), Garching n. Munich, Germany

- 503 **Cost-Effectiveness of Vehicle Barriers and Setback Distance for Protecting Buildings from Vehicle Bomb Attack**
 Nathaniel Heatwole
 University of Southern California, Los Angeles, USA

M16 Policy Making and Legislative Issues

Monday 6/23/2014 1:30 Ewa

Chair: Adrian Ridder, Bergische Universität Wuppertal

- 41 **From Prescriptive Arrival Times to Performance Based Fire Service Delivery – Parallels of Fire Service Planning and Fire Engineering**
 Adrian Ridder, Uli Barth
 University of Wuppertal, Wuppertal, Germany
- 409 **Issues in Incorporating Probabilistic Safety Assessment (PSA) in the Design and Licensing Stages of Generation IV Reactors**
 Ibrahim A. Alrammah
 School of Mechanical, Aerospace and Civil Engineering (MACE), University of Manchester, Manchester, United Kingdom
- 501 **Need for PRA in the Oil and Gas Industry**
 Matt Johnson, Nicholas Lovelace (a), and Michael Lloyd (b)
 a) Hughes Associates, Inc., Lincoln, NE, USA, b) Risk Informed Solutions Consulting Services, Ball Ground, GA, USA
- 564 **Learning how to Learn from Failures: The Case of Fukushima Nuclear Disaster**
 Ashraf Labib
 University of Portsmouth, Portsmouth, United Kingdom
- 556 **Toward Demonstrating the Monetary Value of Probabilistic Risk Assessment for Nuclear Power Plants**
 Marzieh Abolhelm, Justin Pence, Zahra Mohaghegh (a), and Ernie Kee (b)
 a) University of Illinois at Urbana-Champaign, IL, USA, b) YK.risk, LLC, TX, USA

M17 Low-power and Shutdown

Monday 6/23/2014 1:30 Kona

Chair: Stefan Eriksson, Ringhals AB

- 45 **A methodology for determining of Plant Operating States of Low Power Shutdown Probabilistic Safety Assessment for the Next-Generation Nuclear Power Plants**
 Jae Gab Kim (a), Kwang Nam Lee (b), Hak Kyu Lim (a)
 a) KEPCO-ENC, Integrated Engineering Department, Korea, b) KEPCO-ENC, Power Engineering Research Institute, Korea
- 255 **Shutdown PSA for Ringhals NPP Unit 1. Insights, Overview and Results**
 Stefan Eriksson, Marie Gryte (a), and Erik Cederhorn (b)
 a) Ringhals AB, Väröbacka, SWEDEN, b) Risk Pilot, Stockholm, SWEDEN
- 554 **Developing a Low Power/Shutdown PRA for a Small Modular Reactor**
 Nathan Wahlgren
 NuScale Power, LLC, Corvallis, OR, USA
- 99 **Risk-Informed Design Changes of an Advanced Reactor in Low Power and Shutdown Operation**
 Ji-Yong Oh, Ho-Rim Moon, Han-Gon Kim and Myung-Ki Kim
 Korea Hydro and Nuclear Power Co. Ltd, Central Research Institute, Deajeon, Korea

548 **An Implementation Strategy of Low Power Shutdown PSA for KHNP NPPs**

Jang-Hwan Na, Seok-Won Hwang, Ho-Jun Jeon
Central Research Institute of Korea Hydro & Nuclear Power Co.,Ltd., Daejeon, Korea

M21 Reliability Analysis and Risk Assessment Methods I

Monday 6/23/2014 3:30 PM Honolulu

Chair: Kaushik Chatterjee, FM Global

46 **Proof Testing of Safety-Instrumented Systems: New Testing Strategy Induced by Dangerous Detected Failures**

Yiliu Liu, Marvin Rausand
Department of Production and Quality Engineering, Norwegian University of Science and Technology, Trondheim, Norway

77 **A New Interfacing Approach between Level 1 and Level 2 PSA**

Nicolas Duflot, Nadia Rahni, Thomas Durin, Yves Guigueno and Emmanuel Raimond
IRSN, Fontenay aux Roses, France

78 **An Approach to Ensure the Availability of Complex Systems**

Kaushik Chatterjee, Kumar Bhimavarapu, Robert Kasiski, and William Doerr
FM Global, Norwood, MA, USA

101 **Reliability/Availability Methods for Subsea Risers and Deepwater Systems Design and Optimization**

Annamaria Di Padova (a), Fabio Castello (b), Fabrizio Tallone (a), Michele Piccini (b)
a) Saipem S.p.A., Fano, Italy, b) RAMS&E S.R.L., Turin, Italy

M22 Dependent Failure Modeling I

Monday 6/23/2014 3:30 PM Kahuku

Chair: Andrew O'Connor, Acuitas Reliability Pty Ltd

56 **Statistical Analysis of Common Cause Failure Events Using ICDE Data**

S. Yu, M.D. Pandey (a), S. Yalaoui and Y. Akl (b)
a) University of Waterloo, Waterloo, Canada, b) Canadian Nuclear Safety Commission, Ottawa, Canada

133 **Extending the Alpha Factor Model for Cause Based Treatment of Common Cause Failure Events in PRA and Event Assessment**

Andrew O'Connor, Ali Mosleh
Center for Risk and Reliability, University of Maryland, College Park, United States

383 **Estimating Common Cause Failure Probabilities for a PRA Taking into Account Different Detection Methods**

Kalle E. Jänkäälä
Fortum Power and Heat Oy, Espoo, Finland

473 **Time Dependent Analysis with Common Cause Failure Events in RiskSpectrum**

Pavel Krcaľ (a,b) and Ola Bäckström (a)
a) Lloyd's Register Consulting, Stockholm, Sweden, b) Uppsala University, Uppsala, Sweden

M23 Risk and Hazard Analyses I

Monday 6/23/2014 3:30 PM Oahu

Chair: Ingrid Bouwer Utne, NTNU, Department of Marine Technology, Norway

9 **A State of the Practice Investigation Guiding the Development of Visualizations for Minimal Cut Set Analysis**

Yasmin I. Al-Zokari, Liliana Guzman (a), Barboros Can Conar (b), Dirk Zeckzer (c), Hans Hagen (a)
a) TU Kaiserslautern, Kaiserslautern, Germany, b) University of Applied Sciences, Kaiserslautern, Germany, c) Leipzig University, Leipzig, Germany

71 **Risk Analysis and Decision Theory: An Extended Summary**

E. Borgonovo, V. Cappelli, F. Maccheroni, M. Marinacci (a), and C. Smith (b)
a) Department of Decision Sciences and IGIER, Università Bocconi, Milan, Italy, b) Idaho National Laboratory, Idaho Falls, Idaho, USA.

105 **Maritime Oil Spill Risk Assessment for Hanhikivi Nuclear Power Plant**

Juho Helander
Fennovoima, Helsinki, Finland

159 **Using Bond Graphs for Identifying and Analyzing Technical and Operational Hazards in Complex Systems**

Ingrid Bouwer Utne, Eilif Pedersen and Ingrid Schjøllberg
Department of Marine Technology, Norwegian University of Science and Technology, Trondheim, Norway

M24 **Risk Governance and Societal Safety I**

Monday 6/23/2014 3:30 PM **Waialua**

Chair: Woody Epstein, Lloyd's Register Consulting

33 **Estimating Farmer's Risk Aversion**

Patrick Momal
IRSN, Fontenay-aux-Roses, France

42 **Development of a Methodological Approach to Strategic Fire Service Planning Combining Concepts of Risk, Hazard and Scenario-based Design**

Adrian Ridder, Uli Barth
University of Wuppertal, Wuppertal, Germany

43 **Ambiguity in Risk Assessment**

Inger Lise Johansen and Marvin Rausand
Norwegian University of Science and Technology, Trondheim, Norway

157 **How is Capability Assessment Related to Risk Assessment? Evaluating Existing Research and Current Application from a Design Science Perspective**

Hanna Palmqvist, Henrik Tehler, and Waleed Shoaib
Division of Risk Management and Societal Safety, Centre for Risk Assessment and Management, and Centre for Societal Resilience, Lund University, Lund, Sweden

M25 **Risk Informed Applications I**

Monday 6/23/2014 3:30 PM **Waianae**

Chair: Hao Zheng, Lloyd's Register Consulting

60 **Analyses of AP1000® Expanded Event Tree Sequences Based on Best-Estimate Calculations**

J.Montero-Mayorga, C.Queral, J.Gonzalez-Cadelo and G. Jimenez
Universidad Politecnica de Madrid, Madrid, Spain

88 **Application of Web-based Risk Monitor in Tianwan Nuclear Power Plant**

Hao Zheng (a), Wei Wang (b), Xiaohui Gu, Yong Qu, Zhenli Bao (c), Xuhong He (b)
a) Lloyd's Register Consulting, Beijing, China, b) Lloyd's Register Consulting, Stockholm, Sweden, c) Jiangsu Nuclear Power Co., Lianyungang, China

106 **Analyzing System Changes with Importance Measure Pairs: Risk Increase Factor and Fussell-Vesely Compared to Birnbaum and Failure Probability**

Janne Laitonen, Ilkka Niemelä
Radiation and Nuclear Safety Authority (STUK), Helsinki, Finland

15 **Energy Loss Optimization in Basic T-Shaped Water Supply Piping Networks for Probabilistic Demands**

KW Mui, LT Wong, and CT Cheung
Department of Building Service Engineering, The Hong Kong Polytechnic University, Hong Kong, China

502 **Insights and Improvements Based on Updates to Low Power and Shutdown PRAs**

J. F. Grobelaar, J. A. Julius, K. D. Kohlhepp, and M. D. Quilici
Scientech, a Curtiss-Wright Flow Control Company, Tukwila, WA, U.S.A.

M26 Risk Informed Licensing and Regulation I

Monday 6/23/2014 3:30 PM Ewa

Chair: Dennis Damon, NRC

34 When Is It Justified to Delay the Implementation of Safety Improvements After They Have Been Approved?

Patrick Momal
IRSN, Fontenay-aux-Roses, France

65 The Underlying Principles and Quantitative Values of Risk Limits

Dennis R. Damon
U. S. Nuclear Regulatory Commission, Washington DC

86 Development of A Framework for Establishment of Risk-informed Safety Goals for Nuclear Power Plants Operation in the UAE

Jun Su Ha (a), Sung-yeop Kim (b), Jamila Khamis Al Suwaidi (c), and Philip Beeley(a)
a) Khalifa Univ. of Science, Technology and Research, Abu Dhabi, UAE, b) Korea Advanced Institute of Science and Technology (KAIST), Republic of Korea, c) Federal Authority for Nuclear Regulation (FANR), Abu Dhabi, UAE

254 Insights from PSA Comparison in Evaluation of EPR Designs

Ari Julin, Matti Lehto (a), Patricia Dupuy, Gabriel Georgescu, Jeanne-Marie Lanore (b), Shane Turner, Paula Calle-Vives (c), Anne-Marie Grady, Hanh Phan (d)
a) Radiation and Nuclear Safety Authority (STUK), Finland, b) Institute of Radiological Protection and Nuclear Safety (IRSN), France, c) Office for Nuclear Regulation (ONR), United Kingdom, d) Nuclear Regulatory Commission (USNRC), United States of America

237 OECD WGRISK – Challenges and Recent Tasks

Marina Roewekamp (a), Jeanne-Marie Lanore (b), Kevin Coyne (c), Milan Patrik (d), Abdallah Amri, Neil Blundell (e)
a) Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH, Köln, Germany, b) Institut de Radioprotection et de Sécurité Nucléaire (IRSN), Fontenay-aux-Roses, France, c) U.S. Nuclear Regulatory Commission, Washington, DC USA, d) UJV Rez, Rez, Czech Republic, e) OECD Nuclear Energy Agency (NEA), Issy-les-Moulineaux, France

M27 Automotive Engineering

Monday 6/23/2014 3:30 PM Kona

Chair: Stefan Bracke, University of Wuppertal

146 RAPP: Method for Risk Prognosis on Complex Failure Behaviour in Automobile Fleets Within the Use Phase

Stefan Bracke and Sebastian Sochacki
University of Wuppertal, Chair of Safety Engineering and Risk Management, Wuppertal, Germany

168 Stress-Dependent Weibull Shape Parameter Based on Field Data

Jochen Juskowiak and Bernd Bertsche
University of Stuttgart, Stuttgart, Germany

314 APTA Approach: Analysis of Accelerated Prototype Test Data Based on Small Data Volumes Within a Car Door System Case Study

Marcin Hinz, Philipp Temminghoff, and Stefan Bracke
University of Wuppertal, Chair of Safety Engineering and Risk Management, Wuppertal, Germany

9:00 AM

John O'Donnell
Online Trading Academy
Chief Knowledge Officer



Globalization 3.0 Credit Purge Cycle: Short Term Income & Long Term Wealth

Abstract: The inflation vs deflation debate as defined by the Austrian School of Economics & discuss and show examples of how to identify high probability low risk trades in the global capital markets using the newly patented OTA core strategy to identify supply v demand of institutional order flow on a price chart

John is known for his focus and thoughts on issues such as historic boom/bust business cycles and the potential coming burst of the credit bubble in the "Globalization 3.0 Era." His background in both education and financial services gives him a unique ability to teach complex financial theories and trading skills to beginner investors and seasoned traders alike..

Biography: Mr. O'Donnell's background in both education and financial services gives him a unique ability to teach complex financial theories and trading skills to beginner investors and seasoned traders alike. As Chief Knowledge Officer, John has been an instrumental player in making Online Trading Academy the premier trading educators in the world with 35 physical learning centers in 8 countries.

Mr. O'Donnell earned a BS in Science from Southwest Baptist University and has personally been involved in the stock market since 1968. In 1975, he founded the Economic Monetary Investment Research Society, Atlanta. He began his career as a public school teacher, which he later transitioned to public corporations, working as an investment banker.

Mr. O'Donnell has 40+ years of successful corporate leadership experience. He was the Founder and CEO of Precious Metals Exchange. His next venture was as CEO with Penn Pacific Financial Corp, a public company. He then founded and became the CEO of Republic Resources, Inc, which was the world's largest publicly traded grower of jojoba oil with a \$75 million market cap. Prior to joining Online Trading Academy Mr. O'Donnell was Co-founder and CEO of Double Win Capital, Inc, a boutique investment banker. Mr. O'Donnell's leadership and vision has not gone unnoticed, as he was a Finalist two consecutive years in the "Entrepreneur of the Year" contest in Orange County, Calif managed by Ernst & Young Inc magazine.

Mr. O'Donnell came to Online Trading Academy in 1998. As one of the first equity partners and pioneers in developing the education division he helped transition the company from a floor based equities broker/dealer model with \$500 million per day in day trades to one of the largest Direct Market Access franchisor trading schools that are currently operating today. Mr. O'Donnell is instrumental in Online Trading Academy's business development initiatives with strategic partners and industry leaders like NYSE, CME, and NASDAQ. He has been a featured speaker at many major active trader/investor expos in New York, London, Paris, Rio de Janeiro, Toronto, Las Vegas, San Francisco, Miami, and Dallas. He has been interviewed on and featured in a variety of financial media such as Wall Street Journal, CNBC, Bloomberg, Fox Business, FT.com, Equities Magazine and Traders Journal. He is also co-host of PowerTradingRadio.com

This year marks his greatest accomplishment, in his opinion, becoming a second time grandparent.

T01 Aviation and Space I

Tuesday 6/24/2014 10:30 Honolulu

Chair: Sergio Guarro, ASCA Inc.

116 Cabin Environment Physics Risk Model

Christopher J. Mattenberger (a) and Donovan L. Mathias (b)

a) Science and Technology Corporation, Moffett Field, CA, USA, b) NASA Ames Research Center, Moffett Field, CA, USA

541 Quantitative Launch and Space Transport Vehicle Reliability and Safety Requirements: Useful or Problematic?

Sergio Guarro

ASCA Inc., Redondo Beach, USA

470 Conception of Logistic Support Model for Controlling Passengers Streams at the Wroclaw Airport

Kierzkowski Artur and Kisiel Tomasz

Wroclaw University of Technology, Wroclaw, Poland

243 The Effects of Light Exposure on Flight Crew Alertness Levels to Enhance Fatigue Risk Management Predication Models

L. Brown (a), A.M.C. Schoutens (b), G. Whitehurst, T. Booker, T. Davis, S. Losinski, and R. Diehl (a)

a) Western Michigan University, Kalamazoo, USA, b) FluxPlus, BV, The Netherlands

472 Conception of Logistic Support Model for the Functioning of a Ground Handling Agent at the Airport

Kierzkowski Artur, Kisiel Tomasz

Wroclaw University of Technology, Wroclaw, Poland

T02 Fire Modeling and Applications

Tuesday 6/24/2014 10:30 Kahuku

Chair: Yan Gao, Westinghouse Electric Company

426 Preliminary Assessment of the Probabilistic Risk of Nuclear Power Plant Against to the Aircraft Impact Loading

Daegi Hahm, Sang Shup Shin, and In-Kil Choi

Korea Atomic Energy Research Institute, Deajeon, Korea

530 Significance of Structural Integrity Assessment in the Sustenance of Nigeria's Infrastructural Development

Olaniyi Abraham Oluseun (a), Ogunseye Olatunde David (b), Engr. 'Wale Lagunju FNSE (c)

a) Ministry of Works, Akure, Ondo State, Nigeria, b) Federal Polytechnic, Bida, Niger State, Nigeria, c) INTECON PARTNERSHIP LTD., Ibadan, Oyo State, Nigeria.

591 Fire Maintenance Rule (a)(4) Implementations in Us Nuclear Plants

Yan Gao (a), Victoria K Anderson (b), Anil K. Julka (c)

a) Westinghouse, Windsor, CT, b) NEI, Washington, DC, c) NextEra Energy, Juno Beach, FL

235 Event Tree Methodology as Analytical Tool for Fire Events

Svante Einarsson (a), Michael Tuerschmann (b), Marina Roewekamp (a)

a) Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH, Köln, Germany, b) Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH, Berlin, Germany

162 The Implementation Standard for Internal Fire Probabilistic Risk Assessment of Nuclear Power Plants

Toshiyuki Takagi (a), Naoyuki Murata (b)

a) Tohoku University, Aoba-ku, Sendai, Japan, b) Japan Nuclear Safety Institute, Minato-ku, Tokyo, Japan

230 Technical Reliability of Active Fire Protection Features – Generic Database Derived from German Nuclear Power Plants

Burkhard Forell, Svante Einarsson, Marina Roewekamp

Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH, Köln, Germany

T03 Reliability Analysis and Risk Assessment Methods II

Tuesday 6/24/2014 10:30 O'ahu

Chair: *Smain Yalaoui, Canadian Nuclear Safety Commission*

- 54 **Risk Assessment and Vulnerable Path in Security Networks Based on Neyman-Pearson Criterion and Entropy**
 Ruimin Hu (b,a), Haitao Lv, and Jun Chen (a)
a) National Engineering Research Center for Multimedia Software, Wuhan University, Wuhan, China, b) School of Computer, Wuhan University, Wuhan, China
- 471 **Dependability Evaluation of Data Center Power Infrastructures Considering Substation Switching Operations**
 Suellen Silva, Bruno Silva, Paulo Romero Martins Maciel (a), Armin Zimmermann (b)
a) Federal University of Pernambuco, Recife, Brasil, b) Ilmenau University of Technology, Ilmenau, Germany
- 57 **Fukushima Accident Implications on PSA and on the Regulatory Framework in Canada**
 Y. Akl, S. Yalaoui
Canadian Nuclear Safety Commission, Ottawa, Canada
- 59 **Strength of ZBDD Algorithm for the Post Processing of Huge Cutsets in Probabilistic Safety Assessment**
 Woo Sik Jung (a) and Jeff Riley (b)
a) Sejong University, Gwangjin-Gu, Seoul, South Korea, b) Electric Power Research Institute, Palo Alto, CA, USA
- 96 **Scoping Estimates of Multiunit Accident Risk**
 Martin A. Stutzke
U.S. Nuclear Regulatory Commission, Rockville, Maryland, USA

T04 The Petro-HRA Project: Adapting SPAR-H to a Petroleum Context I

Tuesday 6/24/2014 10:30 Waialua

Chair: *Ronald Boring, Idaho National Laboratory*

- 92 **Analysis of Human Actions as Barriers in Major Accidents in the Petroleum Industry, Applicability of Human Reliability Analysis Methods (Petro-HRA)**
 Karin Laumann (a), Knut Øien (b), Claire Taylor (c), Ronald L. Boring (d), Martin Rasmussen (a)
a) Norwegian University of Science and Technology, Trondheim, Norway, b) SINTEF, Trondheim, Norway, c) Institute for Energy Technology, Halden, Norway, d) Idaho National Laboratory, Idaho Falls, US
- 181 **Qualitative Data Collection for Human Reliability Analysis in the Offshore Petroleum Industry**
 Claire Taylor
OECD Halden Reactor Project, Institute for Energy Technology (IFE), Halden, Norway
- 224 **Defining Human Failure Events for Petroleum Risk Analysis**
 Ronald L. Boring (a) and Knut Øien (b)
a) Idaho National Laboratory, Idaho Falls, Idaho, USA, b) SINTEF, Trondheim, Norway
- 147 **Human Reliability Assessment of Blowdown in a Gas Leakage Scenario on Offshore Production Platforms: Methodological and Practical Experiences**
 Sondre Øie, Koen van de Merwe, Sandra Hogenboom (a), Karin Laumann (b), and Kristian Gould (c)
a) DNV GL, Hovik, Norway, b) NTNU, Trondheim, Norway, c) Statoil, Oslo, Norway

T05 Risk Management Methods and Applications for Asset Management

Tuesday 6/24/2014 10:30 Wai'anae

Chair: *Stephen Hess, Electric Power Research Institute*

- 63 **Risk Informed Margins Management as part of Risk Informed Safety Margin Characterization**
 Curtis Smith
Idaho National Laboratory, Idaho Falls, USA
- 110 **IPOP, an Industrial Assets Management Tool to Support Integrated Life Cycle Management**
 Jérôme Lonchamp, Karine Aubert-Fessart
EDF R&D, Chatou, France

211 **Integrated Life Cycle Management for Nuclear Power Plant Long Term Operation**

Stephen M. Hess and Charles A. Mengers
Electric Power Research Institute, West Chester, PA, USA

559 **Asset Integrity – Process Safety Management (Techniques and Technologies)**

Soliman A. Mahmoud
Engineering Specialist, Saudi Aramco Oil Company, Saudi Arabia

T06 Aging Management Issues for Nuclear (Spent) Fuel and HLW Transport and Storage

Tuesday 6/24/2014 10:30 Ewa

Chair: Bernhard Droste, BAM Federal Institute for Materials research and Testing

179 **Reliability of Cask Designs under Mechanical Loads in Storage Facilities**

Uwe Zencker, Linan Qiao, Mike Weber, Eva-Maria Kasperek, Holger Völzke
BAM Federal Institute for Materials Research and Testing, Berlin, Germany

180 **Considerations of Aging Mechanisms Influence on Transport Safety and Reliability of Dual Purpose Casks for Spent Nuclear Fuel or HLW**

Bernhard Droste, Steffen Komann, Frank Wille, Annette Rolle, Ulrich Probst, Sven Schubert
BAM Federal Institute for Materials Research and Testing, Berlin, Germany

413 **Development of Domestic Maritime Transportation Scenario for Nuclear Spent Fuel**

Min Yoo and Hyun Gook Kang
KAIST, Daejeon, Korea

183 **The German Aging Management Approach for Dry Spent Fuel Storage in Dual Purpose Casks**

Holger Völzke
Federal Institute for Materials Research and Testing (BAM), Berlin, Germany

468 **Understanding the Environment on the Surface of Spent Nuclear Fuel Interim Storage Containers**

Charles R. Bryan and David G. Enos
Sandia National Laboratories, Albuquerque, NM, USA

T07 Dynamic Reliability I

Tuesday 6/24/2014 10:30 Kona

Chair: Cristian Rabiti, Idaho National Laboratory

68 **Automatic Synthesis of Fault Trees from Process Modelling with Application in Ship Machinery Systems**

Gabriele Manno (a), Alexandros S. Zymaris, and Nikolaos M.P. Kakalis (b)
a) DNV GL, Strategic Research & Innovation, Høvik, Norway, b) DNV GL, Strategic Research & Innovation, Piraeus, Greece

365 **Ontology-based Disruption Scenario Generation for Critical Infrastructure**

Paolo Trucco, Boris Petrenj and Massimiliano De Ambroggi
Politecnico di Milano, Milan, Italy

227 **Methodologies for a Dynamic Probabilistic Risk Assessment of the Fast Cascade Occurring in Cascading Failures Leading to Blackouts**

Pierre Henneaux (a,b), Daniel Kirschen (b), and Pierre-Etienne Labeau (a)
a) Université libre de Bruxelles, Brussels, Belgium, b) University of Washington, Seattle, USA

372 **RAVEN, a New Software for Dynamic Risk Analysis**

C. Rabiti, A. Alfonsi, J. Cogliati, D. Mandellia, R. Kinoshita
Idaho National Laboratory, Idaho Falls, USA

375 **Dynamic Methods for the Assessment of Passive System Reliability**

Acacia Brunett, David Grabaskas, and Matthew Bucknor
Nuclear Engineering Division, Argonne National Laboratory, Argonne, IL, U.S.

T11 Reliability Analysis and Risk Assessment Methods III

Tuesday 6/24/2014 1:30 PM Honolulu

Chair: HyungJu Kim, NTNU, Department of Marine Technology, Norway

102 A PRA Application to Support Outage Schedule Planning at OL1 and OL2 Units

Hannu Tuulensuu
Teollisuuden Voima Oyj, Eurajoki, Finland

120 Loss Of Offsite Power Frequency Calculation II

Zhiping Li
Callaway Energy Center-Ameren Missouri, Fulton, USA

320 Mean Fault Time for Estimation of Average Probability of Failure on Demand PFDavg

Isshi KOYATA (a), Koichi SUYAMA (b), and Yoshinobu SATO (c)
a) The University of Marine Science and Technology Doctoral Course, Course of Applied Marine Environmental Studies, Tokyo, Japan and Japan Automobile Research Institute, Tokyo, Japan, b) The University of Marine Science and Technology Doctoral Course, Professor, Tokyo, Japan, c) Japan Audit and Certification Organization for Environment and Quality, Tokyo, Japan

164 Reliability Analysis Including External Failures for Low Demand Marine Systems

HyungJu Kim, Stein Haugen (a), and Ingrid Bouwer Utne (b)
a) Department of Production and Quality Engineering NTNU, Trondheim, Norway, b) Department Marine Technology NTNU, Trondheim, Norway

339 Heterogeneous Redundancy Analysis based on Component Dynamic Fault Trees

Jose Ignacio Aizpurua, Eñaut Muxika (a), Ferdinando Chiacchio (b), and Gabriele Manno (c)
a) University of Mondragon, Mondragon, Spain, b) University of Catania, Catania, Italy, c) Strategic Research & Innovation DNV GL, Høvik, Norway

T12 Application of Probability and Physics for NASA Risk Assessment Applications

Tuesday 6/24/2014 1:30 PM Kahuku

Chair: Jason Reinhardt, Stanford University

151 Probabilistic Analysis of Asteroid Impact Risk Mitigation Programs

Jason C. Reinhardt, Matthew Daniels, and M. Elisabeth Paté-Cornell
Stanford University, Stanford, United States of America

72 Physics-based Entry, Descent and Landing Risk Model

Ken Gee (a), Loc Huynh (b), and Ted Manning (a)
a) NASA Ames Research Center, Moffett Field, USA, b) Science and Technology Corporation, Moffett Field, USA

121 Physics-Based Fragment Acceleration Modeling for Pressurized Tank Burst Risk Assessments

Ted A. Manning, Scott L. Lawrence
NASA Ames Research Center, Moffett Field, CA, USA

192 A Failure Propagation Modeling Method for Launch Vehicle Safety Assessment

Scott Lawrence, Donovan Mathias, and Ken Gee
NASA Ames Research Center

191 An Integrated Reliability and Physics-based Risk Modeling Approach for Assessing Human Spaceflight Systems

Susie Go, Donovan Mathias (a), Chris Mattenberger (b), Scott Lawrence, and Ken Gee (a)
a) NASA Ames Research Center, Moffett Field, CA, USA, b) Science and Technology Corp., Moffett Field, CA, USA

T13 External Events Hazard/PRA Modeling for Nuclear Power Plants I

Tuesday 6/24/2014 1:30 PM O'ahu

Chair: Michael Saunders, ERIN Engineering and Research, Inc.

19 Apportioning Transient Combustible Fire Frequency via Areal Factors: More Complicated Than It May Seem

Raymond H.V. Gallucci
U.S. Nuclear Regulatory Commission (USNRC), MS O-10C15, Washington, D.C. 20555

267 **Characterizing Fire PRA Quantitative Models: An Evaluation of the Implications of Fire PRA Conservatism**

M.B. Saunders, E.T. Burns
ERIN Engineering and Research, Inc., Walnut Creek, California, USA

454 **Approach for Integration of Initiating Events into External Event Models**

Nicholas Lovelace, Matt Johnson (a), and Michael Lloyd (b)
a) Hughes Associates, Lincoln, NE, USA, b) Risk Informed Solutions Consulting Services, Ball Ground, GA, USA

44 **Development of Margin Assessment Methodology of Decay Heat Removal Function Against External Hazards □ Project Overview and Preliminary Risk Assessment Against Snow □**

Hidemasa Yamano, Hiroyuki Nishino, Kenichi Kurisaka, and Takaaki Sakai (a),
 Takahiro Yamamoto, Yoshihiro Ishizuka, Nobuo Geshi, Ryuta Furukawa, and Futoshi Nanayama (b), and Takashi Takata (c)
a) Japan Atomic Energy Agency, Ibaraki, Japan, b) National Institute of Advanced Industrial Science and Technology, Ibaraki, Japan, c) Osaka University, Osaka, Japan

590 **Screening of Seismic-Induced Fires**

James C. Lin, Donald J. Wakefield (a), and John Reddington (b)
a) ABSG Consulting Inc., Irvine, California, United States, b) First Energy Nuclear Operating Company, Akron, Ohio, United States

T14 **Cyber Security and Digital I&C**

Tuesday 6/24/2014 1:30 PM Waialua

Chair: Jose Emmanuel Ramirez-Marquez, Stevens Institute of Technology

28 **Minimization of Vulnerability for a Network under Diverse Attacks**

Jose Emmanuel Ramirez-Marquez (a) and Claudio Rocco (b)
a) School of Systems and Enterprises, Stevens Institute of Technology, Hoboken, NJ, USA, b) Facultad de Ingeniería, Universidad Central de Venezuela, Caracas, Venezuela

90 **Applications of Bayesian Networks for Evaluating Nuclear I&C Systems**

Jinsoo Shin, Rahman Khalil Ur (a), Hanseong Son (b), and Gyunyoung Heo (a)
a) Kyung Hee University, Yongin-si, Gyeonggi-do, Korea, b) Joongbu University, Geumsan-gun, Chungnam, Korea

367 **Portfolio Analysis of Layered Security Measures**

Samrat Chatterjee, Stephen C. Hora, Heather Rosoff
CREATE, University of Southern California

32 **Cyber security: the Risk of Supply Chain Vulnerabilities in an Enterprise Firewall**

Marshall A. Kuypers, Greg Heon, Philip Martin, Jack Smith, Katie Ward, and Elisabeth Paté-Cornell
Stanford University, Stanford, CA

489 **Security Informed Safety Assessment of Industrial FPGA-Based Systems**

Vyacheslav Kharchenko (a,b), Oleg Illiashenko (a), Eugene Brezhnev (a,b), Artem Boyarchuk (a), Vladimir Golovanevskiy (c)
a) National Aerospace University KhAI, Kharkiv, Ukraine, b) Centre for Safety Infrastructure Oriented Research and Analysis, Kharkiv, Ukraine, c) Western Australian School of Mines, Curtin University, Australia

T15 **Reliability of Passive Systems I**

Tuesday 6/24/2014 1:30 PM Wai'anāe

Chair: David Grabaskas, Argonne National Laboratory

47 **Uncertainty of the Thermal-Hydraulic Model Analysis**

Yu YU, Yingqiu HU, Junchi CAI, Shengfei WANG, Fenglei NIU
School of Nuclear Science and Engineering, Beijing Key Laboratory of Passive Nuclear Safety Technology, North China Electric Power University, Beijing, China

239 **Sensitivity Analysis and Failure Damage Domain Identification of the Passive Containment Cooling System of an AP1000 Nuclear Reactor**

Francesco Di Maio, Giancarlo Nicola (a), Yu Yu (b) and Enrico Zio (a,c)
a) Energy Department, Politecnico di Milano, Milano, Italy, b) North China Electric Power University, Beijing, China, c) Chair on System Science and Energetic Challenge, European Foundation for New Energy, Electricite de France, Ecole Centrale, Paris, and Supélec, Paris, France

374 **The Development of a Demonstration Passive System Reliability Assessment**

Matthew Bucknor, David Grabaskas, and Acacia Brunett
Nuclear Engineering Division, Argonne National Laboratory, Argonne, IL U.S.

T16 **Human Reliability Analysis II**

Tuesday 6/24/2014 1:30 PM Ewa

Chair: Jeffrey C. Joe, Idaho National Laboratory

153 **Visual Monitoring Path Forecasting for Digital Human-Computer Interface in Nuclear Power Plant and its Application**

Hu Hong, Zhang Li (a), Jiang Jian-Jun (b), Yi Can-Nan (a), Dai Li-Cao (b), Chen Qin-Qin (a)
a) Ergonomics and safety management Institute, HuNan Institute of Technology, Hengyang, China, b) Human Factors Institute, University of South China, Hengyang, China

13 **Individual Differences in Human Reliability Analysis**

Jeffrey C. Joe and Ronald L. Boring
Idaho National Laboratory, Idaho Falls, ID, USA

281 **Cultural Profiles of Non-MCR Operators Working in Domestic NPPs**

Jinkyun Park, and Wondea Jung
Korea Atomic Energy Research Institute, Daejeon, Rep. of Korea

219 **Improving Scenario Analysis for HRA**

Claire Taylor
OECD Halden Reactor Project, Institute for Energy Technology (IFE), Halden, Norway

308 **Can we Quantify Human Reliability in Level 2 PSA?**

Lavinia Raganelli (a,b), Barry Kirwan (c)
a) Imperial College, London, United Kingdom, b) Corporate Risk Associate, London, United Kingdom, c) Eurocontrol, Brétigny-sur-Orge, France

T17 **Integrated Deterministic and Probabilistic Safety Assessment I**

Tuesday 6/24/2014 1:30 PM Kona

Chair: Robert Youngblood, Idaho National Laboratory

50 **A Perspective on the Use of Risk Informed Safety Margin Characterization to Support Nuclear Power Plant Long Term Operation**

Stephen M. Hess
Electric Power Research Institute, West Chester, PA, USA

277 **Application of Gaussian Process Modeling to Analysis of Functional Unreliability**

R. W. Youngblood
Idaho National Laboratory, Idaho Falls, ID, USA

330 **An Approach to Grouping and Classification of Scenarios in Integrated Deterministic-Probabilistic Safety Analysis**

Sergey Galushin and Pavel Kudinov
Royal Institute of Technology (KTH), Stockholm, Sweden

382 **Developing Probabilistic Safety Performance Margins for Unknown and Underappreciated Risks**

Allan Benjamin (a), Homayoon Dezfuli (b), Chris Everett (c)
a) Independent Consultant, Albuquerque, NM, USA, b) Office of Safety & Mission Assurance, NASA Headquarters, Washington, DC, USA, c) Information Systems Laboratories, Inc., Rockville, MD, USA

435 **Modeling Operator Actions in Integrated Deterministic-Probabilistic Safety Assessment**

Vinh N. Dang and Durga Rao Karanki
Paul Scherrer Institute, Villigen PSI, Switzerland

TUESDAY LUNCHEON

Woody Epstein Senior Principal Consultant Lloyd's Register Energy - Japan



Which way PRA?

Abstract: March 11, 2011 was a wakeup call. The events of that day, and for several months afterwards, convinced many of us that to help society deal with disastrous events we might somehow have to change the way we do probabilistic risk assessment.

It was not only of the disaster at the Fukushima Daiichi Nuclear Power Station, but the impacts on oil and gas plants, public infrastructure, business continuity, supply chain, emergency preparedness and response, medical facilities, the understanding of extreme natural events, risk communication with the public ... the 3.11 list seems endless.

How can we continue to make PRA relevant in the light of March, 11?

Over 50 risk professionals from the nuclear, health, oil/gas, aerospace industries, from academia and from government were asked to write down a couple of topics/ideas which they think have been weak points of PRA, things we must change going forward, and perhaps even some tentative solutions.

During this talk, we will present some of their ideas and analyze how they pertain to the future of PRA.

Biography: Since 1983, Woody Epstein has been a quantitative risk assessment (QRA) consultant, manager, mathematician, and technical advisor for large organizations, both public and private. Since 2011, he has been the Manager of Risk Consulting, for Lloyd's Register Consulting, Japan; from 2001 – 2011, he was the Operations Manager and Manager of Risk Consulting for ABS Consulting, Japan.

In March, 2011, Tokyo Institute of Technology invited Woody to be a visiting scientist at Tokyo Institute of Technology, where he authored an independent evaluation of the accident at Fukushima Daiichi for the Ninokata Laboratory, "A PRA Practitioner looks at the Great East Japan Earthquake and Tsunami"

In August, 2012, he was the operations manager for the International Atomic Energy Agency's Mission to the Onagawa NPS, to do a damage walk down of the station after the Great Eastern Japan Earthquake..

From March, 2013 until the present, Woody has been the project manager for the active faults studies for the Japan Atomic Power Company and the Tohoku Electric Power Company at the Tsuruga and Higashidori NPPs.

In August, 2013, he served as the operations manager for the United Nations Scientific Committee for the Effects of Radiation Mission to Fukushima Prefecture to listen to and film the Fukushima people.

He is one of the founders of the Open PSA Initiative, is a Core Group Member of the Resilience Engineering Group, member of the Japan Nuclear Safety Institute's Technical Review Committee for PRA and Seismic PRA and is a member of the Risk Technical Committee of the Atomic Energy Society of Japan.

Jerzy Grynblat Nuclear Business Director for Lloyd's Register and Scandpower



Biography: Jerzy Grynblat started working in the nuclear risk management business in the mid 1970s. During his career he has been involved in several reliability and economical analysis for power industry, including nuclear, coal, oil and solar energy. Mr. Grynblat has, among other assignments, worked in several nuclear power plants modernisation projects for Swedish utility OKG Aktiebolag. In those projects Mr. Grynblat has worked with establishing of safety criteria, performing deterministic safety analysis and preparing safety related licensing documentation to be submitted to Swedish Nuclear Power Inspectorate. Mr. Grynblat possesses a broad experience within the field of deterministic safety analysis, safety standards, norms and criteria for Nuclear Power Plants.

Mr. Grynblat was in 1984 one of the co-founder of RELCON, a risk management consulting company that joined Scandpower in the beginning of 2007, now itself a member of the Lloyd's Register Group. Mr. Grynblat was the president of the company between 1995 and 2010. RELCON developed and marketed RiskSpectrum®, the software that dominates the probabilistic risk analysis market in the nuclear business. RiskSpectrum PSA is licensed for use at more than 50% of the world's nuclear power plants. Following the acquisition of Scandpower by Lloyd's Register Mr. Grynblat has been appointed in the beginning of February 2010 as the Nuclear Business Director for Lloyd's Register and Scandpower.

T21 Reliability Analysis and Risk Assessment Methods IV

Tuesday 6/24/2014 3:30 PM Honolulu

Chair: Royce Francis, George Washington University

220 Reliability Analysis and Experimental Reliability Parameter Determination of Nuclear Reactor Equipments

Gheorghe Vieru
AREN, Bucharest, ROMANIA

236 Multi Units Probabilistic Safety Assessment: Methodological elements suggested by EDF R&D

Tu Duong Le Duy, Dominique Vasseur, and Emmanuel Serdet
Industrial Risk Management Department, EDF R&D

369 Automated Selection of Number of Clusters for Determining Proliferation Resistance Measures

Daniya Zamalieva (a), Zachary Jankovsky (b), Alper Yilmaz (a), Tunc Aldemir (b), and Richard Denning (b)
a) Photogrammetric Computer Vision Laboratory, The Ohio State University, Columbus, OH, USA, b) Department of Mechanical and Aerospace Engineering, The Ohio State University, Columbus, OH, USA

266 Analysis Of The Main Challenges With The Current Risk Model For Collisions Between Ships and Offshore Installations On The Norwegian Continental Shelf

Martin Hassel, Ingrid Bouwer Utne and Jan Erik Vinnem
Department of Marine Technology, NTNU, Trondheim, Norway

215 Information-based Reliability Weighting for Failure Mode Prioritization in Photovoltaic (PV) Module Design

Royce Francis (a) and Alessandra Colli (b)
a) The George Washington University, Washington, DC, USA, b) Brookhaven National Laboratory, Upton, NY, USA

T22 Dependent Failure Modeling II

Tuesday 6/24/2014 3:30 PM Kahuku

Chair: Ashraf El-Shanawany, Corporate Risk Associates Limited

311 UK Experience of Developing Alpha Factors for Use in Nuclear PRA Models

Garth Rowlands (a) and Ashraf El - Shanawany (a,b)
a) Corporate Risk Associates, Warrington, United Kingdom, b) Imperial College London, London, United Kingdom

172 On the Use of Qualitative Methods for Common Cause Analysis: Zonal and Common Mode Analysis

Cristina Johansson (a,b), Johan Tengroth, Jan Hjelmsstedt (a)
a) Saab Aeronautics, Linköping, Sweden, b) Linköping University, Department of Machine Design, Linköping, Sweden

302 A Computer Program for Evaluating the Alpha Factor Model Parameters Using the Bayesian Operation

Baehyeuk Kwon, Moosung Jae (a), and Dong Wook Jerng (b)
a) Department of Nuclear Engineering, Hanyang University, Seoul, Korea, b) Department of Energy Systems Engineering, Chung-Ang University, Dongjak-Gu, Seoul, Korea

134 A General Cause Based Methodology for Analysis of Common Cause and Dependent Failures in System Risk and Reliability Assessments

Andrew O'Connor, Ali Mosleh
Center for Risk and Reliability, University of Maryland, College Park, United States

T23 Risk and Hazard Analyses II

Tuesday 6/24/2014 3:30 PM O'ahu

Chair: James Knudsen, Idaho National Laboratory

178 Copulas applied to Flight Data Analysis

Lukas Höhndorf, Javensius Sembiring, and Florian Holzapfel
Institute of Flight System Dynamics, Technische Universität München, Munich, Germany

193 Application of Severity Indices Developed for Adiabatic Compression Testing

Barry Newton (a) and Theodore Steinberg (b)
a) Wendell Hull and Associates, Inc, Las Cruces, NM USA, b) Queensland Univ. of Technology, Brisbane, Qld, AU

459 **Method for Analysing Extreme Events**

J.Sörman, O. Bäckström (a), Luo Yang (a), I. Kuzmina, A.Lyubarskiy (b) and M. El-Shanawany (c)
 a) Lloyd's Register Consulting – Energy AB, Stockholm, Sweden, b) IAEA, Vienna, Austria, c) Lloyd's Register, Energy, London, UK

477 **Modeling Common Cause Failures of Thrusters on ISS Visiting Vehicles**

Megan Haught and Gary Duncan
 ARES Technical Services, Houston, TX, USA

T24 Risk Governance and Societal Safety II

Tuesday 6/24/2014 3:30 PM Waialua

Chair: Vicki Bier, University of Wisconsin-Madison

171 **Challenges with Risk and Vulnerability Analyses: Strategies for Integration in Risk and Crisis Management**

Kirsti Russell Vastveit (a), and Kerstin Eriksson (b,c)
 a) University of Stavanger, Stavanger, Norway, b) Division of Risk Management and Societal Safety, Lund University, Lund, Sweden, c) Lund University Centre for Risk Assessment and Management and Centre for Societal Resilience, Lund University, Sweden

199 **Development of an Updated Societal-Risk Goal for Nuclear Power Safety**

Vicki Bier, Michael Corradini (a), Robert Youngblood (b), Caleb Roh, Shuji Liu (a)
 a) University of Wisconsin-Madison, Madison, Wisconsin, U.S., b) Idaho National Laboratory (INL), Department of Energy (DOE), Idaho Falls, Idaho, U.S.

240 **The Effect of Including Societal Consequences for Decisions on Critical Infrastructure Vulnerability Reductions**

J. Johansson (a,c), L. Svegrup, and H. Hassel (a,b)
 a) Lund University Centre for Risk Assessment and Management (LUCRAM) and Centre for Societal Resilience (CSR), Lund, Sweden, b) Division of Risk Management and Societal Safety, Lund University, Lund, Sweden, c) Division of Industrial Electrical Engineering and Automation, Lund University, Lund, Sweden

437 **Validation of Proxy Random Utility Models for Adaptive Adversaries**

Richard S. John (a) and Heather Rosoff (b)
 a) Department of Psychology, University of Southern California, Los Angeles, California, USA, b) Sol Price School of Public Policy, University of Southern California, Los Angeles, California, USA

T25 Risk Informed Applications II

Tuesday 6/24/2014 3:30 PM Wai'anae

Chair: Katrina Groth, Sandia National Laboratories

104 **Risk-Informed Review of Actual Maintenance Strategy at Paks NPP**

Tibor Kiss (a), Zoltan Karsa (b)
 a) Paks NPP, Paks, Hungary, b) NUBIKI, Budapest, Hungary

538 **“Smart Procedures”: Using Dynamic PRA to Develop Dynamic, Context-Specific Severe Accident Management Guidelines (SAMGs)**

Katrina M. Groth, Matthew R. Denman, Jeffrey N. Cardoni, Timothy A. Wheeler
 Sandia National Laboratories, Albuquerque, NM, USA

567 **Application of PRA in Risk-informed Risk Management**

Jie Wu
 Institute of Nuclear Energy Safety Technology, Chinese Academy of Sciences

571 **PRA Insights Used for SBO Mitigation in Barakah Nuclear Power Plant – Lessons Learned from the Fukushima Accident**

Yu Shen, Abdullah Al Yafei, Mohamed Abdulla Sabaan Al Breiki
 ENEC, Abu Dhabi, UAE

T26 Fire and Combustibles Analysis

Tuesday 6/24/2014 3:30 PM Ewa

Chair: James Lin, ABSG Consulting Inc.

508 **Insights from the Risk Analysis of a Nearby Propane Tank Farm**

James C. Lin
 ABSG Consulting Inc., Irvine, California, United States

321 **Composite-bonded Steel Substrate with Silyl-modified Polymer Exposed to Thermal Distress**

Yail J. Kim (a), Seung Won Hyun (b), Isamu Yoshitake (c), Jae-Yoon Kang (d), and Junwon Seo (e)

a) University of Colorado Denver, Denver, CO, USA, b) North Dakota State University, Fargo, ND, USA, c) Yamaguchi University, Ube, Japan, d) Korea Institute of Construction Technology, Ilsan, Korea, e) South Dakota State University, Brookings, SD, USA

18 **Statistical Characterization of Cable Electrical Failure Temperatures Due to Fire, with Simulation of Failure Probabilities**

Raymond H.V. Gallucci

U.S. Nuclear Regulatory Commission (USNRC), MS O-10C15, Washington, D.C. 20555

550 **OECD FIRE Database Applications and Challenges – A Recent Perspective**

Marina Roewekamp (a), Matti Lehto (b), Heinz-Peter Berg (c), Nicholas Melly (d), Wolfgang Werner (e)

a) Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH, Köln, Germany, b) Radiation and Nuclear Safety Authority (STUK), Helsinki, Finland, c) Bundesamt für Strahlenschutz (BfS), Salzgitter, Germany, d) United States Nuclear Regulatory Commission (NRC) Office of Research, Rockville, MD, United States of America, e) SAC, Breitbrunn, Germany

T27 The Petro-HRA Project: Adapting SPAR-H to a Petroleum Context II

Tuesday 6/24/2014 3:30 PM Kona

Chair: Martin Rasmussen, Norwegian University of Science and Technology

93 **Suggestions for Improvements to the Definitions of SPAR-H Performance Shaping Factors, to the Definitions of the Levels, and Suggestions for Changes in the Multipliers.**

Karin Laumann and Martin Rasmussen

Norwegian University of Science and Technology, Trondheim, Norway

141 **Expert Judgment in Human Reliability Analysis: Development of User Guidelines**

Nicola Paltrinieri and Knut Øien

SINTEF Technology and Society, Trondheim, Norway

175 **The Suitability of the SPAR-H “Ergonomics/HMI” PSF in a Computerized Control Room in the Petroleum Industry**

Martin Rasmussen and Karin Laumann

Norwegian University of Science and Technology, Trondheim, Norway

9:00 AM

Sandeep Bobby Reddy MD
Clinical Associate Professor, Geffen/UCLA School of Medicine
Chief Medical Officer, CARIS Life Sciences



A new look at risk assessment in cancer: the molecular era

Biography: Graduated from UCLA School of Medicine, trained in Internal Medicine at Harbor-UCLA Medical Center, and fellowship in Medical Oncology and Hematology at City of Hope National Medical center. Currently in practice at Los Alamitos Hematology Oncology with an academic position as clinical instructor at Harbor-UCLA Medical Center. Dr. Reddy has authored numerous publications and given presentations at National and International meetings and worked extensively as a consultant in the field of molecular diagnostics. He is currently Chief Medical Officer of CARIS Life Sciences. His presentation will focus on the evolving paradigm shift away from statistically modeled risk assessment tools to individualized risk assessment through rapid technology changes in the field.

W01 Aviation and Space II

Wednesday 6/25/2014 10:30 Honolulu

Chair: Gary Duncan, ARES Aerospace & Technology Services

20 Quantifying Risk in Commercial Aviation with Fault Trees and Event Sequence Diagrams

Robin L. Dillon-Merrill (a), Vicki Bier (b), Sherry S. Borener, Mindy J. Robinson (c), Kandi K. Mitchell (d), Poornima Balakrishna (e), Amanda Hepler (f), Aleta Best (c)

a) Georgetown University, Washington, DC, United States, b) University of Wisconsin-Madison, Madison, WI, United States, c) Federal Aviation Administration, Washington DC, United States, d) Crown Consulting, Inc., Arlington, VA, e) Saab Sensis Corporation, Washington, DC, f) Innovative Decisions Inc., Vienna, VA

209 Reliability-Based Design Optimization of Space Tether Considering Hybrid Uncertainty

Liping He, Jian Xiao, Tao Zhao (a), Yi Chen (b), Shuchun Duan (a)

a) School of Mechanics, Electronic, and Industrial Engineering, University of Electronic Science and Technology of China, Chengdu, China, b) School of Engineering and Built Environment, Glasgow Caledonian University, Glasgow, UK

280 Using Subset Simulation to Quantify Stakeholder Contribution to Runway Overrun

Ludwig Drees, Chong Wang, and Florian Holzapfel

Institute of Flight System Dynamics, Technische Universität München, Garching, Germany

476 International Space Station End-of-Life Probabilistic Risk Assessment

Gary Duncan

ARES Technical Services, Houston, TX, USA

W02 Reliability Analysis and Risk Assessment Methods V

Wednesday 6/25/2014 10:30 Kahuku

Chair: Mohammad Pourgol-Mohammad, Sahand University of Technology

533 MCSS Based Numerical Simulation for Reliability Evaluation of Repairable System in NPP

Daochuan Ge (a,b), Ruoxing Zhang, Qiang Chou (b), Yanhua Yang (a)

a) School of Nuclear Science and Engineering, Shanghai Jiao Tong University, Shanghai, China, b) Software Development Center, State Nuclear Power Technology Corporation, Beijing, China

410 Design for Reliability of Complex System with Limited Failure Data; Case Study of a Horizontal Drilling Equipment

Morteza Soleimani (a), Mohammad Pourgol-Mohammad (b)

a) Tabriz University, Tabriz, Iran, b) Sahand University of Technology, Tabriz, Iran

514 Analyzing Simulation-Based PRA Data Through Clustering: a BWR Station Blackout Case Study

Dan Maljovec, Shusen Liu, BeiWang, Valerio Pascucci (a), Peer-Timo Bremer (b), Diego Mandelli, and Curtis Smith (c)

a) SCI Institute, University of Utah, Salt Lake City, USA, b) Lawrence Livermore National Laboratory, Livermore, USA, c) Idaho National Laboratory, Idaho Falls, USA

456 Quantification of MCS with BDD, Accuracy and Inclusion of Success in the Calculation – the RiskSpectrum MCS BDD Algorithm

Wei Wang, Ola Bäckström (a), and Pavel Krcaľ (a,b)

a) Lloyd's Register Consulting, Stockholm, Sweden, b) Uppsala University, Uppsala, Sweden

573 Developing a New Fire PRA Framework by Integrating Probabilistic Risk Assessment with a Fire Simulation Module

Tatsuya Sakurahara, Seyed A. Reihani, Zahra Mohaghegh, Mark Brandyberry (a), Ernie Kee (b), David Johnson (c), Shawn Rodgers (d), and Mary Anne Billings (d)

a) The University of Illinois at Urbana-Champaign, Urbana, IL, USA, b) YK.risk, LLC, Bay City, TX, USA, c) ABS Consulting Inc., Irvine, CA, USA, d) South Texas Project Nuclear Operating Company, Wadsworth, TX, USA

W03 Human Reliability Analysis III

Wednesday 6/25/2014 10:30 O'ahu

Chair: Yung Hsien Chang, U.S. Nuclear Regulatory Commission

347 Lessons Learned from the US HRA Empirical Study

Huafei Liao (a), John Forester (a,b), Vinh N. Dang (c), Andreas Bye (d), Erasmia Lois, Y. James Chang (e)

a) Sandia National Laboratories, Albuquerque, NM, USA, b) Idaho National Laboratory, Idaho Falls, ID, USA, c) Paul Scherrer Institute, Villigen PSI, Switzerland, d) OECD Halden Reactor Project, Institute for Energy Technology, IFE, Halden, Norway, e) U.S. Nuclear Regulatory Commission, Washington, DC, USA

- 360 **Extracting Human Reliability Information from Data Collected at Different Simulators: A Feasibility Test on Real Data**
Salvatore Massaiu
OECD Halden Reactor Project, Halden, Norway
- 380 **Simplified Human Reliability Analysis Process for Emergency Mitigation Equipment (EME) Deployment**
Don E. MacLeod, Gareth W. Parry, Barry D. Sloane (a), Paul Lawrence (b), Eliseo M. Chan (c), and Alexander V. Trifanov (d)
a) ERIN Engineering and Research, Inc., Walnut Creek, USA, b) Ontario Power Generation, Inc., Pickering, Canada, c) Bruce Power, Toronto, Canada, d) Kinectrics, Inc., Pickering, Canada
- 126 **Study on Operator Reliability of Digital Control System in Nuclear Power Plants Based on Boolean Network**
Yanhua Zou, Li Zhang (a,b,c), Licao Dai, Pengcheng Li (c)
a) Institute of Human Factors Engineering and Safety Management, Hunan Institute of Technology, Hengyang, China, b) School of Nuclear Science and Technology, University of South China, Hengyang, China, c) Human Factor Institute, University of South China, Hengyang, China
- 392 **Toward Modelling of Human Performance of Infrastructure Systems**
Cen Nan (a,c) and Wolfgang Kröger (b)
a) Reliability and Risk Engineering Group (RRE), ETH Zürich, Switzerland, b) ETH Risk Center, ETH Zürich, Switzerland, c) Land Using Engineering Group (LUE), ETH Zürich, Switzerland

W04 Marine Engineering

Wednesday 6/25/2014 10:30 Waialua

Chair: Arsham Mazaheri, Aalto University

- 26 **A Bayesian Network Model for Accidental Oil Outflow in Double Hull Oil Product Tanker Collisions**
Floris Goerlandt and Jakub Montewka
Aalto University, Department of Applied Mechanics, Marine Technology, Research Group on Maritime Risk and Safety, P.O. Box 15300, FI-00076 AALTO, Finland
- 37 **Ship Grounding Damage Estimation Using Statistical Models**
Otto-Ville Sormunen
Aalto University, Department of Applied Mechanics, Marine Technology, Research Group on Maritime Risk and Safety, Espoo, Finland
- 61 **Effects of the Background and Experience on the Experts' Judgments through Knowledge Extraction from Accident Reports**
Noora Hyttinen (a), Arsham Mazaheri (b), and Pentti Kujala (c)
a) Aalto University, Department of Applied Mathematics, School of Science, Espoo, Finland, b) Aalto University, Department of Applied Mechanics, School of Engineering, Espoo, Finland Kotka Maritime Research Center (Merikotka), Kotka, Finland, c) Aalto University, Department of Applied Mechanics, School of Engineering, Espoo, Finland
- 327 **A Study for Adapting a Human Reliability Analysis Technique to Marine Accidents**
Kenji Yoshimura (a), Takahiro Takemoto (b), Shin Murata (c), and Nobuo Mitomo (d)
a) National Maritime Research Institute, Mitaka, Japan, b) Tokyo University of Marine Science and Technology, Tokyo, Japan, c) National Institute for Sea Training, Yokohama, Japan, d) Nihon University, Funabashi, Japan
- 364 **Quantifying the Effect of Noise, Vibration and Motion on Human Performance in Ship Collision and Grounding Risk Assessment**
Jakub Montewka, Floris Goerlandt (a), Gemma Innes-Jones, Douglas Owen (b), Yasmine Hifi (c), Markus Porthin (d)
a) Aalto University, Department of Applied Mechanics, Marine Technology, Research Group on Maritime Risk and Safety, Espoo, Finland, b) - Lloyd's Register, EMEA, Bristol, UK, c) - Brookes Bell R&D, Glasgow, UK, d) - VTT Technical Research Centre of Finland, Espoo, Finland

W05 Uncertainty, Sensitivity, and Bayesian Methods I

Wednesday 6/25/2014 10:30 Wai'anae

Chair: David Esh, US Nuclear Regulatory Commission

- 10 **Further Development of the GRS Common Cause Failure Quantification Method**
Jan Stiller, Albert Kreuser, Claus Versteegen
Gesellschaft für Anlagen- und Reaktorsicherheit mbH (GRS), Cologne, Germany
- 75 **Plant-Specific Uncertainty Analysis for a Severe Accident Pressure Load Leading to a Late Containment Failure**
S.Y.Park and K.I.Ahn
a) Korea Atomic Energy Research Institute, Daejeon, KOREA

87 **Comparison of Uncertainty and Sensitivity Analyses Methods Under Different Noise Levels**

David Esh and Christopher Grossman
US Nuclear Regulatory Commission, Washington, DC, USA

115 **Understanding Relative Risk: An Analysis of Uncertainty and Time at Risk**

A. El-Shanawany (a,b)
a) Imperial College London, London, United Kingdom, b) Corporate Risk Associates, London, United Kingdom

W06 Aging Management Issues for Nuclear (Spent) Fuel and HLW Transport and Storage

Wednesday 6/25/2014 10:30 Ewa

Chair: Dietmar Wolff, BAM Federal Institute for Materials Research and Testing

257 **Understanding the Long-term Behavior of Sealing Systems and Neutron Shielding Material for Extended Dry Cask Storage**

Dietmar Wolff, Matthias Jaunich, Ulrich Probst, and Sven Nagelschmidt
Federal Institute for Materials Research and Testing (BAM), Berlin, Germany

259 **Gap Analysis Examples from Periodical Reviews of Transport Package Design Safety Reports of SNF/HLW Dual Purpose Casks**

Steffen Komann, Frank Wille, Bernhard Droste
Federal Institute for Materials Research and Testing (BAM), Berlin, Germany

417 **The Evolution of Safety Related Parameters and their Influence on Long-Term Dry Cask Storage**

Klemens Hummelsheim (a), Jörn Stewering (b), Sven Keßen and Florian Rowold (a)
a) Gesellschaft für Anlagen und Reaktorsicherheit (GRS) mbH, Garching, Germany, b) Gesellschaft für Anlagen und Reaktorsicherheit (GRS) mbH, Cologne, Germany

542 **Aging Management of Dual-Purpose Casks on the Example of CASTOR® KNK**

Iris Graffunder (a), Ralf Schneider-Eickhoff and Rainer Nöring (b)
a) EWN Energiewerke Nord GmbH, Lubmin, Germany, b) GNS Gesellschaft für Nuklear-Service mbH, Essen, Germany

W07 Dynamic Reliability II

Wednesday 6/25/2014 10:30 Kona

Chair: Diego Mandelli, Idaho National Laboratory

513 **Overview of New Tools to Perform Safety Analysis: BWR Station Black Out Test Case**

D. Mandelli, C. Smith (a), T. Riley (c), J. Nielsen, J. Schroeder, C. Rabiti, A. Alfonsi, J. Cogliati, R. Kinoshita (a), V. Pascucci, B. Wang, D. Maljovec (b)
a) Idaho National Laboratory, Idaho Falls (ID), USA, b) University of Utah, Salt Lake City (UT), USA, c) Oregon State University, Corvallis (OR), USA

80 **Simulation Methods to Assess Long-Term Hurricane Impacts to U.S. Power Systems**

Andrea Staid, Seth D. Guikema (a), Roshanak Nateghi (a,b), Steven M. Quiring (c), and Michael Z. Gao (a)
a) Johns Hopkins University, Baltimore, MD USA, b) Resources for the Future, Washington, DC USA, c) Texas A&M University, College Station, TX USA

238 **Towards Reliability Evaluation of AFDX Avionic Communication Systems With Rare-Event Simulation**

Armin Zimmermann, Sven Jäger (a), and Fabien Geyer (b)
a) Software and Systems Engineering, Ilmenau University of Technology, Ilmenau, Germany, b) Airbus Group Innovations, Dept. TX4CP, Munich, Germany

486 **Extension of DMCI to Heterogeneous Infrastructures: Model and Pilot Application**

Paolo Trucco, Massimiliano De Ambroggi, Pablo Fernandez Campos (a), Ivano Azzini, and Georgios Giannopoulos (b)
a) Department of Management, Economics and Industrial Engineering, Politecnico di Milano, Milan, Italy, b) European Commission - DG Joint Research Centre (JRC), Ispra, Italy

532 **A Longitudinal Analysis of the Drivers of Power Outages During Hurricanes: A Case Study with Hurricane Isaac**

Gina Tonn, Seth Guikema (a), Celso Ferreira (b), and Steven Quiring (c)
a) Johns Hopkins University, Baltimore, MD, US, b) George Mason University, Fairfax, VA, US, c) Texas A&M University, College Station, TX

W08 Special Session

Wednesday 6/25/2014 12:00

Chair: John O'Donnell

SPECIAL SESSION

W11 Digital I&C and Software Reliability II

Wednesday 6/25/2014 1:30 PM Honolulu

Chair: Robert Enzinna, AREVA Inc.

- 148 **Experimental Approach to Evaluate the Reliability of Digital I&C Systems in Nuclear Power Plants**
Seung Jun Lee (a), Man Cheol Kim (b), and Wondea Jung (a)
a) Korea Atomic Energy Research Institute, Daejeon, Korea, b) Chung-ang University, Seoul, Korea
- 170 **The Contribution to Safety of a Diverse Backup System for Digital Safety I&C Systems in Nuclear Power Plants, a Probabilistic Approach**
W. Postma, J.L. Brinkman
NRG, Arnhem, the Netherlands
- 196 **Modeling of Digital I&C and Software Common Cause Failures: Lessons Learned from PSAs of TELEPERM® XS-Based Protection System Applications**
Robert S Enzinna (a), Mariana Jockenhoevel-Barttfeld, Yousef Abusharkh (b), and Herve Bruneliere (c)
a) AREVA Inc. Lynchburg, VA, USA, b) AREVA GmbH, Erlangen, Germany, c) AREVA SAS, Paris, France
- 283 **Methodology for Safety Assessment of the Defense-in Depth and Diversity Concept of the Digital I&C by Modernization of an NPP in Finland**
Ewgenij Piljugin (a), Jarmo Korhonen (b)
a) Gesellschaft fuer Anlagen und Reaktorsicherheit (GRS) mbH, Garching, Germany, b) Fortum, Power and Heat, Helsinki, Finland

W12 Safety Assessment Software and Tools I

Wednesday 6/25/2014 1:30 PM Kahuku

Chair: Daniel Clayton, Sandia National Laboratories

- 31 **Scrum, documentation and the IEC 61508-3:2010 software standard**
Thor Myklebust(a), Tor Stålhane (b), Geir Kjetil Hanssen (a), Tormod Wien (c) and Børge Haugset (a)
a) SINTEF ICT, b) IDI NTNU, c) ABB
- 378 **A Software Package for the Assessment of Proliferation Resistance of Nuclear Energy Systems**
Zachary Jankovsky, Tunc Aldemir, Richard Denning (a), Lap-Yan Cheng and Meng Yue (b)
a) The Ohio State University, Columbus, Ohio, USA, b) Brookhaven National Laboratory, Uptown, New York, USA
- 241 **Risk Estimation Methodology for Launch Accidents**
Daniel J. Clayton, Ronald J. Lipinski (a), and Ryan D. Bechtel (b)
a) Sandia National Laboratories, Albuquerque, NM, USA, b) Office of Space and Defense Power Systems, U.S. Department of Energy, Germantown, MD, USA
- 296 **Development of Online Reliability Monitors Software for Component Cooling Water System in Nuclear Power Plant**
Yunli Deng, He Wang, Biao Guo
Fundamental Science on Nuclear Safety and Simulation Technology Laboratory, College of Nuclear Science and Technology, Harbin Engineering University, Harbin, P.R. China
- 340 **A Parallel Manipulation Method for Zero-suppressed Binary Decision Diagram**
Jin Wang, Shanqi Chen, Liqin Hu, Rongxiang Hu, Fang Wang, FDS Team
Institute of Nuclear Energy Safety Technology, Chinese Academy of Sciences, Hefei Anhui, China

W13 External Events Hazard/PRA Modeling for Nuclear Power Plants II

Wednesday 6/25/2014 1:30 PM O'ahu

Chair: In-Kil CHOI, Korea Atomic Energy Research Institute

89 Realistic Modelling of External Flooding Scenarios - A Multi-Disciplinary Approach

J. L. Brinkman
NRG, Arnhem, The Netherlands

149 Insights from the Analyses of Other External Hazards for Nuclear Power Plants

James C. Lin
ABSG Consulting Inc., Irvine, California, United States

245 The Next-Generation Risk Assessment Method About the Effect of a Slope And Foundation Ground on a Facility in a Nuclear Power Plant

Susumu Nakamura (a), Ikumasa Yoshida (b), Masahiro Shinoda (c), Tadasi Kawai (d), Hidetaka Nakamura (e), and Masaaki Murata (f)
a) Dept. of Civil & Environmental Eng., College of Engineering, Nihon University, Koriyama, Japan, b) Tokyo City University, Tokyo, Japan, c) Railway technical research institute, Kunitachi, Japan, d) Tohoku University, Sendai, Japan, e) Japan nuclear regulation authority, Tokyo, Japan, f) Mitsubishi heavy industry, Takasago, Japan

289 Probabilistic Tsunami Hazard Analysis for Nuclear Power Plants on the East Coast of Korean Peninsula

In-Kil Choia, Min Kyu Kim, Hyun-Me Rhee
Korea Atomic Energy Research Institute, Daejeon, Korea

305 External Events PSA for the Spent Fuel Pool of the Paks NPP

Attila Bareith (a), Jozsef Elter (b), Zoltan Karsa, Tamas Siklossy (a)
a) NUBIKI Nuclear Safety Research Institute, Budapest, Hungary, b) Paks Nuclear Power Plant Ltd., Paks, Hungary

W14 Safety Management and Decision Making I

Wednesday 6/25/2014 1:30 PM Waialua

Chair: Chris Everett, Information Systems Laboratories, Inc.

132 Ramifications of Modeling Impact On Regulatory Decision-making - A Practical Example

Ching Guey
Tennessee Valley Authority, Chattanooga, TN, U.S.A.

138 A Fresh Look at Barriers from Alternative Perspectives on Risk

Xue Yang, Stein Haugen
Norwegian University of Science and Technology, Trondheim, Norway

140 Monitoring Major Accident Risk in Offshore Oil and Gas Activities by Leading Indicators

Helene Kjær Thorsen (a) and Ove Njå (b)
a) Safetec Nordic AS, Oslo, Norway, b) University of Stavanger, Stavanger, Norway

185 The Role of NASA Safety Thresholds and Goals in Achieving Adequate Safety

Homayoon Dezfuli (a), Chris Everett (b), Allan Benjamin (c), Bob Youngblood (d), and Martin Feather (e)
a) NASA, Washington, DC, USA, b) ISL, Rockville, MD, USA, c) Independent Consultant, Albuquerque, NM, USA, d) Idaho National Laboratory, Idaho Falls, ID, USA, e) Jet Propulsion Laboratory, Pasadena, CA, USA

195 Improving Consistency Checks between Safety Concepts and View Based Architecture Design

Pablo Oliveira Antonino, Mario Trapp
Fraunhofer IESE, Kaiserslautern, Germany

W15 Reliability of Passive Systems I

Wednesday 6/25/2014 1:30 PM Wai'anae

Chair: James Knudsen, Idaho National Laboratory

379 Uncertainty Evaluation in Multi-State Physics Based Aging Assessment of Passive Components

Askin Guler, Tunc Aldemir, and Richard Denning
Nuclear Engineering Program The Ohio State University, Columbus, OH, USA

- 537 **Passive System Evaluation by Using Integral Thermal-Hydraulic Test Facility in Passive NPP(nuclear power plant) PSA (probabilistic safety assessment) Process**
 Ruichang Zhao, Huajian Chang, Yang Xiang
State Nuclear Power Technology Research & Development Center, Beijing, China

- 576 **Probabilistic Assessment of Composite Plate Failure Behavior under Specific Mechanical Stresses**
 Somayeh Oftadeh, Mohammad Pourgol-Mohammad, and Mojtaba Yazdani
Sahand University of Technology, Tabriz, Iran

- 216 **Development of Feedwater Line & Main Steam Line Break Initiating Event Frequencies for Ringhals Pressurized Water Reactors**
 Anders Olsson, Erik Persson Sunde (a), and Cilla Andersson (b)
a) Lloyd's Register Consulting, Stockholm, Sweden, b) Ringhals NPP, Våröbacka, Sweden

W16 Uncertainty, Sensitivity, and Bayesian Methods II

Wednesday 6/25/2014 1:30 PM Ewa

Chair: Mohammad Pourgol-Mohammad, Sahand University of Technology

- 158 **Improvement of the Reliability and Robustness of Variance-Based Sensitivity Analysis of Final Repository Models by Application of Output Transformation**
 Dirk-Alexander Becker
Gesellschaft fuer Anlagen- und Reaktorsicherheit (GRS) mbH, Braunschweig, Germany

- 177 **Bayesian Approach Implementation on Quick Access Recorder Data for Estimating Parameters and Model Validation**
 Javensius Sembiring, Lukas Höhndorf, and Florian Holzappel
Institute of Flight System Dynamics TUM, München, Germany

- 194 **Comparative Assessment of Severe Accidents Risk in the Energy Sector: Uncertainty Estimation Using a Combination of Weighting Tree and Bayesian Hierarchical Models**
 M. Spada, P. Burgherr and S. Hirschberg
Laboratory for Energy Systems Analysis, Paul Scherrer Institute (PSI), Villigen PSI, Switzerland

- 234 **Investigation of Different Sampling and Sensitivity Analysis Methods Applied to a Complex Model for a Final Repository for Radioactive Waste**
 Sabine M. Spiessl, and Dirk-A. Becker
Gesellschaft fuer Anlagen- und Reaktorsicherheit (GRS) mbH, Braunschweig, Germany

- 253 **Importance Analysis for Uncertain Thermal-Hydraulics Transient Computations**
 Mohammad Pourgol-Mohammad (a), Seyed Mohsen Hoseyni (b)
a) Department of Mechanical Engineering, Sahand University of Technology, Tabriz, Iran, b) Department of Basic Sciences, East Tehran Branch, Islamic Azad University, Tehran, Iran

W17 Integrated Deterministic and Probabilistic Safety Assessment II

Wednesday 6/25/2014 1:30 PM Kona

Chair: Martina Kloos, Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH

- 304 **Insights from an Integrated Deterministic Probabilistic Safety Analysis (IDPSA) of a Fire Scenario**
 M. Kloos, J. Peschke (a), B. Forell (b)
a) GRS mbH, Garching, Germany, b) GRS mbH, Cologne, Germany

- 430 **Uncertainty Propagation in Dynamic Event Trees - Initial Results for a Modified Tank Problem**
 Durga R. Karanki, Vinh N. Dang, and Michael T. MacMillan
Paul Scherrer Institute, Villigen PSI, Switzerland

- 460 **An Approach to Physics Based Surrogate Model Development for Application with IDPSA**
 Ignas Mickus, Kaspar Kööp, Marti Jeltsov (a), Yuri Vorobyev (b), Walter Villanueva, and Pavel Kudinov (a)
a) Royal Institute of Technology (KTH), Stockholm, Sweden, b) Moscow Power Engineering Institute, Moscow, Russia

- 315 **A Toolkit for Integrated Deterministic and Probabilistic Risk Assessment for Hydrogen Infrastructure**
 Katrina M. Groth (a), Andrei V. Tchouvelev (b,c)
a) Sandia National Laboratories, Albuquerque, NM, USA, b) AVT Research, Inc., Canada, c) International Association for Hydrogen Safety, HySafe

W21 Human Reliability Analysis IV

Wednesday 6/25/2014 3:50 PM Honolulu

Chair: Jeffrey Julius, Scientech

- 398 **A Human Reliability Analysis Approach Based on the Concepts of Meta-Operation and Task Complexity**
 Yongping Qiu (a), Dan Pan, Zhizhong Li, and Peng Liu (b)
a) Shanghai Nuclear Engineering Research & Design Institute, Shanghai, China, b) Department of Industrial Engineering, Tsinghua University, Beijing, China
- 543 **Human Reliability Analysis for Digital Human-Machine Interfaces: A Wish List for Future Research**
 Ronald L. Boring
Idaho National Laboratory, Idaho Falls, Idaho, USA
- 495 **Phoenix – A Model-Based Human Reliability Analysis Methodology: Qualitative Analysis Overview**
 Nsimah J. Ekanem and Ali Mosleh
Center for Risk and Reliability, University of Maryland, College Park, USA
- 496 **Phoenix – A Model-Based Human Reliability Analysis Methodology: Quantitative Analysis Procedure and Data Base**
 Nsimah J. Ekanem and Ali Mosleh
Center for Risk and Reliability, University of Maryland, College Park, USA
- 494 **Next Generation Human Reliability Analysis – Addressing Future Needs Today for Digital Control Systems**
 Jeffrey A. Julius (a), Parviz Moieni (b), Jan Grobbelaar and Kaydee Kohlhepp (a)
a) Scientech, a Curtiss-Wright Flow Control Company, Tukwila, WA, U.S.A., b) Scientech, a Curtiss-Wright Flow Control Company, San Diego, CA, U.S.A

W22 Nuclear Engineering I

Wednesday 6/25/2014 3:30 PM Kahuku

Chair: Mazleha Maskin, Malaysia Nuclear Agency

- 251 **Discussion of Developing HTGR Emergency Action Levels Applying Probabilistic Risk Assessment**
 LIU Tao, Tong Jiejuan
Institute of nuclear and new energy technology, Tsinghua University, Beijing, China and The key laboratory of advanced reactor engineering and safety, Ministry of education, Beijing, China
- 288 **Building Competence for Safety Assessment of Nuclear Installations: Applying IAEA's Safety Guide for the Development of a Level 1 Probabilistic Safety Assessment for the TRIGA Research Reactor in Malaysia**
 F.C. Brayon (a), M. Mazleha, P. Prak Tom (b), A.H.S Mohd Sarif (c), Z. Ramli (a), F. Zakaria (b), F. Mohamed (c), Abid Aslam (d), A. Lyubarskiy, I.Kuzmina, P.Hughes, A.Ulises (e)
a) Atomic Energy Licensing Board, Selangor, Malaysia, b) Malaysia Nuclear Agency, MOSTI, Selangor, Malaysia, c) Universiti Kebangsaan Malaysia, Selangor, Malaysia, d) Pakistan Nuclear Regulatory Authority, Pakistan, e) International Atomic Energy Agency, Vienna, Austria
- 297 **Development of State Categorization Model for Necessity of Feed and Bleed Operation and Application to OPR1000**
 Bo Gyung Kim (a), Ho Joon Yoon (b), Sang Ho Kim, and Hyun Gook Kang (a)
a) Department of Nuclear and Quantum Engineering, Korea Advanced Institute of Science and Technology, Daejeon, Republic of Korea, b) Department of Nuclear Engineering, Khalifa University of Science, Technology & Research, Abu Dhabi, UAE
- 163 **Thermal-Hydraulic Analysis for Supporting PSA of SBLOCA in APR+**
 Sang Hee Kang, Ho Rim Moon, and Han Gon Kim
Korea Hydro & Nuclear Power Co., Ltd, Daejeon, Republic of Korea

W23 Industrial Safety and Accident Analysis II

Wednesday 6/25/2014 3:30 PM O'ahu

Chair: Jose E. Ramirez-Marquez, Stevens Institute of Technology

- 316 **Towards the development of the Observability-in-Depth Safety Principle for the Nuclear Industry**
 Francesca M. Favarò, and Joseph H. Saleh
Georgia Institute of Technology, Atlanta, GA, USA

- 324 **Research on Leakage and Fire Accidents of the Heating and Refrigerating Systems Charging with the Flammable Working Fluids**
 Zhao Yang, Xi Wu
School of Mechanical Engineering, Tianjin University, Tianjin, P.R. China
- 344 **Radiotherapy Errors Analysis before Plan Delivery based on Probabilistic Safety Analysis Method**
 Wenyi Li, Xi Pei (1,3), Shanqi Chen, Jin Wang, Liqin Hu, Yican Wu (1,2,3), FDS Team
 1) Institute of Nuclear Energy Safety Technology, Chinese Academy of Sciences, Hefei, Anhui, China, 2) University of Science and Technology of China, Hefei, Anhui, China, 3) Engineering Technology Research Center of Accurate Radiotherapy of Anhui Province, Hefei, Anhui, China
- 442 **Accident Analysis of a Transport System: The Case of the Bus Rapid Transit System in Mexico City**
 Jaime Santos-Reyes, Vladimir Avalos-Bravo, and Edith Rodriguez-Rojas
SARACS Research Group, SEPI-ESIME, IPN, Mexico City, Mexico
- 40 **Emergency Resource Allocation for Disaster Response: An Evolutionary Approach**
 Mohammed Muaafa, Ana Lisbeth Concha, and Jose Emmanuel Ramirez-Marquez
School of Systems and Enterprises, Stevens Institute of Technology, Hoboken, NJ, USA

W24 Digital I&C and Software Reliability III

Wednesday 6/25/2014 3:30 PM Waialua

Chair: Pavol Hlavac, RELKO Ltd.

- 377 **Optimal Selection of Diversity Types for Safety-Critical Computer Systems**
 Vyacheslav Kharchenko (a,b), Tetyana Nikitina (a), and Sergiy Vilkomir (c)
 a) National Aerospace University named after N.E. Zhukovsky "KhAI", Kharkiv, Ukraine, b) Centre for Safety Infrastructure-Oriented Research and Analysis, Kharkiv, Ukraine, c) East Carolina University, Greenville, NC, USA
- 390 **Development of Post-Accident Monitoring System for Severe Accidents**
 Chang-Hwoi Kim, Sup Hur, Kwang-Sub Son, and Tong-II Jang
Korea Atomic Energy Research Institute, Daejeon, South Korea
- 405 **Relko Experience with Reliability Analyses of Safety Digital I&C**
 Jana Macsadiova, Vladimir Sopira, Pavol Hlavac
RELKO Ltd., Bratislava, Slovak Republic
- 455 **Markov's Model and Tool-Based Assessment of Safety-Critical I&C Systems: Gaps of the IEC 61508**
 Valentina Butenko (a), Vyacheslav Kharchenko (a,b), Oleg Odarushchenko (b), Peter Popov (c), Vladimir Sklyar (b) and Elena Odarushchenko (d)
 a) National Aerospace University "KhAI", Kharkiv, Ukraine, b) Research and Production Company "Radiy", Kirovograd, Ukraine, c) Centre of Software Reliability, City University London, London, United Kingdom, d) Poltava National Technical University, Poltava, Ukraine
- 458 **Quantification of Reactor Protection System Software Reliability Based on Indirect and Direct Evidence**
 Ola Bäckström (b), Jan-Erik Holmberg (c), Mariana Jockenhoevel-Bartfeld (d), Markus Porthin (a), Andre Taurines (d)
 a) VTT Technical Research Centre of Finland, Espoo, Finland, b) Lloyd Register Consulting, Stockholm, Sweden, c) Risk Pilot, Espoo, Finland, d) AREVA GmbH, Erlangen, Germany

W25 Risk Informed Applications III

Wednesday 6/25/2014 3:30 PM Wai'ananae

Chair: Justin Taylor Pence, University of Illinois

- 569 **A Methodology for Ranking of Diverse Nuclear Facilities As a Tool to Improve Nuclear Safety Supervision**
 Alexander Khamaza, Mikhail Lankin
Scientific and Engineering Centre for Nuclear and Radiation Safety, Moscow, Russia
- 319 **Application of Design Review to Probabilistic Risk Assessment in a Large Investment Project**
 Seppo Virtanen (a), Jussi-Pekka Penttinen (b), Mikko Kiiski, and Juuso Jokinen (c)
 a) Tampere University of Technology, Finland, b) Ramentor Oy, Tampere, Finland, c) Pöyry Finland Oy, Vantaa, Finland

184 **Risk-Informed Nuclear Safety Management Program Development in CGNPC**

Zhong Shan
Suzhou Nuclear Power Research Institute

W26 Risk Informed Licensing and Regulation II

Wednesday 6/25/2014 3:30 PM Ewa

Chair: Marie Pohida, United States Nuclear Regulatory Commission

223 **Technical Challenges Associated with Shutdown Risk when Licensing Advanced Light Water Reactors**

Marie Pohida, Jeffrey Mitman
United States Nuclear Regulatory Commission, Washington, DC, USA

284 **Experiences gained from a Living PSA workshop held on the PSA Castle Meeting in April 2013 in Stockholm**

Ralph Nyman, Per Hellström, Frida Olofsson
Swedish Radiation Safety Authority, Stockholm, Sweden

299 **An Initiative towards Risk-Informing Nuclear Safety Regulation in Hungary**

Attila Bareith (a) and Geza Macsuga (b)
a) NUBIKI Nuclear Safety Research Institute Ltd., Budapest, Hungary, b) Hungarian Atomic Energy Authority, Budapest, Hungary

387 **Mapping the Risks of Swedish NPPs to Facilitate a Risk-Informed Regulation**

Frida Olofsson, Ralph Nyman, Per Hellström
Swedish Radiation Safety Authority, Sweden

575 **Proposed Initiative to Improve Nuclear Safety and Regulatory Efficiency**

Antonios M. Zoulis, Fernando Ferrante
US Nuclear Regulatory Commission, Washington, DC, USA

W27 Benchmark Problem #1 - A Space Propulsion System

Wednesday 6/25/2014 3:30 PM Kona

Chair: Curtis L. Smith, Idaho National Laboratory

200 **Engineering Risk Assessment of Space Thruster Challenge Problem**

Donovan L. Mathias (a), Christopher J. Mattenberger (b), and Susie Go (a)
a) NASA Ames Research Center, Moffett Field, CA, USA, b) Science and Technology Corp., Moffett Field, CA, USA

376 **Application of the Dynamic Flowgraph Methodology to the Space Propulsion System Benchmark Problem**

Michael Yau, Scott Dixon, and Sergio Guarro
ASCA, Inc., Redondo Beach, USA

511 **Analysis of the Space Propulsion System Problem Using RAVEN**

Diego Mandelli, C. Smith, A. Alfonsi, C. Rabiti
Idaho National Laboratory, Idaho Falls (ID), USA

9:00 AM

Dr. Shunsuke Kondo

Retired Chairman of the Atomic Energy Commission (Japan)

Learning from Experience to Improve Nuclear Safety – A Perspective from Japan

Abstract: The current situation of on-site and off-site of Fukushima Daiichi as well as of Japanese nuclear energy utilization will be reported, with his view on the weaknesses regarding defense against natural hazards, regulatory oversight, accident management and emergency response that allowed the accident to unfold as it did.

Biography: Dr. Shunsuke Kondo is currently an independent consultant. He retired from the post of Chairman of the Atomic Energy Commission, Cabinet Office, on March 31st 2014, after serving for more than ten years.

He joined the Department of Nuclear Engineering, School of Engineering, the University of Tokyo (UT) as lecturer in 1970, after receiving BE, ME, and DE in nuclear engineering from the UT in 1965, 1967 and 1970, respectively. Since then he dedicated to research and teaching in the area of nuclear engineering, promoting to Associate Professor in 1971 and Professor in 1984. He retired from the UT in 2004 when he was appointed to the Chairman of the Atomic Energy Commission by the Prime Minister. He was conferred Professor Emeritus from the UT in 2004.



His research interest is in the field of nuclear reactor design and accident analysis, the development and application of probabilistic safety assessment (PSA) methodology, the human interface design and analysis, and the analysis for nuclear energy utilization and safety regulation policies.

He was a Board member of International Association for Probabilistic Safety Assessment and Management (IAPSAM) during 1994 -2004 for which he was President during 2001-2002 and organized PSAM 5 Conference in Osaka, Japan in 2000.

Th01 Nuclear Engineering II

Thursday 6/26/2014 10:30 Honolulu

Chair: Pamela Nelson, UNAM

322 Effects of Source Term on Off-site Consequence in LOCA Sequence in a Typical PWR

Seok-Jung Han, Tae-Woon Kim, and Kwang-II Ahn
Korea Atomic Energy Research Institute, Daejeon, South Korea

373 A Review of U.S. Sodium Fast Reactor PRA Experience

David Grabaskas
Nuclear Engineering Division, Argonne National Laboratory, Argonne, IL, U.S.

527 Applicability of PSA Level 2 in the Design of Nuclear Power Plants

Estelle C. Sauvage (a), Gerben Dirksen (b), and Thierry Coye de Brunellis (c)
a) AREVA-NP SAS, Paris, France, b) AREVA-NP GmbH, Erlangen, Germany, c) AREVA-NP SAS, Lyon, France

547 Use of Corrective Action Programs at Nuclear Plants for Knowledge Management

Pamela F. Nelson (a), Teresa Ruiz-Sánchez (b), and Cecilia Martín del Campo (a)
a) Universidad Nacional Autónoma de México, Mexico City, Mexico, b) Universidad Autónoma de Tamaulipas, Reynosa, Mexico

583 AES-2006 PSA Level 1. Preliminary Results at PSAR STAGE

A. Kalinkin, A. Solodovnikov, S. Semashko
JSC "VNIPIET", Saint-Petersburg, Russian Federation

Th02 Reliability Analysis and Risk Assessment Methods VI

Thursday 6/26/2014 10:30 Kahuku

Chair: Federico Gabriele, Gran Sasso National Laboratory - INFN

262 Quantitative Risk Assessment for DarkSide 50, a Nuclear Physics Experimental Apparatus Installed at Gran Sasso Nat'l Lab: Results and Technical Solutions Applied

Federico Gabriele (a), Andrea Ianni, Augusto Goretti (b), Michele Montuschi (a), and Paolo Cavalcante (a) on behalf of DarkSide Collaboration
a) Gran Sasso National Laboratory, L'Aquila, Italy, b) Princeton University, Princeton, USA

270 Safety Analysis and Quantitative Risk Assessment of a Deep Underground Large Scale Cryogenic Installation

Effie Marcoulaki and Ioannis Papazoglou
National Centre for Scientific Research "Demokritos", Athens, Greece

295 Centrifugal Pump Mechanical Seal and Bearing Reliability Optimization

Peymaan Makarachi, and Mohammad Pourgol-Mohammad
Sahand University of Technology, Tabriz, Iran

463 A Science-Based Theory of Reliability Founded on Thermodynamic Entropy

Anahita Imanian, Mohammad Modarres
Center for Risk and Reliability, University of Maryland, College park, USA

534 Quick Quantitative Calculation of DFT for NPP's Repairable Systems Based on Minimal Cut Sequence Set

Daochuan Ge (a,b), Qiang Chou, Ruoxing Zhang (b), Yanhua Yang (a)
a) School of Nuclear Science and Engineering, Shanghai Jiao Tong University, Shanghai, China; b) Software Development Center, State Nuclear Power Technology Corporation, Beijing, China

Th03 Human Reliability Analysis V

Thursday 6/26/2014 10:30 O'ahu

Chair: Ronald Boring, Idaho National Laboratory

415 Air Traffic Controllers' Workload on the Period of ATC Paradigm Shift

Kakuichi Shiomi
Electronic Navigation Research Institute, Tokyo, Japan

- 416 **Quantification of Bayesian Belief Net Relationships for HRA from Operational Event Analyses**
Luca Podofillini, Lusine Mkrtchyan, Vinh N. Dang
Paul Scherrer Institute, Villigen PSI, Switzerland
- 544 **Task Decomposition in Human Reliability Analysis**
Ronald L. Boring and Jeffrey C. Joe
Idaho National Laboratory, Idaho Falls, Idaho, USA
- 421 **A Comparison of Two Cognition-driven Human Reliability Analysis Processes - CREAM and IDHEAS**
Kejin Chen, Zhizhong Li (a), Yongping Qiu and Jiandong He (b)
a) Department of Industrial Engineering, Tsinghua University, Beijing, P. R. China, b) Shanghai Nuclear Engineering Research & Design Institute, Shanghai, P. R. China
- 203 **Human Reliability in Spacecraft Development: Assessing and Mitigating Human Error in Electronics Assembly**
Obibobi K. Ndu (a), Monifa Vaughn-Cooke (b)
a) Space Mission Assurance Group, Johns Hopkins University Applied Physics Laboratory, Laurel, MD, USA, b) Dr. , Department of Mechanical Engineering, Reliability Engineering Program, University of Maryland, College Park, MD USA

Th04 Shipping and Offshore Oil & Gas I

Thursday 6/26/2014 10:30 Waialua

Chair: Christopher Jablonowski, Shell E&P Company

- 112 **Use of Bayesian Network to Support Risk-Based Analysis of LNG Carrier Loading Operation**
Arthur Henrique de Andrade Melani, Dennis Wilfredo Roldán Silva, Gilberto Francisco Martha Souza
University of São Paulo, São Paulo, Brazil
- 14 **Probabilistic Analysis of Geological Properties to Support Equipment Selection for a Deepwater Subsea Oil Project**
Christopher J. Jablonowski, Edward E. Shumilak, Kenneth F. Tyler (a), Arash Haghshenas (b)
a) Shell Exploration and Production Company, Houston, TX, U.S.A. b) Boots & Coots Services LLC, Houston, TX, U.S.A.
- 85 **Gas Detection for Offshore Applications**
Peter Okoh
Norwegian University of Science and Technology, Trondheim, Norway
- 165 **BOP Risk Model Development and Applications**
Xuhong He, Johan Sörman (a), Inge A. Alme (b), and Scotty Roper (c)
a) Lloyd's Register Consulting, Stockholm, Sweden, b) Lloyd's Register Consulting, Kjeller, Norway, c) Lloyd's Register Drilling Integrity Services Inc., Houston, USA
- 411 **Determination of the Design Load for Structural Safety Assessment against Gas Explosion in Offshore Topside**
Migyeong Kim, Gyusung Kim, Jongjin Jung and Woooseung Sim
Advanced Technology Institute, Hyundai Heavy Industries, Ulsan, Republic of Korea

Th05 Uncertainty, Sensitivity, and Bayesian Methods III

Thursday 6/26/2014 10:30 Wai'anae

Chair: Sergio Guarro, ASCA Inc.

- 309 **Propagating Uncertainty in Phenomenological Analysis into Probabilistic Safety Analysis**
A. El-Shanawany (a,b)
a) Imperial College London, London, United Kingdom, b) Corporate Risk Associates, London, United Kingdom
- 349 **A Procedure Estimating and Smoothing Earthquake Rate in a Region with the Bayesian Approach**
J.P. Wang
The Hong Kong University of Science and Technology, Kowloon, Hong Kong
- 512 **Open Conceptual Questions in the Application of Uncertainty Analysis in PRA Logic Model Quantification**
Sergio Guarro
ASCA Inc., Redondo Beach, USA

565 **System Initiating Event Frequency Estimation using Uncertain Data**

Kurt G. Vedros
NuScale Power, LLC, Corvallis, Oregon, United States

584 **SUnCISTT - A Generic Code Interface for Uncertainty and Sensitivity Analysis**

Matthias Behler (a), Matthias Bock (b), Florian Rowold, and Maik Stuke (a)
a) Gesellschaft für Anlagen und Reaktorsicherheit GRS mbH, Garching n. Munich, Germany, b) STEAG Energy Services GmbH, Essen, Germany

Th06 Nuclear Engineering III

Thursday 6/26/2014 10:30 Ewa

Chair: Jeffrey Brewer, Sandia National Laboratories

312 **BWR-club PSA Benchmarking – Bottom LOCA during Outage, Reactor Level Measurement and Dominating Initiating Events**

Anders Karlsson (a), Maria Frisk (b), and Göran Hultqvist (c)
a) Forsmarks Kraftgrupp AB, Östhammar, Sweden, b) Risk Pilot AB, Stockholm, Sweden, c) Havsbrus Consulting, Öregrund, Sweden

371 **Effects of an Advanced Reactor's Design, Use of Automation, and Mission on Human Operators**

Jeffrey C. Joe and Johanna H. Oxstrand
Idaho National Laboratory, Idaho Falls, USA

391 **For the Completeness of the PRA Implementation Standard**

Yoshiyuki Narumiya (a), Akira Yamaguchi (b), Takayuki Ota, Haruhiro Nomura (a)
a) The Kansai Electric Power Co., Inc, Osaka, Japan, b) Osaka University, Suita, Osaka, Japan

497 **Nuclear Safety Design Principles & the Concept of Independence: Insights from Nuclear Weapon Safety for Other High-Consequence Applications**

Jeffrey D. Brewer
Sandia National Laboratories, Albuquerque, NM, USA

498 **Advancing Human Reliability Analysis Methods for External Events with a Focus on Seismic**

Jeffrey A. Julius, Jan Grobbelaar, and Kaydee Kohlhepp
Scientech, a Curtiss-Wright Flow Control Company, Tukwila, WA, U.S.A.

Th07 Maintenance and Availability Modeling

Thursday 6/26/2014 10:30 Kona

Chair: Yail Jimmy Kim, University of Colorado Denver

572 **Expected Maintenance Costs Model for Time-Delayed Technical Systems in Various Reliability Structures**

Anna Jodejko-Pietruczuk, Sylwia Werbińska-Wojciechowska
Wroclaw University of Technology, Wroclaw, Poland

394 **Modeling the Reliability and the Performance of a Wind Farm Using Cyclic Non-Homogenous Markov Chains**

Theodoros V. Tzioutzias, Agapios N. Platis, Vasilis P. Koutras
University of the Aegean Department of Financial and Management Engineering, Chios, Greece

273 **Performance and Reliability of Bridge Girders Upgraded with Posttensioned Near-surface-mounted Composite Strips**

Yail J. Kim (a), Jae-Yoon Kang, and Jong-Sup Park (b)
a) University of Colorado Denver, Denver, CO, USA, b) Korea Institute of Construction Technology, Ilsan, Korea

393 **A Quantitative Method for Assessing the Resilience of Infrastructure Systems**

Gen Nan (a,b), Giovanni Sansavini (b,c), Wolfgang Kröger (c) and Hans Rudolf Heinemann (a,c)
a) Land Using Group, ETH Zürich, Switzerland, b) Reliability and Risk Engineering, ETH Zürich, Switzerland, c) ETH Risk Center, ETH Zürich, Switzerland

113 **Use of Reliability Concepts to Support Pas 55 Standard Application to Improve Hydro Power Generator Availability**

Gilberto F. M. de Souza (a), Erick M.P. Hidalgo (a), Claudio C. Spanó (b), and Juliano N. Torres (c)
a) University of São Paulo, São Paulo, Brazil, b) ReliaSoft Brasil, São Paulo, Brazil, c) AES Tietê, Bauru, Brazil

Th12 Safety Assessment Software and Tools II

Thursday 6/26/2014 01:30 Kahuku

Chair: Rongxiang Hu, Chinese Academy of Sciences

341 Processing of Switching Events Sets in Reliability and Probabilistic Safety Assessment Program RiskA

Shanqi Chen, Jin Wang (a,b), Fang Wang (b), Liqin Hu, Yican Wu (a,b), FDS Team

a) University of Science and Technology of China, Hefei Anhui, Chin, b) Institute of Nuclear Energy Safety Technology, Chinese Academy of Sciences, Hefei Anhui, China

342 A New Reliability Allocation Method Based on FTA and AHP for Nuclear Power Plant

Boyuan Li (a,b), Rongxiang Hu (b), Jin Wang (a,b), Fang Wang (b), Shanqi Chen, Jiawen Xu (a,b), FDS Team

a) University of Science and Technology of China, Hefei Anhui, China, b) Institute of Nuclear Energy Safety Technology, Chinese Academy of Sciences, Hefei Anhui, China

208 Preventive Maintenance Optimization for Slovak Power Grid Using E00S Risk Monitor

Pavol Hlavac, Zoltan Kovacs

RELKO Ltd., Bratislava, Slovak Republic

395 Supporting Tool for Cooperative Work Analysis Based on Distributed Cognition

Satoru Inoue (a), Stuart Moran (b), and Keiichi Nakata (c)

a) ATM Department, Electronic Navigation Research Institute, Tokyo, Japan, b) Mixed Reality Lab, University of Nottingham, Nottingham, UK, c) BISA, Henley Business School, University of Reading, Reading, UK

Th13 External Events Hazard/PRA Modeling for Nuclear Power Plants III

Thursday 6/26/2014 01:30 O'ahu

Chair: Takahiro Kuramoto, Nuclear Engineering, Ltd.

403 Seismic PRA for Kashiwazaki-Kariwa NPP

Keiichiro Saito, Masanori Takeuchi, Takashi Uemura, Yasunori Yamanaka

Tokyo Electric Power Company Inc, Tokyo, Japan

298 Development of Implementation Standard Concerning the Risk Evaluation Methodology Selection for the External Hazards

Takahiro KURAMOTO (a), Akira YAMAGUCHI (b), Yoshiyuki NARUMIYA (c), Takayuki OTA (d), Yutaka MAMIZUKA (a)

a) Nuclear Engineering, Ltd., Osaka, Japan, b) Osaka University, Osaka, Japan, c) The Kansai Electric Power Company, Osaka, Japan, d) The Kansai Electric Power Company, Fukui, Japan

333 Technical Approach for Safety Assessment of Multi-Unit NPP Sites Subject To External Events

Sujit Samaddar, Kenta Hibino, Ovidiu Coman

International Atomic Energy Agency

520 An Approach to Estimate the Compartment Fire Ignition Frequency for HTGR NPP Based on LWR Generic Data

Wei Wang, Jiejuan Tong, Chuan Li, Jun Zhao, and Tao Liu (a,b)

a) Institute of Nuclear and New Energy Technology, Tsinghua University, Beijing, P.R. China, b) Key Laboratory of Advanced Reactor Engineering and Safety, Ministry of Education, Beijing, P.R. China

474 Study on Next Generation Seismic PRA Methodology (1): Program Plan and Proposal of New Mathematical Framework (Presentation Only)

Ken Muramatsu (a), Tsuyoshi Takada (b), Akemi Nishida (c), Tomoaki Uchiyama (d), Hitoshi Muta, Osamu Furuya, Sigeru Fujimoto (a), Tatsuya Itoi (b)

a) Tokyo City University, b) The University of Tokyo, c) Japan Atomic Energy Agency, d) CSA of Japan

Th14 Safety Management and Decision Making II

Thursday 6/26/2014 01:30 Waialua

Chair: Hossein Nourbakhsh, NRC

198 Oil & Gas Projects Alternative Selection using Analytic Hierarchy Process - A Case Study

Stefania Benucci (a) and Fabrizio Tallone (b)

a) Auriga Consulting s.r.l., Rome, Italy, b) Saipem, Fano, Italy

- 434 **The Role of Safety Professionals in Organizations – Developing and Testing a Framework of Competing Safety Management Principles**
Teemu Reiman (a), and Elina Pietikäinen (b)
a) VTT Technical Research Centre of Finland, Espoo, Finland, b) VTT Technical Research Centre of Finland, Tampere, Finland
- 475 **Dealing with Beyond-Design-Basis Accidents in Nuclear Safety Decisions**
Hossein P. Nourbakhsh
Office of Advisory Committee on Reactor Safeguards (ACRS), Nuclear Regulatory Commission, Washington, DC, USA
- 490 **Dynamic Context Quantification for Design Basis Accidents List Extension and Timely Severe Accident Management**
Emil Kostov (a,b) and Gueorgui Petkov (a)
a) Technical University, Sofia, Bulgaria, b) WorleyParsons, Sofia, Bulgaria
- 519 **Incident Investigation on the basis of Business Process Model of Plant Lifecycle Engineering Activities for Process Safety Leading Metrics**
Tetsuo Fuchino (a), Kazuhiro Takeda (b), and Yukiyasu Shimada (c)
a) Chemical Engineering Dept., Tokyo Institute of Technology, Tokyo, Japan, b) Applied Chemistry and Biochemical Engineering, Shimizu University, Hamamatsu, Japan, c) Chemical Safety Research Gr., National Institute of Occupational Safety and Health, Tokyo, Japan

Th15 Shipping and Offshore Oil & Gas II

Thursday 6/26/2014 01:30 Wai'anae

Chair: Luiz Fernando Oliveira, DNV GL Oil & Gas

- 182 **What Inter-Organizational Factors are Related to Risk of Major Accidents in Offshore Operations?**
Vibeke Milch, Karin Laumann and Gunhild B. Sætnen
NTNU, Trondheim, Norway
- 484 **PRA Application to Offshore Drilling Critical Systems**
S. Massoud (Mike) Azizi
Reliability, System Safety and Specialty Engineering, Aerojet Rocketdyne – Extreme Engineering
- 487 **Evolution of Offshore Safety in Brazil – Comparison with International Data**
Luiz Fernando Oliveira, Flávio Luiz Diniz, and Jaime Eduardo Lima
DNV GL, Rio de Janeiro, Brazil
- 150 **Study on the Assessment Method for Results of sHip Maneuvering Training with the Simulator**
Nobuo Mitomo (a), Fumiaki Takedomi, and Tadatsugi Okazaki (b)
a) Nihon University, Chiba, Japan, b) Tokyo University of Marine Science and Technology, Tokyo, Japan
- 222 **Challenges and New Developments in Maritime Risk Assessment**
Di Zhang (a,b)
a) Intelligent Transport Systems Research Center, Wuhan University of Technology, Wuhan, P.R.China, b) Engineering Research Center for Transportation Safety (Ministry of Education), Wuhan University of Technology, Wuhan, P. R. China

Th16 SOARCA Uncertainty Analyses

Thursday 6/26/2014 01:30 Ewa

Chair: S. Tina Ghosh, U.S. Nuclear Regulatory Commission

- 438 **SOARCA Peach Bottom Atomic Power Station Long-Term Station Blackout Uncertainty Analysis: Overview**
S. Tina Ghosh (a), Patrick D. Mattie, Randall O. Gauntt, Nathan E. Bixler, Kyle W. Ross, Cedric J. Sallaberry, and Douglas M. Osborn (b)
a) Nuclear Regulatory Commission, Washington, DC, USA, b) Sandia National Laboratories, Albuquerque, NM, USA
- 439 **SOARCA Peach Bottom Atomic Power Station Long-Term Station Blackout Uncertainty Analysis: Knowledge Advancement**
Patrick D. Mattie, Nathan E. Bixler, Kyle W. Ross, Randall O. Gauntt, Douglas M. Osborn, Cedric J. Sallaberry, Jeffrey N. Cardoni, Donald A. Kalinich (a), and S. Tina Ghosh (b)
a) Sandia National Laboratories, Albuquerque, USA, b) U.S. Nuclear Regulatory Commission, Washington DC, USA

- 441 **SOARCA Peach Bottom Atomic Power Station Long-Term Station Blackout Uncertainty Analysis: Convergence of the Uncertainty Results**
 Cedric J. Sallaberry, Douglas M. Osborn, Nathan E. Bixler, Aubrey C. Eckert-Gallup, Patrick D. Mattie (a), and S. Tina Ghosh (b)
 a) Sandia National Laboratories, Albuquerque, USA, b) U.S. Nuclear Regulatory Commission, Washington DC, USA
- 443 **SOARCA Peach Bottom Atomic Power Station Long-Term Station Blackout Uncertainty Analysis: Contributions to Overall Uncertainty**
 Nathan E. Bixler, Douglas M. Osborn, Joseph A. Jones, Cedric J. Sallaberry, Patrick D. Mattie (a), and S. Tina Ghosh (b)
 a) Sandia National Laboratories, Albuquerque, NM, USA, b) Nuclear Regulatory Commission, Washington, DC, USA
- 446 **SOARCA Surry Power Station Uncertainty Analysis: Parameter Methodology and Insights**
 Joseph Jones, Douglas M. Osborn, Kyle W. Ross, Jeffrey N. Cardoni (a), S. Tina Ghosh (b)
 a) Sandia National Laboratories, Albuquerque, NM, USA, b) U.S. Nuclear Regulatory Commission, Washington, DC, USA

Th17 Nuclear Engineering IV

Thursday 6/26/2014 01:30 Kona

Chair: Pavel Kudinov, Royal Institute of Technology (KTH)

- 21 **Verification of PRA Results by Applications in Full Scale Simulators**
 Cilla Andersson (a) and Antanas Romas (b)
 a) Ringhals AB, Väröbacka, Sweden, b) GSE Power Systems AB, Nyköping, Sweden
- 154 **A Framework for Assessment of Severe Accident Management Effectiveness in Nordic BWR Plants**
 Pavel Kudinov, Sergey Galushin (a), Sergey Yakush (b), Walter Villanueva, Viet-Anh Phung, Dmitry Grishchenko (a), Nam Dinh (c)
 a) Division of Nuclear Power Safety, Royal Institute of Technology (KTH), Stockholm, Sweden, b) Institute for Problems in Mechanics of the Russian Academy of Sciences, Moscow, Russia, c) North Carolina State University, Raleigh, NC, USA.
- 156 **A Plant's Perspective on a Full Scope PSA Update**
 E.P. Roose, H.A. Schoonakker (a), J.L. Brinkman (b), and M.D. Quilici (c)
 a) EPZ, Borssele, Netherlands, b) NRG, Arnhem, Netherlands, c) Scientech, Seattle, USA
- 166 **Risk of Sloshing in the Primary System of a Lead-Cooled Fast Reactor**
 Marti Jeltsov, Walter Villanueva, and Pavel Kudinov
 KTH Royal Institute of Technology, Stockholm, Sweden
- 560 **Analyzing Importance Measure Methodologies for Integrated Probabilistic Risk Assessment in Nuclear Power Plants**
 Tatsuya Sakurahara, Seyed Reihani, Mehmet Ertem, Zahra Mohaghegh (a), and Ernie Kee (b)
 a) Department of Nuclear, Plasma, and Radiological Engineering, University of Illinois at Urbana-Champaign, IL, USA, b) YK.Risk, LLC, TX, USA

Th21 External Events Hazard/PRA Modeling for Nuclear Power Plants IV

Thursday 6/26/2014 03:30 Honolulu

Chair: Curtis L. Smith, Idaho National Laboratory

- 539 **Study on Next Generation Seismic PRA Methodology Part II: Quantifying Effects of Epistemic Uncertainty on Fragility Assessment**
 Akemi Nishida (a), Tsuyoshi Takada, Itoi Tatsuya (b), Osamu Furuya, and Ken Muramatsu (c)
 a) Japan Atomic Energy Agency, Tokyo, Japan, b) University of Tokyo, Tokyo, Japan, c) Tokyo City University, Tokyo, Japan
- 582 **Analyses of Severe Accident Sequences During Shutdown and Caused by External Hazards**
 Michael Kowalik, Horst Löffler, Oliver Mildenerger, Thomas Steinrötter
 Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH, Köln, Germany
- 258 **Lessons Learned from the New Fire PRA Methodology (NUREG/CR-6850) Application in Korea under Fire Ignition Frequency Perspectives**
 Sung-Hyun Kim (a), Kwang-Nam Lee (b), and Hak-Kyu Lim (a)
 a) KEPCO-E&C, Integrated Engineering Department, Korea, b) KEPCO-E&C, Power Engineering Research Institute, Korea

462 **Revision of the AESJ Standard for Seismic Probabilistic Risk Assessment (4): Accident Sequence Evaluation (Presentation Only)**

Yasuhiro Iwaya (a), Ken Muramatsu (b), Katsunori Ogura (c)
a) CHUBU Electric Power Co., Inc., b) Tokyo City University, c) Japan Nuclear Energy Safety Organization

Th22 Crisis and Emergency Management

Thursday 6/26/2014 03:30 Kahuku

Chair: Stephen Hora, Center for Risk and Economic Analysis of Terrorism Events, USC

84 **Crisis Organization and Severe Accident Management: Contribution of Ergonomic Considerations in the Definition of Severe Accident Management Guidelines (SAMG)**

Violaine Bringaud, Jean-Paul Labarthe
Department of Industrial Risk Management, EDF Lab Clamart, France

160 **Disaster Context Modeling for the Creation of Exercise Scenarios**

Taro KANNO, Wataru ONO, Shengxin HONG, and Kazuo FURUTA
The University of Tokyo, Tokyo, Japan

566 **Bayesian Networks as a Decision Making Tool to Plan and Assess Maritime Safety Management Indicators**

Osiris A. Valdez Banda (a), Maria Hänninen, Floris Goerlandt and Pentti Kujala (b)
a) Aalto University, Department of Applied Mechanics, Kotka Maritime Research Centre, Kotka, Finland, b) Aalto University, Department of Applied Mechanics, Espoo, Finland

Th23 Risk and Hazard Analyses III

Thursday 6/26/2014 03:30 O'ahu

Chair: James Lin, ABSG Consulting Inc.

217 **Addressing Off-site Consequence Criteria Using PSA Level 3 - Enhanced Scoping Study**

Anders Olsson, Andrew Caldwell, Malin Nordqvist (a), Gunnar Johansson (b), Carl Sunde, Jan-Erik Holmberg (c), and Ilkka Karanta (d)
a) Lloyd's Register Consulting, Stockholm, Sweden, b) ES-Konsult, Stockholm, Sweden, c) Risk Pilot, Stockholm, Sweden, d) VTT, Helsinki, Finland

568 **A Unified Approach to PSA Accident Sequence Model Quantification**

Donald J. Wakefield and James C. Lin
ABSG Consulting Inc. (ABS Consulting), Irvine, CA, USA

445 **Earthquake Risk Perception: The case of Mexico City**

Tatiana Gouzeva, Galdino Santos-Reyes, and Jaime Santos-Reyes
SARACS Research Group, SEPI-ESIME, IPN, Mexico City, Mexico

Th24 Digital I&C and Software Reliability IV

Thursday 6/26/2014 03:30 Waialua

Chair: James K. Knudsen, Idaho National Laboratory

574 **Reliability Analysis of Core Protection Calculator System using Petri Net**

Hyejin Kim (a), Jonghyun Kim (b)
a) KEPCO Nuclear Fuel, Daejeon-si, Korea, b) KEPCO International Nuclear Graduate School, Ulsan-si, Korea

492 **Degradation Modeling and Algorithm for On-line System Health Management using Dynamic Hybrid Bayesian Network**

Chonlagarn Iamsumang, Ali Mosleh, Mohammad Modarres
The Center for Risk and Reliability, University of Maryland College Park, Maryland, USA

453 **Survivability Evaluation of Disaster Tolerant Cloud Computing Systems**

Bruno Silva, Paulo Romero Martins Maciel (a), Armin Zimmermann (b) and Jonathan Brilhante (a)
a) Federal University of Pernambuco, Recife, Brasil, b) Ilmenau University of Technology, Ilmenau, Germany

Th25 Nuclear Fuel Analysis

Thursday 6/26/2014 03:30 Wai'anae

Chair: Allan Hedin, Swedish Nuclear Fuel and Waste Management Co., SKB

- 98 **Probability of Adventitious Fuel Pin Failures in Fast Breeder Reactors and Event Tree Analysis on Damage Propagation up to Severe Accident in Monju**
Yoshitaka Fukano (a), Kenichi Naruto (b), Kenichi Kurisaka, and Masahiro Nishimura (a)
a) Japan Atomic Energy Agency, Tsuruga, Japan, b) NESI Inc., O-arai, Japan
- 91 **License Application for a Spent Nuclear Fuel Repository in Sweden**
Allan Hedin
Swedish Nuclear Fuel and Waste Management Co. (SKB), Stockholm, Sweden
- 517 **Current Research in Storage and Transportation of Used Nuclear Fuel and High-Level Radioactive Waste**
Sylvia J. Saltzstein
Sandia National Laboratories, Albuquerque, New Mexico, USA

Th26 Safety Integrity Level (SIL)

Thursday 6/26/2014 03:30 Ewa

Chair: Mohammad Pourgol-Mohammad, Sahand University of Technology

- 418 **Modified-LOPA; a Pre-Processing Approach for Nuclear Power Plants Safety Assessment**
Seyed Mohsen Gheyasi, Mohammad Pourgol-Mohammad
Sahand University of technology, Tabriz, Iran
- 388 **Uncertainty Analysis for Target SIL Determination in the Offshore Industry**
Sungteak Kim, Kwangpil Chang, Younghun Kim, and Eunhyun Park
Hyundai Heavy Industries, Yongin, Korea
- 581 **Using Fault Trees to Analyze Safety-Instrumented Systems**
Joseph R. Belland
Isograph, Inc., Irvine, USA

Th27 Safety Culture and Human & Organizational Factors

Thursday 6/26/2014 03:30 Kona

Chair: Justin Pence, Argonne National Laboratory

- 55 **Are Cognitive and Organizational Human Factors Missing From the Blunt End in the Oil and Gas Industry?**
Stig O. Johnsen
SINTEF, Trondheim, Norway
- 326 **Achieving a Total Safety Culture Through Behavior Based Safety, Establishing and Maintaining an Injury Free Culture**
NJF van Loggerenberg
University of South Africa, Pretoria, South Africa
- 401 **Organising Human and Organisational Reliability**
Pierre Le Bot and H el ene Pesme
EDF Lab, Clamart, France
- 432 **On the Relation Between Culture, Safety Culture and Safety Management**
Teemu Reiman (a), Carl Rollenhagen (b) and Kaupo Viitanen (a)
a) VTT Technical Research Centre of Finland, Espoo, Finland, b) Royal Institute of Technology, Stockholm, Sweden
- 549 **Toward Monitoring Organizational Safety Indicators by Integrating Probabilistic Risk Assessment, Socio-Technical Systems Theory, and Big Data Analytics**
Justin Pence (a), Zahra Mohaghegh (a), Cheri Ostroff (b), Ernie Kee (c), Fatma Yilmaz (d), Rick Grantom (e), and David Johnson (f)
a) Department of Nuclear, Plasma, and Radiological Engineering, University of Illinois at Urbana-Champaign, Urbana, USA, b) University of South Australia, Adelaide, Australia, c) YK.risk, LLC, Bay City, USA, d) South Texas Project Nuclear Operating Company, Bay City, USA, e) C.R. Grantom PE & Assoc. LLC, West Colombia, USA, f) ABS Consulting, Irvine, USA

9:00 AM

Heather Bell
Pacific Disaster Center
Director of Applied Science

& Ray Shirkhodai
Pacific Disaster Center
Executive Director



A People Centered Approach to Risk and Vulnerability Assessment.

Biography of Heather Bell: Dr. Heather Bell leads risk and vulnerability assessment, modeling, and GIS analysis groups for PDC. She and her team develop information products and services that help inform disaster risk reduction decisions and humanitarian assistance initiatives at multiple levels. Recent contributions include leading a global risk assessment project, supporting the Association of Southeast Asian Nations (ASEAN) on the ASEAN Agreement on Disaster Management and Emergency Response (AADMER) Work Programme 2010 – 2015, and leading an APEC Workshop on Hazard Mapping and Risk and Vulnerability Assessment.

Biography of Ray Shirkhodai: Mr. Ray Shirkhodai provides leadership and oversight for PDC's operation, management, administration, and program development. He joined PDC in January 2002 as Chief of Information Systems and also served as Chief Operating Officer prior to his appointment as Executive Director in 2006. Shirkhodai has overseen PDC's expansion into the global hazard and risk information markets and directed the development of DisasterAWARE and Disaster Alert, PDC's flagship early warning tool and mobile application, respectively. His experience in information management and senior leadership includes corporate governance, executive management, strategic planning, program development, and management of web-based applications and Information Technology infrastructure.

F01 Human Reliability Analysis VI

Friday 6/27/2014 10:30 Honolulu

Chair: Ronald Boring, Idaho National Laboratory

440 Human Reliability Dependency Analysis and Model Integration Process

Jan Grobbelaar, Michael Hirt (a), Mary Presley (b), and Chris Cragg (c)

a) Scientech, a business unit of Curtiss-Wright Flow Control Company, Tukwila, WA, USA, b) EPRI, Charlotte, NC, USA, c) Cragg Consulting, Grapevine, TX, USA

545 Formative Evaluation for Optimal Upgrades in Nuclear Power Plant Control Rooms

Ronald L. Boring

Idaho National Laboratory, Idaho Falls, Idaho, USA

586 Research on HRA Methods and Application for Digital Human-System Interfaces Design

Xiufeng Tian, Xingwei Jiang, Jinggong Liu

CNNC, China Nuclear Power Engineering Co., Ltd, Beijing, P.R.China

310 A Methodology for Safety Culture Index Assessment Using Minimal Cut Sets

Kiyoon Han, Yongjin Lee and Moosung Jae

Department of Nuclear Engineering, Hanyang University, Seoul, Korea

F02 Reliability Analysis and Risk Assessment Methods VII

Friday 6/27/2014 10:30 Kahuku

Chair: Pablo Viveros Gunckel, UTFSM

562 Probabilistic Performance Assessment for Crushing System. A Case Study for a Mining Process

P. Viveros (a,b), A. Crespo (b), F. Kristjanpoller (a,b), R. Stegmaier, E. Johns (a), V. Gonzalez-Prida (b)

a) Universidad Técnica Federico Santa María, Department of Industrial Engineering, Valparaiso, Chile City, Country, b) Department of Industrial Management, University of Seville

563 An Innovative Proposal for Systemic Modeling, Analysis and Simulation in a Continuous Production Process

René Tapia (a), Pablo Viveros (b,c), Adolfo Crespo (c)

a) RelPro S.A, Santiago, Chile, b) Universidad Técnica Federico Santa María, Department of Industrial Engineering, Valparaiso, Chile, c) Department of Industrial Management, University of Seville, Spain

247 Risk Quadruplet: Integrating Assessments Of Threat, Vulnerability, Consequence And Perception For Homeland Security

Kara Norman Hill (a) and Adrian V. Gheorghe (b)

a) Booz Allen Hamilton, Norfolk, VA, USA, b) Old Dominion University, Norfolk, VA, USA

F03 Revision of Seismic PRA Standards of Japan

Friday 6/27/2014 10:30 O'ahu

Chair: Yoshiyuki Narumiya, The Kansai Electric Power Co., Inc.

389 Revision of the AESJ Standard for Seismic Probabilistic Risk Assessment (1): Extension and Enhancement of Accident Scenario

Yoshiyuki Narumiya (a), Mitsumasa Hirano (b), Tsuyoshi Takada (c) and Kentaro Hayashi (a)

a) The Kansai Electric Power Co., Inc., Osaka, Japan, b) Tokyo City University, Tokyo, Japan, c) The University of Tokyo, Tokyo, Japan

531 Revision of the AESJ Standard for Seismic Probabilistic Risk Assessment (2) Seismic Hazard Evaluation

Katsumi Ebisawa (a), Katsuhiko Kamae (b), Tadashi Annaka (c), Hideaki Tsutsumi (d) and Atsushi Onouchi (e)

a) Tokyo City University, Tokyo, Japan, b) Kyoto University, Kyoto, Japan, c) Tokyo Electric Power Services Co., Ltd., Tokyo, Japan, d) Former Japan Nuclear Energy Safety Organization, Tokyo, Japan, e) Chubu Electric Power Co., Inc., Nagoya, Japan

381 Revision of the AESJ Standard for Seismic Probabilistic Risk Assessment (3): Fragility Evaluation

Akira Yamaguchi (a), Susumu Nakamura (b), Yoshitaka Tsutsumi (c), Tadashi Iijima (d) and Yoshinori Mihara (e)

a) Osaka University, Osaka, Japan, b) Nihon University, Koriyama, Japan, c) Chubu Electric Power Co., Inc., Nagoya, Japan, d) Hitachi-GE Nuclear Energy, Ltd., Hitachi, Japan, e) Kajima Corporation, Tokyo, Japan

337 **Seismic Quantification Enhancements for getting CDF/LERF Distribution from the Point Estimates Results**

Ovidiu Coman

International Atomic Energy Agency

402 **Tsunami PRA for Kashiwazaki-Kariwa NPP**

Keiichiro Saito, Masanori Takeuchi, Takashi Uemura, Yasunori Yamanaka

Tokyo Electric Power Company Inc, Tokyo, Japan

F04 Transportation and Storage

Friday 6/27/2014 10:30 Waialua

Chair: Kumar Bhimavarapu, FM Global

128 **Reliability and Safety Models of Transportation Systems - a Literature Review**

Franciszek J. Restel

Wroclaw University of Technology, Wroclaw, Poland

444 **Analysis of Interdependencies of the Mexico City Metro System**

Jaime Santos-Reyes, and Diego Padilla-Pérez

SARACS Research Group, SEPI-ESIME, IPN, Mexico City, Mexico

535 **Bottlenecks of Inland Container Terminals**

Mateusz Zajac, Franciszek J. Restela

Wroclaw University of Technology

130 **A Risk Informed Assessment of Hydrogen Dispensing in Warehouses**

Kumar Bhimavarapu

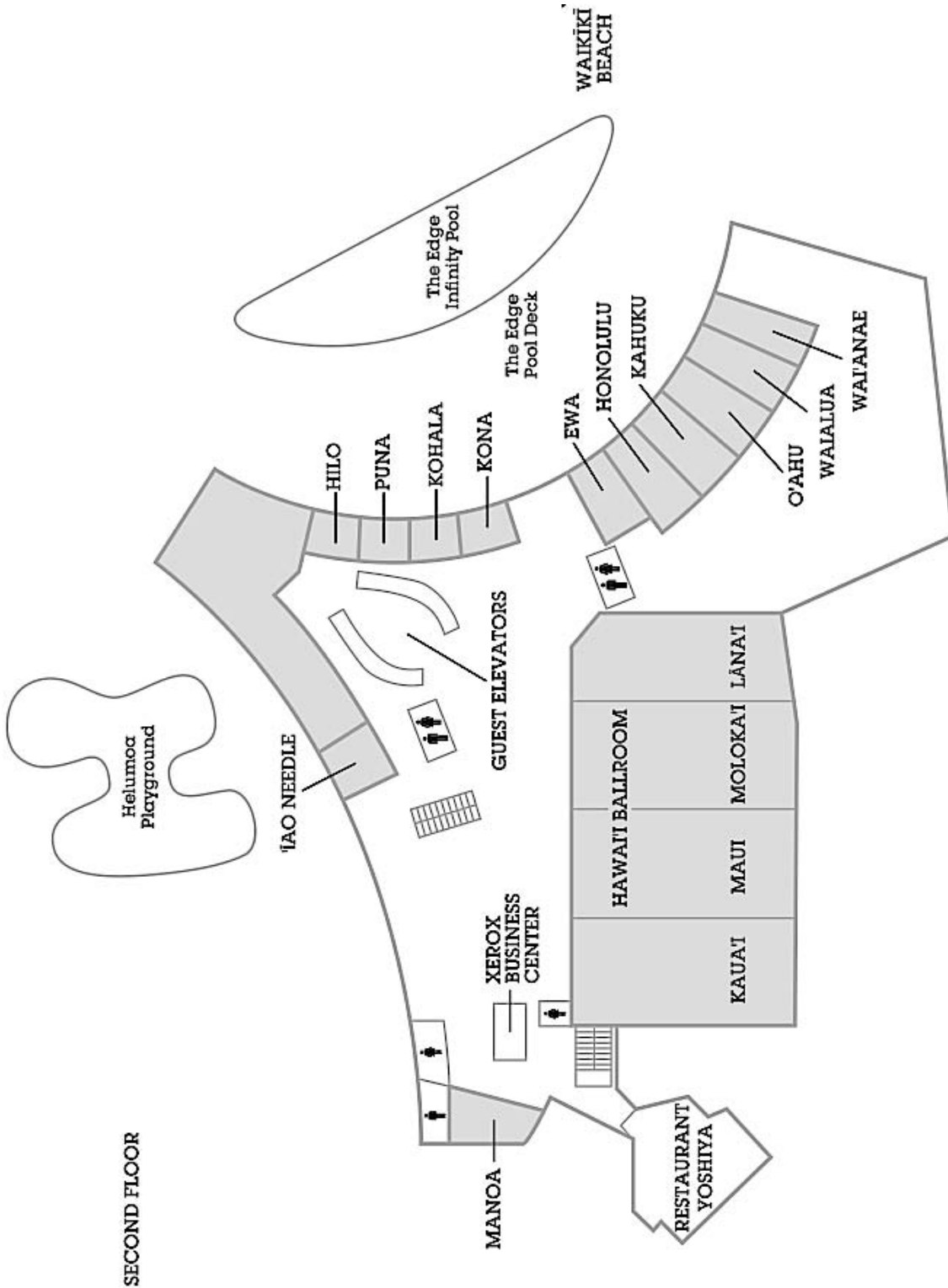
FM Global, Norwood, MA, USA

Notes

Notes

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Meeting Rooms



PSAM 12 Program Outline

Time	Room	Monday - June 23	Tuesday - June 24	Wednesday - June 25	Thursday - June 26	Friday - June 27
09:00-10:00	Plenary	George Apostolakis	John O'Donnell	Sandeep Reddy	Shunsuke Kondo	Heather Bell and Ray Shirkhodai
10:00-10:30	Honolulu	M01 Consequence Modeling and Management	T01 Aviation and Space I	AM Break	Th01 Nuclear Engineering II	F01 Human Reliability Analysis VI
	Kahuku	M02 Digital I&C and Software Reliability I	T02 Fire Modeling & Applications	W02 Reliability Analysis and Risk Assessment Methods V	Th02 Reliability Analysis and Risk Assessment Methods VI	F02 Reliability Analysis and Risk Assessment Methods VII
	O'ahu	M03 Enterprise Risk Management	T03 Reliability Analysis and Risk Assessment Methods II	W03 Human Reliability Analysis III	Th03 Human Reliability Analysis V	F03 Revision of Seismic PRA Standards of Japan
10:30-12:00	Waialua	M04 Environmental Modeling	T04 The Petro-HRA Project: Adapting SPAR-H to a Petroleum Context I	W04 Marine Engineering	Th04 Shipping and Offshore Oil & Gas I	F04 Transportation and Storage
	Waia'anae	M05 Fire Modeling and Simulation	T05 Risk Management Methods and Applications for Asset Management	W05 Uncertainty, Sensitivity, and Bayesian Methods I	Th05 Uncertainty, Sensitivity, and Bayesian Methods III	
	Ewa	M06 Human Reliability Analysis I	T06 Aging Management Issues for Nuclear (Spent) Fuel and HLW Transport and Storage Installations I	W06 Aging Management Issues for Nuclear (Spent) Fuel and HLW Transport and Storage Installations II	Th06 Nuclear Engineering III	
	Kona	M07 Industrial Safety and Accident Analysis I	T07 Dynamic Reliability I	W07 Dynamic Reliability II	Th07 Maintenance and Availability Modeling	
12:00-01:30		Break	Luncheon Speakers: Steve "Woody" Epstein & Jerzy Grynblat	Special Session: John O'Donnell	Break	
	Honolulu	M11 Lifetime and Ageing Management	T11 Reliability Analysis and Risk Assessment Methods III	W11 Digital I&C and Software Reliability II	Th12 Safety Assessment Software and Tools II	
	Kahuku	M12 Maintenance Modelling and Optimisation I	T12 Application of Probability and Physics for NASA Risk Assessment Applications	W12 Safety Assessment Software and Tools I	Th13 External Events Hazard/PRA Modeling for Nuclear Power Plants III	
	O'ahu	M13 Occupational Safety and Management	T13 External Events Hazard/PRA Modeling for Nuclear Power Plants I	W13 External Events Hazard/PRA Modeling for Nuclear Power Plants II	Th14 Safety Management and Decision Making II	
01:30-03:00	Waialua	M14 Operational Experience and Data Analysis	T14 Cyber Security and Digital I&C	W14 Safety Management and Decision Making I	Th15 Shipping and Offshore Oil & Gas II	
	Waia'anae	M15 Phenomena Modeling	T15 Reliability of Passive Systems I	W15 Reliability of Passive Systems I	Th16 SOARCA Uncertainty Analyses	
	Ewa	M16 Policy Making and Legislative Issues	T16 Human Reliability Analysis II	W16 Uncertainty, Sensitivity, and Bayesian Methods II	Th17 Nuclear Engineering IV	
	Kona	M17 Low-power and Shutdown	T17 Integrated Deterministic and Probabilistic Safety Assessment I	W17 Integrated Deterministic and Probabilistic Safety Assessment II		
03:00-03:30		PM Break				
	Honolulu	M21 Reliability Analysis and Risk Assessment Methods I	T21 Reliability Analysis and Risk Assessment Methods IV	W21 Human Reliability Analysis IV	Th21 External Events Hazard/PRA Modeling for Nuclear Power Plants IV	
	Kahuku	M22 Dependent Failure Modeling I	T22 Dependent Failure Modeling II	W22 Nuclear Engineering I	Th22 Crisis and Emergency Management	
	O'ahu	M23 Risk and Hazard Analyses I	T23 Risk and Hazard Analyses II	W23 Industrial Safety and Accident Analysis II	Th23 Risk and Hazard Analyses III	
03:30-05:00	Waialua	M24 Risk Governance and Societal Safety I	T24 Risk Governance and Societal Safety II	W24 Digital I&C and Software Reliability III	Th24 Digital I&C and Software Reliability IV	
	Waia'anae	M25 Risk Informed Applications I	T25 Risk Informed Applications II	W25 Risk Informed Applications III	Th25 Nuclear Fuel Analysis	
	Ewa	M26 Risk Informed Licensing and Regulation I	T26 Fire and Combustibles Analysis	W26 Risk Informed Licensing and Regulation II	Th26 Safety Integrity Level (SIL)	
	Kona	M27 Automotive Engineering	T27 The Petro-HRA Project: Adapting SPAR-H to a Petroleum Context II	W27 Benchmark Problem # 1 - A Space Propulsion System	Th27 Safety Culture and Human & Organizational Factors	



PSAM 13

13th International Conference on Probabilistic
Safety Assessment and Management

October 2 (Sun) ~ 7 (Fri), 2016

*Sheraton Grande Walkerhill
Seoul, Korea*

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Date!

Abstract Submission Due : December 31, 2015

Online abstract submission will be open from September 1, 2015.

For more information, please visit the official website; www.psam13.org
or contact the secretariat by email at info@psam13.org.

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