2020 MARY KAY O'CONNOR PROCESS SAFETY SYMPOSIUM Beyond Regulatory Compliance: Making Safety Second Nature

In Association with IChemE

Program



MARY KAY O'CONNOR PROCESS SAFETY CENTER TEXAS A&M ENGINEERING EXPERIMENT STATION

	I: TUESDAY, OCTOBER 20 VIRtual Symposium				
8:00AM	Welcome & State of the Mary Kay O'Connor Process Safety Center — Dr. Stewart Behie, Interim Director, MKOPSC				
8.300M	Welcome Webinar — Session Room D				
0.30AW	Track I: Risk/Consequence Analysis & Design Aspects	Track II: Human Factors—People in Action	Track III: Managing Operations and Maintenance		
	Session Room A	Session Room B	Session Room C		
	Risk Assessment I Session Chair: Rob Bellair	Training/Engagement Session Chair: Mindy Bergman	Modeling and Asset Integrity Session Chair: Jeff Thomas		
8:45AM	Importance of Process Safety Time in Design Shanmuga Prasad Kolappan, TechnipFMC	Cassion Proak	<i>RBI Study using Advanced Consequence Assessment</i> <i>for Topside Equipment on Offshore Platforms</i> Chetan Birajdar, <i>Monaco Engineering Solutions</i>		
9:15AM	Limitations of Layers of Protection Analysis (LOPA) in Complicated Process Systems Abdulaziz Alajlan, <i>Saudi Aramco</i>	Session preak	Indicators of an Immature Mechanical Integrity Program. Derek Yelinek , <i>Siemens Process & Safety</i> <i>Consulting</i>		
9:45AM	On the Usage of Ontologies for the Automation of HAZOP Studies Johannes I, Single, CSE Center of Safety Excellence	Virtual Reality Process Safety in Counterfactual Thinking Kianna Arthur , <i>Texas A&M University</i>	Remember the à la Mode: Lessons Learned from Ammonia Release at Frozen Foods Warehouse Matthew S. Walters, Exponent Inc		
10:15AM		Break			
	Risk Assessment II	Human Performance/Decision Making I	Recalling and Learning from Incidents		
	Session Chair: Robert Bellair	Session Chair: Mindy Bergman	Session Chair: Jeff Thomas		
10:30AM	Cost Benefit Analysis, with Two Case Studies Henrique (Henry) M. Paula, Galvani Risk Consulting, LLC	with Hazard Statement Compliance? An Experi- mental Investigation Using Eye-Tracking Technology S. Camille Peres, Texas A&M University	Process Related Incidents with Fatality—Trends and Patterns Syeda Zohra Halim, <i>MKOPSC</i>		
11:00AM	Does Your Facility Have the Flu? How to Use Bayes Rule to Treat the Problem instead of the Symptom. Keith Brumbaugh , <i>aeSolutions</i>	Risk management entails decision making: Does decision making in complex situations come down to somebody's gut feeling? Hans Pasman , <i>MKOPSC</i>	Application of Mind Mapping to Organize and Recall Potential Hazards. T. Michael O'Connor , <i>MKOPSC</i>		
11:30AM	Integrating the PHA and FSS into a Site Risk Assessment Life Cycle. Colin Armstrong and Sam Aigen, AcuTech	Decision Making using Human Reliability Analysis Fabio Kazuo Oshiro, Monaco Engineering Solutions	Would a HAZOP, LOPA, or STPA have Prevented Bhopal? Howard Duhon, <i>GATE Energy</i>		
12:00PM	Lunch Break Virtual Exhibitor Booths Join BakeRisk Q&A Session				
1:00PM	Keynote Address: "Mission-Oriented Leadership" by Katherine A. Lemos, Ph.D. Chairperson and CEO, U.S. Chemical Safety Board <u>Keynote Webinar — Session Room D</u>				
2:00PM	M Break				
	Track I: Risk/Consequence Analysis & Design Aspects	Track II: Human Factors—People in Action	Track III: Managing Operations & Maintenance		
	Session Room A	Session Room B	Session Room C		
	SIS—LOPA Session Chair: Robin Pitblado	Safety Culture and Leadership Session Chair: Ranjana Mehta	Improving Process Safety with Technological Advances Session Chair: Trish Kerin		
2:15PM	A Framework for Automatic SIS Verification in Process Industries using Digital Twin Nitin Roy, <i>California State University, Sacramento</i>	Improving Industry Process Safety Performance through Responsible Collaboration Ryan Wong, ExxonMobil Research and Engineering; and Shanahan Mondal , CVR Energy	Predictive Process Safety Analytics and IIoT - PSM Plus: The AI+PSM Analytic Framework Michael Marshall, <i>Tratus Group</i>		
2:45PM	The use of Bayesian Networks in Functional Safety Paul Gruhn, aeSolutions	How Much Does Safety Culture Change Over Time? Stephanie C. Payne, Texas A&M University	Guidance to Improve the Effectiveness of Process Safety Management Systems in Operating Facilities Syeda Zohra Halim, MKOPSC		
3:15PM	My Vision of Future Instrumented Protective Systems Greg Hall, <i>Eastman Chemical Company</i>	Administering a Safety Climate Assessment in a Multicultural Organization: Challenges and Findings Atif Mohammed Ashraf , <i>Texas A&M University</i>	Unified Wall Panel System (UWPS) - A Value Engineering Solution for Protective Construction in the Petroleum Industry Scott Hardesty, Applied Research Associates		
3:45PM		Break			
	Relief Systems Session Chair: Robin Pitblado	Procedures Session Chair: Farzan Sasangohar	Exploring NaTech Events and Domino Impacts Session Chair: Trish Kerin		
4:00PM	Overlooked Reverse Flow Scenarios Gabriel Martiniano Ribeiro de Andrade, Chris Ng and Derek Wood, Siemens Process & Safety Consulting	A Comparison of Procedure Quality Perceptions, Procedure Utility, Compliance Attitudes, and Deviation Behavior for Digital and Paper Format Procedures Joseph W. Hendricks, Texas A&M University	Protect Process Plants From Climate Change Victor Edwards, VHE Technical Analysis		
4:30PM	Failure Under Pressure: Proper Use of Pressure Relief Device Failure Rate Data based on Device Type and Service Todd W. Drennen, Baker Engineering and Risk Consultants (BakerRisk)	Practical Writing Tips To Prevent Human Error When Following Procedures Monica Philippart, <i>Ergonomic Human Factors Solutions</i>	Process Safety Implications in a Changing Environment Trish Kerin , <i>IChemE Safety Centre</i>		
5:00PM	Additional Engineering and Documentation to Reduce Pressure Relief Mitigation Cost Gabriel Martiniano Ribeiro de Andrade, and	The Impact of Hazard Statement Design in Proce- dures on Compliance Rates: Some Contradictions to Best (or Common) Practices	A Critical Evaluation of Industrial Accidents Involving Domino Effect Ravi Kumar Sharma , <i>Indian Institute of Technology</i> -		

DAY 2: WEDNESDAY, OCTOBER 21 | Virtual Symposium

8:00AM	Welcome & Mary Kay O'Connor Process Safety Center Awards — Dr. Stewart Behie, Interim Director, MKOPSC				
8:15AM	Break				
	Track I: Risk/Consequence Analysis &	Track II: Human Factors—People in Action	Track V: Explosions and Flammability		
	Session Room A	Session Room B	Session Room C		
	Risk Assessment III	Human Performance/Decision Making II	Explosion Modelling		
	Session Chair: Brenton Drake	Session Chair: Camille Peres	Session Chair: Delphine Laboureur		
8:30AM	Applying PHA Methodologies such as HAZOP and Bowtie to Assessing Industrial Cybersecurity Risk John Cusimano, <i>aeSolutions</i>	Preventing Cognitive-Attributed Errors in Safety Critical Systems: A Path Forward Tom Shephard , <i>Wood</i>	The Influence of the Velocity Field on the Stretch Factor and on the Characteristic Length of Wrinkling of Turbulent Premixed Flames Tássia L. S. Quaresma, University of Campinas		
9:00AM	Large Hydrocarbon Tank Fires: Modelling of the Geometric and Radiative Characteristics Ravi Kumar Sharma, Indian Institute of Technology - Roorkee	Two Views of Evaluating Procedural Task Performance: A Transition from Safety-I to Safety-II Approach Changwon Son , <i>Texas A&M University</i>	Towards a Comprehensive Model Evaluation Protocol for LNG Hazard Analyses Filippo Gavellia , <i>Blue Engineering and Consulting</i>		
9:30AM	Risk assessment of a large chemical complex during the construction phase using Intuitionistic Fuzzy Analytic hierarchy process. Suresh G , <i>Bharat</i> <i>Petroleum Corporation, Kochi Refinery</i>	Beyond Human Error: Integration of the Interactive Behavior Triad and Toward a Systems Model Joseph W. Hendricks. Texas A&M University	Beirut: How behaves Ammonium Nitrate Exposed to Fire and How Strong and Damaging is its Explosion? Charline Fouchier , <i>von Karman Institute of Fluid Dynamics</i>		
0:00AM		Break			
	Risk Mitigation Session Chair: Brenton Drake	Fatigue and Stress Session Chair: Camille Peres	Explosion Phenomena I Session Chair: Delphine Laboureur		
0:15AM	Development of Resilient LNG Facilities Onder Akinci, Daros Consulting	Operator Performance Under Stress: A Neurocentric Virtual Reality Training Approach	Flammable Mist Hazards Involving High-Flashpoint Fluids		
0:45AM	Development of Risk Mitigation Programs using a Quantitative-Risk-Based Approach Rafael Callejas-Tovar , BakerRisk	Towards a Predictive Fatigue Technology for Oil and Gas Drivers John Kang, Texas A&M University	Measuring Suspended Explosive Dust Concentration from Images Yumeng Zhao , <i>Purdue University</i>		
1:15AM	Incorporating Mitigative Safeguards with LOPA Edward Marszal, <i>Kenexis</i>	Validation of the Fatigue Risk Assessment and Man- agement in High-Risk Environments (FRAME) Survey Stefan V. Dumlao , <i>Texas A&M University</i>	The HBT-A Large-Scale Facility for Study of Detonations and Explosions Elaine S. Oran, <i>Texas A&M University</i>		
1:45AM	Lunch Break Virtua	Exhibitor Booths Join IChemE and Operational S	ustainability Q&A Sessions		
	Track I: Risk/Consequence Analysis	Track IV: Research and Next Generation	Track V: Explosions and Flammability		
	Session Room A	Session Room B	Session Room C		
	Consequence Analysis: Gas Release Session Chair: Marisa Pierce	Next Generation Process Safety I Session Chair: Nick Gonzales	Explosion Phenomena II Session Chair: Chris Clonev		
12:45PM	Hole Size Matters Jeffrey D. Marx, Quest Consultants Inc.	Identifying contributing factors of pipeline incident from PHMSA database based on NLP and text min- ing techniques. Guanyang Liu , <i>MKOPSC</i>	Development of Flammable Dispersion Quantitative Property-Consequence Relationship Models Using Ma- chine Learning. Zeren Jiao , <i>MKOPSC</i>		
1:15PM	How Can I Effectively Place My Gas Detectors Jesse Brumbaugh, <i>aeSolutions</i>	Causation analysis of pipeline incidents using artificial neural network (ANN)	An Unsupervised Model to Predict the Liquid In-cylinder Combustion Risk Ratings of Marine Fuels		
1:45PM	Consequence Assessment Considerations for Toxic Natural Gas Dispersion Modeling	Development of Hazard Factor for Engineered Particles	Fireball and Flame Venting Comparisons Peter A. Diakow, BakerRisk		
2:15PM	Break				
2:30PM	Plenary Panel: Integrating Pandemic Preparedness and Response Into Business Continuity and Risk Management Planning Panelists: Gerald Parker, Director, Pandemic and Biosecurity Policy Program, Scowcroft Institute, Bush School of Government and Public Services, TAMU; Paul Thomas, VP Health, Environment, Safety & Security, OxyChem; Malick Diara, Public Health Manager, Workplace Infectious Disease Control Manager, Exx- onMobil; and Richard Wells, VP Gulf Coast Operations, Dow Chemical Corporation. Moderator: Stewart Behie, Interim Director, MKOPSC				
2.45 DM	Panel Webinar — Session Room D				
5.45PIVI	Session Room A	Session Room B	Session Room C		
	Reactive Chemicals Session Chair: Marisa Pierce	Next Generation Process Safety II Session Chair: Nick Gonzales	Consequence Analysis: Flammability Session Chair: Chris Cloney		
4:00PM	Modelling and Simulation to Predict Energetic Material Properties Kok Hwa Lim, Singapore Institute of Technology	Can a Virtual Reality Application Better Prepare Millennials and the Z-Generation for Working with Systems in the Process Industry? Nir Keren , <i>Iowa State University</i>	Numerical Simulation of Methane-Air DDT in Channels Containing Trace Amounts of Impurities Logan N. Kunka, <i>Texas A&M University</i>		
4:30PM	Safety Assessment of Low Temperature Radical Initiators for Proper Storage and Safe Handling Conditions Cuixian (Trisha) Yang, <i>Merck & Co</i>	Process Safety Risk Index Calculation Based on Historian Data Prasad Goteti , <i>Honeywell Process Solutions</i>	The Use of Bent Poles as a Detonation Indicator J. Kelly Thomas, <i>BakerRisk</i>		
5:00PM	Analysis of Pressure Behavior during Reaction Runa- way and Estimation of Available Depressurization Design. Yuto Mizuta , <i>Mitsubishi Chemical</i>	A Brief Review of Intrusion Detection in Process Plants and Advancement of Machine Learning in Process Security. Sinijoy P J , <i>Cochin University of</i>	Machine Learning Based Quantitative Prediction Model for Chemical Mixture Flammability Limits Zeren Jiao , <i>MKOPSC</i>		

DAY 2: WEDNESDAY, OCTOBER 20 | Virtual Exhibitor Booths Q&A



Virtual Zoom Q&A Session Details: ADVANCING Cher CHEMICAL ENGINEERING WORLDWIDE When: Wednesday, October 21^{st,} 11:45 AM-12:45 PM **Zoom Link** Join IChemE on Zoom Trish Kerin will run an interactive Case Study. In this case study, the user will encounter a stream of crucial decision making points which would typically occur while on shift, operating a gas plant. Users will practice managing the tenuous balance between meeting production output targets, while managing a process plant. 11:45AM-12:45PM Virtual Zoom Q&A Session: **Driving Operational** When: Wednesday, October 21^{st,} 11:45 AM-12:45 PM Excellence™ **Zoom Link** Operational Sustainability, LLC® Join Operational Sustainability, LLC on Code: 7QEJ7r Zoom

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In Association with IChemE

Awards and Scholarships

Trevor Kletz Merit Award The Harry H. West Memorial Service Award Lamiya Zahn Memorial Safety Scholarships

2020 MKOPSC Consortium Members

Keynote Speaker

Mission-Oriented Leadership Katherine A. Lemos, Chairperson and CEO, U.S. Chemical Safety Board

Plenary Panel

Integrating Pandemic Preparedness and Response Into Business Continuity and Risk Management Planning Gerald Parker, Paul Thomas, Malick Diara, Richard Wells and Stewart Behie Symposium Coordinators

Symposium Track Chairs

Symposium Technical Support Team

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WELCOME TO THE 2020 ANNUAL PROCESS SAFETY SYMPOSIUM

I am delighted to welcome you to the 2020 Annual Symposium of the Mary Kay O'Connor Process Safety Symposium. The 2020 Symposium is the 23th in the series and is offered virtually for the first time due to the impacts of the ongoing coronavirus pandemic. Our symposium honors the memories of our namesake, Mary Kay O'Connor, and our founding director, Professor M. Sam Mannan. The symposium is an important annual event that focuses on research, education, training and service issues that impact process safety and risk management. Your participation is very much appreciated, particularly in these trying time as we all struggle with the impacts of the coronavirus pandemic on our lives and day to day operations. Your involvement is crucial in making the symposium a success and to advance the cause of process safety technologies and concepts to the end of making industry safer. We believe that proactive improvements in process safety programs are good business and have a positive impact on the industries bottom line particularly in these difficult times.

The objectives for holding this annual symposium are three-fold. First, this annual event provides an independent and unbiased forum for exchange of ideas and discussion where industry, academia, government agencies and other stakeholders come together to discuss critical issues of research and advances in the field of process safety. Secondly, it provides an excellent platform for networking whereby process safety professionals can build peer-topeer connections for future and also gain knowledge of the various services they can avail from others. Finally, we strongly believe that as we navigate the uncertain waters of COVID-19 today, good, robust research can help solve the complex and intriguing problems faced by the industry today. Identifying these problems and exchanging ideas and opinions with the expertise brought together through discussions at the symposium will provide context to help resolve the issues at hand

In addition, participants in the Symposium can also take this opportunity to benefit from being acquainted with the cutting-edge research done at the Mary Kay O'Connor Process Safety Center.

The 2020 symposium proceedings contain the symposium program, the papers presented at the symposium and submitted before the deadline, and other informative items from the center.

We wish you maximum benefit from this symposium and strongly encourage you to participate in the virtual discussions. Please feel free to contact me or other center personnel with your ideas and input regarding the symposium and other activities of the center. We look forward to welcoming everyone to our face to face symposium at Texas A&M University in October 2021. Best wishes for a safe return to normalcy.

Stewart W. Behie, Ph.D., P.Eng. Interim Director, Mary Kay O'Connor Process Safety Center Professor of Practice, Artie McFerrin Department of Chemical Engineering Texas A&M University

2020 Symposium Sponsors

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DUST SAFETY SCIENCE	<u>Visit Dust Safety Science Here</u>		
DUST SAFETY	<u>Visit Dust Safety Academy Here</u>		
g gateway	<u>Visit Gateway Group Here</u>		
Cheme ADVANCING CHEMICAL ENGINEERING WORLDWIDE	Visit IChemE Here Virtual Booth Q&A Session: Join IChemE on Zoom When: Wednesday, October 21 ^{st,} 11:45 AM-12:45 PM Where: Zoom Link Trish Kerin will run an interactive Case Study. In this case study, the user will encounter a stream of crucial decision-making points which would typically occur while on shift, operating a gas plant. Users will practice managing the tenuous balance between meeting production output targets, while managing a process plant.		
Operational Sustainability, LLC*	 <u>Visit Operational Sustainability Here</u> <u>Process Safety Risk Management Plan</u> <u>2020: The State of Process Safety</u> <u>The OESuiteTM Platform – Integrated Software</u> for Operational Excellence <u>Why Operational Sustainability, LLC is the</u> Right Choice? Virtual Zoom Q&A Session: Join OS on Zoom When: Wednesday, October 21^{st,} 11:45 AM-12:45 PM Where: <u>Zoom Link</u> Code: 7QEJ7r 		

Process Safety in the 21st Century

As an industry, our inability to learn from past incidents and demonstrate that process safety is improving has led to the project Process Safety in the 21st Century and Beyond. The aim of this project is to envision better process safety by outlining efforts that each stakeholder can take. How was the project undertaken?

Gaining a global perspective of the key challenges in process safety is the first important step. The challenges were considered across four stakeholders: industry, academia, regulators, and society. To determine the challenges, a series of workshops at international symposia were undertaken, including in the UK (with input from other European countries), North America, Asia, Australia/New Zealand, and the Middle East. Various methods of consultation were used, but the key questions remained consistent. In process safety:

- What are the key industry challenges?
- What are the key academic challenges?
- What are the key regulatory challenges?
- What are the key societal challenges?

These questions were answered by professionals from various levels in industry, academia, and regulatory bodies. Once the challenges were identified, a top five list was drawn up for each stakeholder group.

Our goal with this document is to lay out a series of actions to be undertaken at various levels and across all stakeholders to improve process safety because people have a right to not get hurt. To enable this vision, this roadmap is a call to action to all stakeholders and not just process safety professionals. We invite you to look at the opportunities and think about how you can influence them and positively impact process safety. Every professional is obliged to improve process safety because engineering and science are essential to us all and it must be sustainable in all senses of the word, including process safety. If we, as engineers, do not develop new strategies for continuous improvement, the engineering profession will become irrelevant to society and the need for process safety will become extinct, thus increasing process safety incidents. A question that needs to be answered is where this roadmap is intended to take us. The simple answer is that the roadmap and the associated journey are focused towards improvements in process safety performance, which will ultimately lead us to our vision of zero incidents.

In Association with IChemE

The Institution of Chemical Engineers (IChemE) is the global professional membership organization for chemical, biological and process engineers and other professionals involved in the chemical, process and bioprocess industries. With a membership exceeding 44,000 members in over 120 countries, and offices in Australia, New Zealand, Singapore, Malaysia and the UK; IChemE aims to be the organization of choice for chemical engineers.

We promote competence and a commitment to the best practice, advance the discipline for the benefit of society and support the professional development of our member. We are the only organization licensed to award Chartered Chemical Engineer and Professional Process Safety Engineer status.

IChemE exists because chemical engineering matters.

OUR MISSION

IChemE's four key aims are:

- To build and sustain an active international professional community, united by a commitment to qualifications and standards that foster excellence and the delivery of benefits to society.
- To engage with others to promote development, understanding of chemical engineering and an appreciation of its importance.
- To provide support and services to individuals, employers and others who contribute to improving the practice and application of chemical engineering.
- To enable chemical engineers to communicate effectively with each other and with other disciplines.

To support these aims, we operate as an effective, efficient and responsive organization, providing leadership and demonstrating good practice as well as complying with our obligations as a charitable organization.

IChemE is a registered charity in England & Whales (214379) and a charity registered in Scotland (SC 039661).



Awards and Scholarships

Trevor Kletz Merit Award

The Merit Award recognizes an individual who has made significant contributions to the advancement of education, research, or service activities related to process safety concepts and/or technologies. The contributions or accomplishments leading to the annual Merit Award need not be associated with the Center but must fit within the central theme of the Center, i.e., Making Safety Second Nature. In establishing the Merit Award, the Steering Committee underscores the importance of promoting and recognizing significant contributions and accomplishments of practitioners and researchers worldwide.

The Harry H. West Memorial Service Award

The Service Award was established by the Steering Committee to honor and recognize individuals who have contributed directly to the success of the Center and have played a significant role in advancing the mission of the Center.

Lamiya Zahn Memorial Safety Scholarship

On July 31, 2004, an explosion and fire occurred in a university apartment on the Texas A&M University campus. Four members of the family of Saquib Ejaz, a chemical engineering graduate student - were critically injured and hospitalized. Saquib's mother and his four-year old daughter, Lamiya Zahin subsequently died from injuries sustained in the fire.

In fond and living memory of Lamiya, the Department of Chemical Engineering and the Mary Kay O'Connor Process Safety Center have established the Lamiya Zahin Memorial Safety Scholarship. Graduate students are encouraged to apply for the \$1,000 scholarship by writing a 1000-word essay on "Safety Innovations in Research Projects".

Trevor Kletz Merit Award Recipient



Dr. William (Bill) Rogers, TAMU Safety Engineering Lecturer

Bill is currently a Lecturer at the Department of Chemical Engineering, Texas A&M University and has been associated with various research activities at MKOPSC for over twenty years. He has published and continues to publish numerous peer-reviewed articles on process safety and risk management and has been teaching Risk Analysis and Quantitative Risk Analysis at for the last 10 years. Bill developed several Safety Engineering courses at the Center and taught them at different times and has inspired thousands of undergraduate and graduate students with his enthusiasm and passion for process safety and his unparalleled dedication to teaching. His key contribution to process safety has been disseminating the importance of quantitative risk assessment in engineering problems to his students. Each student passing his class enters the industry knowing the importance of "uncertainty" in risk assessment. There is probably no other educator with a greater number of students in process safety than Bill. In his silent way, Bill continues to pave the way to safer processes by imparting wisdom on the fundamentals of QRAs among the large number of his students.

Harry West Service Award Recipients



Jeff Thomas, MKOPSC Technical Advisory Committee Member

Research Fellow and Volunteer Mentor, Mary Kay O'Connor Process Safety Center Jeff has been a long-time supporter of the Center and has worked hard in providing direction through the Steering Committee and Technical Advisory Committee and special projects related to process safety. Jeff has also been an active participant in the MKOPSC annual symposium serving on the technical program committee for the past few years as well as serving as track chairs, reviewing presentations, and helping coordinate activities to make this event successful. He engages with the students and is always keen to offer assistance

Lamiya Zahin Memorial Safety Scholarship Recipient



Cassio Brunoro Ahumada

PhD Chemical Engineering Student, Texas A&M University Graduate Research Assistant, MKOPSC

Cassio Brunoro Ahumada is a doctoral candidate in the Chemical Engineering Department. He holds a Master's in Chemical Engineering from Texas A&M and a Bachelor's in chemical engineering from the Federal University of Espirito Santo, Brazil.

His research investigates how the congestion pattern variation affects the deflagration-to-detonation transition (DDT) mechanism on flammable gaseous mixtures. He is also involved in many safety-related projects, including facility risk assessments, facility siting, and vapor cloud explosion modeling. During his time as a graduate student at TAMU, he interned at Tesla's car manufacturing site and Wood PLC, conducting activities related to process safety management and technical consulting.

2020 MKOPSC Consortium Members

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- Shell
- Total Petrochemicals & Refining

We appreciate all of our member companies and its representatives. Their expertise in our Steering and Technical Advisory Committee is essential to the success of the Center. Email us at <u>mkopsc@tamu.edu</u> if you would like to become a member.

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Day 1 Keynote Speaker



Keynote Lecture: Mission-Oriented Leadership

Katherine A. Lemos, Ph.D. Chairperson and CEO U.S. Chemical Safety Board

Katherine A. Lemos, Ph.D. was nominated by the President in June 2019 and confirmed by the Senate in March 2020.

Prior to her confirmation as Chairperson and CEO of the U.S. Chemical Safety Board (CSB) Dr. Lemos served as Director for Northrop Grumman Corporation's Aerospace Sector, driving performance improvements across the product lifecycle with a focus on engagement early in the value stream.

As an expert in accident investigation, human decision-making and safety management, she is known for her innovative and strategic approaches leveraging advances in analytics and autonomy. She has a documented record of turning new technologies into solutions trusted by operators, overseers, and the public they serve.

Before joining Northrop Grumman in 2014, Dr. Lemos worked at the Federal Aviation Administration (FAA) as a technical leader and program manager in Aircraft Certification and Aviation Safety. Prior to this she worked for the National Transportation Safety Board (NTSB) as a Senior Human Performance Investigator in Aviation Safety, and then as Special Assistant to Vice Chairman of the Board.

In academia Dr. Lemos focused her research on decision-making, studying the influence of information and technology on beliefs and behaviors to more reliably yield safe outcomes during risky and uncertain conditions. In aviation, Dr. Lemos conducted applied research to balance the strengths of technology and humans for optimal performance. Dr. Lemos earned a B.B.A. from Belmont University, a M.S. from California Lutheran University, and a Ph.D. from the University of lowa.

Throughout her career, Dr. Lemos has focused on improving safety and efficiency at the level of the individual and the organization. She has contributed individually as a researcher, professor and technical expert, and also contributed as a leader in managing programs and initiatives, bringing consensus and order to efforts that result in tangible safety and efficiency outcomes.

Day 2 Plenary Panelists

Plenary Panel: Integrating Pandemic Preparedness and Response Into Business Continuity and Risk Management Planning



Gerald Parker

Director, Pandemic and Biosecurity Policy Program,

Scowcroft Institute, Bush School of Government and Public Services



Paul Thomas Vice President, Health, Environment, Safety & Security, Occidental Chemical Corp.

Malick Diara

Public Health Manager, Workplace Infectious Disease Control Manager,

ExxonMobil





Richard Wells VP Gulf Coast Operations, Dow Chemical Corporation

Stewart Behie, Moderator Interim Director, *MKOPSC*

Symposium Coordinators, MKOPSC



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Paola Camposeco paolacamposeco@tamu.edu

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Laurel Patterson laurel0601@tamu.edu



Tanner Thornton tannerthornton@tamu.edu



Lauren Guerra laurenguerra@tamu.edu

Symposium Track Chairs

The Mary Kay O'Connor Process Safety Center would like to recognize and thank the **Track Chairs** who have volunteered their time to assist with the abstract review, selection process, and session coordination. Their input, expertise, and leadership have been essential to the Symposium's success.

Day 1, Track I Chairs: Risk/Consequence Analysis & Design Aspects



Robert Blair, Dow RJBellair@dow.com



Robin Pitblado, DNV GL robinpitblado@gmail.com

Day 1, Track II Chairs: Human Factors-People In action



Mindy Bergman, TAMU Mindybergman@tamu.edu



Ranjana Mehta, TAMU rmehta@tamu.edu



Farzan Sasangohar, TAMU sasangohar@tamu.edu

Day 1, Track III Chairs: Managing Operations and Maintenance



Jeff Thomas jjt1234@aol.com



Trish Kerin, IChemE TKerin@icheme.org

Day 1 and Day 2 Keynote and Panel Moderator



Stewart Behie, MKOPSC Stewart_behie@tamu.edu

Day 2, Track I Chairs: Risk/Consequence Analysis & Design Aspects



Brenton Drake, Dow bdrake1@dow.com



Marisa Pierce, DNV GL mmarisa.pierce@dnvgl.com

Day 2, Track II Chair: Human Factors-People In action



Camille Peres, TAMU peres@tamu.edu

Day 2, Track IV Chair: Research and Next Generation



Nick Gonzales, Shell nick.gonzales@shell.com

Day 2, Track V Chairs: Explosions and Flammability



Delphine Laboureur, Von Karman Institute delphinelaboureur@gmail.com



Chris Cloney, Dust Safety Science chris@dustsafetyscience.com

Symposium Technical Support Team

The Mary Kay O'Connor Process Safety Center would like to recognize and thank the **Technical Support Team** who put in countless of hours to make the virtual symposium successful. They are the ones behind the scenes who took on the challenge of tackling the set up and handle of the virtual sessions. Their virtual session research and coordination was integral to the Symposium's success.



Henry Goyette, MKOPSC Technical Program Coordinator hgoyette1@outlook.com



Harold Escobar, MKOPSC hu.escobar2208@tamu.edu



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ВАСК ТО ТНЕ ТОР

DAY 1: Tuesday Oct 20 Summaries

Track I - Risk/Consequence & Design Aspects Category: Risk Assessment I Session

8:45 AM to 9:15 AM

Importance of Process Safety Time in Design

Speaker: Shanmuga Prasad Kolappan

This work demonstrates the importance of this Process Safety Time and its role in the design of the safety protection system, in particular the factor of SIF response time to achieve potential risk mitigation. Although the Process Safety time is complex predict, its importance is being demonstrated with a simple example.

9:15 AM to 9:45 AM

Limitations of Layers of Protection Analysis (LOPA) in Complicated Process Systems

Speaker: Abdulaziz Alajlan

This presentation presents a case study showing the limitations of applying LOPA in upstream scenarios to develop protection layers requirements for a complicated network of pipelines and processing units with unlimited number of causes contributing to the risk. It compares LOPA with the more sophisticated, more quantified other techniques such as Fault Tree Analysis (FTA). Based on the cases analysis, it is recommended that LOPA can be used to assess simple scenarios with limited number of causes, while more complicated cases are better assessed using FTA. Detailed analysis is presented in the paper to support such recommendation.

9:45 AM to 10:15 AM

On the Usage of Ontologies for Computer-aided HAZOP Studies

Speaker: Johannes. I. Single

The presentation is about the usage of ontologies for the automation of HAZOP studies. Therefore, the questions are answered why computer-aid should be provided and what added value can be provided. After that, the process and plant representation, as well as the representation of expert knowledge via ontologies, is explained. Special attention is paid to the representation of expert knowledge and the automatic drawing of conclusions. The necessary steps are explained by means of a hexane storage tank. Furthermore, the automatic generation of HAZOP worksheets based on an inference algorithm is presented and discussed. The results are summarized at the end of the presentation.

Category: Risk Assessment II Session

10:30 AM to 11:00 AM

An Efficient and Effective Approach for Performing Cost Benefit Analysis, with Two Case Studies

Speaker: Henry M. Paula

Cost benefit analysis is a powerful tool to help managers sort through the recommendations and effectively/efficiently prioritize them. It consists of evaluating the risk reduction and the estimated cost associated with each recommendation, including Capital Expenditures (CAPEX) and Operational Expenditures (OPEX). This presentation provides a simple, efficient, and effective approach for performing cost benefit analysis, illustrated through two case studies. This method is not intended to replace more detailed methodologies. Rather, it is a complementary tool particularly useful for applications with many recommendations.

11:00 AM to 11:30 AM

Does your facility have the flu? Use Bayes rule to treat the problem instead of the symptom

Speaker: Keith Brumbaugh

Stop pretending to meet ultra low targets. Use Bayes theory to identify problems and prioritize the management of independent protection layers (IPLs).

11:30 AM to 12:00 PM

Integrating the PHA and Facility Siting into a Site Risk Assessment Life-Cycle

Speakers: Colin Armstrong and Sam Aigen

PHAs provide an accepted framework in organizations which details scenarios to be evaluated, credible safeguards, and the organization's acceptable risk criteria. Siting studies may consider risk in the same way as PHAs, but organizations typically fail to align the two assessments.

Category: SIS – LOPA Session

2:15 PM to 2:45 PM

A Framework for Automatic SIS Verification in Process Industries using Digital Twin

Speaker: Nitin Roy

Increasing complexity of distributed control systems (DCS) and control logics has made (safety instrumented systems) SIS validation complex and time-consuming. IEC and ISA safety standards recommend comprehensive logic checks of Safety instrumented functions. It can take months to check logic in delivered product. This work introduces automated testing of logic in process plants using Digital Twins. This method makes the process efficient and saves considerable amount of time, manpower and in turn capital. The verification which takes months can be reduced to weeks. It also ensures the verification is comprehensive and accurate making the system safer. In this work we also review the current practices in SIS verification and future improvements.

2:45 PM to 3:15 PM

The use of Bayesian Networks in Functional Safety

Speaker: Paul Gruhn

Functional safety engineers follow the ISA/IEC 61511 standard and perform calculations based on random hardware failures. These result in very low failure probabilities, which are then combined with similarly low failure probability of an accident is extremely low (e.g., 1E-5/yr). Unfortunately, such numbers are based on frequentist assumptions and cannot be proven. Yet accidents are not caused by random hardware failures, they are typically the result of steady and slow normalization of deviation (a.k.a. drift). Bayes' theorem can be used to update our prior belief (the initial calculated failure probability) based on observing other evidence (e.g., the effectiveness of the facility's process safety management process). The results can be dramatic.

3:15 PM to 3:45 PM

My Vision of Future Instrumented Protective Systems

Speaker: J. Gregory Hall

I will share my vision of what future Instrumented Protective systems IPS will look like and what is our current objective to achieve that future.

Category: Relief Systems Session

4:00 PM to 4:30 PM

Overlooked Reverse Flow Scenarios

Speakers: Gabriel Martiniano Ribeiro de Andrade, Christopher Ng, Derek Wood

Reverse flow scenarios due to latent check valve failure are critical in the design of relief systems, but often overlooked or incompletely evaluated. This type of scenario is often

controlling for relief device sizing, especially for systems involving high differential pressure across pumps or compressors. This presentation reviews current industry best practices to evaluate such scenarios. Specific application examples are then presented to highlight key aspects for the analysis, including identification of pressure sources as well as potential paths for reverse flows, location of and credit for relief devices, initiating events, and limiting basis for system pressure rating. In addition, potential to relieve both forward plus reverse flow simultaneously should be evaluated. Guidance is also provided to determine if vapor, liquid, or two-phase relief should be expected and whether liquid displacement or other non-obvious backflow from utility header should also be considered. Criteria to allow credit for system settle-out pressure, if applicable, and how to evaluate such credit are also provided. As system complexity increases, tips on how to estimate relief loads accurately and efficiently are also provided. Lastly, consideration of other safeguards beyond relief devices for high-risk cases is also discussed.

4:30 PM to 5:00 PM

Failure under Pressure: Proper Use of Pressure Relief Device Failure Rate Data based on Device Type and Service

Speaker: Todd W. Drennen

Component failure rate data is used in a variety of quantitative and semi-quantitative study methods related to process safety and reliability, including Fault Tree Analysis (FTA) and Layers of Protection Analysis (LOPA). In each of these methodologies, failure rate data is used to determine the probability that specific protective components, such as pressure relief devices, will fail to function as designed when called upon to prevent an incident. In the case of pressure relief devices, standardized probabilities of failure on demand are often applied with minimal consideration of the device type or the process service in which the device is employed. This presentation will examine pressure relief device failure rate data from multiple published sources, categorize the data based on device type and service, and then develop guidelines for determining probability of device failure on demand based on the proposed device type and service categories. Additionally, this presentation will provide commentary on the administrative aspects of relief device handling relative to observed relief valve reliability.

5:00 PM to 5:30 PM

Additional Engineering and Documentation to Reduce Pressure Relief Mitigation Cost

Speakers: Gabriel Martiniano Ribeiro de Andrade and Kartik Maniar

Unit revalidation and baseline studies for pressure relief analysis can result in a long list of potential deficiencies, which may result from an increase in unit throughput, changes to industry guidance or standards, changes to company internal guidelines for such studies, conservative assumptions in the absence of required data or based on simplified initial approach, management of change (MOC) at system or unit level, or may be a combination of all these. This presentation addresses what kind of additional engineering tools or processes can be applied on typical systems during revalidation studies, such as reactor loops, columns, turbines and heat exchangers, to ensure a more accurate representation of the relief scenarios to validate the deficiencies. In addition, the paper addresses what improvements in MOC processes can be implemented in order to capture, assess, and reduce the cumulative adverse effect to unit pressure relief analysis due to changes.

Track II - Human Factors – People in Action **Category**: Training/Engagement Session

9:45 AM to 10:15 AM

Virtual Reality Process Safety in Counterfactual Thinking

Speaker: Kianna Arthur

Counterfactual thoughts (i.e., "If only...") are common thoughts of the mental landscape. The current study is interested in further investigating if these thoughts can be used to improve workplace safety and future adherence to procedures.

Category: Human Performance/Decision Making I Session

10:30 AM to 11:00 AM

Is Attentional Shift the Problem (or something else) with Hazard Statement Compliance? An Experimental Investigation Using Eye-Tracking Technology

Speaker: S. Camille Peres

The current study utilized eye-tracking technology to determine whether or not participants are attending to hazard statements based on two different exemplar designs that have yielded the largest gap in hazard statement compliance. In other words, do we observe significant differences in attention to hazard statements based on a few predominant design characteristics (i.e., warning icon, yellow highlighting, numbering, and borders)?

11:00 AM to 11:30 AM

Risk management entails decision making: Does decision making in complex situations come down to somebody's gut feeling?

Speaker: Hans J. Pasman

Every day, we take hundreds of decisions and perhaps, all guided by intuition. However, if it concerns a decision to choose an option from several alternatives that must fulfil a number of requirements, and where a wrong decision can have disastrous consequences, a rational method should be preferred. The presentation presents an overview of available decision aiding methods suitable to apply at risk management.

11:30 AM to 12:00 PM Decision Making using Human Reliability Analysis

Speaker: Fabio Kazuo Oshiro

In this presentation the human error probability was quantified using standardized methods. The study was based on the evaluation of some methodologies of human reliability and decision making. The method was assessed through a case study of an accident occurred in 2004 at Formosa Plastics Corp. Illiopolis. Initially, an analytical method was developed as Hierarchical Task Analysis (HTA), then by Predictive Human Error Analysis (PHEA) and a qualitative analysis using Systems for Predicting Human Error and Recovery (SPEAR). To complete the study a quantitative assessment using Fault Tree Analysis (FTA) and Human Error Assessment and Reduction Technique (HEART) was developed.

Category: Safety Culture and Leadership Session

2:15 PM to 2:45 PM

Improving Industry Process Safety Performance through Responsible Collaboration

Speakers: Ryan Wong and Shanahan Mondal

Since 2012, the American Fuel & Petrochemical Manufacturers (AFPM) and the American Petroleum Institute (API) have been working together on industry process safety programs under the umbrella of Advancing Process Safety (APS) programs. This presentation will provide learning from experience case studies from participants on how they are using the APS programs, what changes they have implemented at their sites, and what improvements have been achieved by those changes. Examples include practice sharing documents, training, industry safety bulletins, and Walk the Line. Ultimately, I will discuss a variety of practical takeaways that highlight the application and sharing of industry lessons learned.

2:45 PM to 3:15 PM

How Much Does Safety Culture Change Over Time?

Speaker: Stephanie C. Payne

Literature review of longitudinal studies of safety culture over time.

3:15 PM to 3:45 PM

Administering a Safety Climate Assessment in a Multicultural Organization: Challenges and Findings

Speaker: Atif Mohammed Ashraf

This presentation provides a brief description of the administration of a safety climate assessment across four different sites to a 1200 employee organization in the Middle East. The inter-disciplinary approach between psychology and engineering to formulate a science-based safety climate survey is highlighted. Challenges including but not limited to achieving maximum survey participation, overcoming language barriers and the involvement of contractors is discussed. Finally, a review of the strengths and areas in need of improvement concerning safety at the respective sites will be presented.

Category: Procedures Session

4:00 PM to 4:30 PM

A Comparison of Procedure Quality Perceptions, Procedure Utility, Compliance Attitudes, and Deviation Behavior for Digital and Paper Format Procedures

Speaker: Joseph W. Hendricks

There is a dearth of research on digital (hand-held, interactive; not .pdf) procedures in the process safety industries. This study surveyed chemical processing and logistics employees to determine if there are substantial differences in procedure quality perceptions, deviations and attitudes between digital and paper procedure formats. Results suggest that quality perceptions are better for digital procedures. Other results indicated differences in deviations, compliance and utility attitudes with non-trivial effect sizes. Future research and limitations will be discussed.

4:30 PM to 5:00 PM

Practical Writing Tips To Prevent Human Error When Following Procedures

Speaker: Monica Philippart

This presentation begins explaining how people process information and how written information can lead to human error, to help the audience recognize the importance of adhering to the writing tips are subsequently presented. There are many writing standards and guidelines. The Pareto principle was applied to collect a practical selection of tips that procedure writers in high-risk industries can easily implement to reduce the likelihood of error when users follow their procedures. The goal of this presentation is to help improve the safety and effectiveness of operations by reducing human error when following written procedures.

5:00 PM to 5:30 PM

The Impact of Hazard Statement Design in Procedures on Compliance Rates: Some Contradictions to Best (or Common) Practices

Speaker: Joseph W. Hendricks

This study was designed to examine whether or not certain design elements of hazard statements (HS) actually impact compliance rates. We manipulated four HS elements (present vs. absent) – Icon, Number, Fill (Highlight), and Boxed in a virtual environment (2nd Life) – leading to a 16 condition within-subjects design. We observed a range of approximately 20 percentage points in compliance rates across the various conditions. The two most robust findings were that the presence of a warning icon surprisingly hurt performance and numbering was consistently helpful. Banner blindness is considered one possible explanation for the effects and future research will be discussed.

Track III - Managing Operations and Maintenance

Category: Modeling & Asset Integrity Session

8:45 AM to 9:15 AM

RBI Study using Advanced Consequence Assessment for Topside Equipment on Offshore Platforms

Speaker: Chetan Birajdar

An important driver that influences the production profile of an offshore facility is the reliability of production critical equipment. The improvement in production profile can be achieved by minimizing the equipment downtime using reliable components, inclusion of redundant units and effective-efficient inspection maintenance service.

9:15 AM to 9:45 AM

Indicators of an Immature Mechanical Integrity Program

Speaker: Derek Yelinek

Oil, gas, and chemical facilities face many challenges to ensure overall safety, risk management, operational efficiency, and improved reliability. One area of focus will be on the maturity of your Mechanical Integrity program. Organizations frequently benchmark their programs' effectiveness against best-in-class mechanical integrity programs. In this presentation, three common indicators that your Mechanical Integrity program might be limiting your strategic capabilities will be discussed as well as ways to mature your program toward a best-in-class state.

9:45 AM to 10:15 AM

Remember the à la Mode: Lessons Learned from Ammonia Release at Frozen Foods Warehouse

Speaker: Matthew S. Walters

Intentionally opening a line that carries a hazardous substance — a procedure known as a line break — is often necessary for performing maintenance activities on pipes, valves, pumps, compressors, and other process equipment. However, inadequate or improper line break practices may increase the risk for a loss of containment event, complicate troubleshooting efforts if a loss of containment occurs, or inadvertently expose workers to hazardous materials. A case study that examines an incident related to a line break in a frozen foods warehouse will be presented. The loss of containment event described here provides valuable lessons that can aid in developing an effective procedure for safe process operation following a line break, and the impact that improper line break procedures can have on leak identification and system troubleshooting.

Category: Recalling and Learning from Incidents Session

10:30 AM to 11:00 AM

Process Related Incidents with Fatality- Trends and Patterns

Speaker: Syeda Z. Halim

A database of the Occupational Safety and Health Administration (OSHA) captures incident data from investigations for fatal incidents and hospitalizations since 1984. OSHA Region 6 includes 5 states including Texas and Louisiana, where much of the US chemical manufacturing and petroleum refining industry is located. An analysis of process related investigations by OSHA in Region 6 shows that large-scale multi-fatality incidents have been significantly decreased since the implementation of Process Safety Management (PSM) program in 1995. It is noticeable that currently majority of the fatalities occurs in single fatality incidents. Our preliminary analysis suggests that these individual process related fatalities are a result of operating and maintenance activities that are not well addressed by current process safety practices or by personal safety measures. An analysis of such incidents and their circumstances will be conducted proving recommendations for improved performance to reduce the incidents with single fatality.

11:00 AM to 11:30 AM

Application of Mind Mapping to Organize and Recall Potential Hazards

Speaker: T Michael O'Connor

Failure to learn lessons from previous incidents has been a recognized problem for decades. We attempt to improve this situation for certain high hazard tasks. Mind maps are used to categorize hazards from past incidents to aid in their recall and avoidance.

11:30 AM to 12:00 PM

Would a HAZOP, LOPA or STPA have Prevented Bhopal?

Speaker: Howard Duhon

This presentation attempts to answer three questions: 1) Would a HAZOP on the Bhopal MIC design, conducted in the 1960's, have prevented the tragedy? Would a LOPA have prevented it? 3) would and STPA have prevented it?

Category: Improving Process Safety with Technological Advances Session

2:15 PM to 2:45 PM

Predictive Process Safety Analytics and IIoT - PSM Plus: The AI+PSM Analytic Framework

Speaker: Michael Marshall

With an IIoT predictive application environment as the backdrop and an asset integrity and process safety analytic framework as the primary enabler, the paper and presentation discuss methods, metrics, performance analyses, and KPI benchmarking techniques for driving Operational Excellence as it relates to the ultimate concern of any PSM program, i.e., the loss of primary containment (LOPC) and associated impacts to production, profitability and process safety.

2:45 PM to 3:15 PM

Guidance to Improve the Effectiveness of Process Safety Management Systems in Operating Facilities

Speaker: Syeda Zohra Halim

In this presentation we analyze the recent trend in process safety incidents and identify issues behind current incidents. Based on the identified issues we recommend methods to improve the effectiveness of process safety systems.

3:15 PM to 3:45 PM

Unified Wall Panel System (UWPS) - A Value Engineering Solution for Protective Construction in the Petroleum Industry

Speaker: Scott Hardesty

An overview of the novel protection technologies being developed for use in the UWPS, including high- cementitious structural paneling, non-aramid advanced mineral fiber reinforcement and metallic foam energy absorption.

Category: Exploring NaTech Events and Domino Impacts Session

4:00 PM to 4:30 PM

Protect Process Plants From Climate Change

Speaker: Victor H. Edwards

Outlined here is how to conduct a climate risk vulnerability assessment for a process plant.

4:30 PM to 5:00 PM

Process Safety Implications in a Changing Environment

Speaker: Trish Kerin

While much research has been undertaken in natural hazards triggering technological disasters (Natech) it still remains a challenging area. It can be difficult to move past the psychological bias to focus on the possible incident outcome without discounting a seeming incredible cause.

5:00 PM to 5:30 PM

A Critical Evaluation of Industrial Accidents Involving Domino Effect

Speaker: Ravi Kumar Sharma

In this study, an incident analysis of 326 accidents since 1961 involving the domino effect in process, storage plants and the transportation of hazardous materials were analysed. Coding of incidents were done based on data obtained from different sources. The domino incident database analysis includes several categories such as fatalities over time, incidents over time, and incidents with respect to location, materials involved, causes and consequences.

> BACK TO THE PROGRAM

DAY 2: Wednesday Oct 22 Summaries

Track I - Risk/Consequence & Design Aspects Category: Risk Assessment III Session

8:30 AM to 9:00 AM

Applying PHA Methodologies such as HAZOP and Bowtie to Assessing Industrial Cybersecurity Risk

Speakers: John Cusimano, Jacob Morella, Tim Gale

Process hazard assessments (PHA) are a well-established practice in process safety management. These assessments focus on failures (aka deviations) that are typically caused by equipment failures or human error. By design, PHAs do not consider cyber threats to industrial control systems (ICS). However, cyber threats represent additional failure modes that may lead to the same health, safety and environmental consequences identified in the PHA. Functional safety (i.e. ISA 84 / IEC 61511) and industrial cybersecurity standards (i.e. ISA/IEC 62443) recognize this issue and provide guidance on how to integrate these two disciplines to ensure that cyber incidents cannot impact process safety.

9:00 AM to 9:30 AM

Large Hydrocarbon Tank Fires: Modelling of the Geometric and Radiative Characteristics

Speaker: Ravi Kumar Sharma

A proven methodology, called Cyber PHA, based on ISA/IEC 62443-3-2 has been developed and applied to conduct ICS cyber risk assessments throughout the process industries. This presentation will describe the methodology with examples of actual applications to identify, rank and mitigate cyber risk in ICS systems. Furthermore, we will demonstrate how Bowtie Analysis can be used to visualize the results and apply degradation factors and controls related to cyber barrier assurance.

9:30 AM to 10:00 AM

Risk assessment of a large chemical complex during the construction phase using Intuitionistic Fuzzy Analytic hierarchy process

Speaker: Suresh G.

This presentation will discuss the risks that possess in critical operations carried out during construction phase of project were considered. Which are categorized based on a novel method of Interval Valued Intuitionistic Fuzzy Analytical hierarchy process. The different categories are Catastrophic, Critical, Serious, Minor. The Analytical hierarchy process (AHP) possess the unique advantage of comparing parameters that have no units or scale of measurements.

Category: Risk Mitigation Session

10:15 AM to 10:45 AM Development of Resilient LNG Facilities

Speaker: Onder Akinci

Resilient Design of LNG Facilities is discussed in this study. Problem statement, design fundamentals, case studies and best practice recommendations are presented.

10:45 AM to 11:15 AM

Development of Risk Mitigation Programs using a Quantitative-Risk-Based Approach

Speaker: Rafael Callejas-Tovar

This presentation will utilize example case studies to demonstrate how a quantitative-risk-based approach can be leveraged in a risk mitigation program to optimize risk mitigation solutions such as building reinforcement, building replacement, and/or scenario mitigation. Also, the presentation will present examples of facility siting issues that the processing industries struggle with, such as focusing on implementing solutions to mitigating explosion hazards while neglecting other equal or high risk hazards, or implementing solutions company-wide that might be only effective for some assets, which results in unnecessary costs that do not mitigate the risk effectively.

11:15 AM to 11:45 AM Incorporating Mitigative Safeguards with LOPA

Speaker: Edward Marszal

Layer of Protection Analysis (LOPA) is a ubiquitous tool for assessing risk in more detail than a purely quantitative HAZOP but not so much as a QRA. It is efficient due to its conservative simplifications. Unfortunately, the simplifications prevent assessing the benefit of mitigative safeguards, such as fire detection systems that trigger water deluges. This presentation presents a methodology for extending to LOPA process to allow assessment of mitigative safeguards. The extension requires the evaluation of the situation where the safeguard fails to operate and also the residual risk that remains even if the mitigative safeguard effectively functions. For preventive safeguards the residual risk is zero, but for mitigative safeguards it cannot be ignored.

Category: Consequence Analysis: Gas Releases Session

12:45 PM to 1:15 PM Hole Size Matters

Speaker: Jeffrey D. Marx

Consequence analysis is an integral tool for many process safety studies.

1:15 PM to 1:45 PM

How Can I Effectively Place My Gas Detectors

Speaker: Jesse Brumbaugh

The approach taken for selection and placement of gas detectors is found to vary widely between different companies. There is a growing interest in not only the confidence but also the effectiveness of these gas detection systems as a key mitigation barrier. The intention of this presentation is to provide a methodology that is both effective and cost efficient while also presenting the main considerations that design engineers and process safety professionals should address for the gas detection system elements of (1) a comprehensive gas detection philosophy, (2) appropriate detector technology selection, and (3) correct detector placement.

1:45 PM to 2:15 PM

Consequence Assessment Considerations for Toxic Natural Gas Dispersion Modeling

Speakers: SreeRaj Nair and Noma Ogbeifun

Consequence modeling provides information on the potential impact zone and is key for process risk management.

Category: Reactive Chemicals Session

4:00 PM to 4:30 PM

Modelling and Simulation to Predict Energetic Material Properties

Speaker: Kok Hwa Lim

With the rapid development and advancement in computing power, modelling and simulation (M&S) has demonstrated its vast potential in predicting the properties of energetic material and helping to design energetic material. One such application is predicting crystal packing and crystalline structure from first-principle simulation. Such technique has demonstrated the ability to distinguish different polymorphs of the same energetic molecules and accurately predict the crystal structure and density. In addition to the ability to predict detonation pressures and velocities of more established classes of energetic materials based on their thermochemical code or empirical equations, M&S has also demonstrated its ability to screen designed energetic materials for potential application. The application of M&S vastly improves the safety of developing potential energetic materials - the ability to screen potential energetic materials based on M&S-predicted heats of formation and detonation properties means that less hazardous experiments are required to be conducted as well as reducing developmental cost.

4:30 PM to 5:00 PM

Safety Assessment of Low Temperature Radical Initiators for Proper Storage and Safe Handling Conditions

Speaker: Cuixian (Trisha) Yang

Commercially available azo-type low temperature radical initiators provide efficient initiation of many chemical reactions. However, the azo group initiators are energetic compounds that also have thermal stability issues at ambient or even sub-ambient temperatures. These initiators can also generate nitrogen gas during slow decomposition under heat and/or light, which could present a safety challenge for shipping, storage and usage. In order to define safe storage and handling conditions, a variety of calorimetry studies were carried out. Exotherm and pressure data were collected from these studies in an effort to gain a better understanding of the decomposition kinetics. Thermalkinetics and thermal safety model simulations were then used to obtain the self-accelerating decomposition temperature (SADT) and decomposition activation energy for the azo-type initiator. This methodology for thermal decomposition kinetics data and parameter determination, acquired with 5mg to 1g scale samples, enables safe storage, handling, and scale-up process preparation.

5:00 PM to 5:30 PM

Analysis of Pressure Behavior during Reaction Runaway and Estimation of Available Depressurization Design

Speaker: Yuto Mizuta

Analysis of pressure behavior during reaction runaway and estimation of available depressurization design, dynamic simulation by Aspen, runaway experiment by ARSST, twophase flow model of ISO.

Track II - Human Factors - People in Action Category: Human Performance/Decision Making II Session

8:30 AM to 9:00 AM

Preventing Cognitive-Attributed Errors in Safety Critical Systems: A Path Forward

Speaker: Tom Shephard

The presentation provides background and example models, methods and tools for assessing and eliminating cognitive attributed errors in active human barriers.

9:00 AM to 9:30 AM

Two Views of Evaluating Procedural Task Performance: A Transition from Safety-I to Safety-II Approach

Speaker: Changwon Son

This presentation provides the development of new procedural task performance measures based on Safety-II perspective, an emerging safety paradigm.

9:30 AM to 10:00 AM

Beyond Human Error: Integration of the Interactive Behavior Triad and Toward a Systems Model

Speaker: Joseph W. Hendricks

In an effort to move beyond the "human error" explanation for safety incidents, we surveyed individuals employed in the process safety industry and were primarily from the Oil & Gas and Chemical industries. Results indicated that perceptions of procedure quality was the focal variable in all of the results, including positive relationships with attitudes toward the procedure change process and negative relationships with procedure deviations, and both safety incidents and near-misses. Additionally, we integrated the three elements of the Interactive Behavior Triad—person, task, and context—into Dekker's Model 2 of safety. We found support for two-way interactions using moderator regression analyses. We conclude that these elements are important factors to consider when evaluating and developing procedure systems.

Category: Fatigue & Stress Session

10:15 AM to 10:45 AM

Operator Performance Under Stress: A Neurocentric Virtual Reality Training Approach

Speaker: Ranjana Mehta

Operators in the process industries work under extreme pressures in complex hazardous environments that are associated with critical consequences at the cost of lives. Thus, ensuring operator safety is of utmost importance in this domain, and in particular in stressed contexts. Advances in Virtual Reality (VR) have enabled cost-effective, relatable, and remote trainings that can potentially transform the future of operator training in complex environments.

10:45 AM to 11:15 AM

Towards a Predictive Fatigue Technology for Oil and Gas Drivers

Speaker: John Kang

Towards a Predictive Fatigue Technology for Oil and Gas Drivers.

11:15 AM to 11:45 AM

Validation of the Fatigue Risk Assessment and Management in High-Risk Environments (FRAME) Survey

Speaker: Stefan V. Dumlao

The oil and gas extraction (OGE) industry continues to experience a fatality rate nearly seven times higher than that for all U.S. workers. OGE workers are exposed to intensive shift patterns and long work durations inherent in this environment. This leads to fatigue, thereby increasing risks of accidents and injuries. In the absence of any regulatory guidelines, there is a critical need for the development of comprehensive fatigue assessment practices specific to OGE operations that take into consideration not only the various OGE-specific sources of fatigue, but also the barriers associated with effective and feasible fatigue assessments in OGE work. In response to this need, Shortz, Mehta, Peres, Benden, and Zheng (2019) developed the Fatigue Risk Assessment & Management in high-risk Environments (FRAME) survey. Further, they provided evidence that the FRAME survey content captures fatigue-related information specific to the OGE industry not found in any one other measure of fatigue. The present study expands on these efforts by examining the psychometric properties (i.e., reliability and validity) of the FRAME survey-a critical step before the survey can be recommended for use in practice. A sample of 210 OGE and petrochemical refinery workers were sought to participate in this study. Linkages between the FRAME survey and a number of fatigue-related measures validated for use outside of the OGE industry will be examined. Once data analysis is complete, the FRAME survey will be refined for implementation, and recommendations for implementation will be provided.

Track IV - Research and Next Generation Category: Next Generation Process Safety I Session

12:45 PM to 1:15 PM

Identifying contributing factors of pipeline incident from PHMSA database based on NLP and text mining techniques

Speaker: Guanyang Liu

Recently there are a few attempts that develop methods to enable automated content analysis of incident reports by natural language processing (NLP) techniques, but with a manual list of key words still needed, the methods are not intelligent or automated enough to extract information that is outside the pre-defined vocabulary. In this work, advanced NLP techniques for text mining, are employed to identify causal relations from incident reports based on unsupervised learning and co-occurrence network algorithms. The proposed method is capable of extracting latent causal factors of the incident causes described in the reports and indicating the potential of identifying root causes with more comprehensive training text data applied in the future work.

1:15 PM to 1:45 PM

Causation analysis of pipeline incidents using artificial neural network (ANN)

Speaker: Pallavi Kumari

Failure of hazardous liquid (HL) pipelines is a potentially significant hazard to people, property and the environment. One of the main causes of HL pipeline failures is corrosion. To predict cause and consequences of corrosion in HL pipelines, this article presents an artificial neural network (ANN) using incidents data collected by the Pipeline Hazardous Material Safety Administration (PHMSA) of the US Department of Transportation corresponding to the onshore HL transmission pipelines in the US between 2010 and 2019. From this incident database, 70 attributes has been selected for their ability to predict corrosion. Using selected attributes as input to the ANN model, the model is constructed and optimized for its hyper parameters; and it predicts the type of corrosion, total cost of property damage, net material loss and type of incident (rupture/release) with 60-90% accuracy. In order to establish credibility of developed ANN model, the model accuracy obtained using ANN model is compared against another machine learning model.

1:45 PM to 2:15 PM

Development of Hazard Factor for Engineered Particles

Speaker: Nabila Nazneen

Particles from nano to micro ranges, being a comparatively new discovery in the field of science and engineering, poses many risks to the industry. Apart from their health effect, scientists and engineers are concerned about their explosion possibilities. A hazard factor would be able to identify the hazard level of nano to micron range particles and help take proper controls of the risk associated with them. This study creates a database of the different properties of various particles and fashions a hazard factor to formulate a ranking system. The hazard factor is based on properties like particle size, maximum overpressure, maximum rate of pressure rise, minimum ignition energy, minimum explosible concentration, minimum ignition temperature, etc. Based on the data collected, the research uses statistical analysis to check the behavior of the properties and modify the NFPA ranking to formulate the hazard factor.

Finally, the factors will be ranked to precisely identify the hazard level against their respective properties. This hazard factor will be an effective indicator of a potential hazard that the engineered particles may hold and alert the users to take preventive action to moderate the risk of the hazard.

Category: Next Generation Process Safety II Session

4:00 PM to 4:30 PM

Can a Virtual Reality Application Better Prepare Millennials and the Z-Generation for Working with Systems in the Process Industry?

Speaker: Nir Keren

Use of Virtual Reality to Enhance Students' systems mental model.

4:30 PM to 5:00 PM

Process Safety Risk Index Calculation Based on Historian Data

Speaker: Prasad Goteti

This presentation details the Process Safety Risk Index calculation based on Historian data using a real-life example from the process industry.

5:00 PM to 5:30 PM

A Brief review of Intrusion Detection System in Process plants and advancement of Machine Learning in Process Security

Speaker: Sinijoy P J

Rapid technology growth has given rise to new vulnerabilities and threats to the Computer Oriented Process Plants. Production Plant's dependency on Computers, Sensors, IIoT and networks wide opened Intrusion based threats and attacks. Intrusion Detection System [IDS] has become very popular due to its demand in Industry as the protection of information/processes controls are to be secured from the reach of unauthorized personals.

Track V - Explosions and Flammability **Category**: Explosion Modelling Session

8:30 AM to 9:00 AM

The Influence of the Velocity Field on the Stretch Factor and on the Characteristic Length of Wrinkling of Turbulent Premixed Flames

Speaker: Tássia L. S. Quaresma

The stretch factor accounts for the effects of strain, due to fluid dynamic effects, and curvature, due to propagation. However, within the BML approach, flame stretching is commonly neglected due to difficulties in modelling the stretch factor, which is assumed as a constant parameter and equals to unity. Recent works based on more sophisticated analyses such as LES and DNS have suggested that this consideration may lead to an inaccurate representation to flames with a non-zero mean curvature. Therefore, we propose a dynamic expression to the stretch factor within the BML approach that is based on the physical understanding of the phenomenon. The study is carried out within an in-house developed RANS code for simulation of turbulent reacting flows in complex geometries. The approach explores the influence of the velocity field on the flame surface and its contribution to flame stretching, which it is not accounted in typical flamelet approaches. We follow the reasoning line that the velocity divergent influences the fluid hydrodynamics when reaching obstacles ahead of the flame front and the stretch factor as well as the characteristic wrinkling length of the flame. The hypothesis is that the velocity divergent contributes to the flame stretching the same way it contributes to the fluid motion. As a consequence, the stretch factor is modelled as a function of the velocity, changing both in time and space.

9:00 AM to 9:30 AM

Towards a Comprehensive Model Evaluation Protocol for LNG Hazard Analyses

Speaker: Filipo Gavellia

Blue Engineering and Consulting and the Gas Technology Institute are collaborating on a DOT-PHMSA sponsored project to develop a new set of Model Evaluation Protocols, that will allow the review of modeling tools for each of the main hazards associated with LNG facilities. The new MEP will include methodologies for evaluating the modeling of hazard phenomena such as release, dispersion, vapor cloud explosion, and pressure vessel failure events. This presentation will describe the framework of the new MEPs and provide an update on the status of the work.

9:30 AM to 10:00 AM

Beirut: How behaves Ammonium Nitrate Exposed to Fire and How Strong and Damaging is its Explosion?

Speaker: Charline Fouchier

The Beirut explosion on the 4th of August is one more accident to be added to the long list of tragedies caused by Ammonium Nitrate. While many investigations have been conducted to understand better the behaviors of the molecule, it is still unclear how the Ammonium Nitrate can detonate in an unconfined environment while heated by fire.

A rapid summary of the state of art on Nitrate Ammonium is given, followed by an analysis of the Beirut accident, with a proposed scenario that could have led to the explosion. Finally, methods to estimate the explosion energy, based on the blast arrival time, the damages on buildings and the crater dimensions are applied on the Beirut accident and compared.

Category: Explosion Phenomena I Session

10:15 AM to 10:45 AM

Flammable Mist Hazards Involving High-Flashpoint Fluids

Speaker: Simon Gant

This presentation on "flammable mist hazards involving high-flashpoint fluids", given by Simon Gant from the UK Health and Safety Executive (HSE), provides an overview of the work led by HSE on flammable mists over the last decade, including preliminary results from an ongoing joint industry project. The work has involved a collaboration between HSE and the Gas Turbine Research Centre (GTRC) at Cardiff University.

10:45 AM to 11:15 AM

Measuring Suspended Explosive Dust Concentration from Images

Speaker: Yumeng Zhao

Dust dispersion during powder handling and processing is of great concern for both workers' health and explosion risk. Dust emission locations in industries can vary during handling and processing, while dust concentration sensing would require the installation of an additional equipment in every location prone to dust generation. A method of using a digital camera or photograph to measure the dust concentration based on two target intensity value has been developed at Purdue University. The method was developed based on the relationship between the suspended dust concentration and extinction coefficient. Calibrated equations have been developed for cornstarch, grain dust, and sawdust. This method does not require any training and can be integrated with security system cameras and/or other independent imaging source.

11:15 AM to 11:45 AM

The HBT-A Large-Scale Facility for Study of Detonations and Explosions

Speaker: Elaine S. Oran

This presentation describes the design and development of the new HBT, the large-scale shock and detonation tube facility for the study of deflagrations, detonations, and the transition processes.

Category: Explosion Phenomena II Session

12:45 PM to 1:15 PM

Development of Flammable Dispersion Quantitative Property-Consequence Relationship Models Using Machine Learning

Speaker: Zeren Jiao

Incidental release of flammable gases and liquids can lead to the formation of flammable vapor clouds. When their concentrations are above the lower flammable limit (LFL), or ½ LFL for conservative evaluation, fires and explosions can result with the presence of an ignition source. The objective of this work is to develop highly efficient consequence models to accurately predict the downwind maximum distance, minimum distance, and maximum vapor cloud width within the flammable limit. In this study, a novel quantitative property-consequence relationship (QPCR) model is proposed and constructed for the first time to accurately predict flammable dispersion consequences in a machine learning and data-driven manner. Flammable dispersion database consists of 450 leak scenarios of 41 flammable chemicals were constructed using PHAST simulations. A state-of-art machine learning regression method, extreme gradient boosting algorithm, was implemented to develop models. The coefficient of determination (R2) and root-mean-square error (RMSE) were calculated for statistical assessment and the developed QPCR models achieved satisfactory predictive capabilities. All the developed models have high accuracy, with the overall RMSE of three models being 0.0811, 0.0741, and 0.0964, respectively. The developed QPCR models can be used to obtain instant flammable dispersion estimations for novel flammable chemicals and mixtures at much lower computational costs.

1:15 PM to 1:45 PM

An Unsupervised Model to Predict the Liquid In-cylinder Combustion Risk Ratings of Marine Fuels

Speaker: Chenxi Ji

A novelty unsupervised machine learning approach to establish an in-cylinder combustion risk criterion for marine fuels.

1:45 PM to 2:15 PM Fireball and Flame Venting Comparisons

Speaker: Peter A. Diakow

This presentation compares flame jetting distances from vented explosion tests to predictions made using NFPA 68, EN 14994 and the FLACS CFD code.

Category: Consequence Analysis: Flammability Session

4:00 PM to 4:30 PM

Numerical Simulation of Methane-Air DDT in Channels containing Trace Amounts of Impurities

Speaker: Logan N. Kunka

Accidental explosions are not only deadly, but often disastrous to the industry. Understanding these explosions are key to protecting against them. This session explores explosions and deflagration-to-detonation transition (DDT) in natural gas filled channels typically found in sealed sections of coal mines. A detailed investigation is presented on how heavy hydrocarbon impurities, present in realistic natural gas compositions, effect the run-up distance to DDT.

4:30 PM to 5:00 PM

The Use of Bent Poles as a Detonation Indicator

Speaker: J. Kelly Thomas

This presentation covers an analysis of the response of poles to both deflagration and detonation loading with discshaped clouds to evaluate the use of bent poles as a detonation indicator.

5:00 PM to 5:30 PM

Machine Learning Based Quantitative Prediction Model for Chemical Mixture Flammability Limits

Speaker: Zeren Jiao

Flammability limits (FL), including lower flammable limit (LFL) and upper flammable limit (UFL), are crucial for fire and explosion hazards assessment and consequence analysis. In this study, by using an extended FL database of chemical mixture, quantitative structure-property relationship (QSPR) models have been established using gradient boosting (GB) machine learning algorithm. Feature importance based descriptor screening method is also implemented for the first time to determine the optimal set of descriptors for model development. The result shows that all developed models have significantly higher accuracy than other published models, with the test set RMSE of LFL and UFL models being 0.058, 0.129, respectively. All the developed QSPR models can be used to obtain reliable chemical mixture FL estimation and provide useful guidance in fire and explosion hazard assessment and consequence analysis.

> BACK TO THE PROGRAM

Speaker Bios

Day 1 Track 1 Risk/Consequence Analysis & Design Aspects Risk Assessment I



Shanmuga Prasad Kolappan TechnipFMC



Abdulaziz Alajlan Saudi Aramco



Johannes I. Single CSE Center of Safety Excellence

Importance of Process Safety Time in Design Concept

Shanmuga Prasad Kolappan is a driven Process Safety Engineer with considerable rich experience in the field of Safety, Risk and Loss prevention engineering. He has 9 years of experience including Process and commissioning, risk consulting, and loss prevention. He has also had exposure to safety studies such as Hazop, SIL, QRA, and active/ passive fire protection, as well as to safety software such as PHA Pro, PHA works, PHAST, SAFETI, exSILentia, Pipenet, Detect3D and BowTieXP. Shanmuga is continuously learning and updating the recent trends in the field of Safety.

Limitations of Layers of Protection Analysis (LOPA) in Complicated Process Systems

An experienced Process Safety and Risk Engineer with 20 years of experience in different regions and countries. Author of multiple scientific papers and chairman of safety conferences.

On the Usage of Ontologies for the Automation of HAZOP Studies

Johannes I. Single is a researcher at the CSE Center of Safety Excellence in Pfinztal, Germany and he is currently pursuing his PhD at the University of Kaiserslautern. Previously, Johannes worked as a research engineer in the field of software engineering for CSE and interned at BASF and GEA Group. He graduated from Karlsruhe University of Applied Sciences and holds a master's degree in mechanical engineering specializing in process engineering.

Risk Assessment II



Henrique (Henry) M. Paula Galvani Risk Consulting, LLC



Keith Brumbaugh aeSolutions



Sam Aigen AcuTech

An Efficient and Effective Approach for Performing Cost Benefit Analysis, with Two Case Studies

Dr. Henrique Martini Paula has 40+ years of engineering experience with expertise in integrity management, risk management/PSM activities, risk and reliability analyses, and project quality management. He participated in more than 100 projects in a variety of industries from offshore oil & gas to nuclear to the petrochemical industry. Dr. Paula has provided consulting and training services in over 30 countries, including instructing for the American Petroleum Institute (API), the American Institute of Chemical Engineers (AIChE), and the Process Safety Institute (PSI). He has authored/co-authored well over 100 documents, including journal articles, conference papers, technical reports, and sections of "Guidelines for Chemical Process Quantitative Risk Assessment" and "Guidelines for Developing Quantitative Safety Risk Criteria" (both by AIChE). He served as guest editor for a special issue of the journal Reliability Engineering and System Safety.

Does Your Facility Have the Flu? How to Use Bayes Rule to Treat the Problem instead of the Symptom Keith Brumbaugh is currently serving as a Discipline Lead in aeSolutions' Safety Instrumented Systems Engineering department, with over fifteen years of experience in instrumentation and safety systems engineering.

Keith is a licensed Professional Engineer (Control Systems - Texas), and holds a Certified Functional Safety Expert (CFSE) certificate. Keith went to Texas Tech University and holds a B.S. in Electrical Engineering, and Minor in Computer Science.

Integrating the PHA and Facility Siting into a Site Risk Assessment Life-Cycle

Sam Aigen, CCPSC is a Senior Engineer at AcuTech. Mr. Aigen previously worked in various capacities for ExxonMobil, including the Research and Engineering Company's Central Engineering Office in Virginia and the Refining and Supply Company, based out of the Beaumont Refinery in Texas. He has extensive experience in both process engineering and process design, and is skilled in Process Hazard Analysis, consequence modeling, facility siting, and Quantitative Risk Assessment.



Colin Armstrong AcuTech Layers of Protection: Relief Systems



Nitin Roy California State University



Paul Gruhn aeSolutions



Greg Hall Eastman Chemical Company

Integrating the PHA and Facility Siting into a Site Risk Assessment Life-Cycle

Colin Armstrong is a technical Lead for numerous FSS and QRA projects in oil, gas, LNG, and specialty chemical industries worldwide. He has experience in all aspects of QRA, consequence modeling, frequency assessment, scenario analysis (FTA, FMEA, event tree, LOPA, etc.) Mr. Armstrong is an instructor of QRA and Consequence Modeling for operating companies and students at University of Maryland. He is also an investigator and expert witness in response to incidents and OSHA citations.

A Framework for Automatic SIS Verification in Process Industries using Digital Twin Nitin Roy is an Assistant Professor (Safety) at California State University, Sacramento.

The use of Bayesian Networks in Functional Safety

Paul Gruhn is a Global Functional Safety Consultant with aeSolutions in Houston, Texas. Paul is an ISA (International Society of Automation) Life Fellow, a 30 year member and co-chair of the ISA 84 standard committee (on safety instrumented systems), the developer and instructor of ISA courses on safety systems, the author of two ISA textbooks, and the developer of the first commercial safety system modeling software. Paul has a B.S. degree in Mechanical Engineering from Illinois Institute of Technology, is a licensed Professional Engineer (PE) in Texas, a member of the Control Systems Engineering PE exam committee, and both a Certified Functional Safety Expert (CFSE) and an ISA 84 Safety Instrumented Systems Expert. Paul was the 2019 ISA President.

My Vision of Future Instrumental Protective Systems

Greg Hall is a Principal Electrical Engineer with Eastman Chemical Company with 39 years experience at Texas Operations in Longview, Texas. Greg is the IPS (Instrument Protective Systems) Design engineer, chairman of the Texas Operations IPS Committee, member of the Eastman Corporate IPS Governance Council, and received an Electrical Engineering degree from the University of Texas at Austin.

Relief Systems



Gabriel Martiniano Ribeiro de Andrade Siemens Process & Safety Consulting

Christopher Ng Siemens Process & Safety Consulting

Overlooked Reverse Flow Scenarios

Gabriel Andrade is a lead process engineer for Siemens Energy and has worked in process safety since 2011. Gabriel started his career at Chemtech, a Siemens engineering company in Brazil, after obtaining his chemical engineering Bachelor's degree from the Universidade Federal do Rio de Janeiro in 2010. Passion and dedication brought him to the Siemens process safety group in Houston, where he has happily lived with his wife since 2014.

Overlooked Reverse Flow Scenarios

Christopher Ng is a Technical Advisor at Siemens Energy Inc. with over 22 years of process engineering experience in the upstream and downstream industry. He has expertise in process design and modeling, process safety, hazard and risk analysis. He has a bachelor's degree in Chemical Engineering from the University of Western Ontario (Canada) and is a licensed professional engineer in Texas.



Overlooked Reverse Flow Scenarios

Derek Wood is a lead process engineer for Siemens Energy with 11 years of experience in process engineering in the energy industry, with expertise in process safety, simulation, and design. He has a master's degree in Petroleum Engineering from the University of Texas at Austin.

Derek Wood Siemens Process & Safety Consulting



Todd W Drennen Baker Risk

Failure Under Pressure: Proper Use of Pressure Relief Device Failure Rate Data based on Device Type and Service

Todd W. Drennen, P.E., is a senior engineer for Baker Engineering and Risk Consultants, Inc. (BakerRisk). He has more than 15 years of experience in process safety, including pressure-relief system design and analysis, simulation of complex process upset scenarios, process hazard analysis (PHA), layers of protection analysis (LOPA), fault tree analysis (FTA), and process safety management (PSM) compliance auditing. He has a BS in chemical engineering from Drexel University and is a licensed professional engineer in Illinois and Delaware.



Gabriel Martiniano Ribeiro de Andrade Siemens Process & Safety Consulting



Kartik Maniar Siemens Process & Safety Consulting

Day 1 Track 2 Human Factors-People In Action Training/ Engagement

Kianna Arthur Texas A&M University

Additional Engineering and Documentation to Reduce Pressure Relief Mitigation Cost

Gabriel Andrade is a lead process engineer for Siemens Energy and has worked in process safety since 2011. Gabriel started his career at Chemtech, a Siemens engineering company in Brazil, after obtaining his chemical engineering Bachelor's degree from the Universidade Federal do Rio de Janeiro in 2010. Passion and dedication brought him to the Siemens process safety group in Houston, where he has happily lived with his wife since 2014.

Additional Engineering and Documentation to Reduce Pressure Relief Mitigation Cost

Kartik Maniar is a principal process engineer for Siemens Energy and has worked in the field of process safety since 2006. He has lead and completed various refinery wide pressure relief and flare studies. Recent work has included relief studies based on dynamic simulation and also flare load minimization using nonnormal devices and instrumentation credit.

Virtual Reality Process Safety in Counterfactual Thinking

Kianna Arthur is a second-year PhD student in the Social-Personality Psychology program. She works with Dr. Rachel Smallman in examining the functionality of counterfactual thoughts (i.e., "If only...") in healthrelated contexts. This includes both the generation and subsequent consequences of counterfactuals (motivation, behavioral intentions, risk perception, etc.). Kianna also works with Next Generation Advanced Procedures and RIHM Lab with Dr. Camille Peres.

Human Performance/Decision Making I



S. Camille Peres Texas A&M University



Hans J. Pasman Mary Kay O'Connor process Safety Center



Fabio Kazuo Oshiro Monaco Engineering Solutions

Is Attentional Shift the Problem (or something else) with Hazard Statement Compliance? An Experimental Investigation Using Eye-Tracking Technology

Dr. Camille Peres is an Associate Professor with Environmental and Occupational Health at Texas A&M University as well as the assistant director of Human Systems Engineering with the Mary Kay O'Connor Process Safety Center. Her expertise is Human Factors and she does research regarding: procedures; Human Robotic Interaction in disasters; and team performance in Emergency Operations.

Risk Management entails decision making: Does design decision making in complex situations come down to somebody's gut feeling?

Dr. Hans J. Pasman studied chemical technology at Delft University of Technology, the Netherlands. Ph.D. in 1964. He worked for Shell before moving to the research organization TNO. He has investigated numerous process industry accidents, worked on a variety of topics and managed units of TNO Defense research. 1980-90s Chairman NATO group on Explosives, OECD group on Unstable Substances, Chairman European Working Group on Risk Analysis, Chairman European Working Party on Loss Prevention. Dr. Pasman is a Co-founder of the European Process Safety Centre and he coordinated late 90s industrial safety research TNO. He was a Professor of Chemical Risk Management at Delft University for nearly 10 years. He is also member of former Dutch Hazardous Substances Council and since 2008 Research Professor at Mary Kay O'Connor Process Safety Center in the Chemical Engineering department of Texas A&M University.

Decision Making using Human Reliability Analysis Fabio Oshiro is a Principal Risk, Safety & Reliability Engineer with over 15 years of experience in the Oil & Gas industry. He has vast experience executing more than 100 risk and reliability studies performed on behalf of clients based throughout the globe for the successful completion of upstream, midstream and downstream projects located mainly in Middle East, Brazil and Africa. In the past 7 years Fabio has been working as Reliability Expert based in Surrey, UK.

Safety Culture and Leadership



Ryan Wong AFPM



Shanahan Mondal AFPM



Stephanie C. Payne Texas A&M University



Atif Mohammed Ashraf Mary Kay O'Conner Process Safety Center

Improving Industry Process Safety Performance through Responsible Collaboration

Ryan Wong is currently a Process Safety Analyst with ExxonMobil with about 7 years of experience in the field of process safety. Prior to moving into the field of Process Safety, Ryan spent approximately 5 years at the ExxonMobil Baton Rouge Refinery in process design, process support, and risk management roles. Ryan graduated from the University of Michigan with a Bachelors in Chemical Engineering.

Improving Industry Process Safety Performance through Responsible Collaboration

Shanahan Mondal is Corporate Process Safety lead for CVR Energy providing oversight across the company's refineries and fertilizer facilities. Shanahan has held several positions in site leadership in disciplines including Operations, Process Engineering, Process Control, and Process Safety. Mr. Mondal holds a B.S. degree in Chemical Engineering from the Massachusetts Institute of Technology and has 23 years of experience in the refining and petrochemical industries.

How Much Does Safety Culture Change Over Time? Dr. Stephanie C. Payne is a Professor of Psychology and Faculty Fellow of the Mary Kay O'Connor Process Safety Center at Texas A&M University, College Station, TX. Her program of research on workplace and laboratory safety focuses on the measurement of safety climate, antecedents and consequences of climate, and moderators of these relationships. Dr. Payne's safety research has been published in various safety and psychology journals including Journal of Safety Research and Safety Science. Her safety research has been funded by various agencies including the National Institute of Occupational Safety and Health and the National Academies of Science, Engineering, and Medicine. She has collaborated with multiple chemical and oil and gas companies.

Administering a Safety Climate Assessment in a Multicultural Organization: Challenges and Findings

Atif M. Ashraf is a Research Associate at the Mary Kay O'Connor Process Safety Center – Qatar. He obtained an MSc in Chemical Engineering from Texas A&M University in 2016. Atif's research areas include runaway reactions, dust explosion characterizations, toxic gas dispersion modelling, evacuation modelling, risk communication, and human factors. Since 2017, Atif's research, predominantly in the Middle East, has been focused on understanding and assessing safety climate and culture through the application of psychology and engineering principles.

Procedures



Joseph W. Hendricks Texas A&M University



Monica Philippart Ergonomic Human Factors Solution



Joseph W. Hendricks Texas A&M University

A Comparison of Procedure Quality Perceptions, Procedure Utility, Compliance Attitudes, and Deviation Behavior for Digital and Paper Format Procedures

Dr. Hendricks earned a PhD in Industrial and Organizational Psychology from Texas A&M University. He is currently a research associate – senior investigator with the Next Generation Advanced Procedures consortium at Texas A&M University.

Practical Writing Tips To Prevent Human Error When Following Procedures

Dr. Philippart specializes in managing operational risks associated with human performance. Her career begun at NASA's Kennedy Space Center, where she applied her mechanical and industrial engineering degrees to develop and improve spaceflight equipment and processes. Since 2006, she has dedicated primarily to enhancing deep-water drilling process safety and risk management in the petroleum industry. Dr. Philippart has also developed and imparted courses for NASA and Embry-Riddle Aeronautical University, and has enjoyed working for The Walt Disney Company.

The Impact of Hazard Statement Design in Procedures on Compliance. Rates: Some contradictions to Best (or Common) Practices

Dr. Hendricks earned a PhD in Industrial and Organizational Psychology from Texas A&M University. He is currently a research associate – senior investigator with the Next Generation Advanced Procedures consortium at Texas A&M University.

Day 1 Track 3 Managing Operations and Maintenance Modeling and Asset Integrity



Chetan Birajdar Monaco Engineering Solutions



Derek Yelinek Siemens Process & Safety Consulting

RBI Study using Advanced Consequence Assessment for Topside Equipment on Offshore Platforms

Chetan has more than 10 years of global experience in the Oil and Gas Industry working for Engineering Contracting Companies, major international operators and specialist consultancies for various onshore and offshore projects in Asia, Middle East, UK & Europe and Eurasia. He has been instrumental in developing and modifying Hazard Management tools used in Risk Calculations (Consequence Modelling, Risk Calculations, SIL Calculations, etc.) and has extensive experience of using various software packages.

Indicators of an Immature Mechanical Integrity Program

Mr. Derek Yelinek is the Risk Based Inspection Lead for Siemens Process & Safety Consulting business located in Houston, TX. Mr. Yelinek has over 10 years of experience in the development, implementation, and management of Mechanical Integrity programs with a focus on Inspection Data Management Systems (IDMS), Risk-Based Inspection (RBI), and procedure and workprocess development. His experience ranges in consultant/services as well as the user/owner side, across the oil & gas, chemical, and mining industries. Derek is API 570, 571, and 580 certified and holds a B.S. in Chemical Engineering from Western Michigan University.

Remember the à la Mode: Lessons Learned from Ammonia Release at Frozen Foods Warehouse

Dr. Walters is a Senior Engineer in the Thermal Sciences Practice at Exponent. Dr. Walters' background is in chemical engineering with specific expertise in the areas of separations, process modeling, and process control. He has applied his expertise to a variety of pollution mitigation systems, including postcombustion carbon capture, gas processing, combustion gas clean-up, and liquid-liquid extraction of contaminants from silicone polymers. Dr. Walters leverages his knowledge of process systems to provide incident investigation and process safety consulting services, as well as proactive technical evaluations of novel systems and processes.

Dr. Walters is a member of the American Institute of Chemical Engineers, where he participates in the Center for Chemical Process Safety committee for Abnormal Situation Management. He is also a licensed professional engineer in Illinois and a Certified Fire and



Matthew S. Walters Exponent, Inc

Explosion Investigator. Dr. Walters received M.S. and Ph.D. degrees in Chemical Engineering from the University of Texas at Austin. He also earned B.S. degrees in both Chemistry and Chemical Engineering from Purdue University.

Recalling and Learning from Incidents



Syeda Zohra Halim Mary Kay O'Conner Process Safety Center



T. Michael O'Connor Mary Kay O'Conner Process Safety Center



Howard Duhon GATE Energy

Process Related Incidents with Fatality-Trends and Patterns

Syeda Zohra Halim is currently employed as a Postdoctoral Research Associate at the Mary Kay O'Connor Process Safety Center (MKOPSC) and as a Lecturer of Chemical Engineering at the Texas A&M University. She overlooks several industry and federal funded projects ongoing at the MKOPSC, generates proposals for new ones and mentors graduate students in process safety-related dissertation projects. Zohra completed her PhD in Chemical Engineering in Spring 2019 with Mary Kay O'Connor Process Safety Center at Texas A&M University. Her research focused on developing a model for assessing cumulative risk arising from impaired barriers in offshore oil and gas facilities.

Application of Mind Mapping to Classify and Recall Potential Hazards

T. Michael O'Connor is the President of O'Connor Ventures, Inc. in Houston, Texas. O'Connor established the Mary Kay O'Connor Process Safety Center at Texas A&M University, College Station, TX, where he currently serves as a Research Associate, as well as on the Steering Committee and Technical Advisory Committee. He is a member of the Engineering Advisory Council and the Industrial Advisory Board of the School of Public Health at Texas A&M University. Since June 2005, he has been a member of the Board of Directors at StarRotor Corporation, College Station. Formerly he was Vice-Chairman, Heat Transfer Research, Inc His primary interests include process safety, heat transfer in high temperature heat exchangers and furnaces, and metallurgy associated with these applications. He has a BS, Chemical Engineering, University of Missouri – Rolla. Would a HAZOP, LOPA, or STPA have Prevented Bhopal?

Howard Duhon, P.E. is a founder and a principal of Gibson Applied Technology and Engineering, Inc. (GATE) in Houston, TX. He has 46 years of experience in the Petrochemical and Oil and Gas industries mainly in process design and project engineering roles. For the past 15 years that work has mainly involved deep-water developments and has been focused on managing the interfaces between topsides and other disciplines. Duhon has a chemical engineering degree from the University of Louisiana at Lafayette. Throughout his

career he has had a particular interest in the study of decision theory and in the application of that knowledge to improve project execution. From 2013 to 2016 he served a term on the International Board of Directors of the Society of Petroleum Engineers (SPE) as the Projects, Facilities and Construction Technical Director.

Predictive Process Safety Analytics and IIoT-PSM

Plus: The AI+PSM Analytical Framework

Missing Biography

Improving Process Safety With Technological Advances



Michael Marshall Tratus group



Syeda Zohra Halim Mary Kay O'Conner Process Safety Center



Scott Hardesty Applied Research Associates

Guidance to Improve the Effectiveness of Process Safety Management Systems in Operating Facilities

Syeda Zohra Halim is currently employed as a Postdoctoral Research Associate at the Mary Kay O'Connor Process Safety Center (MKOPSC) and as a Lecturer of Chemical Engineering at the Texas A&M University. She overlooks several industry and federal funded projects ongoing at the MKOPSC, generates proposals for new ones and mentors graduate students in process safety-related dissertation projects. Zohra completed her PhD in Chemical Engineering in Spring 2019 with Mary Kay O'Connor Process Safety Center at Texas A&M University. Her research focused on developing a model for assessing cumulative risk arising from impaired barriers in offshore oil and gas facilities.

Unified Wall Panel System (UWPS) - A Value Engineering Solution for Protective Construction in the Petroleum Industry

Scott Hardesty is a Senior Engineer, Program Manager and Employee Owner at Applied Research Associates / Rocky Mountain Division in Littleton, CO. Joining ARA in 2002, Mr. Hardesty has been focused on the assessment of protection technologies and analysis of existing or emerging threats across a wide spectrum of energetic scenarios. These include ballistic, blast, fragmentation and focused explosive energy. He has executed a wide range of materials testing programs for governmental and commercial clients, including utilization of both conventional and improvised explosives with charge sizes up to 10,000 lb. He is a

subject matter expert in developing customized instrumentation plans for complex test environments. He is the lead facilities coordinator for ARA large scale explosives operations at multiple facilities, and regulatory compliance coordinator responsible for interface with the ATF, DHS, FAA, DCMA, DSS, OSHA or other federal/state/local agencies. Mr. Hardesty served on Active Duty as a Captain (O3) in the United States Army Ordnance Corps after graduating from the Colorado School of Mines with a BS in Engineering (Mechanical Specialty) in 1998.

Exploring NaTech Events and Domino Impacts



Victor Edwards VHE Technical Analysis



Dr. Edwards retired as Director of Process Safety for IHI Engineering and Construction International Corporation in 2013. Since retiring, Vic has been actively consulting, editing, and writing. He specializes in process safety management and in process and environmental engineering. He has over 70 publications. Recent books include "Careers in Chemical and Biomolecular Engineering" with Suzanne Shelley and Section 10 of the 9th Edition of Perry's Chemical Engineers' Handbook. Vic chaired the 9th Global Congress on Process Safety in 2013 and the first Process Plant Safety Symposium in 1992. In 2015, Edwards received the Walton/Miller Award from the Safety and Health Division of the American Institute of Chemical Engineers. Vic is an AIChE Fellow and a member of AAAS, ACS, NFPA, NSPE, and NYAS.

Process Safety Implications in a Changing Environment

Trish Kerin is a director of the Institution of Chemical Engineers Safety Centre (ISC). After graduating with honors in mechanical engineering, Trish spent several years working in project management, operational and safety roles for the oil, gas and chemical industries. Trish has represented industry on many government committees related to process safety, and sits on the board of the Australian National Offshore Petroleum Safety and Environmental Management Authority and the Mary Kay O'Connor Process Safety Center steering committee. Trish is a Chartered Engineer, registered Professional Process Safety Engineer, Fellow of IChemE and Fellow of Engineers Australia. Trish holds a diploma in OHS and is a Graduate of the Australian Institute of Company Directors.



Trish Kerin IChemE Safety Center



Ravi Kumar Sharma Indian Institution of Technology

Day 2 Track 1 Risk/Consequence Analysis & Design Aspects Risk Assessment III

John Cusimano aeSolutions

A Critical Evaluation of Industrial Accidents Involving Domino Effect

Dr Ravi Sharma did his Master of Technology (M.Tech) in Environmental Engineering in 2010 from Indian Institute of Technology (IIT), Roorkee and received the PhD degree, 2014 in the area of Quantitative Risk Assessment from Indian Institute of Technology (IIT), Roorkee. Presently he is working as a Senior Research Fellow in Indian Institute of Technology (IIT), Roorkee. His research interests are Quantitative Risk Assessment (QRA), Fires and Explosions Modelling, Fire Protection Engineering, Hazard Assessment, Inherent Process Safety, Loss Prevention, and Emergency Response Planning.

Applying PHA Methodologies such as HAZOP and Bowtie to Assessing Industrial Cybersecurity Risk John Cusimano is an industrial control system (ICS) / OT cybersecurity expert with a strong background in process control and functional safety engineering. Since 2009, John has started up and successfully led ICS/OT cybersecurity consulting practices at two consulting/engineering firms. John has personally performed countless ICS cybersecurity vulnerability and risk assessments in wide range of industries per NIST, ISA/IEC 62443 and NERC CIP standards. He developed the CyberPHA methodology through a combination of his work on standards committees and by working with key clients who shared his interest in applying process safety engineering discipline to ICS cybersecurity. He was a leader in the development of the ISASecure™ certification scheme. He led the development of 3 ICS cybersecurity courses for ISA (ISA IC33, IC34 and IC34) as well as the accompanying certificate programs. He also led the development of the "ICS Cybersecurity for Manager's" course hosted by SANS. John served as Chairman of the ISA 99 subcommittee that authored the recently approved ISA/IEC 62443-3-2 standard, "IACS Security Risk Assessment & Design".



Ravi Kumar Sharma Indian Institution of Technology



Suresh G Bharat Petroleum Corporation Risk Mitigation



Onder Akinci Daros Consulting



Rafael Callejas-Tovar BakerRisk

Large Hydrocarbon Tank Fires: Modeling of the Geometric and Radiative Characteristics

Dr Ravi Sharma did his Master of Technology (M.Tech) in Environmental Engineering in 2010 from Indian Institute of Technology (IIT), Roorkee and received the PhD degree, 2014 in the area of Quantitative Risk Assessment from Indian Institute of Technology (IIT), Roorkee. Presently he is working as a Senior Research Fellow in Indian Institute of Technology (IIT), Roorkee. His research interests are Quantitative Risk Assessment (QRA), Fires and Explosions Modelling, Fire Protection Engineering, Hazard Assessment, Inherent Process Safety, Loss Prevention, and Emergency Response Planning.

Risk assessment of a large chemical complex during the construction phase using Intuitionistic Fuzzy Analytic hierarchy process

Suresh G. is a Research Scholar in Safety Engineering. After M Tech in Chemical Engineering, he is working in a large petroleum refinery for the last 21 years.

Development of Resilient LNG Facilities

Onder Akinci has a PhD degree in Civil Engineering and more than 20 years of R&D, Civil/Structural/Architectural Engineering and Project Management experience. He had leadership roles with major EPC, consulting and LNG project development companies previously. He is a registered Professional Engineer in the state of Maryland. Dr. Akinci has extensive non-linear analysis, structural design, PFP optimization and facility upgrade experience. His areas of expertise include design of structures for fire and blast, earthquakes, hurricanes, dropped object and impact loads. He worked on several onshore and offshore Oil&Gas projects, and supported all phases from concept development to construction."

Development of Risk Mitigation Programs using a Quantitative-Risk-Based Approach

Dr. Rafael Callejas-Tovar is a Senior Engineer working in the BakerRisk® Houston office as part of the Process Safety Group. His work is focused on quantitative risk analysis, consequence modeling, and computational fluid dynamics simulations. He received his PhD degree in Chemical Engineering from Texas A&M University. Rafael has over 8 years of industry and consulting experience in the U.S. with a focus on consequence and quantitative risk analysis for chemical plants, refineries, transportation of hazardous materials, and offshore oil & gas facilities.



Edward Marszal Kenexis Consequence Analysis: Gas Release



Jeffrey D. Marx Quest Consulting Inc



Jesse Brumbaugh aeSolutions

Incorporating Mitigation safeguards with LOPA

Ed Marszal is President and CEO of Kenexis. He has over 25 years of experience in risk analysis and technical safety engineering of process industry plants, including design of Safety Instrumented Systems and Fire and Gas Systems. Ed is an ISA Fellow and former Director of the ISA Safety Division and 20 year veteran of the ISA 84 standards committee for safety instrumented systems. He is also the author of the "Safety Integrity Level Selection" and "Security PHA Review" textbooks from ISA.

Hole Size Matters

Jeff Marx is a Senior Engineer with Quest Consultants in Norman, Oklahoma, USA, and a registered professional engineer in the state of Oklahoma. He earned his Bachelor's degree in mechanical engineering from the University of Oklahoma and a Master's degree in Mechanical Engineering from Georgia Tech. In his 27 years at Quest, Jeff's primary responsibilities have been in consequence and risk analysis studies for the petrochemical industry. This work includes facility siting, building siting studies per API RP 752/753, and quantitative risk analysis (QRA) studies for various corporate and regulatory entities. His work has been involved all aspects of the petrochemical system, including pipelines, gas plants, refineries, LPG terminals, and chemical plants. Much of this work has been involved in the LNG industry, including siting for LNG plants (using 49 CFR 193, NFPA 59A, CSA Z276, EN 1473, and other standards), and as a member of the Canadian Standards Association's Z276 committee, the LNG standard for Canada.Jeff is also responsible for several portions of the CANARY by Quest consequence analysis software, and has helped to develop, maintain, and apply the CANARY+ risk analysis toolset used at Quest.

How Can I Effectively Place My Gas Detectors

Mr. Brumbaugh is a process safety engineer with a 13 year background in process modeling, holding degrees in chemical engineering and computer science from Texas Tech University. He has worked in the process safety industry for over 7 years, performing models of gas dispersion, vapor cloud explosions, pool and jet fires, and other hazards in a wide range of software packages including computational fluid dynamics (CFD). He has also participated in numerous PHA studies; conducted process simulations in VMG, HYSYS, and CFD; and also numerical methods based models for various types of projects.



SreeRaj Nair Chevron



Noma Ogbeifun Chevron

Reactive Chemicals



Kok Hwa Lim SIT

Consequence Assessment Considerations for Toxic Natural Gas Dispersion Modeling

Nair is a Process Safety leader with expertise in Technical Safety engineering and safety management. A Chartered Engineer with global experience in stewarding process safety performance and governance in hazardous industries and industry peer groups. Nair, in his current role as Senior Process Risk Engineer, leads technological risk management at Permian operations and projects for Chevron Corporation. Nair, a MSc (Eng.) in Process Safety and Loss Prevention (the University of Sheffield, UK, 2004) is pursuing his PhD in dispersion modeling at the University of Warwick.

Consequence Assessment Considerations for Toxic Natural Gas Dispersion Modeling

Noma Ogbeifun is a Process Risk Engineer with Chevron Corporation in the Permian Basin. Currently, he performs qualitative and quantitative risk assessment studies like HAZOP, HAZOP-LOPAs, Inherently safer design reviews, consequence modeling, etc. on new and existing facilities. In a prior role as an LNG process engineer, he supported major projects including Wheatstone LNG, Gorgon LNG, Wafra Steam Flood, and Angola LNG. He obtained his Bachelor of Science degree in Chemical Engineering from Purdue University in 2013. Noma has co-authored papers covering subjects within LNG, renewable energy, and process safety published in journals and presented at conferences. In his spare time, Noma is pursuing his Master's in Business Administration at the University of Texas at Permian Basin.

Modelling and Simulation to Predict Energetic Material Properties

Kok Hwa Lim is currently the Director (Designate), Professional Officer Division and Programme Director, Pharmaceutical Engineering Programme in Singapore Institute of Technology. Mr. Lim is a registered Professional Engineer and Chartered Engineer (Chemical & Process Engineering). Mr. Lim has been elected as Council Member and is currently the Vice President of The Institution of Engineers Singapore. He was a member of the Working Group for Workplace Health Safety in Higher Education and Research Sector. Mr. Lim is frequently invited as speaker/ panelist in local and regional seminars/ conferences on Process Safety. He helped to organize various local seminars/ conferences with industries and professional societies. Mr. Lim has been teaching Process Safety related courses to undergraduate students as well as process safety professional since 2008.



Cuixian (Trisha) Yang Merck & Co



Yuto Mizuta Mitsubishi Chemical

Day 2 Track II Human Factors: People in Action Human Performance/Design Making II



Tom Shephard Wood (Retired)

Safety Assessment of Low Temperature Radical Initiators for Proper Storage and Safe Handling Conditions

Cuixian Yang studied at Xiamen University in China to study Chemical Engineering. In 2007, she was admitted to Tufts University to pursue her PhD in Chemical Engineering, focusing on the development and application of novel nanomaterials based on Tabacco Mosaic Virus as biotemplate. Later on, she joined Professor Klavs Jensen's group in Chemical Engineering Department of MIT as a postdoctoral associate. Her postdoc research involved continuous catalytic hydrogenation in micro packed bed reactor. In 2015, she started her industry career as a senior scientist in Chemical Engineering R&D department of Merck&Co in New Jersey. She participated in many different projects, and gained experience from early-stage process development, scale-up to late-stage process validation and tech transfer to manufacturing scale. Currently, she is working in Environmental and Process Safety Engineering group, to explore new process safetyrelated techniques and approaches.

Analysis of Pressure Behavior during Reaction Runaway and Estimation of Available Depressurization Design

Yuto Mizuta graduated from the safety engineering course of Yokohama National University in Japan. Mr. Mizuta has worked for Mitsubishi Chemical for 15 years as a safety engineer. He has experience in evaluating and consulting chemical plants in Japan. The main activities are risk analysis of chemical processes, consequence analysis, process simulation and consulting for explosion and thermal reactivity.

Preventing Cognitive-Attributed Errors in Safety Critical Systems: A Path Forward

Tom Shepard has over 40 years working for operating and engineering companies, delivered process safety, control and safety systems, and capital projects to the O&G, refining, petrochemical, pipeline and fuels terminal industries. Projects included some of the world's largest and most complex O&G offshore facilities and world-class refinery projects. Example roles included subject matter expert, project management, discipline lead and discipline department management. A unique skillset is the ability to develop solutions to highly complex, multi-discipline and multi-organizational problems. That skillset led to many successes developing and implementing corporate and project level technical and execution standards, tools, methods, work processes and execution models. Current

focus: Develop, promote and implement new standards, tools and methods for designing safety critical tasks, active human barriers and emergency response systems. The specific focus is on approaches that can reliably and systematically prevent or mitigate cognitive-specific errors in safety critical designs.

Two Views of Evaluating Procedural Task Performance: A Transition from Safety-I to Safety-II Approach

Changwon Son is a Ph.D. candidate in Applied Cognitive Ergonomics (ACE) Lab in the Department of Industrial and Systems Engineering at Texas A&M University. He has obtained his master's degree in Safety Engineering from Mary Kay O'Connor Process Safety Center at Texas A&M University. Son's research is focused on resilience engineering, an emerging paradigm for safety, for complex socio-technical systems such as disaster response, oil and gas processing, and healthcare. After receiving his bachelor's degree in Hanyang University, Seoul, Korea, he worked for Hyundai Heavy Industries, the world's largest shipbuilding and offshore company as safety, health, and environmental manager for over six years

Beyond Human Error: Integration of the Interactive Behavior Triad and Toward a Systems Model

Dr. Hendricks earned a PhD in Industrial and Organizational Psychology from Texas A&M University. He is currently a research associate – senior investigator with the Next Generation Advanced Procedures consortium at Texas A&M University.

Operator Performance Under Stress: A Neurocentric Virtual Reality Training Approach

Ranjana Mehta is Associate Professor in the Department of Industrial and Systems Engineering at Texas A&M University. She is also a graduate faculty with the Texas A&M Institute for Neuroscience at Texas A&M University, director of the NeuroErgonomics Laboratory, co-director of the Texas A&M Ergonomics Center, and a faculty fellow with the Center for Remote Health Technologies and Systems, the Center for Population Health and Aging, and Mary Kay O'Connor Process Safety Center. The NeuroErgonomics Lab examines the mind-motor-machine nexus to understand, quantify, and predict human performance when interacting with emerging technologies (unmanned, collaborative, and wearable systems) in safetycritical extreme environments (e.g., emergency response, space exploration, oil and gas).



Changwon Son Texas A&M University



Joseph W. Hendricks Texas A&M University Fatigue and Stress



Ranjana Mehta Texas A&M University



John Kang Texas A&M University



Stefan V. Dumlao Texas A&M University

Day 2 Track IV Research and Next Generation Next Generation Process Safety I



Guanyang Liu MKOPSC



Pallavi Kumari MKOPSC

Towards a Predictive Fatigue Technology for Oil and Gas Drivers

John Kang is a Ph.D. student in Industrial & Systems Engineering at Texas A&M University and has received a BS in Industrial & Systems Engineering from Georga Tech. His research interests are physiological wearables to quantify fatigue and understanding decision making under fatigue or stress in a high-risk environment.

Validation of the Fatigue Risk Assessment and Management in High-Risk Environments (FRAME) Survey

Stefan V. Dumlao is a doctoral student studying industrial-organizational psychology at Texas A&M University, College Station. His primary research interests are employee reactions to wearable monitors and occupational safety.

Identifying Contributing Factors of Pipeline Incident from PHMSA Database on NLP and Text Mining Techniques

Guanyang Liu, a PhD student in Chemical Engineering with research interest of reaction engineering, process safety, AI applications in process industry

Causation Analysis of Pipeline Incidents using Artificial Neural Network (ANN)

Pallavi Kumari is a fourth-year Ph.D. student working with Dr. Joseph Kwon. Her research focuses on root cause and consequence analysis of rare events in chemical process industries using statistical data analysis methods, process modelling and process control techniques. She received her Bachelor's from IIT Kanpur and worked in Reliance Industries Limited, India.



Nabila Nazneen MKOPSC Next Generation Process Safety II



Nir Keren Iowa State University



Prasad Goteti Honeywell Process Solutions

Development of Hazard Factor for Engineered Particles

Nabila Nazneen is currently pursuing her Master's in Safety Engineering at the Mary Kay O'Connor Process Safety Center. Her Background is in Chemical Engineering. She attained an MBA degree right after her bachelor degree and worked in the ready-made garments sector for two years before coming to the Process Safety Center. Her research interest is on nanoparticle hazards.

Can a Virtual Reality Application Better Prepare Millennials and the Z-Generation for Working with Systems in the Process Industry?

Nir Keren is an associate professor of occupational safety and a graduate faculty member at the Virtual Reality Application Center at Iowa State University. Keren is also the director of the Occupational Safety Program of the NIOSH Heartland Education and Research Center and the Director of the VirtuTrace Laboratory for Applied Decision Making Research in Virtual Reality.

Process Safety Risk Index Calculation Based on Historian Data

Prasad Goteti is a Principal Project Engineer at Honeywell Process Solutions (HPS), Houston Texas USA, in the Safety Engineering Center of Excellence. He is responsible for providing process safety solutions to customers, working on Safety Engineering at the proposal and detailed engineering stage for Safety Instrumented System (SIS) projects, which includes Emergency Shutdown Systems (ESD), Burner Management Systems (BMS) and Fire and Gas Systems (FGS). He is also an Instructor for the TUV Rheinland Germany, approved Functional Safety Training course conducted by HPS Automation College. Prasad holds a degree in Instrumentation from Birla Institute of Technology and Science (BITS), Pilani, India, is a Professional Engineer (P.Eng) with the Association of Professional Engineers and Geoscientists of Alberta (APEGA), Canada, a Certified Functional Safety Expert (CFSE), a TUV Functional Safety Expert (TUV Rheinland, Germany), An Advisory Board member of Purdue Process Safety and Assurance Center (P2SAC) at Purdue Universtiy, a member of WG 7 of ISA TR 84.00.07 and WG 9 of ISA TR 84.00.09 committees



A Brief review of Intrusion Detection System in Process plants and advancement of Machine Learning in Process Security

Missing Biography

Sinijoy P J Cochin University of Science and Technology Day 2 Track V Explosions Explosion Modeling



Tássia L. S. Quaresma University of Campinas



Tássia Lins da Silva Quaresma is a chemical engineer with experience in Risk Analysis and numerical combustion modeling with computational fluid dynamics. Tássia has contributed to several risk analysis methodologies of oil&gas and mining industrial plants. Currently, she has been studying combustion models for turbulent premixed flames focusing on the turbulent-flame interaction in order to predict flame speed and its consequences.

Towards a Comprehensive Model Evaluation Protocol for LNG Hazard Analyses

Dr. Filippo Gavelli is a mechanical engineer who specializes in the analysis of heat transfer and fluid flow phenomena, including multiphase flows and cryogenic fluids. He has 18 years of engineering consulting experience and over 25 years of experience in computational fluid dynamics (CFD) modeling, using several research and commercial codes. He applies his expertise to modeling the consequences of hazardous releases and performing risk assessments for Liquefied Natural Gas (LNG) facilities. Dr. Gavelli has over 16 years of experience with modeling hazard scenarios including vapor cloud dispersion, pool and jet fires and vapor cloud explosions; his experience includes more than 50 LNG installations worldwide, including onshore, offshore and floating facilities for LNG import, export, peakshaving, truck loading and bunkering. He has been a member of the NFPA 59A committee for over 13 years and a frequent contributor to LNG safety related conferences and expert panels.



Filippo Gavellia Blue Engineering and Consulting



Charline Fouchier Von Karman Institution of Fluid Dynamics

Explosion Phenomena I



Simon Gant UK Health and Safety Executive



Yumeng Zhao Purdue University

Beirut: How behaves Ammonium Nitrate Exposed to Fire and How Strong and Damaging is its Explosion

Charline Fouchier is a postdoctoral researcher at the von Karman Institute in Belgium. She completed her Ph.D. degree this year on the *Investigation of the Pollutant Dispersion Driven by a Condensed-Phase Explosion in a Complex Environment*. She has a master's degree in industrial safety, from Ecole national supérieure des Mines d'Alès (France), a master's degree in Environments and Urban Risks from Ecole Nationale supérieure des Mines de Saint-Etienne (France) and a Post-graduate Research Master in Fluid Dynamics from the von Karman Institute (Belgium), during which she won the Excellence in Experimental Research Award for her work on the blast propagation in an urban environment

Flammable Mist Hazards Involving High-Flashpoint Fluids

Simon Gant is a Principal Scientist in the Fluid Dynamics Team at HSE's Science and Research Centre in Buxton, UK, where he undertakes work on incident investigations, research, development of guidance and standards, model reviews and consultancy. He obtained a master's degree in mechanical engineering from Leeds University in 1997 and a PhD in computational fluid dynamics from Manchester University in 2002. His current work is mainly focused on the Jack Rabbit II chlorine release trials, hydrogen energy demonstration projects, carbon capture and storage, and flammable mists

Measuring Suspended Explosive Dust Concentration from Images

Missing Biography



Elaine S. Oran Texas A&M University

Explosions Phenomena II



Zeren Jiao MKOPSC



Chenxi Ji MKOPSC

The HBT-A Large-Scale Facility for Study of Detonations and Explosion

Elaine S. Oran is TEES Eminent Professor in the Department of Aerospace Engineering at Texas A&M University. Previously she was the A. James Clark Distinguished Professor and the Glenn L. Martin Institute Professor at the University of Maryland. For many years before that, she was the Senior Scientist for Reactive Flow Physics at the US Naval Research Laboratory in Washington, DC. She received an A.B. in chemistry and physics from Bryn Mawr College and both a M.Ph. in Physics and a Ph.D. in Engineering and Applied Science from Yale University. She is a Member of the National Academy of Engineering, an Honorary Fellow of the AIAA, and a Fellow of the American Academy of Arts and Sciences. Her recent research interests include chemically reactive flows, turbulence, numerical analysis, high-performance computing, shocks and shock interactions, and rarefied gases, with applications to combustion, propulsion, and all sorts of explosions.

Development of Flammable Dispersion Quantitative Property-Consequence Relationship Models Using Machine Learning

Zeren Jiao joined Mary Kay O'Connor Process Safety Center in September 2016 and he obtained his M.S. degree of chemical engineering in 2018 under the supervision of Dr. Sam Mannan. He is currently a Ph.D. student in the MKOPSC. Zeren Jiao's research focus is on implementing machine learning and big data analysis in process safety.

An Unsupervised Model to Predict the Liquid In-Cylinder Combustion Risk Ratings of Marine Fuels Chenxi Ji is currently a research assistant at Mary Kay

O'Connor Process Safety Center and Gas & Fuel Research Center of Texas A&M University. He is motivated to apply his process systems engineering and chemical process safety on the shipping and oil & gas industry, seeking to make the oil & gas industry faster, greener, safer and more cost-effective.



Peter A Diakow BakerRisk

Consequence Analysis: Flammability



Logan N. Kunka Texas A&M University



J. Kelly Thomas BakerRisk



Zeren Jiao MKOPSC

Fireball and Flame Venting Comparisons

Peter Diakow is a Senior Consultant with the Blast Effects group at BakerRisk, with a master's degree in Mechanical Engineering from Queen's University in Canada. Mr. Diakow has over a decade of experience in experimental testing and research with a focus on vapor cloud explosions, vented deflagrations, and deflagration to detonation transition (DDT). At BakerRisk Mr. Diakow is also involved with Facility Siting Studies (FSS), Quantitative Risk Assessments (QRA), Incident Investigations and Dust Hazard Analyses (DHA).

Numerical Simulation of Methane-Air DDT in Channels Containing Trace Amounts of Impurities

Logan Kunka is a DOE Computational Science Graduate Fellow and currently a graduate student in Aerospace Engineering at Texas A&M University. He holds a B.S. in Aerospace and Mechanical Engineering from Oklahoma State University. His interests include combustion, computational physics, and high-performance computing. His current research involves the simulation of reactive flows including deflagrations, detonations, and DDT in gases.

The Use of Bent Poles as a Detonation Indicator

Missing Biography

Machine Learning Based Quantitative Prediction Models for Chemical Mixture Flammability Limits Zeren Jiao joined Mary Kay O'Connor Process Safety Center in September 2016 and he obtained his M.S. degree of chemical engineering in 2018 under the supervision of Dr. Sam Mannan. He is currently a Ph.D. student in the MKOPSC. Zeren Jiao's research focus is on implementing machine learning and big data analysis in process safety.

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