

51st Annual Loss Prevention Symposium 2017 (LPS)

Topical Conference at the 2017 AIChE Spring Meeting and 13th
Global Congress on Process Safety

San Antonio, Texas, USA
26 - 30 March 2017

ISBN: 978-1-5108-4364-6

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2017) by AIChE
All rights reserved.

Printed by Curran Associates, Inc. (2017)

For permission requests, please contact AIChE
at the address below.

AIChE
120 Wall Street, FL 23
New York, NY 10005-4020

Phone: (800) 242-4363
Fax: (203) 775-5177

www.aiche.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

(1a) AGILE Award Keynote Address	1
<i>John Televantos</i>	
(11a) Data Visualization Connecting Big Data to Integrate Every Level of the Organization- Messaging, Action and Opportunities!	2
<i>John DeGiovanni</i>	
(11b) Leadership in Catastrophic Incident Prevention - Using Organizational Data to Assess and Respond to High Reliability Loss Prevention Precursors.....	3
<i>Michael Snyder</i>	
(11c) Addressing the Dissonance Between Corporate and Individual Process Safety Drivers.....	14
<i>Angus Keddie</i>	
(17a) Dan Crowl on Fire - Basics of Flammability Dan Crowl	28
<i>Daniel A. Crowl</i>	
(17b) How Do Flame Arresters Work?	29
<i>Matthew Barfield</i>	
(17c) BLEVE Basics, A Primer on Boiling Liquid Expanding Vapor Explosions	30
<i>Adrian Pierorazio</i>	
(25a) Large Scale Flammability and Explosivity Testing of Low Burning Velocity Gases: Validity of Prediction Tools and Impact on Siting Studies and Risk Assessments	31
<i>Scott Davis, Kees van Wingerden, Tom DeBold, John Pagliaro, Matthijs van Wingerden</i>	
(25b) Hydrogen Jet Vapor Cloud Explosion: a Model for Predicting Blast Size and Application to Risk Assessment.....	53
<i>Derek Miller, J. Kelly Thomas, Simon Jallais, Elena Vyazmina</i>	
(25c) Aerosol Generation Approach and Aerosol Combustion Behavior Study	77
<i>M. Sam Mannan, Shuai Yuan, Yogesh Koirala, Chad V. Mashuga, Zhengdong Cheng</i>	
(43a) Elongated VCE Blast Waves and Structural Damage.....	96
<i>Jihui Geng, Thomas Mander, J. Kelly Thomas, Quentin A. Baker</i>	
(43b) The Nature of Ammonium Nitrate Decomposition and Explosions	120
<i>Ronald J. Willey</i>	
(43c) Calorimetry and Thermo-Kinetic Modeling to Determine SAPT and Safe Shipping Conditions for Self-Reactive Materials	135
<i>Min Sheng, Steve Horsch, Florin Dan, Robert Bellair, Marabeth Holsinger, Stephan Weinberg, Alan Sopchik</i>	
(57aa) Thermal Decomposition of Mono-Nitrated Toluene (MNT) with Additives	160
<i>Wen Zhu, Chad Mashuga</i>	
(57ab) Addressing Challenges of Controlling Change By Implementing Best MOC Practices	161
<i>Annant Srivastava, Laura Geerlings</i>	
(57ad) Process Change Impact on Relief System Design	162
<i>James Brigman, Shailesh Saraykar</i>	
(57ae) Identification and Local Impact Analysis of Projectile Hazard in the LNG Industry	163
<i>Prema Jain, Wimberly Dick, David A. Rosenberg, Andrew Kohout</i>	
(57ag) Thermal Hazard Analysis and Chemical Incompatibility Tests with Custom High-Pressure Crucibles Made from Commonly Used Metals and Alloys	164
<i>Han Xia, Joan F. Brennecke</i>	
(57ah) Do Dust Hazards Analysis (DHA) Really Differ from a Process Hazards Analysis (PHA) or a Process Analysis (PA)?.....	165
<i>Michael E. Robertson</i>	
(57ai) A Leading Indicators Based Decision Support Tool to Predict Blowout Events.....	175
<i>Nafiz Tamim, Delphine Laboureur, A. Rashid Hasan, M. Sam Mannan</i>	
(57am) Consequence Modeling at the Eastman Kingsport Site	176
<i>Michael D. James, David Skelton</i>	
(57ao) Relief Systems Design: The Importance of Accounting for Static Head	203
<i>Nicholas N. Cristea, Zubin Kumana, Guomin Wang</i>	
(57aq) Study of Factors That Affect Dust Explosion Characteristics of Fibrous Dust Materials	211
<i>Bharatvaaj Ravi, Yan-Ru Lin, Chad Mashuga, M. Sam Mannan</i>	
(57ar) High Integrity Pressure Protection System (HIPPS) and Implementation Challenges	212
<i>Janardhanan Kallambettu</i>	
(57as) Managing Risk Associated w/ Electrical Energy Ignition Sources.....	237
<i>Jim Johnston</i>	
(57at) Review and Analysis of Recent Cyber Security Attacks	238
<i>Ursula Malczewski, Amy Theis</i>	
(57au) Resilience-Based Survival Analysis in the Event of a Process Upset: A Case Study of Utility Plant.....	239
<i>Prema Jain, Efstratios N. Pistikopoulos, Sam Mannan</i>	
(57aw) Model-Based Pressure Relief Design for Reactive Systems	240
<i>Michelle Murphy</i>	

(57ax) Dynamic Modeling of Inbreathing Requirements for Low-Pressure Storage Tanks	241
Dona Chakra, Georges Melhem, Ronald J. Willey	
(57az) Studying the Relationship Between Inherently Safer Design and Equipment Reliability	262
Nilesh Ade, Guanlan Liu, Sam Mannan	
(57b) Pressure Relief Analysis - It's about More Than Just Compliance	263
Robert Siml, Alysson Ferreira	
(57ba) How to Leverage Limited Design Data Along with Historical Incident Data to Assess Inherent Process Safety During Early Stage of Design?	264
Fadwa T. Eljack, Monzure-Khoda Kazi, Ahmed AlNouss	
(57bb) Inherently Safer Design from Overpressure Protection Viewpoint	265
Nancy Faulk, Christopher Ng, Sachin Kanade	
(57bc) Three Reasons Major Event Risk Management Fails on Capital Project.....	274
Denise Chastain-Knight	
(57bd) Safety Rating System Based on Current Situation of China Petrochemical Enterprises	287
Linlin Wang	
(57bf) The Difficulty and Prospect of the Development of Quantitative Assessment Technology in the Field of Chemical Safety in China	296
Jiu Jiangbo	
(57bg) Recipe for a Sizzling HAZOP Chair.....	297
Angus Keddie	
(57bi) Bridging the Divide - OHS and Process Safety	306
Trish Kerin	
(57bk) 20 Years of Personal Process Safety Lessons	307
Steve Strelbow	
(57bl) Identifying Opportunities of Enhancing Safeguard Stewardship through IPL Rationalization	318
SreeRaj Nair, Bernadette Thornton	
(57bm) Process Safety Site Assessment Program (PSSAP) - 5 Years of Assessments	327
Andrew Broadbent	
(57bn) Alarm Management Meets SIS	336
Darwin Logerot	
(57bq) Enhancing Process Safety Management Integration to Improve Process Safety and Profitability in the Fuels and Petrochemicals Industry.....	337
Thomas D. Watson, Harold Phillipi, Ronald Fuchs	
(57br) Reactive Hazards Management: Lessons Learnt from Major Incidents	346
Robert Weber, Sonny Sachdeva	
(57bu) The Study of Safety Evaluation Technique for High Temperature Process	347
Manabu Okuyama	
(57bv) Handling Uncertainty in LOPA and SIF Design	348
Arjan Abeynaike, Venkatesh Sourirajan, Akshat Khirwal	
(57bw) Fundamental Research at Purdue Process Safety Research Center	361
Ray A. Mentzer	
(57by) Bringing New Life to Process Safety	362
Farshad Hendi, Steve Elliott	
(57cb) Developing an Effective System for Action Item Resolution	363
Zubin Kumana, Jason F. White	
(57cc) Where Does Management of Change (MOC) Begin?	364
Juliana Schmitz, Patti Jones, Gabriel Drummond	
(57cd) Effectively Utilizing Calarp/RMP/PSM Contractors to Assist in Optimizing Process Safety Culture, Compliance with Standards, and Workforce Involvement	374
Ivan Cheng, Timothy Lee, Steven T. Maher, Michael Saura	
(57ce) A Streamlined Approach for Full Compliance with SIL Implementation Standard	375
William Bridges, Art Dowell III	
(57cg) The Art of the Audit: Being Audit Ready, Everyday.....	387
Amanda Scalza, Brady Brown	
(57ck) Economic Justification for Better Maintenance in a Safety System	388
William M. Goble, Loren Stewart	
(57cl) How Important Is Realistic Failure Rates for Safety Instrumented Functions?	389
John Day, Loren Stewart	
(57cn) Enabling Sustainable Relief System Management Programs through Independent Reviews.....	390
Aniket Patankar, Norberto Pineda	
(57f) Jack Rabbit II: Experimental Large-Scale Chlorine Release Trials	391
Shannon B. Fox, Thomas O. Spicer III, Leo Stockham, Mark Whitmire, Ronald Meris, Thomas Mazzola, Joseph Chang, Steven Hanna, Michael Sohn, Damon Nicholson, Andy Byrnes	
(57g) Functional Safety - Pitfalls and Good Practices	398
Crystal James, Marisa Pierce, Chris Parr	
(57i) Method for Uncertainty Evaluation of Safety Integrity Level (SIL) Calculations.....	399
Raymond "Randy" Freeman	
(57j) Developing a Methodology for Process Selection in Pharmaceutical Industry Based on Inherent Safety Considerations: A Case Study on Batch Vs Continuous Process.....	449
Shiqi Chen, Yogesh Koirala, M. Sam Mannan	

(57k) Risk Based Decision Making Methods for Evaluating Complex Technologies, a Comparative Analysis on Pipelines and Railroad for Crude Oil Transport.....	473
<i>Pranav Kannan, M. Sam Mannan, Martin A. Wortman</i>	
(57m) Key Modeling Parameters and Process Safety Information for Effective Atmospheric Dispersion Modeling.....	474
<i>Srihari K Maganti</i>	
(57n) Implementation of Hazard Mitigation Solutions: Consequence Vs. Risk-Based Building Specifications.....	475
<i>Travis Holland, Joshua Bruce-Black</i>	
(57o) Generalization of Modeling Along-Wind Dispersion.....	476
<i>Jessica M. Morris, Thomas O. Spicer III</i>	
(57p) Review and Analyze the Effects of Parameters for H₂S Gas Mixture Dispersion Models: Degadis and CFD Models.....	490
<i>Jiayong Zhu, Delphine Laboureur, M. Sam Mannan</i>	
(57s) Considerations When Justifying the Purchase of an Operator Training Simulator.....	491
<i>Ian Willetts</i>	
(57u) Consequence Analysis of Gas Explosion in Underground Common Utility Tunnels.....	492
<i>Mirae Yoo, Yuri Jang, Seungho Jung</i>	
(57v) Air Cooler Explosion Analysis Using CFD	493
<i>Greg R. Knight</i>	
(57w) Revisions to the Qmefs Vapor Cloud Explosion Model.....	494
<i>Jeffrey D. Marx, Benjamin Ishii</i>	
(57x) Do We Need a Quantitative Risk Assessment (QRA) If My Consequence Analysis Facility Siting Presents a Problem?.....	509
<i>Vinicius Simoes</i>	
(57y) Proposed Method for Investigating the Reactivity of Chlorine with Environmental Materials Under Relevant, Controlled Conditions.....	510
<i>Audrey Feuvrier, Thomas O. Spicer III</i>	
(57z) Fire Proofing Cost Reduction Measures for LNG Plant	520
<i>Ramnaindu Girada, Jegar Babu Arumugakan Thuraiswamy, Antonino Nicotra</i>	
(69a) Consideration of Escalation Risks in Facility Siting.....	531
<i>Dennis Ngai, Venkatesh Sourirajan</i>	
(69b) The Facility Siting Cycle (Revalidation)	532
<i>Michael D. Weinberg</i>	
(69c) Strategic Facility Siting - A Different Perspective.....	541
<i>Steve Clepper, Hollie Schmidt</i>	
(91a) Large Scale Testing Confirms Deflagration to Detonation Transition (DDT) Needs to be Considered in Facility Siting	558
<i>Scott Davis, Derek M. Engel, Kees van Wingerden, John Pagliaro, Drew Botwinick, Erik Merilo, Adam Ziembka, Mark Groethe</i>	
(91b) Real World Applications of API 753	588
<i>Darren Malik</i>	
(91c) Shrapnel: Accounting for Blast Fragments in Facility Siting Studies	589
<i>Corey Whelton, Michael S. Schmidt</i>	
(111a) A Risk-Based Approach for Predicting Domino Effects Due to Fires - Combining Exceedance Curves with Thermal Stress Dynamic Analysis.....	603
<i>Jordi Dunjó</i>	
(111b) Quantifying the Mass Release Rate for Flashing Two Phase Releases for Consequence Assessment Purposes	604
<i>Thomas O. Spicer III, Derek Miller</i>	
(111c) Effectiveness of Water Sprays in Mitigating Toxic Releases	605
<i>Samrat Mukherjee, Seshu Dharmavararam, Stephen Jaskolka</i>	
(129a) Limiting Oxygen Concentration of Hybrid Mixtures.....	622
<i>Emmanuel K. Addai, Martin Clouthier, Paul R. Amyotte, Ulrich Krause</i>	
(129b) Ignitability of Combustible Dust Fueled Flash Fires with Industrial Ignition Sources.....	636
<i>Michael C. Stern, Sean C. O'Hern, Alfonso Ibarella, Russell Ogle, Timothy J. Myers</i>	
(129c) A New Methodology to Evaluate System-Level Performance of Explosion Suppression Systems	647
<i>Jenny Chao, Sergey B. Dorofeev</i>	
(143a) Understanding Vapor Cloud Explosions.....	669
<i>Derek Miller</i>	
(143b) Running the Gamut of Hazard Identification and Risk Analysis Methods	670
<i>Robert W. Johnson</i>	
(143c) Q&A on QRA	671
<i>Jeffrey D. Marx</i>	
(154a) The Top Ten Reasons for Fixed Equipment Failures in the Hydrocarbon Process Industries	672
<i>John Reynolds</i>	
(154b) Advancing Asset Integrity in Chevron Upstream	673
<i>Vincent Attanucci, Philip Delpero, Elizabeth Leaverton</i>	
(154c) Using HAZOP/LOPA to Create an Effective Mechanical Integrity Program	686
<i>Steven T. Maher, David J. Childs</i>	
(171a) New Guidelines for Managing Asset (Mechanical) Integrity	703
<i>Eric Freiburger, Michael P. Broadribb, John Murphy, Robert W. Johnson</i>	
(171b) Fracture Toughness and Brittle Failure - A Pressure Vessel Case Study	719
<i>John Puryear, Guillermo Ramirez, Clint Botard, Kollin Kenady</i>	

(171c) An Integrated Prediction Model for H ₂ S/CO ₂ Corrosion in the Pipe of Refinery	730
<i>Lihan Zeng, Yan-Ru Lin, M. Sam Mannan, Yan Cui</i>	
(182a) Waste Solvents to Trash Haulers: Lessons Learned from Hazardous Waste Accidents.....	756
<i>Delmar "Trey" Morrison, Michael Stern, Carmen Osorio-Amado</i>	
(182b) ExxonMobil Torrance Refinery FCC ESP Explosion	784
<i>Mark Wingard</i>	
(182c) Overfill to Overpressure - Investigation Findings and Contributing Events to the CAPECO Explosion.....	785
<i>Scott Davis, Tom DeBold, Bryant Hendrickson, Claudio Marsegan</i>	
(182d) Produced Water Tank Explosion Case Study	806
<i>J. Kelly Thomas</i>	
(182e) Milestone Company Incidents and Their Impact on Air Products Process Safety Journey	821
<i>Brian E Farrell</i>	
(182f) Plymouth Incident	822
<i>Von Studer</i>	
Author Index	