出國報告（出國類別：國際會議）

赴美國紐奧良參加 2014 AIChE Spring Meeting and 10th Global Congress on Process Safety 會議

服務機關：國立雲林科技大學
姓名職稱：洪肇嘉 教授
派赴國家：美國
報告日期：103.05.14
出國期間：103.03.30~04.03

摘要

本人於 3 月 30 日至 4 月 2 日前往美國紐奧良參加 2014 AIChE Spring Meeting 暨 10th Global Congress on Process Safety。該會議主題與負責之行政業務職掌(環保署與本校合設毒災應變諮詢中心)有密切關聯，除有助於了解國際發展趨勢，也吸取許多事故經驗教訓，將陸續採用其資訊，化爲我國教材，對未來課程教學及中心業務發展對各種危害事故之安全知識及妥善應變程序有正面助益。另外，積極與相關研究人員、單位建立聯絡管道，拓展交流，獲中石大邀請於今年 8 月底召開之第二屆亞洲 CCPS 主講台灣經驗，提升台灣與本校知名度。透過此類大型學術交流活動有助提升教學與研究量能，應鼓勵我校師生多加參與。

目次

一、目的

美國化工協會(AIChE)舉辦之 2014 Spring Meeting 暨 10th Global Congress on Process Safety，爲全球化學領域的學術盛會，邀請許多國際知名學者分享學術、實務經驗，內容涵蓋工廠安全、程序安全(PS)、預防損失、安全管理等。與本人行政業務職掌(環保署與本校合設毒災應變諮詢中心)有密切關聯，因此赴美國紐奧良參加，以了解國外化學品安全管理趨勢以及最新研究發展動態，並積極與相關研究人員、單位建立聯絡管道，拓展交流。

二、過程

本人於 3 月 30 日至 4 月 2 日前往紐奧良參加 2014 AIChE Spring Meeting 暨 10th Global Congress on Process Safety 會議(如附件一)。其中留下深刻印象且與中心業務較有關聯者，整理如下(文章摘要如附件二)。

表 **1** 出國行程表

日期		行程
3 月	30 日	美國 LA→美國 New Orleans
3 月 4 月	31 日 1-2 日	參加 2014 AIChE Spring Meeting 暨 10th Global Congress on Process Safety 會議
4 月	3 日	美國 New Orleans→美國 LA

1. **Dispersion of Heavy Gases - Experimental Results and Numerical Simulations** 重質氣體擴散實驗及模擬 (10:30-11:00 AM, 3/31)

   Authors: Christian Rauchegger, Susan Bayley, Volkmar Schröder & Dominique Thévenin

   摘要：使用德國 VDI 3783 擴散模型，因其無法描述氣雲之高及寬度，故需以實驗了解三維方向，研究發現當排放源超過某特定高度，則重質氣體部分將不再適用。

2. **Simplified Methods of Using Probit Analysis in Consequence Analysis** 在後果分析使用簡易機率分析 (13:30-14:00 PM, 3/31)

   Authors: Michael James

   摘要：爲保證在化學品洩漏時人員的安全，需訂定適宜的避難時間，以機率

的概念建立人員暴露及應變的關聯性(以一小時爲限)，定義最大容許暴露時間，因此毒性資料的建立與模式及估計常數尤爲重要。

3. **Infiltration Hazards for Building Siting Studies**

建物之滲透危害 (14:00-14:30 PM, 3/31)

Authors: Jeffrey D. Marx & Benjamin R. Ishii

摘要：OSHA 的 PSM 曾討論設施的設置，API RP 752 也規範了設施設置的指引，毒性氣體衝擊分析被利用爲評估建築場所可能暴露的工具，但並未考量可能影響人員安全之滲透量。透過擴散模型及滲透分析，可對後果分析進行更嚴謹的研討。

4. **Venting Flammable Gas to a "Safe Area": An Objective Review of Best Practices and Guidelines**

排放易燃氣體到安全區域—最佳運用及指引的回顧 (16:30-17:00 PM, 3/31)

Authors: Juan C. Ramirez, D. Trey Morrison, Ryan J. Hart & Todd M. Hetrick

摘要：排放、清空或清理易燃氣體管線或容器可能造成意外火災或爆炸，近年也有不少事故。雖有安全標準或指引，但適用性如何？此研究檢討清空易燃氣體系統，通常是以燃氣清洗，而以後果分析軟體分析氣雲擴散及安全指引，並提供結果參考。

5. **Determination of the Lower Flammability Limit for Hybrid Mixtures**

測定混合氣體的燃燒下限 (14:30-15:00 PM, 4/1)

Authors: Jiaojun Jiang, Yi Liu & M. Sam Mannan

摘要：粉塵及氣體的混合爆炸常造成人員傷亡及財產損失，2010 年美國西維吉尼亞煤礦事故即是煤塵與甲烷之爆炸事件。實驗以 36 升的爆炸鋼球進行，找出適合勒沙特列定律與 Bartknecht 曲線之新方程式，兼顧均質及混合氣體之 LFL。

6. **Overview of Inherently Safer Technology**

本質較安全技術概述 (8:00-8:30 AM, 4/2)

Authors: Dennis C. Hendershot

摘要：本文是過去好文章之再現，檢討本質安全設計(ISD)，回顧起 1984 年印度 Bhopal 事件，至近幾年美國陸續發生的主要工廠事故，都與 ISD 有關，其中包括 2010 年美國華州 Anacortes 煉油廠爆炸、2012 年美國加州 Richmond 煉油廠爆炸、2013 年美國德州的無水氨爆炸事故，均顯得 ISD 益爲重要。

7. **More Lessons "Re-Learned" from Corrosion Under Insulation**

隔熱層下腐蝕的新課題 (8:30-9:00 AM, 4/2)

Authors: Tim Overton

摘要：機械完整性是 PSM 的必要組成，也是化工及煉油業的重點。在維修方面，檢測隔熱層下的腐蝕尤其重要。Dow 化學公司最近差點發生意外，即是因爲如此。因此，本文說明應採行的措施，以避免重蹈覆轍。

8. **Vinyl Chloride Monomer Explosion**

台塑美國廠的爆炸案 (9:00-9:30 AM, 4/2)

Authors: Lisa A. Long

摘要：2004 年在美國佛州 PVC 廠爆炸案，起因爲收購舊廠，並未依其他廠教訓及其安全檢討迅速檢討改善，以致造成 5 人死亡 3 人受傷之事故。

此外，也參與中國 Chinese Section 針對與 CCPS 相關議題，報告及檢討中國現況，會後更獲中國石油大學邀請，於今年 8 月底赴青島舉辦之 2nd Asia CCPS 研討會主講台灣經驗。

三、心得

本次行程參與 2014 AIChE Spring Meeting 暨 10th Global Congress on Process Safety，了解國外化學品安全相關議題之最新研究發展，並積極與國際拓展交流，俾利改善現有化學品災害應變資訊及預防方式。彙整心得如下：

1. 此行與美國 GCPS 人員交流獲取許多經驗及教訓，也獲中石大邀請於第二屆亞洲 CCPS 主講台灣經驗，提升台灣與本校知名度。
2. 學習許多事故經驗及檢討，可運用於中心未來應變作爲以及輔導我國化學、化工、煉油等工業廠家。
3. 了解 PS 的全球發展動態，對未來課程教學及中心業務發展有正面助益。

四、建議事項

1. 透過此類學術合作活動彼此交流研究經驗，有助於了解國際發展趨勢，也吸取經驗教訓，會後攜回相關資料，將陸續採用其資訊，化爲我國教材，俾利提升課程教學與中心業務發展對各種危害事故之安全知識及妥善應變程序。

2. 參加國際交流之活動如大型國際研討會議，有助提升我校的知名度，另對學生提升英語文能力及增廣對於國際觀的視野有極大助益，建議後續學校應提供更多元且豐富的補助獎勵辦法，以鼓勵我校師生參與。

五、附錄

附件一、會議議程

Sunday, March 30	
8:00 AM – 5:00 PM	GCPS Short Courses
6:30 PM – 8:00 PM	2014 AIChE Meeting and 10th GCPS Opening Reception Location: Hilton, Grand Ballrooms C/D
7:30 PM – 10:00 PM	10th GCPS Banquet Location: Hilton, Versailles Ballroom
MONDAY, March 31	
7:00 AM	Complimentary Continental Breakfast Location: Hilton, Grand Ballroom Foyer
8:00 AM	2014 AIChE Spring Meeting and 10th GCPS Opening Plenary Session: **Otis Shelton,** AIChE President and **June C. Wispelwey**, AIChE Executive Director Location: Hilton, Grand Ballrooms C/D
8:30 AM	Keynote Address: **William F. Banholzer**, CTO, The Dow Chemical Company (ret.) Location: Hilton, Grand Ballrooms C/D Keynote Address: Possible vs. Practical: Engineers Must Lead the Development of Practical Technologies
9:15 AM	**Coffee and Networking Break** Location: Hilton Exhibition Center
9:40 AM	**10th GCPS Welcoming Plenary Session** Location: Grand Ballrooms C/D 10th GCPS Introduction and Welcome: **Scott Berger** (Executive Director, CCPS) and **Jatin Shah** (GCPS Chair) Symposia Introductions: **Jeff Fox** (CCPS Chair), **Farzin Sabet** (LPS Chair), **Robert Wasileski** (PPSS Chair), **Carlos Barrera** (PSM^2), and **Cheryl Grounds** (Process Safety Spotlight Track Chair) Presentation of William H. Doyle Award for LPS Best Paper Award and PPSS Best Paper Award

MONDAY, March 31					
	48th Annual Loss Prevention Symposium (LPS)	29th Center for Chemical Process Safety International Conference (CCPS)	16th Process Plant Safety Symposium (PPSS)	3rd Process Safety Management Mentoring (PSM^2) Forum	Process Safety Spotlights
	Risk Assessment and Analysis/Consequence Modeling I	***Learning From Incidents / Near Misses To Drive Improvement***	***Management Of Change***	***PSM Introduction 'Master Class'***	***Understanding, Measuring and Optimizing Human Performance at All Levels of the Organization I***
	Location: Grand Salons 8/9/11/12	Location: Grand Ballroom A	Location: Grand Ballroom B	Location: Grand Salons 7/10	Location: Grand Salons 1-6
	Co-Chairs: **Kathleen Kas** **Ronald Willey**	**Co-Chairs:** **Timothy Murphy** **Swati Umbrajkar**	**Co-Chairs:** **Sandipan Laskar** **Donald DuPont**	**Co-Chairs:** **Lisa Long** **Carlos Barrera**	**Co-Chairs:** **Sunil D. Lakhiani** **Julie Bell**
10:30 AM	Hydrogen Ignitions – Wildly Differing Opinions, and Reasons Why Everyone Could Be Right *Michael Moosemiller*	Too Close for Comfort – Part 2 *Mike Broadribb*	Improving Recognition of Change *Donald K. Lorenzo*	Panelists include: *Michael L. Marshall*, OSHA *John W. Herber*, Process Hazard *Management Services*, LLC.	The Management of Human Factors in UK Major Hazard Sites: Drawing on the UK Regulatory Perspective *(Julie Bell)*
11:00 AM	Dispersion of Heavy Gases - Experimental Results and Numerical Simulations *Christian Rauchegger*	Root Causes and Causal Factors: Effective Incident Investigation Closure *Carlos A. Barrera*	The PHA-MOC Interaction – Getting the Best out of Both Processes *Rainer Hoff*		Task-Based Approach to Addressing Human Performance in Design *(C. Parker, M. Gandhi)*
11:30 AM	Applicability of Currently Available Flare Radiation Models for Hydrogen and Syngas *Derek Miller*	Performing Data Analysis of a Company's Global Process Safety Events *Kelly Keim*	Using Metrics to Make Improvements in Management of Change Systems *Mason Martin*		Operator Errors and What Can be Done to Minimize ***Dustin Beebe***
12:00 PM	**Luncheon with Speaker: Dr. Bea Ponnudurai, Head of Group HSE Division, PETRONAS** Presentation Title: Process Safety Implementation - Challenges and Success Stories Location: Grand Ballrooms C/D				

	48th Annual Loss Prevention Symposium (LPS)	29th Center for Chemical Process Safety International Conference (CCPS)	16th Process Plant Safety Symposium (PPSS)	3rd Process Safety Management Mentoring (PSM^2) Forum	Process Safety Spotlights
	Risk Assessment and Analysis/Consequence Modeling II	***Using Leading Indicators As a Recipe For Success***	***Applying LOPA in Practice***	***PSM: The Academia - Career Connection***	***Understanding, Measuring and Optimizing Human Performance at All Levels of the Organization II***
	Location: Grand Salons 8/9/11/12	Location: Grand Ballroom A	Location: Grand Ballroom B	Location: Grand Salons 7/10	Location: Grand Salons 1-6
	Co-Chairs: **Kathleen Kas** **Ronald Willey**	**Co-Chairs:** **Sara Saxena** **Stacey Moore**	**Co-Chairs:** **John Murphy** **Chad Schaffer**	**Co-Chairs:** **Brian Dickson** **Stephanie Loveland**	**Co-Chairs:** **Sunil D. Lakhiani** **Julie Bell**
1:30 PM	Simplified Methods Of Using Probit Analysis In Consequence Modeling *Michael D. James*	Application of Leading and Lagging Indicators to Improve Situation Analysis *Tianxing Cai*	Overcoming Challenges In Using Layers of Protection Analysis (LOPA) To Determine Safety Integrity Levels (SILs) *Paul Baybutt*	Process Safety in the Classroom: The Current State of Chemical Engineering Programs at US Universities *Sean J. Dee*	The Art, Science and Psychology of Improving Human Performance Using a New Collaborative Based Learning Model *Richard Boutwell*
2:00 PM	Infiltration Hazards for Building Siting Studies *Jeffrey D. Marx*	Driving Performance Improvement Using Progressive Leading Indicators *Joe Stough*	Lessons Learned from Application of LOPA Throughout the Process Lifecycle *William Bridges*	PSM - Just a Job, or a Calling? *Claire Fluegeman*	Human Performance Improvement Going Beyond Human Factors *Charles A. Soczek*
2:30 PM	Assessment of the Likelihood of Exceeding the Flare Capacity of Multiple LNG Processing Trains *Ricardo Lopez*	Indicators in Safety Management: Cartography of Approaches and Applications *Chabane Mazri*	Leading LOPA Forward: A CCPS Evergreen LOPA Database *Wayne Chastain*	Preparing and Presenting a College Workshop on Process Hazard Analysis *Wayne Buck*	Education, Planning, and Design: Three Key Aspects of a Fatigue Risk Management System *Sarah Acton*
3:00 PM	**Coffee and Networking Break** Location: Hilton Exhibition Center				

	Risk Assessment and Analysis/Consequence Modeling III	*Safety of Intended Chemistries*	*Validation and Maintenance of Independent Protection Layers (IPLs)*	*PSM ^{2} – YPD Panel*	*Understanding, Measuring and Optimizing Human Performance at All Levels of the Organization III*
	Location: Grand Salons 8/9/11/12	Location: Grand Ballroom A	Location: Grand Ballroom B	Location: Grand Salons 7/10	Location: Grand Salons 1-6
	Co-Chairs: **Kathleen Kas** **Ronald Willey**	**Co-Chairs:** **John Wincek** **Seshu Dharmavaram**	**Co-Chairs:** **Kathy Shell** **Shannon Ross**	**Co-Chairs:** **Carlos Barrera** **Lisa Long**	**Co-Chairs:** **Sunil D. Lakhiani** **Julie Bell**
3:30 PM	Properly Calculate Vessel and Piping Wall Temperatures during Depressuring and Relief *Georges Melhem*	Assessing Thermal Stability – the Challenge of Powders *Stephen Rowe*	Are You Being Honest with Yourself Regarding IPL Integrity? *Andrew Madewell*	Panelists include: *Cheryl Grounds* , BP *Henry Febo*, FM Global *Lisa Long*, OSHA *Bob Benedetti*, NFPA *Americo Diniz Carvalho Neto*, Braskem	Transforming Near-Miss Experience into Global Risk Reduction & Accident Prevention Training Techniques *Sunil D. Lakhiani*
4:00 PM	Thermodynamic Release Scenario Modeling and Air Dispersion Modeling for Incident Prevention, Mitigation and Emergency Response Planning at an Acrolein Storage and Transfer Facility *Riffat Qadir*	Intrinsic Hazards Assessment: Chemical Reactivity Hazards Assessment for Nitration Processes and Nitrochemicals Handling *R. W. Trebilcock*	IPL/CMS- Integrity Management of Non-SIS Independent Protection Layers After the LOPA *Ronald Nichols*		Multiple Perspectives on the Role of Safety Leadership in Major Hazard Organisations *Julie Bell*
4:30 PM	Venting Flammable Gas to a "Safe Area": An Objective Review of Best Practices and Guidelines *Delmar "Trey" Morrison*	Safe Scale-Up of Advanced Battery Materials *G. K. Krumdick, K.Pipek*	Auditing IPLs -- Using Safety Critical Functions Manuals Michael S. Schmidt		A New Method for Safety Culture Evaluation in Process Systems *Paulo V. R. Carvalho*
5:00 PM	**GCPS Electronic and Paper Poster Session and Cocktail Reception** **Co-Chairs: Nicholas N. Cristea, Joyce M. Becker, Jennifer Mize, Beth Lutostansky, Joan M. Schork** Location: Grand Salons 19-24				

TUESDAY, APRIL 1						
	48th Annual Loss Prevention Symposium (LPS)	29th Center for Chemical Process Safety International Conference (CCPS)	16th Process Plant Safety Symposium (PPSS)	3rd Process Safety Management Mentoring (PSM^2) Forum	Process Safety Spotlights	
	Advanced Prevention and Mitigation Techniques I	***Process Safety in Action***	***Innovations and Best Practices in Process Risk Management I***	***Soft Skills in Process Safety***	***Light Tight Oil and Shale Gas Rapid Growth and Development (Co-programmed by Spring Meeting and GCPS)***	***Chinese Session I***
	Location: Grand Salons 8/9/11/12	Location: Grand Ballroom A	Location: Grand Ballroom B	Location: Grand Salons 7/10	Location: Grand Salons 1-6	Location: Grand Salon 16
	Co-Chairs: **Erdem Ural** **Robert Johnson**	**Co-Chairs:** **Jerry Forest** **Russell A. Ogle**	**Co-Chairs:** **Philip M. Myers** **Nico Versloot**	**Co-Chairs:** **Ruifeng "Ray" Qi** **Sarah Ware**	**Co-Chairs:** **Tim Olsen** **Jatin Shah**	**Co-Chairs:** **Zhao Dongfeng** **Liu Yi**
8:00 AM	Chemical Explosion Isolation for Small Contained Vessels *Jérôme Taveau*	The Illusion of Attention: Are There Gorillas in Your Plant? *Elliot Wolf*	Real-Time Risk Assessment and Decision Support *Andy Bolsover*	How to Influence the Organization *John Wincek*	Panelists include: *Lawrence Kremer*, Baker Hughes *Robert Loughney*, Blue Marble Risk *Brian Kelly*, CCPS *Kai Midboe*, McGlinchey Stafford	The Assessment of 'Vulnerability-Capability' in Oil Transportation: Application to an Oil Pipeline *Dongfeng Zhao*
8:30 AM	Advantages of Constant Flowrate Depressuring *Sanjay Ganjam*	How are We Doing? Project 247 – Merging PSM Metrics and Management Systems *Bruce Vaugh*	The Role of Sequential Automation in Improving Process Safety *David Huffman*	How is Your Process Safety Vision *Steve Arendt*		Professional Accident Emergency System of CNPC and Its Operation *Shengli Chu*
9:00 AM	Lightning Warning Techniques for Risk Mitigation *Mitchell Guthrie*	Where are We Going? Vision 2020 Jack McCavit	Enabling Better Day to Day Process Safety Decision Making by Linking Asset Integrity Risk and Work Risk *Mike Neill*	Blah, Blah, Blah!!! - Effective Individual and Team Communication Lead to Effective PHAs *John T. Perez*		Research on Risk Analysis and Control Measures of Oil Sands Bitumen Processing *Yuming Zhu*
9:30 AM	**Coffee and Networking Break** Location: Hilton Exhibition Center					

	Advanced Prevention and Mitigation Techniques II	*Improving Facility Siting Management*	*Innovations and Best Practices in Process Risk Management II*	*Guidelines for Successful PSM Implementation*	*Process Safety in the Upstream Industry I*	*Chinese Session II*
	Location: Grand Salons 8/9/11/12	Location: Grand Ballroom A	Location: Grand Ballroom B	Location: Grand Salons 7/10	Location: Grand Salons 1-6	Location: Grand Salon 16
	Co-Chairs: **Erdem Ural** **Robert Johnson**	**Co-Chairs:** **Don Connolley** **Martin Timm**	**Co-Chairs:** **Philip M. Myers** **Nico Versloot**	**Co-Chairs:** **David J. Kamrath** **Luke Richardson**	**Co-Chairs:** **Tracy Whipple** **Brian Kelly** **Ignacio Jose Alonso**	**Co-Chairs:** **Zhao Dongfeng** **Liu Yi**
10:15 AM	Using Dynamic Analysis for Accurate Assessment of Pressure Relief and Blowdown System Performance *James Marriott*	Using Quantitative Risk Assessment to make Billion Dollar Decisions *Jim Salter*	Improving Plant Safety – An Operator Centric View on Process Safety *Gregor Fernholz*	Process Safety Performance Management – a Strategic Approach for Sustainable Improvement *Steve Arendt*	Piper Alpha 25 Years – Progress and Challenges Remaining for the Offshore Industry *Robin Pitblado*	Investigation About Three Fire and Explosion Accidents of a Foaming Agent Production Enterprises *Sining Chen*
10:45 AM	Selection of Pressure Protection Disposal Systems for Atmospheric Discharges *Abdul Aldeeb*	Facility Siting Rule Set for the TNO -Multi-Energy Model for Congested Volumes (PES) and Severity Levels *Kelly Thomas*	Design Options for Overfill Protection for Aboveground Atmospheric Tanks – Best Practices *Satyajit Verma*	Systematic Analysis and Learning from Process Safety Incidents *Stephen James*	BP's Process Safety Journey: Enhancing Risk Management in Global Upstream Operations *Steven Flynn*	Safety Research on Methanol-to-Olefins Process *Fan Zhang*
11:15 AM	Risk-Based Fault Detection and Diagnosis *Omid Zadakbar*	Examining the Use of Blast Resistant Modules (BRMs) Within API 753 Zones 1 and 2 *David Skelton*	Process Modelling Requirements for the Safe Design of Blowdown Systems – Changes to Industry Guidelines and How This Impacts Current Practice *James Marriott*	"All in" Means "All the Time" *Jennifer Mize*	Development and Application of Spacing Chart for Simultaneous Operations (SIMOPs) in Unconventional Shale Gas Fields *Peng Lian*	Comprehensive Evaluation of Safety Level on Tank Farm *Dongfeng Zhao*
11:45 AM	**Luncheon with Speaker: Luke Kissam, President and Director of Albemarle** Presentation Title: Creating a Safety Culture Location: Grand Ballrooms C/D					

	Combustible Dust Hazards I	*Enterprise Risk Assessment / Management*	*Process Hazard Analysis: New and Innovative Approaches*	*PSM in Practice I*	*Process Safety in the Upstream Industry II*	*Spanish-Panel Discussion*
	Location: Grand Salons 8/9/11/12	Location: Grand Ballroom A	Location: Grand Ballroom B	Location: Grand Salons 7/10	Location: Grand Salons 1-6	Location: Grand Salon 16
	Co-Chairs: Walt Frank Jérôme Taveau	Co-Chairs: Andrew Goddard Brad Newman	Co-Chairs: Christy Blanchard Andrew P. Hart	Co-Chairs: Brenton L. Cox Mervyn Carneiro	Co-Chairs: Tracy Whipple Brian Kelly Ignacio Jose Alonso	Co-Chairs: Laura Turci Nestor Sposito
1:30 PM	Unknown Aspects of Metal Dust Explosions *Kees Van Wingerden*	Integrating Corporate Safety Culture and Process Safety after merger – a Personal Perspective *Sabine Knedik*	PHA Analysis of Loss of Containment Events Involving Fixed Assets *Russ Davis*	Typical Elements of Process Safety Management *Flavio L B Diniz*	Well, Well! Are We Drilling in the Right Direction? Mike *Broadribb*	*Clara Ines Arbelaez* *Ecopetrol* *Luis Guillermo Alzate* *Equion Energia* *Gustavo Correa* *YPF*
2:00 PM	ASTM E2931: A New Standard for the Limiting Oxygen Concentrations of Combustible Dusts *Ashok Dastidar*	Managing Operational Risk in an Enterprise Risk Management Framework *Jean Bruney*	Requirements For Improved PHA Methods: Addressing Weaknesses In HAZOP and Other Traditional PHA Methods *Paul Baybutt*	Safety Leadership & Implementation Independent of Culture *Kumar (Chris) Israni*	Implementation of Process Safety Metrics in Wells and Drilling Activities at Petrobras *Felipe Carvalho*	
2:30 PM	A Correlation for the Lower Flammability Limit of Hybrid Mixtures *Jiaojun Jiang*	One Company's Approach on Relative Ranking of Portfolio of Process Safety Risk *Derek Miller*	Driving Consistency in the Estimation of Severity Levels in PHA Studies *Marc Guindon*	The Legal Requirements of The PSM Standard: Finding Your Way *Michael T. Taylor*	Are We Really Learning from Major Accidents in Drilling Operations? *Claudio Castaneda*	
3:00 PM	**Coffee and Networking Break** Location: Hilton Exhibition Center					

	Combustible Dust Hazards II	*Risk Assessment Methodologies: Revalidation and Improvement*	*Process Safety Culture*	*PSM Elements Overview: The Three M's: MOC, MI, and Metrics*	*Process Safety in the Upstream Industry III*	*Portuguese Session*
	Location: Grand Salons 8/9/11/12	Location: Grand Ballroom A	Location: Grand Ballroom B	Location: Grand Salons 7/10	Location: Grand Salons 1-6	Location: Grand Salon 16
	Co-Chairs: **Walt Frank** **Jérôme Taveau**	**Co-Chairs:** **John Champion** **Wayne Chastain**	**Co-Chairs:** **Russ Davis** **Luke Kittmer**	**Co-Chairs:** **Jason F. White** **Gustavo Correa**	**Co-Chairs:** **Tracy Whipple** **Brian Kelly** **Ignacio Jose Alonso**	**Co-Chairs:** **Americo Diniz Carvalho Neto** **Antonio Ribeiro**
3:30 PM	Prescriptive Versus Performance Based Mitigation of Combustible Dust Hazards *Alfonso Ibarreta*	A Prudent Approach to Revalidating Process Hazard Analysis *Sandipan Laskar*	Searching for the Variables and Modifiers to Safety Climate and Safety Culture *Fred Infortunio*	Keys to Avoid Making a Dog's Breakfast out of Your MOC System *Revonda Tew*	Tangible Benefits Derived From the Application of the HAZOP Methodology for Process Safety Risk Assessments of MODUs and Land Drilling Units *David A. Jones*	Modeling Oil Spill Defense System Using Functional Resonance Analysis Method *Paulo V. R. Carvalho*
4:00 PM	Lessons Learned and Efficiencies Developed in Conducting Dust PHAs *David Campbell*	Risk Assessment Challenges to 20:20 Vision *Angela E. Summers*	*Benchmarking Safety Culture in Major Hazards Industries in the Rotterdam Area* *Gerard I.J.M. Zwetsloot*	Mechanical Integrity 101 for Process Safety Professionals *Robert C. Smith*	The Regulation of Offshore Process Safety *Jerad Denton*	Influence of Wind Direction on Gas Detector Allocation in Offshore Production Unit *Thábata Maciel*
4:30 PM	From Scotch Tape to Body Armor: Combustible Dust Implementation *Monica Stiglich*	Understand the Main Scenarios and Hazard and How its Controls are Being Managed. *Americo Diniz Carvalho Neto*	Process Safety Culture - Making This a Reality *ChoNai Cheung*	Enabling Performance Management – Producing vs. Collecting Metrics Data *Alfonsius Ariawan*	Implementation of Design Best Practices for Upstream Safety and Environmental Management System Program *Sandipan Laskar*	Model to Implement Industrial and Operational Certification Program *Débora Brito dos Santos*

WEDNESDAY, April 2					
	48th Annual Loss Prevention Symposium (LPS)	29th Center for Chemical Process Safety International Conference (CCPS)	16th Process Plant Safety Symposium (PPSS)	3rd Process Safety Management Mentoring (PSM^2) Forum	Process Safety Spotlights
	Fires, Explosions, and Reactive Chemicals I	*Risk Management: Journey of Continuous Improvement*	*Improving Process Safety Performance*	*PSM in Practice II*	*Best of the Best: 10 Years of GCPS Best Papers I*
	Location: Grand Salons 8/9/11/12	Location: Grand Ballroom A	Location: Grand Ballroom B	Location: Grand Salons 7/10	Location: Grand Salons 1-6
	Co-Chairs: Henry Febo Kendall Werts	Co-Chairs: Ryan Hart Jim Klein	Co-Chairs: Colin S. Howat Yuan Lu	Co-Chairs: Ravi Ramaswamy Michael Morris	Co-Chairs: Fred Henselwood Karen Tancredi
8:00 AM	Are Unconfined Hydrogen Vapor Cloud Explosions Credible? *Kelly Thomas*	Update EPA Actions – Chemical Safety and Security Executive Order *Jennings Kim*	Influence of Customers on PSM Programs – Hitting a Moving Target *Hope A. Luebeck*	Compliance: The Necessary Evil *Brian D. Rains*	Overview of Inherently Safer Technology *Dennis Hendershot*
8:30 AM	Flame Propagation Speed of Hydrocarbon Aerosols Generated by Electroscopy *Yan-Ru Lin*	Risk Adverse or Risk Ad Nauseum *John F. Kill*	Process Safety: Are You Managing Your Hazards or Managing Your Activities? *Stephen Gill*	Engaging Senior Management in Process Safety: A Case History *David J. Kamrath*	More Lessons "Re-Learned" from Corrosion Under Insulation *Kenan Stevick*
9:00 AM	Overlooking Hazards in Hazardous Waste: Lessons Learned from Case Studies of Hazardous Waste/Chemical Reactivity Incidents *Brenton L. Cox*	For Want of a Nail, the Kingdom was Lost: Process Safety Management of Gaskets and Flanged Connections. *Jeremy Nelson*	Walk the Line *Jerry J. Forest*	Engaging Employees in Catastrophic Event Prevention *Greg Robinson*	Vinyl Chloride Monomer Explosion *Lisa Long*
9:30 AM	**Coffee and Networking Break** Location: Hilton Exhibition Center				

	Fires, Explosions, and Reactive Chemicals II	*Leadership: Process Safety Culture & Stakeholder Outreach*	*Process Safety Competency*	*PSM Elements Overview: Risk, Safety Information, and Design*	*Best of the Best: 10 Years of GCPS Best Papers II*
	Location: Grand Salons 8/9/11/12	Location: Grand Ballroom A	Location: Grand Ballroom B	Location: Grand Salons 7/10	Location: Grand Salons 1-6
	Co-Chairs: **Henry Febo** **Kendall Werts**	**Co-Chairs:** **Lizabeth Cisneros** **Amanda Chapman**	**Co-Chairs:** **William Bridges** **Lina Saenz**	**Co-Chairs:** **Bruce K. Vaughen** **Faraz Khan**	**Co-Chairs:** **Fred Henselwood** **Karen Tancredi**
10:15 AM	The Fire Case for Pressure Relief: Radiation Exposure Limited by Fuel Supply *Debby Sielegar*	Becoming a Great Process Safety Leader *Greg Robinson*	Is There an Acceptable Level of Competence in Process Safety for a Graduate Chemical Engineer? *Daniel A. Crowl*	Assessing the Correct Risk in a PHA *Jack Chosnek*	Combustible Dust Explosion Venting *Erdem Ural*
10:45 AM	Impact of DDT on FPSO Explosion Risk Assessment *Olav Hansen*	What Should Leaders Be Held Accountable for When It Comes to PSM Performance? *Brian D. Rains*	Competence Requirements for Process Hazard Analysis (PHA) Teams *Paul Baybutt*	Perspectives on RAGAGEP *Lisa Long*	Emergency Response Leadership: Out of the Frying Pan and into the Fire *Pete Lodal*
11:15 AM	Equations for Flammability Parameters, P_{max} and K_G *Daniel A. Crowl*	A Leader's Tactical Approach to Influence Changes in Process Safety Culture *Laura Ankrom*	Process Safety Competency - Effective Approaches to Creating and Judging Competency on Process Safety *Revonda Tew*	Relief Systems Design: Simplifying Assumptions Gone Wrong *Nicholas N. Cristea*	Safety Culture in the CCPS Risk-based Process Safety Model *Walter Frank*
11:45 AM	**Luncheon with Speaker: Jordan Barab, Deputy Assistant Secretary of Labor for Occupational Safety and Health, OSHA** Presentation Title: Executive Order 13650: Improving Chemical Process Safety and Security Location: Grand Ballrooms C/D				

	Case Histories and Lessons Learned – Joint Session
	Location: Grand Ballrooms A/B
	Co-Chairs: Delmar "Trey" Morrison, Samantha Scruggs, and Karen Study
1:30 PM	**Panel - Executive Order** Panelists Includes: *Lisa long,* OSHA *Kim Jennings,* EPA *Scott Breor,* DHS
2:30 PM	**Break**
2:45 PM	What Have We Really Learned? (25 Years After Piper Alpha) *Mike Broadribb*
3:15 PM	Lac Mégantic Accident: What We Learned *Jean Paul Lacoursiere*
3:45 PM	Case Study of the Domino Effect in a Catastrophic Solid Oxidizer Fire *Russell A. Ogle*
4:15 PM	Complex Explosion Development in Mines: Case Study – 2010 Upper Big Branch Mine Explosion *Scott G. Davis*
4:45 PM	**GCPS Concluding Remarks**

附件二、文章摘要(英文)

Dispersion of Heavy Gases - Experimental Results and Numerical Simulations

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Keywords: Heavy Gas Dispersion, Experimental Results, Numerical Simulations, Geometry of Heavy Gas Cloud

Abstract

The hazardous potential of accidental heavy gas releases, especially those involving flammable and toxic gases, is widely known. In order to predict the area in which these gases are in hazardous concentrations, an estimation of the dispersion of these gases must be carried out. While the hazardous area for flammable heavy gases is determined by the lower flammability limit (ca. > 1 vol.%), the release of toxic heavy gases can result in a much larger hazardous area. Toxic gases, even in very low concentrations (ca. < 3000 ppm), have the potential to be highly damaging.

State-of-the-art dispersion models, such as the VDI[1] (The Association of German Engineers) Guideline 3783, can be used to estimate the dispersion of heavy gases. However, VDI 3783 gives no method for the prediction of the height and width of a heavy gas cloud, which are both required for quantitative risk analysis as well as for a possible coupling of a Lagrangian particle model with the VDI 3783 heavy gas dispersion model. Therefore, further calculation methods were used to describe these dimensions and were evaluated against experimental studies of the length, width and height of the heavy and neutral gas field.

Most of the heavy gas dispersion models assume the point of release at ground level. However, in reality many heavy gas releases take place from elevated positions. As part of the experimental investigations, the influence of the source height on the heavy gas dispersion was also examined. It was found that elevating the source leads to a reduction in the length of the heavy gas area at ground level. Once the source reaches a critical height, a heavy gas area at ground level no longer exists and neutral gas dispersion applies. Therefore, for release heights above the critical height, heavy gas dispersion effects can be neglected and the calculation of the heavy gas area according to VDI 3783 part 2 is therefore no longer necessary. A calculation formula for determining the critical source height has been developed and will be introduced.

All of the experimental investigations were carried out at the Test Site Technical Safety of the Federal Institute for Materials Research and Testing (BAM[2]). The numerical simulations of the heavy gas dispersion were carried out using the Models VDI 3783 and AUSTAL2000 [1]. The experimental results and numerical simulations will be presented.

Simplified Methods of Using Probit Analysis in Consequence Analysis

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Keywords: Probit Analysis, dispersion modeling, consequence analysis, risk assessment, dosage, shelter-in-place, temporary haven, evacuation, toxicity, toxic chemical release, toxic load, downwind concentration

Abstract

Ensuring the safety of sheltered personnel during a chemical release is critical. To determine maximum safe sheltering time, a useful tool is the probit function. Probits provide a link between probability of expected response and the total exposure of a population to a specific event.

At chemical facilities, probit analysis can provide an estimate of the percentage of occupants inside of a structure who may have an adverse response to a specific chemical release. Based upon available data, probits can be used to estimate duration of exposure for probability of nuisance-level response, loss of consciousness, or even fatal exposures.

Dispersion modeling tools readily provide data on predicted effects in response to long-term exposure (typically one hour). However, these tools do not define the maximum allowable exposure time for building occupants before loss of consciousness or fatalities are seen. This paper provides methodology for estimating critical exposure duration.

This paper provides methodology on using existing MS Excel formulas in measuring probits and, along with data from dispersion modeling tools, how to arrive at probability of specified response to a toxic release.

While data on probit values for some chemicals is readily available, there is minimal guidance in the open literature on developing estimates of probit constants for compounds where they do not currently exist, or are not published. This paper also presents a methodology for generating probit constant estimates based on existing toxicological data.

Infiltration Hazards for Building Siting Studies

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Keywords: Building Siting, Infiltration, Ingress, Flammable, API RP 752, Risk Analysis

Abstract

Facility siting studies have been a requirement for many years, specifically for facilities that must comply with OSHA's PSM program. Facility siting is frequently interpreted as performing a building siting study which adheres to the guidance given in API RP 752. Many of the siting studies conducted for large facilities over the past few decades have focused on explosion overpressure impacts to occupied buildings, with more simplistic evaluations for fire and toxic gas impacts. Toxic gas impact analyses often only evaluate the potential exposure of a building location, to a specific gas concentration, and do not evaluate the level of infiltration into the building where occupants may be impacted. Infiltration of flammable gases has largely been ignored in most building siting studies. Despite this oversight, this hazard is one which should be addressed when following the guidance found within API RP 752. Through the use of dispersion modeling and infiltration analyses, the hazards associated with flammable or toxic gas infiltration can be incorporated into a building siting study. This paper outlines the process of conducting a building siting study in accordance with API RP 752, with specific emphasis on the consequence analysis for infiltration analyses.

Venting Flammable Gas to a "Safe Area": An Objective Review of Best Practices and Guidelines

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Keywords: Blowdown, purging, venting, flammable gas, pipelines, consequence modeling, dispersion, process hazard analysis.

Abstract

Venting, purging, or blowing down flammable gas-containing piping systems and vessels may pose unintended fire and explosion hazards to personnel. In fact, several high-profile incidents have occurred in recent years highlighting this hazard. Industrial safety standards and guidelines exist as a basis for safely designing venting systems, but can a designer rely solely upon these standards for every situation? Certainly, site-specific constraints can be incorporated into a hazard analysis to understand potential adverse outcomes of a venting process. In this paper we give a brief overview of the existing safety standards applicable to blowdown and gas purging operations of flammable gas-containing systems. In a blowdown, the piping system is relieved of contained fuel gas pressure, typically in order to make the system safe for maintenance or inspection operations. In gas purging, a fuel gas system is freed of air and replaced with fuel gas in order to bring the system into service. We employ consequence modeling software tools to illustrate the influence of relevant system parameters on vapor cloud dispersion and compare the results with respect to the available safety guidelines. Guidance will be presented for the designer to consider when evaluating their specific venting systems.

Determination of the Lower Flammability Limit for Hybrid Mixtures

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Keywords: Dust Explosion, Hybrid Mixtures, Lower Flammability Limit, Le Châtelier's Law, Bartknecht Curve

Abstract

Hybrid mixtures explosions involving dust and gas can cause significant loss of life and property damage. A recent coal mine explosion involving coal dust and methane in the Upper Big Branch Mine, West Virginia, in April 2010, resulted in the loss of 29 miners' lives. Hybrid mixtures are also widely encountered in industries such as paint factories, pharmaceutical industries, or grain elevators. The lower flammability limit (LFL) is a critical parameter when conducting a hazard assessment or developing mitigation methods for processes involving hybrid mixtures. Unlike unitary dust or gas explosions, which have been widely studied in past decades, only minimal research focuses on hybrid mixtures, and data concerning hybrid mixtures can rarely be found. Although methods to predict the LFL have been developed by using either Le Châtelier's Law, which was initially proposed for homogeneous gas mixtures, or the Bartknecht curve, which was adopted for only certain hybrid mixtures, significant deviations still remain. A more accurate correlation to predict the LFL for a hybrid mixture is necessary for risk assessment. This work focuses on the study of hybrid mixtures explosions in a 36L dust explosion apparatus using a mixture of methane/cornstarch in air. By utilizing basic characteristics of unitary dust or gas explosions, a new formula is proposed to improve the prediction of the LFL of the mixture. The new formula is consistent with Le Châtelier's Law or the Bartknecht curve.

Overview of Inherently Safer Technology

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Keywords: Inherently Safer Design, Inherently Safer Technology, Process Safety, Process De-sign

Abstract

Inherently Safer Design (ISD) is a holistic approach to making the development, manufacturing, and use of chemicals safer. Over time, there have been many developments on the concept of inherent safety; however, currently there is a growing fixation on only one element of ISD: sub-stitution. This paper will present an overview of ISD and its elements of minimize, substitute, moderate, and simplify. In addition, the life cycle of a process will be explained in context of ISD to further explain the most effective use of ISD as well as other risk mitigation methods and strategies.

More Lessons "Re-Learned" from Corrosion Under Insulation

Tim Overton, The Dow Chemical Company

Abstract

Mechanical Integrity programs have been an essential element of process safety programs in the chemical and petroleum industries for decades. This is an area where considerable materials have been published regarding industry best practices for inspection and maintenance – including excellent advice on inspection for "corrosion under insulation". However, The Dow Chemical Company experienced a significant near miss event at one facility recently caused by lapses in understanding by local personnel of corrosion under insulation, as well as inadequate leveraging of learnings from plants of similar design. This paper explains the circumstances behind this event and the key lessons Dow learned to help other companies avoid similar occurrences.

Vinyl Chloride Monomer Explosion

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Abstract

On April 23, 2004, an explosion and fire at the Formosa Plastics Corporation, Illiopolis, Illinois (Formosa-IL) polyvinyl chloride (PVC) manufacturing facility killed five and severely injured three workers. The explosion and fire destroyed most of the reactor facility and adjacent warehouse and ignited PVC resins stored in the warehouse. The plume of smoke from the smoldering fire drifted over the community and resulted in an evacuation that lasted 48 hours. The facility has been closed down since the incident and no actions to rebuild have been taken.

Vinyl chloride (VCM), a highly flammable chemical and known carcinogen, and the major component in the facility's manufacturing process, was the primary fuel for the initial fire and explosion. Formosa-IL used VCM to manufacture a variety of PVC resins in twenty-four heated and pressurized reactors. Formosa-IL, a wholly owned subsidiary of Formosa Plastics Corporation, USA (FPC USA), purchased the Illiopolis facility from Borden Chemical and operated it for approximately two years before the incident.

This paper will include discussion of the incident's root and contributing causes, and CSB recommendations to prevent recurrence.