

16th Process Plant Safety Symposium 2014

(PPSS)

**Topical Conference at the 2014 AIChE Spring Meeting and 10th
Global Congress on Process Safety**

**New Orleans, Louisiana, USA
30 March - 3 April 2014**

ISBN: 978-1-63439-158-0

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© (2014) by AIChE
All rights reserved.

Printed by Curran Associates, Inc. (2014)

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

AIChE
3 Park Avenue
New York, NY 10016-5991

Phone: (203) 702-7660
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: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

| | |
|---|-----|
| (1A) POSSIBLE VS. PRACTICAL: ENGINEERS MUST LEAD THE DEVELOPMENT OF PRACTICAL TECHNOLOGIES | 1 |
| <i>William Banholzer</i> | |
| (10A) IMPROVING RECOGNITION OF CHANGE | 2 |
| <i>Donald K. Lorenzo, Della Wong, Mark Suyama</i> | |
| (10B) THE PHA-MOC INTERACTION – GETTING THE BEST OUT OF BOTH PROCESSES | 13 |
| <i>Rainer Hoff, Paul Gathright</i> | |
| (10C) USING METRICS TO MAKE IMPROVEMENTS IN MANAGEMENT OF CHANGE SYSTEMS | 25 |
| <i>Mason Martin</i> | |
| (16A) OVERCOMING CHALLENGES IN USING LAYERS OF PROTECTION ANALYSIS (LOPA) TO DETERMINE SAFETY INTEGRITY LEVELS (SILS) | 51 |
| <i>Paul Baybutt</i> | |
| (16B) LESSONS LEARNED FROM APPLICATION OF LOPA THROUGHOUT THE PROCESS LIFECYCLE | 73 |
| <i>William Bridges</i> | |
| (16C) LEADING LOPA FORWARD: A CCPS EVERGREEN LOPA DATABASE | 93 |
| <i>J. Wayne Chastain, John F. Murphy</i> | |
| (46AD) ARE YOU BEING HONEST WITH YOURSELF REGARDING IPL INTEGRITY? | 105 |
| <i>Andrew Madewell</i> | |
| (43B) IPL/CMS- INTEGRITY MANAGEMENT OF NON-SIS INDEPENDENT PROTECTION LAYERS AFTER THE LOPA | 115 |
| <i>Ronald Nichols</i> | |
| (43C) AUDITING IPLS -- USING SAFETY CRITICAL FUNCTIONS MANUALS | 133 |
| <i>Alex Sellers, Michael S. Schmidt</i> | |
| (46AA) HOW TO BETTER MANAGE THE COMBINED EFFECTS OF BARRIER (IPL) IMPAIRMENT AND ONGOING WORK HAZARD RISKS | 151 |
| <i>Mike Neill</i> | |
| (46AE) COMPARATIVE CONSEQUENCE ANALYSIS BETWEEN LNG IMPORT AND EXPORT TERMINALS THROUGH THE USE OF PHAST AND GIS | 153 |
| <i>Guido Lamus, Bilkis Islam, Sonny Sachdeva, M. Sam Mannan</i> | |
| (46AH) CHALLENGES OF EXPLOSION RISK MANAGEMENT IN ARTIC ENVIRONMENTS | 155 |
| <i>Derek M. Engel, Are Brattetrig, Tom Debold, Scott G. Davis</i> | |
| (46B) EXPERIMENTAL STUDY ON THE RELATIONSHIP BETWEEN THE CHARGE AMOUNT OF POLYPROPYLENE GRANULES AND ELECTROSTATIC DISCHARGES WHILE SILO LOADING | 156 |
| <i>Kwangseok Choi</i> | |
| (46E) MANAGEMENT OF CHANGE AT SHELL | 165 |
| <i>Soy Tir</i> | |
| (46F) INHERENTLY SAFER DESIGN: LESSONS LEARNED ABOUT THE PRINCIPLE OF SIMPLIFICATION | 166 |
| <i>Russell A. Ogle., Rew R. Carpenter, Sean J. Dee, Brenton L. Cox</i> | |
| (46G) ON WHAT DO YOU BASE THE SAFETY OF YOUR PROCESS | 174 |
| <i>John Wincek</i> | |
| (46I) THE NEED FOR A UNIFIED PROCESS SAFETY MAP | 185 |
| <i>Teddy Bucher, John T. Perez</i> | |
| (46J) HOW IS YOUR PROCESS SAFETY VISION? - TRY PURSUING “PERFECT PROCESS SAFETY” | 187 |
| <i>Steve Arendt</i> | |
| (46K) USING METRICS TO IMPROVE EMERGENCY MANAGEMENT | 189 |
| <i>Rixio E. Medina</i> | |
| (46L) FLAME PROPAGATION IN DUST/AIR MIXTURES UNDER REDUCED PRESSURE CONDITIONS | 191 |
| <i>Hannes Kern, Gerald J. Wieser, Harald Raupenstrauch</i> | |
| (46N) USING INCIDENT RISK ANALYSIS TO LEARN FROM NEAR MISSES | 201 |
| <i>Sharon K. Tinker</i> | |

| | |
|---|-----|
| (46R) USE OF KPI'S FOR PROCESS SAFETY | 213 |
| <i>Prasad Goteti</i> | |
| (46S) PSSR: THE EASIEST AND SOMETIMES FORGOTTEN PSM ELEMENT | 215 |
| <i>Brian D. Rains</i> | |
| (46U) KINETIC IDENTIFICATION AND RISK ASSESSMENT BASED ON NON-LINEAR FITTING OF CALORIMETRIC DATA | 216 |
| <i>Charles Guinand, Michal Dabros, Bertrand Roduit, Thierry Meyer, Francis Stoessel</i> | |
| (46X) INTEGRATION OF LEARNED KNOWLEDGE INTO THE TECHNICAL INFORMATION SYSTEM | 231 |
| <i>Craig A. Richardson</i> | |
| (46Y) CONTROL SYSTEMS INTEGRITY REVIEW - SELECTIVE APPLICATION OF CONTROLS SYSTEMS HAZOP (CHAZOP) STUDY | 232 |
| <i>Steven T. Maher, Pe Csp, David Bent, Whye Foong, Senem Weaver, Stephanie Smith</i> | |
| (47BI) PROCESS SAFETY CULTURE BEST PRACTICES | 234 |
| <i>Laurence Pearlman</i> | |
| (47F) ARE WE IN CONTROL OF OUR SAFETY CRITICAL EQUIPMENT IN DRILLING OPERATIONS? | 235 |
| <i>Claudio Castaneda, Luis Rincon</i> | |
| (49B)DEVELOPMENT OF LOW-CHARRING NANOCOMPOSITES TO AID IN FUNDAMENTAL UNDERSTANDING OF NANOCOMPOSITE FLAME-RETARDANCY | 239 |
| <i>Logan Hatanaka, Sonny Sachdeva, Agustin Diaz, Zhengdong Cheng, Qingsheng Wang, M Sam Mannan</i> | |
| (43A) BEST PRACTICES IN IPL INTEGRITY MANAGEMENT - CASE STUDY IN KUWAIT OIL COMPANY | 248 |
| <i>Chandra Seethepalli</i> | |
| (47A) MULTIPLE PERSPECTIVES ON THE ROLE OF SAFETY LEADERSHIP IN MAJOR HAZARD ORGANISATIONS | 250 |
| <i>Julie Bell, Waddah Ghanem, Chrysanthi Lekka</i> | |
| (47AB) USING EXPLICIT FINITE ELEMENT ANALYSIS TO SIMULATE THE DYNAMIC RESPONSE AND PREDICT THE STRUCTURAL DAMAGE ASSOCIATED WITH A REAL-LIFE PROCESS EQUIPMENT FAILURE DUE TO AN INTERNAL DETONATION | 252 |
| <i>Phillip E. Prueter</i> | |
| (47AC) ANALYSIS OF THE POTENTIAL ENERGY SOURCES OF RISK OF TOOLS IN PRESENCE OF HAZARDOUS AREA IN SEGMENT OF OIL AND GAS | 266 |
| <i>Leandro Erthal, Caetano Moraes, Denize D. Carvalho</i> | |
| (47AD) INCREASE HAZARD DISCOVERY AND MINIMIZE ERRORS IN YOUR PROCESS HAZARD ANALYSES, A GRAPH THEORETICAL APPROACH | 282 |
| <i>Riffat Qadir</i> | |
| (47AF) DEFLAGRATION INCIDENT CASE REVIEW | 300 |
| <i>Amy Theis, Timothy Cullina, Zachary Hachmeister</i> | |
| (47AG) ENHANCED LESSONS LEARNED APPROACH FROM THE BSCAT INVESTIGATION APPROACH | 301 |
| <i>Robin Pitblado, Richard Green, Kate Ascher</i> | |
| (47AH) DEATH OF "LANDLORD" OR COLLAPSE OF "TOMB", WHICH MATTERS MORE? - SOME PERSPECTIVES OF ENGINEERING ETHICS AND ENGINEERING PHILOSOPHY ON ENTERPRISE GLOBAL RISK MANAGEMENT | 303 |
| <i>Long Zhang</i> | |
| (47AJ) NEW TOOLS TO AGGREGATE OPERATIONAL RISK ACROSS AN ENTERPRISE OF ASSETS AND TO HELP GOVERN THIS RISK THROUGH POLICY WHICH CAN BE DIRECTLY LINKED TO FRONT LINE DECISION MAKING | 305 |
| <i>Mike Neill</i> | |
| (47AL) INHERENTLY SAFER DESIGN OF STIRRED REACTORS AND VISIMIX® MODELING SOFTWARE | 307 |
| <i>Yuri Nekhamkin, Leonid Braginsky, Yuri Kokotov</i> | |
| (47AM) AN EASY AND ACCURATE DESIGN OF SAFETY RELIEF VALVE INLET PIPING SYSTEMS FOR GAS/VAPOR RELIEF | 320 |
| <i>Guibing Zhao</i> | |
| (47AO) OFF-GAS FLAMMABILITY CONTROL FOR A HIGH LEVEL NUCLEAR WASTE GLASS MELTER SYSTEM BASED ON PROCESS MODELING AND PILOT TESTING | 334 |
| <i>Alexander S. Choi</i> | |
| (47AP) ADVANCING PROCESS SAFETY - MAJOR IMPACT "ONE "STEP AT A TIME" | 336 |
| <i>Alexander S. Choi, Keith Lapeyrouse, Sam Solomon</i> | |

| | |
|---|-----|
| (47AS) “REDUCING THE FREQUENCY AND LOWERING THE SEVERITY OF HUMAN ERROR: OPTIMIZE PERFORMANCE” | 355 |
| <i>Tom Harvey</i> | |
| (47AU) MANAGEMENT OF PROCESS SAFETY PERFORMANCE INDICATORS | 357 |
| <i>Abdul Aldeeb, Vivek Sud</i> | |
| (47AV) IMPROVING PROCESS SAFETY PERFORMANCE FOR MATURE ASSET BY IMPLEMENTING OF THE PROCESS SAFETY KEY PERFORMANCE INDICATOR | 358 |
| <i>Margaretha Thaliharjanti, Frik Febby</i> | |
| (47AW) AN INNOVATIVE WORK FLOW FOR PERFORMING OVERPRESSURE PROTECTION ANALYSIS INCORPORATING PROCESS SIMULATION, PRESSURE RELIEF VALVE SIZING, AND FLARE SYSTEM ANALYSIS | 360 |
| <i>Wilfried Mofor, Nick Brownrigg</i> | |
| (47AX) RISK BASED INSPECTION APPLIED AT AGING CHEMICAL FACILITIES | 362 |
| <i>Jonas Duarte</i> | |
| (47AZ) IDENTIFYING EARLY INDICATORS OF INCIDENTS THROUGH NEAR-MISSES | 363 |
| <i>Deborah L. Grubbe, Ankur Pariyani, Ulku Oktem</i> | |
| (47B) A METHODOLOGY TO DETERMINE THE MINIMUM NUMBER OF PHA'S FOR PROJECTS | 364 |
| <i>Humbert Joseph Howard III</i> | |
| (47BA) "PEOPLE" MEANS LEADERSHIP, NOT SIMPLY MEAN PEOPLE - 4 NEW DIMENSIONS OF PROCESS SAFETY COMPETENCY | 373 |
| <i>Long Zhang</i> | |
| (47BC) EVALUATING THE NEED FOR DEPRESSURING SYSTEMS - A METHODOLOGY | 391 |
| <i>Neil Prophet, Dave Gaydos, John Paschall</i> | |
| (47BD) THE CAPABILITY-DEMAND GAP IN US REFINING AND PETROCHEMICAL CONSOLE OPERATIONS | 392 |
| <i>George Dzyacky</i> | |
| (47BE) PROCESS SAFETY MANAGEMENT (PSM) IN PILOT PLANTS AND RESEARCH LABORATORIES | 396 |
| <i>Kabier Moideenkutty</i> | |
| (47BF) RESOLVING INHERENTLY SAFER DESIGN CONFLICTS WITH DECISION ANALYSIS | 398 |
| <i>Russell A. Ogle, Sean J. Dee, Brenton L. Cox</i> | |
| (47BJ) OPERATING SAFELY THROUGH INTEGRATED PROCESS SAFETY MANAGEMENT | 399 |
| <i>Alfonsius Ariawan</i> | |
| (47BK) IMPROVING PSM PERFORMANCE THROUGH WORKFORCE CULTURE ASSESSMENT | 404 |
| <i>Carl Green</i> | |
| (47BL) TRACKING INSTRUMENTATION AND CONTROLS RELIABILITY | 406 |
| <i>Shane Pirtle, Brant Smith, Ad Arnold, Angela E. Summers</i> | |
| (47BM) MEASURING OPERATIONAL DISCIPLINE: IS IT POSSIBLE? | 407 |
| <i>Brian D. Rains</i> | |
| (47BN) GUIDELINES FOR PRESSURE RELIEF AND EFFLUENT HANDLING SYSTEMS, 2ND EDITION | 419 |
| <i>Georges Melhem, Harold Fisher, Albert Ness</i> | |
| (47BO) JOURNEY TO WORLD CLASS THROUGH CAPABILITY DEVELOPMENT | 420 |
| <i>Lawrence S. Short</i> | |
| (47BP) INCIDENT LESSONS LEARNED PORTAL | 421 |
| <i>Marco Vela</i> | |
| (47BQ) A FUNCTIONAL SYSTEM APPROACH TO CRITICALITY ANALYSIS, FSCA | 423 |
| <i>Tacoma Zach</i> | |
| (47BR) CAN BLACK SWANS BE RED HERRINGS? | 426 |
| <i>Stephen Shaw</i> | |
| (47BS) EMERGENCY RESPONSE PLAN: IT'S ABOVE AND BEYOND BEST PRACTICES | 428 |
| <i>Sarah Acton, Najmeh Vaez, Suresh Yelisetty, Dennis Butts</i> | |
| (47BT) PROCESS SAFETY HAZARD MANAGEMENT PLAN : HELP YOU IN SUSTAINING PRODUCTION AND PREVENTING LOSSES | 429 |
| <i>Margaretha Thaliharjanti</i> | |
| (47BW) PROCESS RISK ASSESSMENT AND “SAFE AREA” FOR A PETRO-CHEMICAL PLANT IN CHINA | 431 |
| <i>Jing Yu, S. Dharmavaram, Jiming Wang</i> | |

| | |
|---|-----|
| (47BX) IDENTIFYING AND QUANTIFYING MAJOR HAZARD FOR PLATFORMS DECK RAISING USING SYNCHRONOUS HYDRAULIC JACKING SYSTEM | 433 |
| <i>Akhmad Harmantoro, Margaretha Thaliharjanti</i> | |
| (47BY) A CREATIVE & STRATEGIC INITIATIVE (CHAMPIONS MODEL) IN MANAGING PROCESS HAZARD: PROCESS SAFETY CULTURE | 447 |
| <i>Sharad Rathore</i> | |
| (47C) DEFINING DUST HAZARD AREAS | 449 |
| <i>Michelle Murphy</i> | |
| (47CA) CHALLENGES AND ACHIEVEMENTS IN IMPLEMENTING MANAGEMENT OF CHANGE SYSTEM AT BINH SON REFINERY (BSR), VIETNAM | 450 |
| <i>Bong Nguyen Thanh</i> | |
| (47CD) PROCESS SAFETY CULTURE APPLIED IN LATIN AMERICA OIL AND GAS INDUSTRY: EXPERIENCES IN ECOPETROL COLOMBIA | 457 |
| <i>Oscar Barajas</i> | |
| (47CF) AMMONIUM NITRATE CONDITION-DEPENDENT THERMAL DECOMPOSITION | 458 |
| <i>Zhe Han, Sonny Sachdeva, Maria Papadaki, M. Sam Mannan</i> | |
| (47CG) CFD MODELING FOR PREDICTION AND PREVENTION OF RUNAWAY REACTION | 459 |
| <i>Edna Méndez, Yi Liu, M. Sam Mannan</i> | |
| (47CH) SENSITIVITY ANALYSIS OF VARIABLES AFFECTING THE RUNAWAY DECOMPOSITION OF DICUMYL PEROXIDE | 461 |
| <i>Olga Reyes-Valdes, Valeria Casson-Moreno, Luc Vechot</i> | |
| (47CI) BEYOND PHI FACTOR: QUALIFIED EXPERIMENTAL DATA FOR EMERGENCY RELIEF SIZING | 463 |
| <i>Guibing Zhao</i> | |
| (47CJ) THE EFFECT OF NON-UNIFORM DISTRIBUTION OF OBSTACLES ON DEFLAGRATION-TO-DETONATION TRANSITION (DDT) | 477 |
| <i>Camilo Rosas, Hao Chen, Eric L. Petersen, M. Sam Mannan</i> | |
| (47CK) DISPERSION MODELING OF A CLOUD GENERATED BY DEPRESSURIZATION OF A FLASHING MULTI-COMPONENT LIQUID SYSTEM | 479 |
| <i>Laurent Nouailhetas, Ralph Mancik</i> | |
| (47CL) QUANTITATIVE ANALYSIS OF ENVIRONMENTAL AND SOCIETAL RISK FOR ONSHORE FUEL PIPELINES | 492 |
| <i>Alexander Gutierrez, Lina Parra, Maria Camila Suárez, Felipe Muñoz</i> | |
| (47CM) CHARACTERIZATION OF VAPORIZATION RATES OF LIQUID NITROGEN ON WATER AND ICE | 494 |
| <i>Nirupama Gopaldaswami, Luc Vechot, Tomasz Olewski, M. Sam Mannan</i> | |
| (47CN) CONSEQUENCES ANALYSIS ASSOCIATED WITH THE FAILURE OF THE SAFETY INTERLOCK SYSTEM OF METHANATOR (I-351) OF THE AMMONIA PLANT OF FERTILIZANTES NITROGENADOS DE VENEZUELA, C.E.C. (FERTINITRO) | 507 |
| <i>Ruben Garcilazo Sr., Juan Duarte Sr.</i> | |
| (47CQ) BUILDING SITING EVALUATION: A NEW SOFTWARE TOOL FOR THE DETERMINATION OF BLAST LOADS FROM POTENTIAL VAPOUR CLOUD EXPLOSIONS (VCES) | 509 |
| <i>Kehinde Shaba, Nic Cavanagh</i> | |
| (47CR) MODELLING OF TIME-VARYING DISPERSION FROM GROUND-LEVEL LIQUID POOLS OR VAPOUR AREA SOURCES | 511 |
| <i>Henk W. M. Witlox, Mike Harper, Maria Fernandez</i> | |
| (47CU) NANOTECHNOLOGY ON REMOVING ARSENIC USING MODIFIED CARBON NANOTUBES (MCNTS) | 526 |
| <i>Ahmed Ashiq</i> | |
| (47CV) POSSIBLE TWO PHYSICAL HAZARD SCENARIOS FOR POLYSTYRENE FOAMS, BASED ON LIFE CYCLE STAGES | 527 |
| <i>Toyoaki Nakarai, Satoru Yoshino, Atsumi Miyake</i> | |
| (47CW) PROBLEMS ENCOUNTERED IN THE DEVELOPMENT OF A PROCESS SAFETY CLIMATE TOOL | 541 |
| <i>Julie Bell, Sarah Binch, Caroline Sugden</i> | |
| (47D) UPPER EXPLOSIBLE LIMITS FOR COMBUSTIBLE DUSTS | 542 |
| <i>Richard Prugh</i> | |
| (47E) AGGLOMERATION EFFECT ON COMBUSTION AND EXPLOSION PROPERTIES OF NANOPARTICLES | 544 |
| <i>Jiaqi Zhang, Yi Liu, Hao Chen, M. Sam Mannan</i> | |

| | |
|--|------------|
| (47G) SHOCK INTERACTION WITH DUST LAYERS FOR DIFFERENT MACH NUMBERS AND DUST LAYER DEPTHS..... | 557 |
| <i>Amira Yousuf Chowdhury, Brandon Marks, H. Greg Johnston, Eric L. Petersen, Sam M. Mannan</i> | |
| (47H) NUMERICAL SIMULATION OF CRYOGENIC BOILING | 559 |
| <i>Monir Ahammad, Yi Liu, Samina Rahmani, Luc Vechot, Sam Mannan</i> | |
| (47I) HOMOGENOUS-GASEOUS AND PARTICLE-GAS-AIR COMBUSTION IN TURBULENT ENVIRONMENT: ANALYTICAL FORMULATION AND EXPERIMENTAL VALIDATION..... | 561 |
| <i>V'Yacheslav Akkerman, Ali S. Rangwala</i> | |
| (47J) APPLICATION OF LEADING AND LAGGING INDICATORS TO IMPROVE LABORATORY OPERATION SAFETY | 562 |
| <i>Tianxing Cai, Qiang Xu</i> | |
| (47Q) GRAPHIC VISUALIZATION OF IPL STATUS ENABLES BETTER JUDGEMENT OF INSPECTION, MAINTENANCE AND REPAIR PRIORITIES AND HELPS DAY TO DAY ASSESSMENT OF OPERATIONAL RISK AND WORK MANAGEMENT DECISIONS | 564 |
| <i>Mike Neill</i> | |
| (47R) 2. SUCCESSES IN IMPLEMENTING PHA/HAZOP/LOPA IN MAJOR CAPITAL PROJECTS IN A STEEL COMPANY..... | 566 |
| <i>William Bridges</i> | |
| (47S) LIQUID FUELS RELEASE RATE CALCULATION IN TRANSPORT PIPELINES WITH COMPLEX TOPOGRAPHICAL CONDITIONS | 567 |
| <i>Carlos A. Manjarres, Jaime E. Cadena, Felipe Munoz</i> | |
| (47T) DECISION TREE TO OPTIMIZE NFPA 30 CRITERIA IN FIRE PROTECTION SYSTEMS APPLIED IN OIL AND GAS INDUSTRY..... | 569 |
| <i>Oscar Barajas</i> | |
| (47U) SIL DETERMINATION OF HIGH INTEGRITY PRESSURE PROTECTION SYSTEM (HIPPS)..... | 570 |
| <i>Frik Febby, Margaretha Thaliharjanti</i> | |
| (47W) COMPARISON OF DIFFERENT METHODS TO DETERMINE THE ACTIVATION ENERGY OF FLAMMABLE DUSTS MIXED WITH INERT AND INHIBITORY MATERIALS | 572 |
| <i>Christoph Wanke</i> | |
| (47X) ECONOMICAL APPROACH QUANTIFICATION OF IMPACTS IN MAJOR ACCIDENTS..... | 574 |
| <i>Alexander Gutierrez, Carlos A. Manjarres, Felipe Munoz</i> | |
| (47Z) APPLICATION OF CONSEQUENCE ANALYSIS IN THE DEVELOPMENT OF EMERGENCY RESPONSE PLANS FOR ACCIDENTAL EVENTS IN LIQUID FUELS TRANSPORT PIPELINES..... | 576 |
| <i>Carlos A. Manjarres, Alexander Gutierrez, Felipe Munoz</i> | |
| (51A) REAL-TIME RISK ASSESSMENT AND DECISION SUPPORT | 578 |
| <i>Andy Bolsover</i> | |
| (51B) THE ROLE OF SEQUENTIAL AUTOMATION IN IMPROVING PROCESS SAFETY..... | 595 |
| <i>David A Huffman</i> | |
| (51C) ENABLING BETTER DAY TO DAY PROCESS SAFETY RISK DECISION MAKING BY LINKING ASSET INTEGRITY RISK AND WORK MANAGEMENT RISK..... | 603 |
| <i>Mike Neill</i> | |
| (69A) IMPROVING PLANT SAFETY - AN OPERATOR CENTRIC VIEW ON PROCESS SAFETY | 619 |
| <i>Gregor Fernholz, Hans-Rolf Lausch, Ian Willetts</i> | |
| (69B) DESIGN OPTIONS FOR OVERFILL PROTECTION FOR ABOVEGROUND ATMOSPHERIC TANKS – BEST PRACTICES..... | 638 |
| <i>Satyajit Verma, Freeman Self</i> | |
| (69C) PROCESS MODELLING REQUIREMENTS FOR THE SAFE DESIGN OF BLOWDOWN SYSTEMS – CHANGES TO INDUSTRY GUIDELINES AND HOW THIS IMPACTS CURRENT PRACTICE | 656 |
| <i>James Marriott, Praveen Lawrence, Apostolos Giovanoglou</i> | |
| (77A) PHA ANALYSIS OF LOSS OF CONTAINMENT EVENTS INVOLVING FIXED ASSETS..... | 674 |
| <i>F. Russ Davis</i> | |
| (77B) REQUIREMENTS FOR IMPROVED PHA METHODS: ADDRESSING WEAKNESSES IN HAZOP AND OTHER TRADITIONAL PHA METHODS | 684 |
| <i>Paul Baybutt</i> | |
| (77C) DRIVING CONSISTENCY IN THE ESTIMATION OF SEVERITY LEVELS IN PHA STUDIES..... | 715 |
| <i>Marc Guindon, Richard Piette, Chris Wells, Greg R. Knight, Gary A. Fitzgerald</i> | |

| | |
|---|------------|
| (101A) ACCIDENT RATES VS. CULTURE - NATIONAL AND ORGANIZATIONAL CULTURES; SUGGESTED INTERVENTIONS TO MODIFY ORGANIZATIONAL SAFETY CULTURES | 734 |
| <i>Fred Infortunio</i> | |
| (101B) BENCHMARKING SAFETY CULTURE IN MAJOR HAZARDS INDUSTRIES IN THE ROTTERDAM AREA | 755 |
| <i>Gerard I. J. M. Zwetsloot, Robert A. Bezemer</i> | |
| (101C) PROCESS SAFETY CULTURE - MAKING THIS A REALITY | 769 |
| <i>Cho Nai Cheung, William Bridges, Gerald Burch</i> | |
| (110A) INFLUENCE OF CUSTOMERS ON PSM PROGRAMS - HITTING A MOVING TARGET | 786 |
| <i>Hope A. Luebeck</i> | |
| (110B) PROCESS SAFETY: ARE YOU MANAGING YOUR HAZARDS OR MANAGING YOUR ACTIVITIES? | 798 |
| <i>Stephen Gill</i> | |
| (110C) WALK THE LINE | 819 |
| <i>Jerry J. Forest</i> | |
| (132A) IS THERE AN ACCEPTABLE LEVEL OF COMPETENCE IN PROCESS SAFETY FOR A GRADUATE CHEMICAL ENGINEER? | 829 |
| <i>Daniel A. Crowl, Brian Dickson</i> | |
| (132B) COMPETENCE REQUIREMENTS FOR PROCESS HAZARD ANALYSIS (PHA) TEAMS | 846 |
| <i>Paul Baybutt</i> | |
| (132C) PROCESS SAFETY COMPETENCY - EFFECTIVE APPROACHES TO CREATING AND JUDGING COMPETENCY ON PROCESS SAFETY | 871 |
| <i>William Bridges, Gerald Burch, Revonda Tew</i> | |
| (135A) EXECUTIVE ORDER PANEL | 889 |
| <i>Lisa Long, Scott Breor, Kim Jennings</i> | |
| (135B) WHAT HAVE WE REALLY LEARNED? (25 YEARS AFTER PIPER ALPHA)..... | 890 |
| <i>Mike Broadribb</i> | |
| (135C) LAC MÉGANTIC ACCIDENT: WHAT WE LEARNED | 907 |
| <i>Jean-Paul Lacoursiere</i> | |
| (135D) CASE STUDY OF THE DOMINO EFFECT IN A CATASTROPHIC SOLID OXIDIZER FIRE | 935 |
| <i>Russell A. Ogle</i> | |
| (135E) COMPLEX EXPLOSION DEVELOPMENT IN MINES: CASE STUDY - 2010 UPPER BIG BRANCH MINE EXPLOSION..... | 946 |
| <i>Derek M. Engel, Scott G. Davis, Kees Van Wingerden</i> | |
| Author Index | |