

# **26th Ethylene Producers' Conference 2014**

**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: 978-1-63439-061-3**

**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](http://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](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

## TABLE OF CONTENTS

<b>(3a) Getting It Right - Building an Iron-Clad GHG BACT Cost Effectiveness Calculation .....</b>	1
<i>Ron Crum</i>	
<b>(3b) Flameless Combustion Technology for Reduced NOx Emissions in Ethylene Furnaces .....</b>	14
<i>Jonathon Barnes, Rex Isaacs, Seth Marty</i>	
<b>(3c) PM<sub>2.5</sub> Modeling Challenges.....</b>	25
<i>Leslie Fifita</i>	
<b>(3d) Developments in EPA's Ethylene Standard.....</b>	33
<i>Lorraine Gershman</i>	
<b>(6a) From Diagnostics to Predictive Analytics – an Evolution in Total Asset Management .....</b>	38
<i>David Adams, Arun Menon</i>	
<b>(6b) The Effect of Trip Throttle Valve Pressure Loss on Steam Turbine Performance .....</b>	53
<i>Alan Vitalis</i>	
<b>(6c) New Approaches for Turn Around Planning in Petrochemical Plants .....</b>	68
<i>Sam Blaser</i>	
<b>(6d) Turbine Oil Varnish Development in Rotating Equipment .....</b>	79
<i>James Hannon</i>	
<b>(36a) Feedstock Impurities – How to Find Them, If It Is Not Known What They Are? .....</b>	102
<i>Vasily Simanzenkov, Morgan Stante, Tim Giese, Stuart Morrow, Yost Kieboom, Kaisa Nadeau, Steve Christner</i>	
<b>(36b) Avoiding Waterside Corrosion Problems in Ethylene Plant Steam Systems .....</b>	116
<i>James O. Robinson</i>	
<b>(36c) Detail Analysis of Caustic Tower Fouling Mechanism.....</b>	132
<i>Hua Mo, David Dixon</i>	
<b>(36d) Popcorn Polymer Fouling in Light Ends Units.....</b>	144
<i>Debby Rossana, Jessica M. Hancock</i>	
<b>(36e) Inventory and Fate of Chemical Additives to Improve Plant Reliability.....</b>	154
<i>Grace Kim, Morgan Stante</i>	
<b>(37a) The Impact of Elevated SHP Energy Levels on Ethylene Plant SEC and Critical Duty Steam Turbines .....</b>	168
<i>Satoshi Hata, Daniel Jones, Takashi Niityama</i>	
<b>(37b) Turbo Expanders – High Enthalpy Wheel Design .....</b>	186
<i>Gabriele Mariotti, Alberto Scotti Del Greco</i>	
<b>(37c) Design and Implementation of a Reliable and Cost-Effective Surge and Choke Control System on Centrifugal Compressors .....</b>	193
<i>Sterling Schmutz, Krishnan Narayanan</i>	
<b>(37d) API Revisions Update .....</b>	207
<i>Kazim Akhtar, Kevin Kisor</i>	
<b>(55a) Ethylene Furnace Radiant Section Tutorial .....</b>	208
<i>Trobie H. Thompson</i>	
<b>(55b) Ethylene Cracking Heater Decoking Tutorial .....</b>	229
<i>Brian K Sullivan</i>	
<b>(55c) Ethylene Furnace Convection Section Tutorial .....</b>	267
<i>Michael Pelton</i>	
<b>(55d) Ethylene Furnace Steam System Tutorial.....</b>	248
<i>Mark Karrs</i>	
<b>(56a) C2 Splitter Retray and Control Improvement.....</b>	271
<i>Yong Yiu, Timothy M. Zygiela, Stan Ruth</i>	
<b>(56b) Dynamic Simulation for Optimal Operation of Distillation Column Startups in an Ethylene Plant .....</b>	280
<i>Ziyuan Wang, Jian Zhang, Qiang Xu, Thomas C. Ho</i>	
<b>(56c) Optimizing Cracking Furnace Operations with Modular Advanced Control Applications .....</b>	295
<i>James Beall, Patrick Truesdale</i>	
<b>(56d) Optimization Approach for Managing Integrated Petrochemical Business Planning .....</b>	315
<i>Suryo Widjianto, Wisni Rahayu, X Supriyanto, Arturo Cervantes, Bhing Tjoa</i>	
<b>(56e) Plantwide Dynamics and the Integration of Production Scheduling and Supervisory Process Control.....</b>	323
<i>Michael Baldea</i>	

<b>(94a) The Path to New Technology Commercialization .....</b>	339
<i>Dr. Dennis W. McCullough</i>	
<b>(94b) E-FLEX – An Alternative to Increase Propylene to Ethylene Ratio for Liquid Crackers.....</b>	359
<i>Ryuuke Miyazaki, Yoshikazu Takamatsu, Jean-Paul Laugier</i>	
<b>(94c) New Silicon-Carbide Joining Technology.....</b>	375
<i>Frederick Mako, Edward J. Cruz</i>	
<b>(94d) Enhanced Heat Transfer in Radiant Coils by Swirl Flow Tubes.....</b>	406
<i>Marco W. M. Van Goethem, Guotai Zhang, Joel Guillaume</i>	
<b>(94e) Catalytic Coating For Reduced Coke Formation: Experimental and Model Validation .....</b>	422
<i>Kevin M. Van Geem, Patrick Lucas, Larry Kool</i>	
<b>(94f) Safer, More Effective Furnace Coking Control .....</b>	450
<i>Timothy P McGuirk, Mr Ramaswamy, Kyle Mankin</i>	
<b>(95a) Improve Furnace Availability and Control Downtime .....</b>	464
<i>Shailendra Inamdar, Robert Stegemann</i>	
<b>(95b) Repair and Reclamation of Ethylene Plant Equipment.....</b>	508
<i>David Oulton</i>	
<b>(95c) Ethylene Furnace Reliability Engineered Refractory Solutions for Cracking Furnaces .....</b>	526
<i>Malcolm A. Peirson</i>	
<b>(95e) Automatic Operation of Transfer Line and Decoke Valves, Flexibility &amp; Process Safety .....</b>	545
<i>Marcel Schade, Rüdiger Klein</i>	
<b>(95f) Steam Trap Maintenance and Design for Energy Optimization.....</b>	557
<i>Carl Matherne, Neil Davies</i>	
<b>(113a) Köln Ethylene Pipeline and Acrylonitrile Tank Fire .....</b>	574
<i>Christoph Breitkopf</i>	
<b>(113b) Hurricane Ike Recovery - Electrical &amp; Instrument Systems.....</b>	589
<i>Frank Irving</i>	
<b>(113c) Safety Considerations When Entering a Cold Box after an Exchanger Leak .....</b>	627
<i>Rick Swain, Greg Jones</i>	
<b>(113d) Ethylene Decomposition: A Review.....</b>	628
<i>Steve Coleman</i>	
<b>(113e) Pressure Relief Valve Sizing Concerns for Valves in Ethylene, Propylene, and Ethane Service .....</b>	629
<i>John Burgess</i>	
<b>(113f) Prevention of Brittle Fracture Scenarios in Olefins Plants .....</b>	648
<i>Werner A. Verdurnen, Jeff Melching</i>	
<b>(150a) PHA Methodology and Training Practices Addressing Auto-Refrigeration Brittle Fracture Hazards - 25 Years Later .....</b>	665
<i>Craig Thompson, Mike Korst</i>	
<b>(150b) Tutorial on Auto-Refrigeration and Brittle Fracture Analysis (Part 1).....</b>	700
<i>Ralph King</i>	
<b>(150c) Tutorial on Auto-Refrigeration and Brittle Fracture Analysis (Part 2) .....</b>	757
<i>Ralph King</i>	
<b>(152a) Ethylene Plant Operations with Chevron Phillips Chemical Company LP Back End E-Series(R) Catalyst .....</b>	758
<i>Manzoor Khan, Jennifer L. Nill</i>	
<b>(152b) Flare Operation with Low MFR .....</b>	773
<i>Denise Karstensen, Marcus Hatch, Alejandra Garcia</i>	
<b>(152c) Trends in Olefin Plant Reliability-Related Production Loss, 1999-2011 .....</b>	783
<i>Claire Cagnolatti</i>	
<b>(152d) Piping Failure Due to Flow Accelerated Corrosion .....</b>	792
<i>Jason King</i>	
<b>(152e) EZ-Caustic® on-Line Analyzer System for the Control of NaOH Scrubbers in Refining and Olefins (Ethylene) Production Plants.....</b>	800
<i>Chris Du Bois, Wouter Blondeel</i>	
<b>(152f) Benefits from Educated Selection of Advanced Materials for Radiant Coils – A 10 Year Field Performance Review of Alumina Forming Alloys.....</b>	816
<i>Dietlinde Jakobi, Jörg Weigandt</i>	
<b>Author Index</b>	