

Safety & Health News

AIChE
AMERICAN INSTITUTE OF
CHEMICAL ENGINEERS

**SAFETY AND
HEALTH DIVISION**
www.shdiv.aiche.org

SPRING 2009

EMERGENCY MANAGEMENT – ARE YOU READY?

John F. Murphy

Two recent airplane accidents remind us of the importance of emergency management. One incident resulted in no fatalities and the other resulted in everyone on board being killed. The key difference in outcomes can be primarily attributed to emergency management. In one incident the captain took control of the aircraft after a flock of birds was sucked into the engines causing them to shut down and not restart. The captain and crew executed the emergency plan that they had practice numerous times before. The captain looked for a safe area to land the plane. Behind him he could hear the flight attendants calmly giving the passengers instructions on how to prepare for the emergency landing. The plane was landed safely on the Hudson River and everyone on board was rescued. The crew had implemented the emergency plan precisely. The other incident resulted in a crash that killed all aboard, attributed to icing on the wings. Analysis of the wreckage indicated that at the time of the crash, the controls were on auto pilot which is contrary to the emergency plan for weather conditions conducive to icing the wings. Which type of response can you expect from your operating people and emergency responders during an emergency?

Emergency planning has long been recognized as a key element of process safety in the chemical processing industries. Element 18 under the pillar of manage risk in the new CCPS book entitled *Guidelines for Risk Based Process Safety* is Emergency Management. Emergency management includes planning of possible emergencies, providing resources to execute the plan, practicing and continuously improving the plan, training or informing employees, contractors, and neighbors, and local authorities on what to do, how they will be noticed, and how to report an emergency, and effectively communicating with stakeholders in the event that an incident does occur. OSHA Process Safety Management also requires that covered facilities have an emergency plan.

My experience investigating chemical plant incidents as an investigator with the Chemical Safety Board, and on my own as a consultant, has indicated that, in many incidents, emergency management deficiencies are often contributing causes to the incident.

In a recent incident I investigated involving a fuel oil fire in a power generating facility that resulted in a prolonged total power outage, the site fire fighting response capability; including manpower and equipment, was inadequate for the emergency. Reliance on outsiders for assistance resulted in more damage and business interruption than was necessary.

Have you assessed your capability to deal with likely emergencies?

In the same incident there was no clear incident command structure. This may have contributed to the inability to effectively fight the fire.

Do you have a clear incident command structure? Who is in charge when outside help arrives?

Often time's employees are not aware of assembly areas and evacuation routes.

Do you train and drill employees on what to do in the event of emergencies?

In one CSB incident, emergency self contained breathing apparatus was stored adjacent to the source of the toxic release, making the equipment useless in dealing with the release. Because outside assistance was necessary to shut valves, 48,000 pounds of chlorine were released.

Is your emergency response equipment and personal protective equipment accessible in the event of an emergency?

In another CSB incident the fire department supervision and plant management did not communicate effectively during the incident resulting in a prolonged fire. The fire department management did not listen to the plant management concerns regarding the hazards inside the process area and use the information to facilitate the fire fighting.

Do you meet and conduct simulated incidents with your outside responders?

Maybe the chemical processing industries can learn from the nuclear industry on how to effectively train and evaluate emergency response effectiveness. While working on a project at a nuclear plant recently, I learned that at least annually the shift manager and his supervisors and operators are tested as a team in a simulated control room on a hypothetical emergency. Information relating to the hypothetical emergency is presented to the team over time. The manager and his team are evaluated on how they respond. Their performance is analyzed and critiqued by management and peers. If the response is not adequate they cannot continue to operate the plant until they are retrained and evaluated again.

Do you train and evaluate operating personnel and responders by conducting realistic emergency drills?

Now is the time to review your emergency management system. The CCPS book *Guidelines for Risk Based Process Safety*, Chapter 18, Emergency Management is a good place to start. Are you ready?

John Murphy

Editors Note: You can download two free publications from CCPS, *Lessons Learned from Natural Disasters* and *Corporate Crisis Management*, from <http://www.aiche.org/ccps/knowledgebase/emergencyresponsecrisismgt.aspx>.

AICHE SAFETY & HEALTH DIVISION ANNUAL EXECUTIVE COMMITTEE MEETING

All members of the AIChE Safety and Health Division are invited to attend the annual meeting of the executive committee at the AIChE Spring Meeting in Tampa, FL. The meeting will be Tuesday April 28, 2009, from 6:00 PM to 7:30 PM. Please check the meeting list, which will be available in the registration area, for the specific location.

SAFETY & HEALTH DIVISION DINNER

The Safety & Health Division Dinner will be at the AIChE Spring Meeting in Tampa, FL, on Monday April 27, 2009. It will be at Stump's Supper Club, 615 Channelside Drive, Phone 813-226-2261. Cocktail Hour will be from 6:00PM to 7:00PM, and the Dinner and Award Presentation will be from 7:00PM to 10:00PM. Advance registration is required (\$45). You can register on the AIChE Spring Meeting, or the Global Congress on Process Safety, registration form, or at the registration desk at the meeting in Tampa. The Safety and Health Division will present the Norton H. Walton / Russell L. Miller award in recognition of outstanding chemical engineering contributions and achievements in the areas of Loss Prevention, Safety, and Health to Dr. Sam Mannan, Director, Mary Kay O'Connor Process Safety Center. The dinner speaker will be Laurie Miller, Director of Process Safety of the American Chemistry Council. She will discuss the process safety regulatory landscape under the Obama administration.

AIChE SAFETY & HEALTH DIVISION UPDATE

Kathy Pearson, 2009 Chair

The Safety and Health Division of AIChE was founded in 1979, so it is our 30th birthday. The Division sponsors many excellent projects/programs. This year we will sponsor the 43rd Loss Prevention Symposium (held twice per year at times in the past) and the 11th Process Plant Safety Symposium. A CD is available for purchase with an index of all presentations presented since 1967. The *Process Safety Progress* journal is an excellent publication. In addition, the S&H Division sponsors awards for the AIChE college student design competition.

With the current economic situation, people may be tempted to drop AIChE membership, but membership in AIChE may be more relevant than ever. As money and other resources get tighter in the plants, and job movements become more frequent, networking with your peers becomes much more important. In fact, in a recent AIChE webinar, I learned that over 50% of jobs are found through networking. Please send me your ideas of what we can do to maintain or increase our division activities with less travel (katherinepearson@rohmmaas.com). I'm thinking about how we can use new technology like "LinkedIn" and "Plaxo" and how better to utilize our website, etc.

I hope you are scheduled to attend the Global Safety Congress in Tampa, April 27-29, 2009. It looks like another excellent conference! Every year our volunteer chairs and session leads scramble to get papers turned in on-time, presentations collected, interesting keynote and lunch speakers planned; and then it comes together and works. The 2009 Global Congress Opening and Keynote Address will be at 8:30AM on Monday April 27, featuring invited speaker John Bresland, Chairman and CEO of the U.S. Chemical Safety Board. The Monday luncheon Keynote will be given by Laura Itle, Technical Lead for the Office of SAFETY Act Implementation of the US Department of Homeland Security. Dr. Itle will give a presentation titled "SAFETY Act and You." A networking meeting lunch is planned for Tuesday. Tables will have designated topics of interest in process safety. Sit at a table to meet people who work in the same area as you, and share lessons learned about your specific area of process safety. At Wednesday's lunch, Lisa Morrison, PSM Audit Manager of BP International, will discuss BP's PSM Audit Program.

If you are coming to the Spring Meeting, I encourage you to attend both the Safety & Health Division dinner on Monday evening (April 27) and the division's annual meeting on Tuesday evening (April 28). We are always looking for new volunteers to work on the conference.

If you can't travel to attend, please consider attending the Global Congress by webinar. The entire Global Safety Congress will be covered in the webinar. You can purchase either an individual or a site license for the webinar and the price decreases with the number of site licenses purchased.

Please pass this newsletter along to your colleagues and talk with them about the benefits of AIChE membership and the Safety and Health Division too. I have found that a lot of young engineers don't think about joining or hesitate because of the money when they aren't sure of the benefits. Ask them. Bringing new people into AIChE is critical to maintaining the institutions programs and influence. Bringing new people into the Process Safety Area is critical to maintaining the safety of Chemical Plants.

Kathy Pearson
2009 AIChE Safety and Health Division Chair

INHERENTLY SAFER LABORATORIES

Russell Phifer, 2009 Chair, ACS Division of Chemical Health & Safety

Having just completed a book review for the *Journal of Chemical Health & Safety* on a Center for Chemical Process Safety publication, *Inherently Safer Chemical Processes*, I found myself wondering if it is possible to apply these principles to laboratory operations. [Editor's note: See a book review of this publication by John Murphy on Page 6.] Clearly, the book was designed from a manufacturing perspective; this was the intent, at least. So, to what extent can laboratories use the four strategies presented – minimize, substitute, moderate, and simplify?

As it turns out, these are all important principles in the laboratory as well. Many laboratory facilities use these strategies as part of their management plan. For instance, most laboratories, academic as well as industrial, developed minimization efforts long ago. While the traditional 500g / 1 liter reagent bottle is still in common use, labs are now far more likely to purchase between 5 and 100 grams of a material if that's all they need. The days of purchasing cases of acid instead of single bottles because of the lower per unit cost are long gone, and not lamented. Having cleaned out individual labs with as many as 50 old acid bottles before, I think it's safe to say most labs these days recognize that disposal cost is at least as important as purchase cost. Today's micro techniques and computer-assisted procedures mean much smaller quantities are necessary in most labs.

Substitution is also an important lab principle. There are hundreds of examples of less toxic substances being utilized to replace hazardous chemicals with less toxic ones. This is important from a safety perspective first, but also from a disposal standpoint. Since laboratories pay the highest per unit cost of any group of hazardous waste generators, substituting detergent based cleaners for strong acidic cleaners makes a great deal of sense. Nothing cleans glassware like chromium oxide, but the disposal cost (as well as the high toxicity and corrosivity) make this an extremely expensive proposition. Many efforts in the past decade or so have been made to substitute less hazardous materials for solvents, or at least less hazardous solvents. I would venture

to guess that, from an industry perspective, pretty much any substitution effort is going to be tried first at the laboratory scale level.

Moderate? CCPS also refers to this as attenuation, or the use of materials under less hazardous conditions. Sounds like something that should be an important part of laboratory safety. Operating any process which can be better controlled by reducing temperatures, stabilizing pressure, or using catalysts wisely will be inherently safer. The use of active and/or passive protective systems such as secondary containment has not always been as prevalent in labs as in industry, but that has largely changed in the past decade or so. Perhaps a good lesson learned first in industry which is now being copied in lab operations.

The final strategy is simplification. The focus should indeed be on avoiding hazards instead of trying to control them. Looking carefully at the potential hazards beforehand (process hazard analysis) helps the engineer design simpler systems that incorporate safety. Add-ons cost more in both industrial and laboratory settings. Using the right reaction vessel, in particular, is important in the lab. Using a piece of equipment that requires tape or other reinforcement to be added for strength, for instance, may not make sense if there is one properly designed for the process (we need engineers in the laboratory, too).

I am delighted to be writing for Safety and Health News again, as I did during my previous term as chair of ACS DivCHAS. I hope we can continue to learn from each other and help make the chemical enterprise a safer place to work.

Russ Phifer
2009 Chair, ACS Division of Chemical Health and Safety

ACS DCHAS WORKSHOPS – 2009

Below is an updated list of safety-related workshops being offered by the ACS Division of Chemical Health and Safety. The deadlines for registration are rapidly approaching. If you are interested, please go to www.dchas.org, or the indicated contact, and register today. Note that some of these workshops have hosts other than the Division who are handling registration.

CHEMICAL REACTIVITY HAZARDS: Laboratory Scale Recognition & Control, 29 April, 2009
(Stanford University, Mary Dougherty, mdough@stanford.edu)

CHEMICAL REACTIVITY HAZARDS: Laboratory Scale Recognition & Control, 11 May, 2009
(Portland, OR area, Northwest Center for Occupational Health and Safety, Maribeth Moore, moomoore@u.washington.edu)

CHEMICAL REACTIVITY HAZARDS: Laboratory Scale Recognition & Control, 13 May 2009
(University of Washington, Seattle, Northwest Center for Occupational Health and Safety, Maribeth Moore, moomoore@u.washington.edu)

LABORATORY WASTE MANAGEMENT WORKSHOP, 14 Aug 2009 (ACS Meeting, Washington D.C., Register at www.dchas.org)

LABORATORY SAFETY WORKSHOP, 14 Aug 2009 (ACS Meeting, Washington D.C., Register at www.dchas.org)

HOW TO BE A MORE EFFECTIVE CHEMICAL HYGIENE OFFICER, 15 Aug 2009 (ACS Meeting, Washington D.C., Register at www.dchas.org)

CHEMICAL REACTIVITY HAZARDS: Laboratory Scale Recognition & Control, 15 Aug 2009 (ACS Meeting, Washington D.C., Register at www.dchas.org)

LABORATORY SAFETY WORKSHOP; HOW TO BE A MORE EFFECTIVE CHEMICAL HYGIENE OFFICER; CHEMICAL REACTIVITY HAZARDS: Laboratory Scale Recognition & Control, 21-24 Oct, 2009 (exact dates to be determined, ACS Southeast Regional Meeting – Puerto Rico, Registration method to be determined)

Note that workshop registration is generally online. Workshops may be cancelled if registration is insufficient. For more information, please contact either the contact person listed, Russ Phifer (rphifer@wcenvironmental.com), or Neal Langerman (neal@chemical-safety.com).

Book Review:
Inherently Safer Chemical Processes, Second Edition
(AIChE, CCPS, 2009)
John F. Murphy, PE

“What you don’t have can’t leak.” That sentence first spoken by Trevor Kletz in 1977 summarizes the concept of Inherently Safer. What Trevor was saying is that it is better to remove hazards from a process, rather than to accept the hazard, and add safeguards to prevent the hazard from becoming an incident or to mitigate the impact of an incident. Of course it not always possible to remove hazards but removing hazards should be the first strategy used in designing or modifying chemical processes.

The CCPS book *Inherently Safer Chemical Processes, A Life Cycle Approach*, 1996 formalized the inherently safer approach to process design by expanding on the philosophy of inherently safer. It categorized risk management strategies as inherent, passive, active, and procedural. The book also discusses the inherently safer strategies that we are now familiar with: minimize (use less quantities of a hazardous substance), substitute (replace a material with a less hazardous substance), moderate (use less hazardous conditions, less hazard form of a material, or facilities which minimize the impact of hazardous material or energy), and simplify (design facilities which make operating errors less likely and are more forgiving of errors that are made).

So why was a second edition necessary? The second edition was needed to clarify the definition of inherently safer, discuss how the concept of inherently safer has grown and recent research, to provide tools to implement the concept of inherently safer, and finally to discuss the incentives and barriers to the use of inherently safer including regulation and homeland security.

The book introduces the concepts of first and second order inherently safer. The first order view of inherent safety applies only to the elimination of the hazard. Hopefully this can be done without introducing new hazards. The second order view of inherent safety makes the hazard less intense

or less likely to become an incident. This is done by adding layers of protection. The more robust, stronger and or more reliable, the more inherent safer is the layer of protection. Layers of protection are safeguards that are independent of other safeguards. Passive safeguards are usually more robust than active safeguards. Active safeguards are usually more robust than procedural safeguards. The book has many examples that make the concepts clear to the reader.

Other important topics are life cycle stages, human factors, inherent safety and security, implementing inherent safer design, inherent safer design conflicts, and inherent safer design regulatory initiatives. Also included are worked examples and a section on future initiatives. An extensive inherent safer technology checklist in the appendix is of great value to those involved in process design. The book is a necessary addition to the library of anyone involved in process design or process safety.

The book is available for purchase at:

<http://www.wiley.com/WileyCDA/WileyTitle/productCd-0471778923.html>

AIChE members can find information on how to get the AIChE member discount at:

<http://www.aiche.org/Publications/PubCat/Categories/NewTitles.aspx>

NOTE: Members of the ACS Division of Chemical Health and Safety will be able to read Russ Phifer's review of this book in the May-June issue of the *Journal of Chemical Health and Safety* (and the Journal is also available to others through ScienceDirect).

CENTER FOR CHEMICAL PROCESS SAFETY

Latin American Conference

CCPS, the Brazilian Chemical Industry Association (ABIQUIM), and the Brazilian Association of Chemical Engineering (ABEQ), are coordinating to present the 2nd CCPS Latin American Process Safety Conference and Expo. This annual event is the major forum in Latin America for practitioners from the chemical and allied industries, academia, and government to share practical and technological advances in all aspects of process safety. The conference will take place in São Paulo, Brazil on October 21-23, 2009 and will be held in conjunction with ABIQUIM's Responsible Care® conference. The Call for Papers is open, with an Abstract Deadline of June 1, 2009. More information is available at:

<http://www.aiche.org/ccps/conferences/brazil2009.aspx>

Join CCPS

Are you thinking about putting CCPS participation in your budget for 2010? Contact us at 646-495-1372 or ccps@aiche.org for a dues quote and information about membership benefits.

AIChE/CCPS PROCESS SAFETY COURSES

Process Safety Boot Camp

CCPS announces the launch of Process Safety Boot Camp, an intensive course given to early-career engineers to prepare them to meet the process safety responsibilities inherent to an engineer's job. For more information on Process Safety Boot Camp, readers should contact ccps@aiche.org.

HAZOP Studies and other PHA Techniques for Process Safety and Risk Management

May 18 – 20, 2009, San Diego, California

http://catalog.asme.org/Education/ShortCourse/HAZOP_Studies_PHA_Techniques.cfm

PSM: Requirements and the Development of Management Systems

May 6 – 8, 2009, Atlanta, Georgia

http://catalog.asme.org/Education/ShortCourse/PSM_Design_Evaluation_Process.cfm

Fundamentals of Process Safety

October 15 – 16, 2009, Chicago, Illinois

http://catalog.asme.org/Education/ShortCourse/Fundamentals_Process_Safety.cfm

Combustible Dust Hazards and Dust Explosions

May 4 – 5, 2009, Atlanta, Georgia

http://catalog.asme.org/Education/ShortCourse/Dust_Explosions_Fundamentals_2.cfm

Emergency Relief Systems (ERS) Design using DIERS Technology

November 16 – 18, 2009, San Diego, California

http://catalog.asme.org/Education/ShortCourse/EMERGENCY_RELIEF_SYSTEM.cfm

Advanced Concepts for Process Hazard Analysis

May 21 – 22, 2009, San Diego, California

http://catalog.asme.org/Education/ShortCourse/ADVANCED_CONCEPTS_PROCESS.cfm

5th GLOBAL CONGRESS ON PROCESS SAFETY

The 5th Global Congress on Process Safety will be held in Tampa, Florida, April 26-30, 2009. There is still time to register and plan on attending. You can find information at:

<http://www.aiche.org/Conferences/Spring/GCPS/CFP.aspx>

The Center for Chemical Process Safety (CCPS), the Loss Prevention Symposium (LPS), and the Process Plant Safety Symposium (PPSS) are coordinating conferences again in 2009 to present the 5th Global Congress on Process Safety (GCPS). This annual event is the primary forum for practitioners from the chemical and allied industries, academia, and government to share practical and technological advances in all aspects of process safety. This GCPS will provide practitioners the necessary tools and information to address the next generation of process safety. Detailed information about the program can be found at the above web site, and the FALL/WINTER 2008/2009 issue of *Safety and Health News* included a summary of the planned program. If you do not have the FALL/WINTER 2008/2009 issue of *Safety and Health News*, you can download it from:

<http://www.chem.mtu.edu/org/aiches&h/newsletter.html>

Can't make it to Tampa for the 2009 GCPS?

Register for the 2009 GCPS webcast. In an effort to have the GCPS' presentations on the state-of-the-art in process safety reach the widest audience possible, CCPS will be webcasting the 2009 Global Congress on Process Safety. The webcasts will be available for viewing 24 hours after the live sessions take place. Individual, site, and corporate webcast packages are available. For more information about the webcast program, contact Roxy Schneider at 646-495-1372 or by email at roxys@aiiche.org.

CHEMICAL SAFETY SOFTWARE UPDATES

Updated versions of two important software tools for chemical process safety have been released recently.

NOAA Chemical Reactivity Worksheet Version 2.0

The United States National Oceanic and Atmospheric Administration (NOAA) Office of Response and Restoration, in collaboration with CCPS, have released Version 2.0 of the Chemical Reactivity Worksheet. CCPS is pleased to have had the opportunity to collaborate with NOAA and the US EPA Office of Emergency Management in the development of this update to a valuable software tool. The Chemical Reactivity Worksheet is free of charge and can be downloaded from the NOAA web site:

<http://response.restoration.noaa.gov/crw>

CAMEO Version 2.0, MARPLOT Version 4.0, ALOHA Version 5.4.1.1

The US Environmental Protection Agency (EPA) Office of Emergency Management has released updated to these software tools:

<http://www.epa.gov/emergencies/content/cameo/request.htm>

The following information, from the US EPA web site, describes these applications.

<http://www.epa.gov/emergencies/content/cameo/what.htm>

CAMEO contains a chemical database of over 6,000 hazardous chemicals, 80,000 synonyms, and product trade names. CAMEO provides a powerful search engine that allows users to find chemicals instantly. Each one is linked to chemical-specific information on fire and explosive hazards, health hazards, firefighting techniques, cleanup procedures, and protective clothing. CAMEO also contains basic information on facilities that store chemicals, on the inventory of chemicals at the facility (Tier II) and on emergency planning resources. Additionally, there are templates where users can store EPCRA information. CAMEO connects the planner or emergency responder with critical information to identify unknown substances during an incident.

MARPLOT is the mapping application. It allows users to "see" their data (e.g., roads, facilities, schools, response assets), display this information on computer maps, and print the information on area maps. The areas contaminated by potential or actual chemical release scenarios also can be overlaid on the maps to determine potential impacts. The maps are created from the U.S. Bureau of Census TIGER/Line files and can be manipulated quickly to show possible hazard areas.

ALOHA is an atmospheric dispersion model used for evaluating releases of hazardous chemical vapors. ALOHA allows the user to estimate the downwind dispersion of a chemical cloud based on the toxicological/physical characteristics of the released chemical, atmospheric conditions, and specific circumstances of the release. Graphical outputs include a "cloud footprint" that can be plotted on maps with MARPLOT to display the location of other facilities storing hazardous materials and vulnerable locations, such as hospitals and schools. Specific information about these locations can be extracted from CAMEO information modules to help make decisions about the degree of hazard posed.

OBITUARY: KENNETH L. CASHDOLLAR

Kenneth L. Cashdollar passed away on Wednesday March 4, 2009 in Bethel Park, PA at age 61. Ken was a Research Physicist at the Pittsburgh Research Laboratory, National Institute of Occupational Safety & Health. He was a well known expert on dust explosion hazards, and an important contributor to coal mine and dust explosion safety. Memorial donations can be made to Family Hospice, 50 Moffett St., Pittsburgh, PA 15243, or UPMC Liver Cancer Center Research Fund, 3459 Fifth Ave., UPMC Montefiore, 7, South Pittsburgh, PA 15213. In lieu of a funeral, Ken requested his family and friends to have a combination memorial service/retirement party in the spring. The get-together will be held during the day on Saturday May 30th, at a hotel near Pittsburgh, PA. Please contact Dr. John E. Going [(816) 655-4769, john.going@fike.com] or Dr. Erdem A. Ural [(781) 818-4114, erdem.ural@lpsti.com] no later than April 8, 2009 for details if you are interested in attending. Prior to May 15, 2009, you may also email Power Point slides to share your thoughts, messages, and any old or new pictures. These slides will be presented to Ken's family at the gathering.

ARTICLES AND PAPERS OF INTEREST

Thanks to Stan Grossel for providing the following list of papers potentially of interest to Division members.

1. "Experimental Determination of Two-Phase Flow rates of Hydrocarbons Through Restrictions" by Richardson, S. M. et al, *Trans. IChemE, Part B (Proc. Safety. Environ. Prot.)*, pp. 40-53 (January 2006).

Accurate prediction of flow rate through a given restriction is important in the design of pressure relief and blowdown systems. While this prediction is well understood for single-phase gases and liquids, it is much less well understood for two-phase gas-liquid flows. This paper reports a large number of measurements conducted on highly volatile mixtures of hydrocarbons (mainly C1 to C10) at pressures up to 100 bar and flow rates of up to 4 kg/s. For mixtures in which the liquid mass fraction is below about 0.8, it is found that the homogeneous equilibrium model (HEM) provides a good approximation: the discharge coefficient varies from 0.9 for pure single-phase gas flow to about 0.98 when the upstream liquid fraction is 0.8. For flows of compressed volatile liquid, it was found that the incompressible-flow model provides a good approximation, with a discharge coefficient of 0.60; however, preliminary experiments indicate that this simple model progressively breaks down as the volatile gas content increases. It was also found that, in a number of circumstances, the widely-used recommendations of the API can significantly over- or under-predict flow rates through restrictions if misapplied.

2. "Boundary Conditions for Developing a Safety Concept for an Exothermic Reaction" by Hauptmanns, U., *J. Hazardous Mater.*, Vol. 148, Issues 1-2, pp.144-150 (2007).

Kinetic calculations for an example exothermal chemical process, the production of TCB, are carried out. They address both parameter uncertainties and random failures of the cooling system. In this way, they enable one to establish comprehensive boundary conditions for a safety system in terms of unavailability, the quantities of the undesired by-product (TCDD) produced, and the times available before a required intervention, if a pre-determined quantity of TCDD is tolerated. It is shown that accounting for stochastic effects and uncertainties derived from insufficient knowledge provides a broader and more realistic knowledge base for devising a viable safety concept.

3. "Study of Major Accidents Involving Chemical Reactive Substances: Analysis and Lessons Learned" by Sales, J. et al, *Trans. IChemE, Part B (Proc. Safety Environ. Prot.)*, pp. 117-124 (March 2007).

The objective of this paper is to present the results of the analysis performed on a selection of accidents included in the MARS database. This is a database of past accidents that occurred in Europe maintained by the European Commission, in order to help the Member States to meet the requirements of the Seveso and Seveso II directives. The studies are focused on those accidents that involve reactions between chemical substances, whether wanted or unwanted, that generated a hazardous situation by loss of control of such reactions. Runaway reactions are known to be especially dangerous, given that many times they are unexpected, or their possible consequences underestimated, so sometimes chemical industries are not ready to cope with the effects of loss control of reactive processes. The aim of the analysis is to obtain lessons learned from past accidents in order to prevent similar situations in the future, or to reduce their consequences. Understanding the causes of past accidents, including equipment failures, deviations in the course

of a reaction, or deficiencies in process operations performed, can help to a better understanding of similar processes. Industries working with potentially dangerous chemicals should consider introducing lessons learned into their safety management systems.

4. "Emergency Pressure Relief for External Fire Scenarios" by Johnson, G., *Chem. Engng.*, pp. 64-69 (July 2007).

This article presents a simplified, but sufficiently accurate, method to ensure the adequacy of depressuring systems for external fire scenarios. It presents an alternative method to the traditional method given in API RP 521. A detailed example of the proposed calculation procedure for a typical hydrotreater reactor loop is presented.

5. "Runaway Prevention in Liquid-Phase Homogeneous Semibatch Reactors" by Molga, E. J., Lewak, M., and Westerterp, K. R., *Chem. Engng. Sci.*, Vol. 62, pp. 5074-5077 (2007).

A concept of the safety boundary diagram, elaborated in our previous studies for liquid-liquid heterogeneous reactions, has been developed here for liquid-phase homogeneous semi-batch reactors. With the use of this boundary diagram, inherently safe-operating conditions can be easily determined without costly and time-consuming kinetic studies. A rapid procedure to estimate the dosing time and the cooling temperature appropriate for inherently safe operation of the reactor has been elaborated and proposed.

6. "Safety Aspects of the Process Control of Grignard Reactions" by Kryk, H. et al, *Chem. Engng. Sci.*, Vol. 62, pp. 5198-5200 (2007).

Grignard reactions comprise considerable hazard potentials due to the spontaneous heat release during the initiation of the exothermic reactions and the high reactivity of the Grignard compounds. To establish industrially applicable methods for an objective detection of the reaction start-up and for the accumulation of the organic halide during the process, calorimetric studies of a special Grignard reaction in a pressurized vessel were carried out using several on-line monitoring methods. In general the process signal profiles, FTIR measurements and balance-based systems are applicable to provide the operator with additional information on the process state. Further experiments at adiabatic and isothermal conditions show significant influences of impurities (i.e., water) on the thermal process behavior.

7. "An Experimental and CFD Study of Liquid Jet Injection into a Partially-Baffled Mixing Vessel: A Contribution to Process Safety by Improving the Quenching of Runaway Reactions" by Torre, J-P et al, *Chem. Engng. Sci.*, Vol. 63, Issue 4, pp. 924-942 (February 2008).

Thermal runaway remains a problem in the process industries with poor or inadequate mixing contributing significantly to these incidents. An efficient way to quench such an uncontrolled chemical reaction is via the injection of a liquid jet containing a small quantity of a very active inhibiting agent (often called a stopper) that must be mixed into the bulk of the fluid to quench the reaction. The hazards associated with such runaway events mean that a validated Computational Fluid Dynamics (CFD) model would be an extremely useful tool. In this paper, the injection of a jet at the flat free surface of a partially-baffled agitated vessel has been studied both experimentally and numerically. The dependence of the jet trajectory on the injection parameters has been simulated using a single phase flow CFD model together with Lagrangian particle tracking. The comparison of the numerical predictions with experimental data for the jet trajectories shows a very good

agreement. The analysis of the transport of a passive scalar carried by the fluid jet and thus into the bulk, together with the use of a new global mixing criterion adapted for safety issues, revealed the optimum injection conditions to maximize the mixing benefits of the bulk flow pattern.

8. "Pressure-Relief System Design" by Mukherjee, S., *Chem. Engng.*, pp. 40-34 (November 2008).

This article describes some of the causes of overpressureization, the types of valves and rupture disks that are available, and some of the components needed for a pressure relief system. Example calculations are given, as well as a list of installation considerations.

**Preliminary Call for Papers - 44th Annual Loss Prevention Symposium (LPS)
6th Global Congress on Process Safety
AIChE 2010 Spring National Meeting
San Antonio Grand Hyatt
San Antonio, TX
Date: March 21 to 25, 2010**

The Loss Prevention Symposium (LPS) is one of three parallel symposia that comprise The Global Congress on Process Safety. Organized by Group 11A of the AIChE Safety and Health (S&H) Division, the LPS has been held annually since 1967. The Symposium promotes process safety by providing a forum for practitioners from the chemical industry, allied industries, academia, and government to share technological advances in process safety, explosion prevention, and fire protection as well as to share the lessons learned from incident investigations.

The Symposium consists of five sessions, each with six to nine 30-minute presentations. Papers are selected by session chairs based on an abstract of 100 to 200 words. The abstract must offer a brief account of the contents, conclusions, and the relevance of its findings. Submitted abstracts must include the author, their affiliation, full address, email, and phone number. Papers must address pertinent process safety issues or useful loss prevention technologies. The papers will be published in the LPS proceedings. If you wish to present a paper please send an abstract to the appropriate session chair (copying the symposium chair) via email for consideration by September 30, 2009.

The 2010 Loss Prevention Symposium Chair is Dr. Ronald J. Willey, Northeastern University, Department of Chemical Engineering, 342 Snell Engineering Center, 360 Huntington Avenue, Boston, MA 02115-5000 [617-373-3962, r.willey@neu.edu]

1 –Fires, Explosions and Reactive Chemicals (Monday AM & PM, 9 Papers to be selected)

The analysis, prevention, protection and mitigation of fire, explosion, and reactivity hazards continue to be important to the loss prevention community. This session invites papers that identify, characterize, or offer design and operational guidance on fire, explosion and reactivity hazards.

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2 – Combustible Dust Hazards (Tuesday AM, 6 Papers to be selected)

A recent series of devastating dust explosions and a national emphasis program subsequently initiated by OSHA renewed interest on this important topic. This session invites original papers describing advances in combustible dust hazard evaluation, improved methods for prevention and mitigation, and novel approaches for compliance with the safety standards and regulations.

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3 – QRA and Risk Criteria (Tuesday PM, 6 Papers to be selected)

The use of Quantitative Risk Assessment as an integral part of Process Safety Management has been steadily increasing in the last several decades. Efforts have been made by AIChE-CCPS (via the publication of "Guidelines for Chemical Process Quantitative Risk Analysis, 2nd edition" and "Guidelines for Developing Safety Risk Criteria") to encourage use of this methodology. Papers and presentations on (a) the practical use of QRA, (b) the establishment of useful criteria for prioritizing risks and for making informed risk-based decisions, (c) the introduction of QRA into existing PSM systems, and (d) other related topics are encouraged.

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4 – Human Factors (Wednesday AM, 6 Papers to be Selected)

The impact of human performance on process safety has been well recognized within industry. Efforts have been made by AIChE-CCPS (via the publication of "Guidelines for Preventing Human Error in Process Safety") to raise awareness of the importance of human factor issues and to provide tools and techniques for use in assessing human reliability. This session invites original papers that discuss key performance influencing factors and management systems for maximizing human performance, provide actual data on human reliability that can be applied to analyses within the chemical process industry, or offer methodologies for quantifying human error and reducing its frequency.

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5 - Case Histories and Lessons Learned (Wednesday PM, 6 Papers to be selected)

Reviews of process safety incidents and near misses provide valuable learning opportunities. Papers dealing with incidents, near misses, and the lessons learned are requested.

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