SACHE News

CENTER FOR CHEMICAL PROCESS SAFETY
An AIChE Industry Technology Alliance

Safety and Chemical Engineering Education - Spring 2005

Status of SACHE

Dennis Hendershot, Chair
CCPS Undergraduate Education Committee

2005 SACHE Workshop

The 2005 SACHE Workshop will be held on September 18-21 in Bristol, PA, and will be sponsored by Rohm and Haas Company, Arkema, and Chilworth Technologies. The focus of the workshop will be on chemical reactivity hazards and dust explosion hazards. The workshop will include tours of the Rohm and Haas Bristol Plant polymers facility and Chilworth Technologies hazard evaluation laboratories (including reaction calorimetry facilities, dust explosion testing equipment, and static electricity hazard evaluation equipment). We are trying to arrange a tour of a commercial spray drying unit, with a backup plan for using the Rohm and Haas pilot plant spray dryer in Spring House, PA to illustrate dust explosion protection safety features. The workshop is being organized by Dr. Ron Willey of Northeastern University, Dennis Hendershot of Rohm and Haas, and Dr. Dorothy Skaf of Villanova University.

SACHE has set up a web site for the workshop at www.sacheneu.com. The web site includes full information about the schedule, and you can register to attend the workshop at the web site. As usual, workshop attendees will be responsible for their own transportation to the workshop location, and SACHE will cover hotel and meal expenses during the workshop. Please consider joining us for this workshop focusing on two areas of major process safety concern in the chemical industry today, and please pass the information on to any colleagues who might be interested.

Reactive Chemistry Hazards – Web-Based SACHE Module

Watch for the upcoming release of a new type of SACHE module – a web-based "self-teaching" module on reactive chemistry hazards. This product is in the final stages of development and evaluation, and will be made available shortly. The intent is to provide a web based learning tool that students can review on their own schedule, perhaps followed up by classroom discussion. We would like to have your feedback on the utility of this approach once you have had a chance to see the product. This is an experiment for SACHE, and we would like to know if this type of product is useful, and if we should develop similar products in the future.

Chemical Safety Board Dust Explosion Hazard Study

The United States Chemical Safety and Hazard Investigation Board (CSB) is conducting a study of dust explosion hazards and incidents in the United States, prompted by a series of such explosions, resulting in 14 fatalities, which the CSB investigated in 2003. The CSB plans on a public hearing in Washington, DC, some time this summer to receive testimony on the subject. CSB investigators also requested, and received, comments and feedback at the Dust Explosion session at the Loss Prevention Symposium at the AIChE Spring National Meeting in Atlanta in April. You can check on the status of this study at the CSB web site (www.csb.gov). In my personal opinion, one significant contributor to many dust explosion incidents is the lack of knowledge of the hazard, and how to manage the risk. I find that many young chemical engineers that I have met are not familiar with dust explosion hazards. While we can, and do, teach them what they should know at a big company like Rohm and

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SACHE, or Safety and Chemical Engineering Education, is a project under the auspices of AIChE's Center for Chemical Process Safety (CCPS). SACHE's charter is to enhance the presentation of process safety in undergraduate education.

SACHE News is published two times annually by the Undergraduate Education Committee of the AIChE Center for Chemical Process Safety.

The opinions expressed in the articles contained in the *SACHE News* are not necessarily the opinions of the Center for Chemical Process Safety or the American Institute of Chemical Engineers.

Articles related to any aspects of safety in the academic community are solicited from both the academic and industrial communities for publication in *SACHE News*. Material should be sent directly to the editor for consideration.

Undergraduate Education Committee

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Status of SACHE

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Haas, do chemical engineers who work for smaller companies who do not have the knowledge and expertise ever learn to recognize these hazards? As chemical engineering educators, we are responsible for ensuring that all of our graduates have sufficient knowledge of dust explosion hazards to recognize when they may have a problem, and need to call for additional expertise to understand and manage the hazard. That is one of the reasons why we have decided to make dust explosion hazards a major focus of the fall 2005 SACHE Workshop.

Walton-Miller Award to Dr. Gary Powers, Carnegie-Mellon University

The Safety and Health Division of AIChE presented the 2005 Walton-Miller Award to Dr. Gary Powers of Carnegie-Mellon University in recognition of his many years of outstanding contributions to chemical process safety. In particular, Dr. Powers was an early advocate of the application of fault tree analysis and other quantative risk analysis techniques to chemical processes, has applied these techniques in many real world studies, and taught them to many industrial practitioners.

We Want Your Input

As always, the SACHE Committee welcomes feedback, and participation, from anybody in academia or industry who is interested in safety education for chemical engineering students. If you are interested in participating, please contact Joe Louvar, Bob Rosen, or Dennis Hendershot.

Dennis C. Hendershot
Rohm and Haas Company
SACHE Committee Chair

Bob Rosen
BASF, retired
SACHE Committee Co-Chair

American Chemical Society Committee on Chemical Safety

The mission of the Committee on Chemical Safety is to provide professional advice and counsel on the handling of chemicals and seek to ensure safe facilities, designs, and operations by calling attention to potential hazards and stimulating education in safe chemical practices. The Committee provides a variety of resources through http://membership.acs.org/c/ccs/default.htm, the Committee's web site.

One of the newest publications is the brochure entitled "Safety for Introductory Chemistry Students" that summarizes basic safety rules for chemistry laboratories. More detailed information that is also applicable to chemical engineering laboratories (both teaching and research) is "Safety in Academic Chemistry Laboratories, 7th Edition." Volume 1 is written for college and university undergraduate students; Volume 2 is for faculty and administrators. Both focus on accident prevention. Single copies are available free and on-line, and multiple copies are modestly priced.

Another resource is an indexed link to the full text of chemical safety letters that have appeared in *Chemical & Engineering News* since 1993. The index is alphabetized by the chemical involved in the letter.

The Committee has also developed white papers and policy statements that address current and proposed changes in regulation of laboratory wastes. These publications may be useful for introducing faculty and administrators to issues involved in the U. S. Environmental Protection Agency's implementation of the Resource Conservation and Recovery Act (RCRA) to academic laboratories.

The CCS web site also provides links to other resources dealing with chemical safety and compliance with environmental, health, and safety regulations.

New SACHE Products for 2005

These SACHE products are available to the member universities. Faculty and students should contact their SACHE representative for access to these and other SACHE products, including slide and PowerPoint presentations, videos, problem sets, NIOSH publications, and CCPS books. Recent SACHE deliverables are posted at http://www.sache.org.

Emergency Relief System Design for Single and Two-Phase Flow

Ron Darby
Texas A&M University

This design module covers the principles and procedures for sizing emergency relief systems for both single-phase (gas or liquid) and two-phase flow, including relief devices as well as inlet and discharge piping. The Homogeneous Direct Integration method for two-phase flow described herein is simpler, more general, and more rigorous than methods previously presented. The material is in a form which could be incorporated into courses on applied fluid mechanics, process safety, or process design, or it could be presented separately as a "stand alone" topic. It is assumed that the student has a familiarity and working knowledge of the macroscopic conservation laws for mass, energy, and momentum, and Newtonian fluid flow through pipes and fittings, including incompressible as well as compressible flow up to and including choked flow. Several worked examples are included which serve to illustrate applications of the procedures and equations, or which can be used for student exercises. A PowerPoint presentation is included, as are the spreadsheet calculations for the example problem solutions.

University Access to SuperChems and ioXpress

Georges A. Melhem
ioMosaic Corporation

SuperChems is an advanced tool for pressure relief design, consequence analysis, and thermal hazards assessment. Developed by ioMosaic, SuperChems helps companies meet process safety design objectives and management needs. Its rigorous modeling capabilities enable companies to make technically sound decisions about key process design issues. SuperChems contains an extensive database of more than 1200 components with equation-of-state based computer code and incorporates many features that add tremendous value to the quality of a detailed hazards analysis. It has been extensively validated against experimental data to ensure its accuracy.

ioXpress is a web-based enterprise knowledge management solution and is designed to help companies effectively manage their data and documents, enable knowledge sharing, and enhance communication. It serves as a knowledge manager for creating, editing, storing, and retrieving reusable documents within your organization. All documents are categorized, centralized, and managed through a secure database platform. As a web-based application, ioXpress Knowledge Manager allows users to share documents from any location. It can produce significant returns in the form of cost savings and productivity gains for small and large organizations.

Solutions to Student Problem Set Volume 1

J. R. Welker and C. Springer
University of Arkansas

Volume 1 was originally published by CCPS in 1990. Copies were given to universities and sold to industry. This was a very popular and valued product that is currently out of print. J. Wagner (Oklahoma State University) recently put this product in electronic format for distribution. The Instructor's Manual is available only to member universities, but the Student Problems are publicly available at http://www.sache.org/links.asp.

The 90 problems involve issues of safety, health, and loss prevention and provide students and new engineers with important insights to industrial processes. This material can also be used as a reference for industrial courses for new engineering employees. These safety problems and solutions further demonstrate that safety and health issues are handled with basic engineering principles and logic. Finally, through the use of this material, we hope to instill

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SACHE Products

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in students and engineers an increased recognition of the importance of chemical process safety and the recognition that they have the professional and ethical responsibility to provide safe chemical plants, processes and products.

The problems were designed for use in existing engineering courses, such as: stoichiometry, material balance, mass transfer, heat transfer, thermodynamics, process control, and design courses. The authors believe that it is important that students work on these problems while attending their undergraduate courses and throughout their education. This process should develop a safety culture within engineers that will help them throughout their careers.

Solutions to Student Problem Set Volume 2

R. Willey, Northeastern University

D. Crowl, Michigan Technological University

R. Welker, University of Arkansas

R. Darby, Texas A&M University

Volume 2 was originally published by CCPS in 2002 and distributed to SACHE University Members. This was a very popular and valued product that is now out of print. R. Willey recently put this volume in electronic form for distribution. The problems are available at http://www.sache.org/links.asp.

Like the Volume 1 problems, the 218 problems teach safety, health, and loss prevention. This solution set represents problems and solutions produced by SACHE in the period 1990 to 2000.

The problems were designed for use in existing engineering courses, such as Stoichiometry, thermodynamics, fluid mechanics, kinetics, heat transfer, process dynamics and control, computer solutions, and mass transfer. The authors believe that including these problems in a required undergraduate course helps engineering students develop a safety culture and mind set that will benefit them throughout their careers.

SACHE 2005 Faculty Workshop

R. Willey, Northeastern University

We are pleased to announce our 7th SACHE faculty workshop. Rohm Haas Company, Croydon, PA, has agreed to be our host. The dates are September 18 to 21, 2005. The workshop is open to all faculty members whose departments are currently members of SACHE. Our focus this year will be chemical reactivity, dust explosions, and accident investigation. Tours are scheduled for Chilworth Technology, Inc. and a facility that specializes in spray drying. All expenses are covered with the exception of round trip travel expense from your department to the workshop hotel. We especially encourage participation by faculty who have under 10 years teaching experience.

For registration, please visit www.sacheneu.com. For further information, contact Ron Willey at r.willey@neu.edu.

OHSA Chemical Reactivity Hazards Web Page

The Occupational Safety and Administration maintains a web page (http://www.osha.gov/SLTC/reactivechemicals/index.html#alliances) to provide safety and health information on chemicals in the work place. The resource was developed through alliances with The Dow Chemical Company and the Reactives Alliance (the U. S. Environmental Protection Agency and six other organizations involved in the chemical industries).

Major topics include OSHA, EPA, and DOT standards that apply, recognition of hazards in the workplace, evaluation of reactivity hazards, control and prevention, and links to training resources and additional information. The web page also provides links to other safety and health information such as hazard communication, hazardous and toxic substances, and chemical sampling information.

Call for Papers

Special 40th Annual Loss Prevention Symposium
AIChE 2006 Spring National Meeting
Orlando, Florida
April 23-26, 2006

The Loss Prevention Symposium, organized by the American Institute of Chemical Engineers Safety and Health Division, Group 11A, has been held annually since 1967. The objective of the symposium is to promote safety in the chemical process and allied industries by providing a forum for practitioners from industry, academia and government to share experiences, technological advances and new ideas.

Papers are selected based on the abstracts submitted by the authors. Manuscripts of the accepted papers must be well written, contain new and unique technical content, and address process safety issues or technologies that are immediately useful to the industry. Accepted papers will be published in the Symposium Proceedings and may be chosen for publication in the Division journal, *Process Safety Progress (A Wiley periodical)*. The Symposium will consist of six sessions of three to seven papers each. The session topics are as follows.

1 Loss Prevention: Past, Present, and Future

An invited paper will introduce the session by highlighting the 40-year history of the Loss Prevention Symposium (LPS) and by addressing how this forum has remained on the forefront of ever-changing process safety and loss prevention technologies and practices. Papers defining the "State-of-the-Art" and illuminating where this "Art" must go in the future are invited. In addition to emphasizing life-safety issues, the LPS emphasizes the business importance of accident prevention. Papers are encouraged that discuss the long-term consequences of industrial accidents, with special emphasis on continued corporate viability and financial health, on corporate loss prevention programs, and on the ever-changing regulatory roadmap.

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2 Fire, Explosion and Reactive Hazards

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

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3 Hazard Aspects of Combustion Equipment

This session will focus on hazard aspects of various types of combustion equipment, such as fired heaters, flares, thermal oxidizers, steam boilers, waste heat boilers, and paper plant recovery boilers. Papers may be submitted on the following topics: process design for safe operation, equipment specifications for improved safety, control systems and instrumentation for improved operational safety, operating procedures and practices for safe operation, case histories of combustion equipment accidents and failures, etc.

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4 Hazards & Risks Associated With Alternate Energy Systems

The commercialization of alternative energy systems is becoming increasingly important to the loss prevention community as they introduce new hazards and risks that we must address. Systems involving renewable energy sources, fuel cells, compressed natural gas, liquefied natural gas, liquefied petroleum gas, hydrogen, atomic energy and other relatively new technologies will compete with the traditional energy sources, coal, oil and water. In paving the way for complete commercialization of these newer technologies, an understanding of the hazards and risks must be developed. This session invites new research, tools and methods that identify, characterize, and manage the hazards and risks associated with the design and operation of alternative energy systems.

Chair Dr. Brian R. Dunbobbin
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5 Mechanical Integrity

Mechanical integrity is a key requirement for harnessing the tremendous hazard potential created by industrial operations dealing with toxic materials or large quantities of chemical, thermal, mechanical or electrical energy. MI failure is often the initiating event that leads to major fires or explosions. This session invites papers on all aspects of mechanical integrity, including system design, consequence analysis, reliability, maintenance, and near-miss or full-blown incident experience.

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6 Case Histories and Lessons Learned

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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To Present a Paper

Please contact the appropriate session chair and submit a short abstract of 200-300 words by July 7, 2005. Include the names, addresses, telephone numbers and affiliations of the authors with the abstract. Abstracts may be supplemented with extended abstracts and draft manuscripts. Session chairs will select papers to be presented and contact the authors by August 7, 2005. Authors of selected papers will need to complete the Proposal to Present (PTP) form on the AIChE Web site by September 30, 2005. Contact the session chair to make other arrangements if you are unable to submit an electronic PTP. Final manuscripts for publication in the Symposium Proceedings are due to the session chairs by December 11, 2005.

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21st Annual CCPS International Conference

Call for Papers

April 23-27, 2006

Walt Disney World Dolphin Resort, Orlando, Florida

PROCESS SAFETY CHALLENGES IN A GLOBAL ECONOMY

Twenty years ago, when the Center for Chemical Process Safety (CCPS) was founded, we thought of the process industries as global. Looking back from today, we hadn't seen anything yet! The chemical industry continues to participate in the continuing globalization of the world economy, in response to many factors such as changes in raw material availability and cost, off-shoring of customers, increasing technical capabilities of emerging economies, and other factors. This globalization creates many significant issues in process safety. The 21st Annual CCPS Conference will focus on understanding and managing process safety in the global process industries.

Proposed session titles and topics include:

- When and how to say "NO" (or "YES")
  - The use of tools such as cost-benefit analysis, decision analysis, multiattribute utility analysis, and other decision making tools to prioritize hazard mitigation options
- Transportation Safety
  - Process safety issues with global transportation of hazardous materials
  - Understanding and dealing with differing regulations
  - Multimodal shipments
  - Import and export terminals
  - Global transport of time sensitive cargos, temperature sensitive cargos
- International trends in Process Safety regulations, enforcement, cultural differences and Process Safety practices:
  - China and other areas of the Pacific
  - India and the Middle East
  - Europe
  - Latin America
- Synergies between Process Safety and Security
- Process Safety of liquid natural gas (LNG) production, transportation, and distribution
- Process Safety issues in global contract manufacturing and joint ventures
- Human factors considerations for process safety in a global economy
  - Communication of technology and hazard information
  - Creating a good safety culture in a developing country
  - Tips and techniques for conducting a multi-lingual, multi-cultural Process Hazard Analysis
- Global implications and practices of inherently safer technology (IST)
  - Incorporating IST considerations into an existing process safety management system
  - Protocols for identifying IST opportunities in existing facilities
  - Techniques for understanding IST opportunities early in process and product development
  - Understanding IST conflicts, and avoiding unintended consequences of changing technology
  - Is IST more important in developing countries?

For more information:
Call Karen Person at (212) 591-7319 or e-mail karep@aiche.org
ABSTRACTS MUST BE RECEIVED NO LATER THAN SEPTEMBER 2, 2005
(early submittal of abstracts are encouraged)
To submit your abstract, please e-mail ccpsicw@aiche.org.
Visit http://www.aiche.org/ccps/icw

At the 2006 AIChE Spring National Meeting
CCPS joins with the AIChE Safety and Health Division
to present the

2nd Global Congress on Process Safety