

SACHE News



Safety and Chemical Engineering Education - Fall 2002

Status of SACHE

J. F. LOUVAR, CHAIR
CCPS UNDERGRADUATE EDUCATION COMMITTEE

General:

- Great Workshop in 2002
- Planning 2003 Workshop
- Essay Awards
- AIChE Student Design Problem Awards
- New Products
- AIChE Design Problem

2002 Workshop

Companies and organizations that supported the workshop include:

BASF Corporation
Center for Chemical Process Safety (of AIChE)
The Dow Chemical Company
ExxonMobile
Merck & Company, Inc.
Rohm and Haas Company
Shell Chemical Company
U. S. Chemical Safety and Hazard Investigation Board

A special thanks is extended to these sponsors. Their support covered all the expenses for the hotel, meals, and local transportation for all of the twenty-five university professors. The participants were only responsible for their transportation to and from Detroit.

We are currently seeking support for future workshops.

Planning for 2003 Workshop

Our next workshop is scheduled for September 28 to October 1, 2003 at the ExxonMobil Plant in Baton Rouge, Louisiana. This is a huge facility that has knowledgeable engineers, and a great facility for relevant tours. The

directors of this workshop are Scott Ostrowski (ExxonMobil), Ralph Pike (Louisiana State University), and Bob Bethea (Texas Tech University). The program is currently being developed, and based on my review of the progress, it will be an outstanding experience for the attendees. Faculty interested in attending the 2003 workshop should contact Dan Crowl (Crowl@MTU.edu). Since this is a National Security Site, attendance is restricted to U.S. citizens.

2002 Essay Awards

Congratulations to the two winners and two runners-up for the 2002 Essay contest:

Winners:

Faith L. Tartaglia, Syracuse University.
Brian Dunham, University of Missouri, Rolla

Runners-up:

Margie Dickerson, University of Missouri, Rolla
Jedediah James, Northeastern University

2003 Essay Awards

Next year essays will be on a specific topic: Hazards of Reactive Chemistry. This very important subject needs more attention within industries and universities. There are two awards (\$500 each) for the best two essays. Essays are limited to 1500 words, maximum, and should be submitted to

J. F. Louvar
Chem. Eng. and Mat. Sc. Dept.
Wayne State University
5050 Anthony Wayne Drive
Detroit, MI 48202-9988

Entries can also be e-mailed to jlouvar@che.eng.wayne.edu. All entries must be received before June 1, 2003.

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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. All original material is copyrighted by 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.

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Status of SACHE

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AIChE Student Design Awards

This year there were many awards with the same objective - to encourage students and professors to understand and appreciate the importance of design together with chemical process safety. To facilitate the accomplishment of this objective, SACHE and the Safety and Health Division developed additional annual awards for the AIChE Design Problem solutions.

SACHE had the opportunity to evaluate the solutions for the 2002 problem, because two members of the SACHE committee developed the 2002 AIChE Design Problem. One of the objectives of this problem was to illustrate good design integrates both design and safety practices. That is, good designs complement good safety, and vice versa.

This year, there were 10 individual and 30 team entries from 25 different universities. The results of this contest are shown in the following table. One SACHE product for 2002 is the text and a solution to the 2002 AIChE Design Problem. See the description on Page 4.

New Products

The year 2002 products for all SACHE university members include the following:

Spring Package

- 1) Free CCPS book (be sure to request one via Shami Nayak at AIChE, shamn@aiche.org)
- 2) One half-price enrollment in an AIChE safety and health course

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AIChE, SACHE, and Safety and Health Division Design Awards

Individual Solutions

Jonathan Molloy AIChE 1st Place, A. McLaren White Award, \$500
Michigan Technological University

Mae Luen Kuo AIChE 2nd Place, A. E. Marshall Award, \$300
University of Kansas

E. Traci Rector AIChE 3rd Place, Omega Chi Epsilon Award, \$200
University of Missouri, SACHE, Best use of the principles of safety, \$200
Columbia Safety and Health Division, Best application of principles of inherent safety, \$500

Team Solutions

Corey S. Harris AIChE William Cunningham Award, \$600
Katherine Rogers SACHE, Best use of the principles of safety, \$300
Andrew Tillinghas Safety and Health Division, Best application of principles of inherent safety, \$500
Washington University,
Saint Louis

John Giusti Safety and Health Division, Best application of principles of inherent safety, \$500
Jamie Cohea
Matthew Stephens
Oklahoma State University

Nathan Koehler Safety and Health Division, Best application of principles of inherent safety, \$500
Ben Park
Jonathan Park
University of Cincinnati

New SACHE Modules

Text and Solution for the 2002 Student AIChE Design Problem

S. Horsch and J. Louvar, Wayne State University

J. Wehman, BASF Corporation

This product includes some of the features taken from the best solutions of the 2002 AIChE Student Design Problem. A student developed this product with assistance from the problem designers. It should contain many answers to the questions generated by the students while working on this design.

The product contains MathCAD programs for a) an elementary design of the major pieces of equipment, and b) the predictions of the oxide concentrations using the specified kinetics for a semi-batch reactor. It also contains Visio sketches of the PFD and P&ID and pieces of equipment that may be cut and pasted to facilitate future designs. This product, in general, should be an excellent resource for the next generation of student designers.

Some characteristics of the best designs included in this product are:

- 1) Their reports were clearly written with a good index and the pages numbered to facilitate finding the key information.
- 2) Their PFDs and P&IDs included the appropriate features; i.e. a) major pieces of equipment, major valves and controls, and heat and material balances; and b) all equipment, all valves and controls, and major pieces of equipment with specifications, respectively. This may have been the students' first experience with these specific drawings, drawings that are used on a daily basis within an industrial environment.
- 3) The kinetics of the reactions were used appropriately to estimate the PO concentrations during the addition and reaction periods.
- 4) Safety and inherent safety principles were also used appropriately.

Safety features that are in this product include, double block and bleeds on the monomer line, control safeguards to prevent runaway reactions, relief valves sized for runaway reactions for each of the two required reactors, good safety review, and a discussion regarding inherent safety. This product contains definitions of these safety features and concepts.

Student Problems: Safety, Health, and Loss Prevention in Chemical Processes - Volume 2

Ronald J. Willey, Northeastern University
Daniel A. Crow, Michigan Technological University

J. Reed Welker, University of Arkansas
Ron Darby, Texas A&M University

This problem set represents a collection of problems written as SACHE products over the past 10 years. Our intention is to provide instructors with problems that integrate process safety into the core curriculum courses. Problem statements and a solution manual are provided for the general chemical engineering curricula areas listed in the following table. Several of the problems are self-contained regarding the background, and equations needed to complete the process safety portion of the problem (no additional textbook needed). Other problems are written to illustrate the principles of process safety using equations encountered in the course itself.

The fluids problems are new contributions from Professor Ron Darby, Texas A&M University. Our purpose is to introduce students to the concepts of process safety and to have students consider these aspects in their designs and problem solutions. Remember, "Engineers shall hold paramount the safety, health, and welfare of the public in the performance of their professional duties," is the first canon in Professional Registration.¹

Integration of process safety problems into your core courses helps students recognize that the course is more than solutions of equations. Important applications exist

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EDITORS NOTE: This is the first of two winning entries in the 2002 SACHE Student Essay contest. The second essay by Brian Dunham, University of Missouri, Rolla, will be published in the Spring, 2003, issue of *SACHE News*. Each student will receive a \$500 award and a certificate at the AIChE Annual Meeting in Indianapolis.

Process Safety

Faith Tartaglia
Syracuse University

A chief ingredient in the successful mix of any modern industrial corporation is the implementation and practice of strict accident prevention and safety policies. From a personal standpoint, as well as the corporate bottom line, it is advantageous to have the fewest number of injurious incidents as possible. It is for this reason that most chemical and industrial companies today have adopted company-wide policies that seek to educate their workers about safety and minimize the risks involved in modern manufacturing.

Supervisors, engineers, and operators have grown increasingly accustomed to the fact that the issues of safety and risk management are topics of discussion in regular department meetings and employee training sessions. It is not uncommon to walk into a manufacturing facility and see a sign proudly displaying the number of days without a lost-time incident. Next to the sign, one might see various posters about safety and proper procedures posted in plain view. These serve as just a few of the many constant reminders that safety should be given ultimate priority, especially in the area of chemical process safety. However, with all of the training and emphasis placed on safety in the workplace, it is a wonder that the topic is not stressed more in the classroom at the college level.

While chemical and engineering safety is talked about in the undergraduate laboratory and likely discussed at times in the classroom, there are only a few institutions that have courses as a part of the engineering curriculum dedicated solely to the topic of safety in a manufacturing facility. With respect to this area, the link between undergraduate study and the workplace is traditionally weak. This is unfortunate, because both newly hired engineers and the companies for which they work would greatly benefit if prior opportunities had been offered to learn more about modern industrial safety practices. Not

only would the companies have to spend less time, money and effort on the education of their engineers on this topic, but the engineers would already be predisposed to the issue of keeping safety at the top of their list of priorities.

If a course in process safety were to be added to the traditional engineering curriculum, there are several topics that could be covered in an effort to strengthen the link between undergraduate studies and the workplace. One issue that not many students are highly aware of until they enter the work force is the responsibility of each company to adhere to the guidelines set forth by government agencies, in particular the Occupational Safety & Health Administration (OSHA). While most students are aware of the organization's existence, not many are adequately informed about its function or purpose. Enabling students to become more knowledgeable about this agency would give them an advantage upon entering the workplace, because they would be more inclined to automatically consider compliance with the guideline as part of their daily engineering activities.

Many companies have departments specifically dedicated to health, safety, and environmental aspects (generally referred to as HSE). While the specifics of each department will vary from company to company, the general ideas and principles would be the same throughout, making it relatively easy to educate students on their function and importance. Students could perhaps be taught how to prepare for routine inspections and how to comply with general safety practices. Again, the more knowledge an engineering student acquires regarding how safety is addressed in the corporate world, the less difficult it will be for him or her to adjust to the policies upon entering an engineering position.

Perhaps one of the most effective methods of addressing safety in the classroom is to discuss what can happen if adequate safety procedures are not in place or are not properly followed. Most of the major chemical accidents covered in the media did not occur as a result of one problem, but rather from a series of problems in a chain of unsettling events. In many of these cases, safety protocol was either not followed or not outlined in an appropriate manner, and in some instances, serious injury or the unfortunate loss of life resulted. At the undergraduate level, future engineers should be exposed to the fact that their actions have significant importance, and may have consequences. The job of an engineer is

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The Safety and Chemical Engineering Education Program (SACHE)

Undergraduate Engineering Education - The Safety and Chemical Engineering Education (SACHE) program was initiated in 1992 as a cooperative effort between the Center for Chemical Process Safety (CCPS) and engineering schools to provide teaching materials and programs that bring elements of process safety into the education of undergraduate engineers.

SACHE is funded by \$300 (U.S. and Canada) and \$420 (international) annual university memberships. These funds are matched two-for-one by CCPS to a maximum of \$30,000 each year. SACHE members and the CCPS Undergraduate Engineering Subcommittee select the teaching materials to be developed. The products, generally authored by Subcommittee members (see Page 2), are developed and distributed at no additional cost to participating SACHE members. Products include slide/lecture sets, VHS and DVD video lectures, problem sets, course outlines, and instructional modules covering technical topics or case histories. Each year members receive a new package of educational materials with a value substantially greater than the annual cost of membership. New members may order the deliverables from the previous year for an additional cost equivalent to the annual membership fee.

SACHE Members (United States)

Auburn University	Oregon State University	University of Michigan
Brigham Young University	Pennsylvania State University	University of Minnesota at Duluth
Bucknell University	Princeton University	University of Minnesota at Minneapolis/St. Paul
California Polytechnic State University	Purdue University	University of Mississippi
Carnegie Mellon University	Rensselaer Polytechnic Institute	University of Missouri - Columbia
Case Western Reserve University	Rice University	University of Missouri - Rolla
City College of The CUNY	Rose-Hulman Inst. of Technology	University of Nevada at Reno
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Clemson University	South Dakota School of Mines & Tech	University of New Mexico
Colorado State University	Syracuse University	University of Notre Dame
Cornell University	Texas A&M University	University of Oklahoma
Drexel University	Texas Tech University	University of Pennsylvania
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Indiana University of Pennsylvania	University of Alabama in Tuscaloosa	University of Southern California
Iowa State University	University of Alabama in Huntsville	University of Tennessee/Knoxville
Kansas State University	University of Arkansas	University of Texas
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Lamar University	University of California at San Diego	University of Tulsa
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Louisiana Tech University	University of Cincinnati	University of Wisconsin - Madison
Manhattan College	University of Connecticut	Vanderbilt University
Marshall University Graduate College	University of Delaware	Villanova University
Massachusetts Institute of Technology	University of Florida	Virginia Commonwealth University
Michigan State University	University of Hawaii at Manoa	Virginia Polytechnic Inst. & State Univ.
Michigan Technological University	University of Houston	Washington University
Mississippi State University	University of Illinois/Urbana	Washington State University
North Carolina Agricultural & Technical State University	University of Iowa	Wayne State
New Jersey Institute of Technology	University of Idaho	West Virginia University - Institute of Technology
New Mexico State University	University of Kansas	West Virginia University
North Carolina State University	University of Kentucky	Widener University
Northeastern University	University of Louisville	Worcester Polytechnic Institute
Ohio State University	University of Maryland, College Park	Youngstown State University
Ohio University	University of Massachusetts at Amherst	
Oklahoma State University		

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McMaster University
Ryerson Polytechnic University
Universite de Sherbrooke

University of Alberta
University of British Columbia
University of Calgary
University of Montreal

University of New Brunswick
University of Saskatchewan
University of Western Ontario
University of Waterloo

SACHE Members (International)

Chalmers Univ. of Technology
ENSIC/INPL
Indian Inst. of Tech, Kanpur

Sultan Qaboos University
Technical University of Denmark
Universidad Nacional de Ingenieria

Universita di Pisa
University of Durban-Westville
University of Queensland

**SACHE BREAKFAST
2002 ANNUAL MEETING**

Tuesday, November 5, 2002

7:00 a.m. to 8:30 a.m.

Hyatt Regency Indianapolis, Salon E

(For last minute locatation changes, check on-site)

We invite you, the SACHE coordinator, and your department head to join us at our breakfast to learn what SACHE has been doing and what is on tap for 2003.

At the breakfast you will:

- Learn about new products for 2003
- Learn about our workshop plans for 2003
- Recognize essay contest winners
- Have an opportunity to tell us what new products you would like to see, how you are using our materials, and what formats you would like us to use in the future
- Have an oppportunity to network with other SACHE users

Please confirm your attendance by forwarding the following information to

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AIChE/CCPS
3 Park Avenue
New York, NY 10016-5991
Phone: 212/591-7424
Fax: 212/591-8895 or email Ishamn@aiche.org

Names: _____

University: _____

Email: _____

Phone: _____ Fax: _____

Comments: _____

Process Safety

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accompanied by a responsibility to fellow employees and the general public to ensure that the utmost care is taken with respect to health and safety. In many respects, knowing this is as, if not more, important as knowing the theory behind fundamental engineering principles.

One way in which students could be exposed to the types of safety education discussed above is to coordinate courses and/or workshops between chemical manufacturing companies and universities. Coordinating this type of cooperative learning has the potential to benefit both students and companies in that the students are exposed to the important topics affecting health and safety policy in the workplace today, and companies have the ability to influence intelligent young minds, imparting to them the decision-making abilities they will need to function successfully in their facilities.

Strengthening the "safety" link between the collegiate level and the workplace should be a priority of both universities and chemical manufacturing facilities. Both future engineers and the various companies would benefit greatly from an increased focus on safety issues in the classroom, enhancing the overall effectiveness of safety policies in the workplace.

Student Problems

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– applications that influence the safety, health, and welfare of others.

SACHE Problem Set Volume II

Areas of Chemical Engineering Education Covered with Problems Related to Chemical Process Safety:

- Stoichiometry
- Thermodynamics
- Fluid Mechanics
- Kinetics
- Heat Transfer
- Process Dynamics and Control
- Computer Solutions
- Mass Transfer

¹Michael R. Lindeburg, P.E., *Engineering-in-Training Reference Manual, 8th Edition*, Professional Publications, Inc., Chapter 63.

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- 3) Risk Assessment (CD ROM by R. Pike)
- 4) Experiments on Runaway Reactions and Vent Sizing (R. Darby)
- 5) Case History - Hixson Pharma Co. (Birtwistle)
- 6) Attendance at the annual SACHE Workshop

Fall Package

- 1) Flixborough (CD-ROM by A. Stirling)
- 2) Safety Problem Set (Willey, Crawl, Welker, and Darby)
- 3) Fire Protection (DVD by R. Welker)
- 4) AIChE Design Problem Solution (J. Louvar)

The fall package should be delivered during November, 2002. These are all excellent products with a total value far exceeding the SACHE membership fee. For those who may not have noticed, the SACHE products are improving in quality every year; be sure to review them.

Summary

Use our SACHE products. I guarantee that someday your students will return and thank you for your guidance in this area of chemical process safety.

SACHE Awards to Honor Walt Howard and Jack Wehman

Starting in 2003, the SACHE Design Awards will be named as follows:

The **Walt Howard SACHE Individual Design Award** will be for the best application of the principles of Chemical Process Safety for the Individual AIChE Student Design Problem Solution (\$200).

The **Jack Wehman SACHE Team Design Award** will be for the best application of the principles of Chemical Process Safety for the Team AIChE Student Design Problem Solution (\$300).

At their last meeting, members of the Undergraduate Education Committee unanimously agreed to make this change in recognition of the significant and continued contributions these two individuals have made to SACHE.