

SACHE News



Safety and Chemical Engineering Education - Fall 2001

Status of SACHE

J. F. LOUVAR, CHAIR
CCPS UNDERGRADUATE EDUCATION COMMITTEE

General: SACHE university members are continuing to increase in the year 2001. We are currently reminding the universities to renew their membership. The SACHE application form is available via the AIChE Homepage (then search for SACHE).

Workshops:

- 1) The workshop originally scheduled for September 16-19, 2001 at the BASF Corporation in Detroit, will be rescheduled in 2002. The workshop is for university professors. Its title is Chemical Process Safety, and it covers how safety is included in the entire life cycle of a process. The workshop teachers are industrial experts in design, operation and maintenance of plants, safety, and experimental safety.
- 2) The next workshop (2003) will be at the Exxon-Mobile Plant in Baton Rouge. For those interested in attending, contact Dr. C. Sheppard (charles-sheppard@utulsa.edu). This is a great opportunity to obtain some excellent experiences to support your teaching. The attendees only pay for their transportation to and from the workshop site.

Companies and organizations that support this workshop include:

BASF Corporation
Center for Chemical Process Safety (of AIChE)
The Dow Chemical Company
Exxon-Mobile

Merck & Company, Inc.
Rohm and Haas Company
Shell Chemical Company
U. S. Chemical Safety and Hazard Investigation Board

A special thanks for these sponsors. This support covers all the expenses for the hotel, meals, and local transportation for all of the university professor attendees (25 professors). The participants are only responsible for their transportation to and from Detroit.

Awards: Professors, please alert your students about these potential awards:

Essay Awards: There are two awards (\$500 each) for the best two essays on chemical process safety. Topics may include: safety in the unit operations laboratory, should safety be a required course, should safety be an elective course, the most important principles covered in a safety course, etc. Send your essays to

J. F. Louvar
Chemical Engineering and Materials Science
Department
Wayne State University
5050 Anthony Wayne Drive
Detroit, MI. 48202-9988

Or send them by e-mail to jlouvar@che.eng.wayne.edu.

SACHE's Student Design Award: SACHE has two awards for the AIChE Student Design problem:

- 1) A team design with the best application of the principles of chemical process safety will receive \$300 for the team.

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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.

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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 community for publication in *SACHE News*. Material should be sent directly to the editor for consideration.

Undergraduate Education Committee

CHAIR:

Joseph F. Louvar
Chemical Engineering and Material Science Department
College of Engineering
Wayne State University
Detroit, MI 48202
Voice: 313-577-9358
Fax: 313-577-3810
Email: jlouvar@che.eng.wayne.edu

EDITOR:

Jan Wagner
School of Chemical Engineering
423 Engineering North
Oklahoma State University
Stillwater, OK 74078
Voice: 405-744-5280
Fax: 405-744-6338
Email: jwagner@ceat.okstate.edu

COMMITTEE MEMBERS:

Robert Bethea, Texas Tech University
John Birtwistle, RRS Engineering
Kris Chatrathi, Fike Corporation
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Jan Wagner, Oklahoma State University
Jack Wehman, BASF Corporation
J. Reed Welker, University of Arkansas
Ron Willey, Northeastern University
John Yacher, NIOSH (retired)

Letter to the Editor

**Department of Chemical Engineering
Loughborough University
Loughborough, Leicestershire-LE11 3TU, U.K.**

Dear *SACHE News* Recipient:

Safety in the Chemical Industry has moved centre stage ever since the Bhopal Tragedy of 1984. Safety is usually achieved by add-on equipment such as controls, alarms, and trips after the plant has been designed. A concept, called Inherently Safer Design (ISD) by Professor Trevor Kletz, has captured attention globally and is gaining support from industry as well as researchers. It parallels 'Pollution Prevention' and 'Waste Minimization' concepts in pollution control and is in tune with similar other concepts such as 'Green Chemistry,' 'Friendlier Plants,' 'Sustainable Plant Design,' 'Lifetime Cost Analysis,' etc. It builds safety into the process development at early design stages so that the add-on safety measures are not needed, or are minimized, and the remaining risks are more easily controlled. The leading professional bodies, such as the Institution of Chemical Engineers (IChemE, U.K.) and the American Institute of Chemical Engineers (AIChE, USA) are actively supporting it, as are the regulators, such as the Health & Safety Executive (HSE, U.K.).

Realizing the significant potential of ISD to provide a quantum leap in process safety, the U.K. Engineering and Physical Sciences Research Council (EPSRC) has funded a project on making its use more widespread and user friendly. It is being carried out under the auspices of the Frank Lees Centre for Safety and Loss Prevention within the Department of Chemical Engineering at Loughborough University. As an important step, we wish to determine the status of ISD usage by way of a brief questionnaire. It can be obtained from our web site

<http://www.lboro.ac.uk/departments/cg/isd/index.htm>

The questionnaire will take less than 10 minutes to complete. We would be grateful if you will spare the time to do so at the earliest, preferably today, and return it by email, fax or post. After all, all chemical engineers have a stake in making our industry safer so that its public image as well as profitability improves. These will also favourably impact capital investment and R&D funding. The responders to our questionnaire will be kept posted on future developments in this project, if they would so indicate in the questionnaire.

Thank you.

Sincerely yours,

Professor J. P. Gupta
EPSRC Visiting Fellow
J.P.Gupta@Lboro.ac.uk
Phone: 44 (0) 1509 222520
Fax: 44 (0) 1509 223923

Dr. David Edwards
Senior Lecturer
D.W.Edwards@Lboro.ac.uk
Phone: 44 (0) 1509 222515
Fax: 44 (0) 1509 223923

New SACHE Modules

Vapor Cloud Dispersion Modeling

Ron Darby
Texas A&M University

This module contains a CD with Power Point and PDF files. There are about 30 slides, as well as a hard copy of the slides with comments, a description of the contents, and suggestions for use of the module.

The presentation gives background information on the factors that affect vapor cloud dispersion, including atmospheric stability, elevation, cloud properties, ground obstructions, etc. A description of instantaneous (“puff”) and continuous (“plume”) characteristics is given, along with the equations that describe the gas/vapor distribution as a function of time and position assuming either a neutrally buoyant cloud (the Pasquill-Gifford model) or a dense gas cloud (the Britter-McQuaid model).

An example is provided which illustrates the method of determining the isopleth (boundary to a given concentration) for a neutrally buoyant plume release.

BBC Education Website

The BBC Education Disaster website (<http://www.bbc.co.uk/education/archive/disaster/index.shtml>) is produced in collaboration with two BBC television series that examine the issues surrounding major international incidents. These series combine reconstructions and commentary from witnesses and experts to determine if these were preventable accidents or disasters waiting to happen. The intent of the Disaster web site is to raise issues of accountability and regulation and reflect on ways major institutions implement procedures for managing risk.

One of the programs is “Piper Alpha – Spiral to Disaster” that was distributed to SACHE members as part of the 2001 renewal package. Other catastrophes described on the Disaster web site include the 1983 inadvertent sale of a radiotherapy machine containing 6000 highly radioactive Cobalt-60 pellets to a scrap yard in Mexico,

Methacrylic Acid Tankcar Explosion and Methods of Safe Handling

Ronald J. Willey
Northeastern University

Rohm and Haas Company has provided SACHE with a 7-minute CD-ROM video clip showing the results of a railroad tank car explosion. The tank car was being used to ship methacrylic acid. It is useful in a 50-minute class covering kinetics and runaway reactions, or an advanced chemical engineering class in polymerization. It is an example of a major disaster being prevented by advanced thinking and bold decision making. No one was harmed in this accident. Remind students that when the plant guard comes to you and says “Something doesn’t sound right,” listen. It may save lives. Also available is a Power Point presentation on the safe handling of acrylic and methacrylic monomers. The instructor can extract slides and notes of interest to the class and use these along with the video clip to explain to students the hazards associated with, and methods to handle, methacrylic acid. The accident was used as an example of how to perform accident investigations, and a copy of the paper describing this process is included in the package. Finally, a MSDS and two industrial based brochures related to acrylic acid safety and handling are included for student and instructor use.

the 1986 explosion of the space shuttle Challenger, the 1989 collision of the Bowbelle dredger with the Marchioness passenger boat on the Thames River, the 1991 collision of two trains carrying nearly 300 people in the four mile long Severn Tunnel, the 1996 Value-Jet crash, and the 1996 Channel Tunnel fire. Common themes of these incidents are failure of management systems and inadequate emergency response plans.

The site also contains essays on managing risk and risk assessment. These essays introduce the concepts of hazards and risk and differences between voluntary and involuntary risk taking. Since the BBC Education Disaster website has been developed for a non-technical audience, the resources can be used to introduce risk management to a wide spectrum of students.

EDITOR'S NOTE: The following essay is the first of two winning entries in the 2001 SACHE Student Essay Contest. The second essay by Bradley Peyton, University of Iowa, will be published in the Spring, 2002, issue of *SACHE News*. Each student will receive a \$500 award and a certificate at the AIChE Annual Meeting in Reno.

Integration of Safety into Undergraduate Education

Jenny Kauffman
University of Missouri - Rolla

The integration of safety into chemical engineering undergraduate education is extremely important. It is natural for universities to lag behind industry in most matters, including safety. Schools must wait and see if the newest safety "fad" will actually stand the test of time to become an industry safety standard, before they commit their limited resources toward teaching it.

In recent years, the concern for safety in industry has increased exponentially, yet safety instruction in universities has remained about the same. This discrepancy is acceptable at this time because of the delay between industry and university development. But, if chemical engineering departments don't move quickly to increase their safety instruction, they will soon fall too far behind industry standards. This would result in co-op students, interns, and recent graduates entering the work force grossly unprepared to handle the safety aspects of their jobs.

While many of the opportunities for improvement in safety education can be found within the chemical engineering department itself, the first opportunities can be found in the chemistry department. Chemical engineering students are required to take many chemistry classes, including several labs. In these labs, students are instructed not to wear shorts or sandals and are told they must always wear safety goggles. These are great rules, but they aren't enforced. In most labs, students are not required to know anything about the chemicals they are using. This results in chemicals being handled without proper safety considerations and being disposed of in an improper manner. Allowing these unsafe practices

to occur reinforces the idea that safety isn't really important. While these problems aren't within the chemical engineering departments themselves, they require their students to take these classes to graduate. This means that chemical engineering administrators should work closely with chemistry administrators to improve lab safety, thereby reinforcing the importance of safety.

Just as chemical engineering students finish the required chemistry classes, they enter their core chemical engineering department classes. There is little or no mention of safety in these classes. For example, in fluids class, students learn about different types of pumps, but have no idea what safety devices are needed for these pumps. While a decent portion of this material is covered in the required process safety class, students learn it long after they have taken these basic classes. I feel that this safety information would be better understood and retained if it were coupled with the teaching of the basic principles. I realize that time in these classes are limited, but I feel that at least one week of the semester in classes such as fluids, heat transfer, and reactor design should be devoted to safety in that area.

The unit operations laboratory is another excellent opportunity to enforce the importance of safety. These labs give students the opportunity to practice what they have learned in the classroom. Currently, little is done to teach or enforce safety. Chemicals are disposed of improperly or are used in poorly ventilated areas. Equipment is allowed to degenerate to unsafe conditions. Students are not taught how to safely handle dangerous equipment, such as systems that use high-pressure steam. There should be almost as much emphasis on learning safety in unit operations as there is on completing the assigned projects. This is the best hands-on learning opportunity students have and it should be utilized accordingly. A more rigorous safety program should be implemented, requiring students to learn about all of the safety hazards of the equipment before operating it. Students should also have to complete weekly safety audits to ensure the continued safe operation of the equipment. These safety audits would also help students

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Louvar Receives Norton H. Walton/ Russell L. Miller Award



Joseph F. Louvar received the AIChE Safety and Health Division's Norton H. Walton/Russell L. Miller Award. The award was presented at the Division's Annual Banquet held in conjunction with the AIChE Spring National Meeting in Houston, Texas, on April 23, 2000.

This award recognizes an individual's outstanding contributions to chemical engineering and achievements in the fields of loss prevention, safety, and health.

Joe Louvar recently retired from BASF Corporation in Wyandotte, Michigan, where he served as Director of BASF's Analytical and Chemical Engineering Department from 1989 to 2000. During his tenure at BASF, he managed the implementation and maintenance of five processes that are covered under the OSHA Process Safety Management Standard. He is now Professor of Chemical Engineering at Wayne State University, where he teaches process safety, risk assessment, and the design of experiments.

Dr. Louvar specializes in chemical process safety and is the author of many publications related to safety. He has coauthored two books: *Chemical Process Safety: Fundamentals with Applications*, and *Health and Environmental Risk Analysis: Fundamentals with Applications*. His current research is in the area of runaway reactions and developing ways to mitigate them. Computational fluid dynamics is being used to simulate the addition and mixing of short-stop agents in reactors and vessels.

Joe Louvar is a Fellow of AIChE and has served as Chairman of the CCPS Undergraduate Engineering Committee, since it was initiated in 1992. He is also Chairman of the Safety and Health Division Awards Committee.

SACHE BREAKFAST 2001 ANNUAL MEETING

Tuesday, November 6, 2001

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

Check meetings listings for location.

We invite you to join us at our breakfast to learn what SACHE has been doing and what is on tap for 2002.

At the breakfast you will:

Learn about new products for 2002

Learn about our workshop plans for 2002

Recognize Essay Contest winners

Have an opportunity to tell us how you are using our materials, what new products you would like to see, and what formats you would like us to use in the future.

Have an opportunity to network with other SACHE users

Please confirm your attendance by forwarding the following information by October 15, 2001, to

Jack Weaver
AIChE/CCPS
3 Park Ave.
New York, NY 10016-5901
Phone: 212/591-7319
Fax: 212/591-8895

Name: _____

University: _____

Email: _____

Phone: _____

Fax: _____

Shami Nayak, Technical Programming

Status of SACHE

Continued from page 1

- 2) An individual's design with the best application of the principles of chemical process safety will receive \$200.

The awards may be made for designs that do not receive awards for the "best" design.

The Safety and Health Division of AIChE Awards.

Starting in 2002, the Safety and Health Division of AIChE has four \$500 awards for individuals or teams that appropriately include the concepts of "inherent" safety in their design solutions. The purpose of these awards is to increase the safety culture within universities, and to encourage students to join AIChE and the Safety and Health Division when they enter the professional arena.

Awardees: The year 2001 winners are:

SACHE Essay winners:

Bradley Peyton, University of Iowa
Jenny Kauffman, University of Missouri-Rolla

SACHE Design Award:

Adi Kuriadi, The Washington University at St. Louis.

These students and their universities are congratulated.

Products: The year 2001 products that are planned for all SACHE university members include:

- 1) Free CCPS book (be sure to request one via AIChE or Owen Kubias).
- 2) One half-price enrollment in an AIChE safety and health course.
- 3) Video – Piper Alpha (Willey).
- 4) Video on Fires (R. Welker).
- 5) Case History - Hixson Pharma Co. (Birtwsitle).
- 6) Case history on a methylacrylic acid tankcar explosion (Willey).
- 7) Slide/Lecture – Dispersion Modeling (Darby/Welker).
- 8) Attend the annual SACHE Workshop.

Integrating Safety

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adjust to the type of behavior that will be expected from them when they enter industry.

Currently, the main portion of safety students learn is taught in the required process safety course. This is a good course, but could be improved greatly. If more safety was taught in the basic principles classes, more hands-on safety teaching could occur in the safety class. More case studies could be covered, allowing students to learn from past industrial mistakes. Industry speakers could be brought in to share their experiences. In addition, plant trips could be arranged during the semester to allow students to see safety in practice. These hands on experiences would augment the safety that is learned from books. As it stands now, many students make it through the process safety class with no problems - but all they have really learned is how to find the right equation in the book. Actually seeing and experiencing the different equipment and safety scenarios would help students actually learn how to be safe, identify possibly hazardous situations, and the best way to remedy these situations - which is what is expected of them when they enter industry.

Safety in chemical engineering undergraduate education is very important. Our universities have done a good job of educating their students in safety measures so far. But if they do not act quickly to compensate for the recent emphasis on safety in industry, they will soon fall far behind industry, leaving students ill equipped to handle the safety requirements they will face when they first enter industry.

These are all excellent products. The SACHE workshop alone is worth approximately \$1000. Clearly the return on investment (\$300 per university) is significant.

Summary: SACHE is delighted to develop these products for universities. Your return on investment exceeds 3 to 1, but the real benefit is to your students and industry. I guarantee that someday your students will return and thank you for your guidance in this area of chemical process safety.

SACHE Members (United States)

Auburn University	Oklahoma State University	University of Maryland, College Park
Brigham Young University	Oregon State University	University of Massachusetts at Amherst
Bucknell University	Pennsylvania State University	University of Michigan
California Polytechnic State University	Prairie View A&M University	University of Minnesota Duluth
Carnegie Mellon University	Princeton University	University of Minnesota at Minneapolis/St. Paul
Case Western Reserve University	Purdue University	University of Mississippi
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Clarkson University	Rice University	University of Missouri - Rolla
Clemson University	Rose-Hulman Inst. of Technology	University of Nevada at Reno
Colorado State University	Rowan University	University of New Haven
Cornell University	San Jose State University	University of New Mexico
Drexel University	South Dakota School of Mines & Tech	University of Notre Dame
FAMU - FSU College of Engineering	Syracuse University	University of Oklahoma
Georgia Institute of Technology	Texas A&M University	University of Pennsylvania
Illinois Institute of Technology	Texas Tech University	University of Pittsburgh
Indiana University of Pennsylvania	Tri-State University	University of Puerto Rico
Iowa State University	Tufts University	University of South Carolina
Kansas State University	Tuskegee University	University of Southern California
Lafayette College	University of Akron	University of Tennessee/Chattanooga
Lamar University	University of Alabama	University of Tennessee/Knoxville
Lehigh University	University of Alabama in Huntsville	University of Texas
Louisiana State University	University of Arizona	University of Tulsa
Louisiana Tech University	University of Arkansas	University of Washington
Manhattan College	University of California at Berkeley	University of Wyoming
Marshall University Graduate College	University of California at San Diego	Vanderbilt University
Massachusetts Institute of Technology	University of California at Santa Barbara	Villanova University
Michigan State University	University of Cincinnati	Virginia Polytechnic Inst. & State Univ.
Michigan Technological Univ.	University of Connecticut	Washington University
Mississippi State University	University of Delaware	Washington State University
North Carolina Agricultural & Technical State University	University of Hawaii at Manoa	Wayne State
New Jersey Institute of Technology	University of Houston	West Virginia University - Institute of Technology
New Mexico State University	University of Illinois/Urbana	West Virginia University
North Carolina State University	University of Iowa	Widener University
Northeastern University	University of Idaho	Yale University
Ohio State University	University of Kansas	
Ohio University	University of Kentucky	
	University of Louisville	

SACHE Members (Canada)

DalTech, Dalhousie University	University of Alberta	University of New Brunswick
McMaster University	University of British Columbia	University of Saskatchewan
Ryerson Polytechnic University	University of Montreal	University of Western Ontario
Universite de Sherbrooke		

SACHE Members (International)

Chalmers Univ. of Technology	Sultan Qaboos University	Universita di Pisa
Indian Inst. of Tech, Kanpur	Technical University of Denmark	University of Queensland