SACHE News

CCPS CENTER FOR CHEMICAL PROCESS SAFETY
An AIChE Industry Technology Alliance

Safety and Chemical Engineering Education - Fall 2007

AIChE Student SACHE Initiative

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Gift to Universities: Starting in 2008 all AIChE affiliated U.S. Universities (approximately 160 schools) will receive complimentary membership in SACHE. This membership gift is part of the AIChE "Scale-Up" Program which grants free AIChE undergraduate student membership and promotes student AIChE activities, thanks to the sponsorship of chemical, petroleum, and pharmaceutical companies. The sponsors of "Scale-Up" Program wish to encourage all universities to use the SACHE materials and SACHE activities to give students a good foundation in the principles of chemical process safety and, ultimately, to help companies continue to improve their safety performance.

Non-U.S. universities will continue to pay the standard $300 annual SACHE membership fee.

The Safety and Chemical Engineering Education (SACHE) program was initiated in 1986 by AIChE's Center for Chemical Process Safety (CCPS). At that time, chemical companies asked CCPS for help in providing universities with teaching materials and programs that bring elements of process safety into the education of undergraduate and graduate students.

SACHE: This SACHE membership offering entitles AIChE U.S. university members to access all on-line products (beginning in 2003). There are 31 products currently on-line (2003-2008). These products were designed to assist professors (or student self-study efforts) who want to add elements of process safety to their courses. They include case histories and fundamentals, e.g., mini-case histories, static electricity, relief valves, problem sets and solutions, risk assessment, hazards of dusts, inherent safety, etc. The SACHE.org site was developed for web distribution of SACHE products. Other tools of the site include:

1. News section to search for safety related topics as well as view archived SACHE newsletters;

2. Workshop section to discuss the annual SACHE Faculty Workshop where faculty members can learn more about safety issues in an industrial setting; and

3. Links section to post and search web links on safety related topics.

Benefits: The ultimate benefit of using the SACHE products is the elimination of accidents when handling hazardous materials, including chemicals and dusts. The targeted industries include chemical, pharmaceutical, biological, microchip, petroleum, etc. Additionally:

1. These materials are developed for chemical, mechanical, control, instrument, safety engineering, and chemistry students.

2. These materials include the most important safety concepts and safety technology; and are in a format that is effective for teaching because they are developed by industrial experts (who understand the targeted industries and the principals of safety that must be included to

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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 twice annually by the Undergraduate Education Committee of the AIChE Center for Chemical Process Safety.

The opinions expressed in the articles contained in *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

AIChE Design Problem Awards for the Application of Process Safety and Inherent Safety

Awards were presented at the Student Awards Brunch on Sunday, November 4 at the Annual Student Conference in Salt Lake City.

Safety &Health Division Awards for Inherent Safety

The Safety & Health Divisions Awards are granted to the teams or individuals who apply one or more of the following concepts of inherent safety in their designs: (a) design the plant for easier and effective maintainability, (b) design the plant with less waste, (c) design the plant with special features that demonstrate inherent safety, or (d) include design concepts regarding the entire life cycle.

T. Ventrone Individual Award - $600

Thomas Brennan
Michigan Technological University
Advisor: Tony Rogers

Ephraim Scheirer Team Awards - $600 each

Kathryn Marie Geer, Joseph Skuza
Michigan State University
Advisor: Martin Hawley

Jeiran Jahani, Brian McMahon, Melissa Semple
Northeastern University
Advisor: Barry Satvat

Andrew Brentari, Kristy McCarty, Roland Buckner
Lamar University
Advisor: John Gossage

SACHE Awards

The SACHE Awards are presented to team and individuals for designs that apply appropriate principles of chemical process safety.

Walt Howard Award for an Individual Solution - $200

Jonathon Guscinski
Tri-State University
Advisor: Majid Salim

Jack Wehman Award for a Team Solution - $300

Kanwal Abidi, Chad Jumonville, Arturo Rios, Jr.
Lamar University
Advisor: John Gossage

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prevent major accidents), and professors (who understand the principals of developing educational materials that can be used effectively in classrooms).

3. These materials are ready to use by educators (e.g., PowerPoint presentations, Excel programs, and movies). Most of the products can be downloaded and modified to fit the educators' style of teaching.

4. As part of this initiative, SACHE is facilitating/developing a program for students to receive "SACHE Safety Certificates." To receive a SACHE Safety Certificate, the student will go to SACHE.org and pick a topic of interest. The on-line education module will lead the student to view and study specific SACHE products (covering the topic of interest), which will be followed by an on-line test. CCPS, SACHE, and AIChE believe that these SACHE Safety Certificates will be especially valued additions to the student's resume. This certificate program is being developed, and we expect to have two or three modules on-line in 2008.

SACHE Deliverables

SACHE membership allows the members to download most of the products.

The SACHE Newsletter (via SACHE.org) can be searched for safety related topics.

The SACHE members are invited to periodic faculty workshops. The SACHE Faculty Workshops give members a unique opportunity to learn more about safety in an industrial setting.

Links are provided that focus on especially effective safety training and education materials.

SACHE Products for 2008

The following 2008 SACHE educational resourses are available to member universities through the SACHE website (http://www.sache.org):

Seveso Accidental Release Case History

Ronald J. Willey
Northeastern University

This presentation describes a widely discussed case history that illustrates how minor engineering errors can cause significant problems; problems that should not be repeated. The accident was in Seveso, Italy in 1976. It was a small release of a dioxin that caused many serious injuries.

The package can be used in an undergraduate classroom or an industrial training session. The package can be modified to fit different contexts including: reaction engineering (runaway reactions), heat transfer (heat transport from the reactor walls to the liquid), mass transfer (the resultant dispersion of material from a release), and reaction stoichiometry. The entire module can be presented in about 50 minutes.

The Seveso case history is an especially good teaching module, showing how a minor problem and a minor release can cause very serious injuries. The root cause of this release included a poor engineering design, operator negligence, and poor supervision. The intent of this teaching module is to motivate engineers and supervisors to pay attention to the details.

This product includes five excellent problems and solutions that illustrate the lessons to be learned from this case history. The problems can be used in the following courses: a) Stoichiometry, b) Thermodynamics, c) Kinetics, d) Heat Transfer, and e) Ethics. Or they can be used in industrial training sessions in the areas of process design and engineering management.

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Risk Assessment

Ralph W. Pike
Louisiana State University

This web browser-based, self-study course is designed to provide a working knowledge of risk assessment, management and reduction as applied to chemical plants and petroleum refineries. It includes descriptions of methods with examples and exercises, and it requires about three hours to complete. Although developed for chemical engineering faculty and students, the course material can also be used as part of the safety orientation at industrial facilities. Topics focus on the detection, prevention and mitigation of risks including:

- Screening Analysis Techniques
- Checklist Reviews
- Preliminary Hazards Analysis
- Safety Audit
- What-if Analysis
- Failure Modes and Effects Analysis (FMEA)
- Hazard and Operability Studies (HAZOPS)
- Fault Tree and Event Tree Analysis
- Chemical Plume and Dispersion Analysis
- Explosion and Fire Analysis
- Assessment of Health Effects
- Quantified Risk Assessment

The course material prepares students to develop the information needed in plant design in a senior-level design course (e.g., a HAZOP on a process flow diagram) or provides background to topics discussed in a process safety course. The course material emphasizes how the methods for risk assessment, management, and reduction are related and function together.

Much of the material in the course is summarized from: *Risk Assessment and Risk Management for the Chemical Process Industry*, H. R. Greenberg and J. J. Cramer, Editors, John Wiley and Sons, New York, NY (1991); and *Process Synthesis and Design, A Self-lnstructional Problem Workbook*, D. Kauffman, ETS International, Inc., Roanoke, VA (1992). These books are recommended for further details on the topics.

Although following the order of the material as presented is recommended, the course sections can be studied in any sequence if the person has adequate background, and there are links to move easily among topics.

This is a narrated course, and the text is available by clicking on a text icon on each of the topic slides. The text and slides can be modified. The course is in a zipped file to preserve the directory structure. After unzipping the file, start the course by pointing a browser to the file index1.html in the RiskAssessment fold

Static Electricity as an Ignition Source

Konanur Manjunath
DOW Chemical

This PowerPoint presentation covers the fundamentals of selected ignition sources and control methods with an emphasis on static electricity. The presentation was developed to make it easy to jump or return to the desired sections which are:

- Introduction and non-electrical ignition sources (fires, hot surfaces, and mechanically generated sparks)
- Electrically generated sparks and electrical area classifications
- Static electricity and electro-static charge generation
- The meaning of the term “relaxation time”
- Basics of grounding and bonding
- Charge dissipation in dusts (solids) and how it differs in metals and liquids
- Types of dust electro-static discharges
- Induction charging
- Summary

The chemical industry continues to have accidents due to static electricity. The CSB recently stated that “industry and safety professionals often lacked awareness of combustible dust hazards, and MSDSs ineffectively communicate to employers and workers the hazards of combustible dust explosions and ways to prevent them.” This presentation will help professionals become aware of static electricity as an ignition source and methods to prevent static charge buildup, thus reducing the potential for fires and explosions.

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Inherently Safer Design Conflicts and Decisions

Dennis C. Hendershot (Rohm and Haas Company, retired)
John Murphy (United States Chemical Safety and Hazard Investigation Board, retired)

Inherently Safer Design (ISD) is a different philosophy for addressing safety issues in the design and operation of chemical plants. ISD focuses on eliminating or significantly reducing hazards. Often, the traditional approach to managing chemical process safety has accepted the existence and magnitude of hazards in a process, and efforts to reduce risk have concentrated on managing the risk associated with the hazards. Where feasible, ISD provides more robust and reliable risk management, and has the potential to make the chemical processing technology simpler and more economical in many cases.

However, it is important to recognize that any change to a technology or product, even a change intended to enhance safety, has the potential to introduce new hazards and risks, and to increase the magnitude of existing hazards and risks. It is important to recognize this potential and fully evaluate any change in technology with regard to all hazards and potential risks. Thus, a process or product which is inherently safer with respect to one or more hazards may introduce new risks, and these must be considered in choosing the appropriate process technology. This module describes these issues with respect to ISD, with examples of ISD conflicts. Once the potential conflicts are understood, the problem becomes a traditional engineering optimization problem, with the objective of selecting a technology option which generates the greatest overall value considering all of the conflicting requirements.

The basic principles of Inherently Safer Design are covered in more detail in the SACHE module "Introduction to Inherently Safer Design", distributed to SACHE members in 2006 and available for download by SACHE members on the SACHE web site.

Seminar on Tank Failures

Ronald J. Willey
Northeastern University

Storage tanks are encountered in every process environment. This SACHE product covers three significant tank failures:

- BLEVE (boiling liquid expanding vapor explosion) in Mexico City (1984);
- LNG (liquefied natural gas) tank failure in Cleveland (1944); and
- diesel storage tank failure (1988).

Each case demonstrates a different root cause (secondary events due to an initial surrounding fire, materials compatibility issues with cryogenic materials, and flaws in a relocation project that did not follow codes and guidelines). This presentation concludes with a review of common failure modes for storage tanks and prevention measures. This presentation increases the student's awareness of process safety requirements for storage tanks. It can be used effectively by university professors or industrial trainers. This is a PowerPoint revision of the original 1993 SACHE product.

Safety Coordinators Needed for Regional Chem-E-Car Competitions

Safety Coordinators for Chem-E-Car competitions are needed for the Southwest, Rocky Mountain, Mid America, Mid Atlantic, and Western Regional Conferences. These regional competitions cannot be held without safety coordinators.

Dan Crowl of Michigan Technological University is asking for help in identifying safety coordinators and will provide training or phone assistance for anyone that feels they need help. For more information contact

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