

Mary Kay
O'Connor
Process
Safety
Center

Chemical Engineering
Division of the
Texas Engineering
Experiment Station

The Texas A&M
University System

Centerline

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Featured in this issue:

2009 International Symposium

The 2009 Mary Kay O'Connor Process Safety Center International Symposium, Beyond Regulatory Compliance, Making Safety Second



Hopkins

Nature will be held October 27-28, 2009, at the College Station Hilton. The *Lees Memorial Lecture* keynote speaker is Dr. Andrew Hopkins, professor of sociology from the Australian National University. His talk is entitled "Why BP Failed to Learn the Lessons: The Texas City Refinery Explosion." See page 14 for the complete program and registration information.

Center Associates Highlighted

Dr. Nir Keren, Iowa State University

Dr. Carl Laird, TAMU Chemical Engineering

Look inside this issue for articles on Center associates that are making an impact on the Center and the process safety industry.

Consortium Restructuring Implemented

A restructuring of the consortium will be phased in through 2011. Consortium benefits can be found on page 19.



Director's Corner

In 1997, the year I was appointed Director, the Center established a consortium comprised of different size companies in the chemical industry. At that time, a fee structure was established without consideration of company size or function. The consortium membership consisted of Partner, Sponsor and Advisor at levels of participation of \$20,000, \$10,000 and \$5,000. These consortium members each have a representative on the Center Steering Committee. Twelve years later, this fee structure was still in place!

In October 2008, arising out of an action item raised by the current Steering Committee members, a task force was formed to study the current structure and report back to the Committee at large whether a fee and consortium restructuring was needed. The scope and objective of the study limited itself to the evaluation of current membership levels and recommending a restructured membership criteria designed to encourage membership and limit the risk of decreasing current participation.

The committee looked at other organizations and their fee structures, such as CCPS, EPSC and SOCMA. After reviewing their fee structures and after much discussion among the subcommittee members and with the steering committee, the members made their recommendations. These changes will take effect immediately for all new members joining the Center consortium. There are two levels of membership with voting rights regarding the direction of Center programs through representation on the MKOPSC Steering Committee. Operating firms (25+ employees) may become members for a yearly commitment of \$20,000 (*Partner*). Engineering firms (25+ employees) may become members for a yearly commitment of \$10,000 (*Sponsor*). *Partners* have two (2) votes and *sponsors* have one (1) vote and enjoy the benefits listed in the table found on

page 19 of this newsletter. Of course, engineering companies may elect to join the Center Consortium at the *Partner* level if they choose to do so and then enjoy the same benefits as *Partners*.

To fulfill one of the center's missions — provide service to small businesses — a category of *Associate* for annual membership dues of \$5,000 is available to organizations that employ less than 25 employees. In addition, individuals can become individual members for annual dues of \$1,000. Associate Members and Individual Members can serve on the Steering Committee as observers (without any voting privileges), and they have access to many of the center's programs, services and activities. Associate and Individual Members may be invited to serve on the MKOPSC Technical Advisory Committee. Because all membership amounts are minimum participation levels companies may opt to increase their membership to a higher level.

Many of you already have experienced the benefits of membership with the Center's consortium. However, there are several companies still out there who are not members. Some argue that in these economic times another fee to be a member of another group is not in the budget. My challenge to those of you sitting on that fence is to ask how can you not afford to be sitting at the table with your peers from large successful members of industry, with the best research based-science for process safety in the nation, at a table where research based science, industry and government meet both literally and figuratively? How can you not afford to invest in the safety of your employees, company, and industry? And finally, how can you not invest in the future leaders and practitioners in process safety?

M. Sam Mannan
Summer, 2009

Recent Publications

1. Dinh, L.T.T., Y. Guo and M.S. Mannan, "Sustainability Evaluation of Biodiesel Production Using Multi Criteria Decision-Making," Environmental Progress, vol. 28, no. 1, April 2009, pp. 38-46.
2. Cormier, B.R., R. Qi, G.W. Yun, Y. Zhang and M.S. Mannan, "Application of Computational Fluid Dynamics for LNG Vapor Dispersion Modeling: A Study of Key Parameters," Journal of Loss Prevention in the Process Industries, vol. 22, no. 3, May 2009, pp. 332-352.
3. Suardin, J.A., A.J. McPhate Jr, A. Sipkema, M. Childs and M.S. Mannan, "Fire and explosion assessment on oil and gas floating production storage offloading (FPSO): An effective screening and comparison tool," Transactions of the Institute of Chemical Engineers, Part B, Process Safety and Environmental Protection, vol. 87, no. 3, May 2009, pp. 147-160.
4. Wang, Q., Y. Zhang, W.J. Rogers and M.S. Mannan, "Molecular Simulation Studies on Chemical Reactivity of Methylcyclopentadiene," Journal of Hazardous Materials, vol. 165, no. 1-3, June 2009, pp. 141-147.
5. Liu, L., M. Papadaki, E. Pontiki, P. Stathi, W.J. Rogers and M.S. Mannan, "Isothermal Decomposition of Hydroxylamine and Hydroxylamine Nitrate in Aqueous Solutions in the Temperature Range 80-160°C," Journal of Hazardous Materials, vol. 165, no. 1-3, June 2009, pp. 573-578.
6. Suardin, J.A., Y. Wang, M. Willson and M.S. Mannan, "Field Experiment on High Expansion Foam (HEX) Application for Controlling LNG Pool Fire," Journal of Hazardous Materials, vol. 165, no. 1-3, June 2009, pp. 612-622.
7. Patel, S.J., D. Ng and M.S. Mannan, "QSPR flash point prediction of solvents using topological indices for application in computer aided molecular design," Industrial and Engineering Chemistry Research, vol. 48, no. 15, 2009, pp. 7378-7387.
8. Saenz, L.R., W.J. Rogers, M.S. Mannan, and M. Papadaki, "Approach for the Development of a More Efficient and Safer Process in the Pharmaceutical Industry," *Proceedings of the 43th Annual Loss Prevention Symposium*, Tampa, Florida, April 26-30, 2009, pp. 1-14.



News & Events

Faculty Fellow

Dr. Hae-Kwon Jeong joins as the Center's newest Faculty Fellow. At the April 8 Steering Committee meeting, Dr. Jeong introduced research he has been conducting using CO₂ containing zeolites as micro fire extinguishers for flame retardant application such as in paint. He and the Center have partnered to explore the different areas or applications that can be developed. As part of this partnership, the Center has agreed to provide funding support for this joint research effort. We are pleased that Dr. Jeong accepted this designation and has joined us.



Mannan Addressed Auditing Roundtable

As part of the keynote address at the national meeting of the Auditing Roundtable, **Sam Mannan** discussed emerging trends in process safety management. The roundtable meeting took place on April 21-23, 2009 at the Hyatt Regency San Antonio.

The Auditing Roundtable is a professional organization dedicated to the development and professional practice of environmental, health and safety (EHS) auditing. For more information on the Auditing Roundtable, visit www.auditing-roundtable.org.



White Paper Released by the Center

MKOPSC has released the white paper, "Developing a Roadmap for the Future of National Hazardous Substances Incident Surveillance." The paper has been made available on-line at: <http://psc.tamu.edu/library/center-publications/white-papers-and-position-statements>.



Visitors to the Center

The Center was host to an "educational field trip" on April 1. The FPSO Forum (Floating Production, Storage and Offloading) attendees, hosted by **Lloyd's Register**, arrived in College Station by bus from Houston, TX. **Dr. Ray Mentzer** and **Dr. Sam Mannan**

gave an overview of the Center and Center activities and research to approximately 70 attendees. Then, guided by MKOPSC graduate students, the group toured the experimental labs in the Jack E. Brown Engineering building as well as the Center library located on the 2nd floor. We were pleased to be able to contribute to the field trip and to meet the participants of this event.

Dr. Vyacheslav Kafarov, Director of the Center for Sustainable Development in Industry and Energy, and Professor and Director of Post Graduate Programs at the Industrial University of Santander, Colombia, visited the Center in the spring. On April 23, 2009, Dr. Kafarov presented to the department's faculty and students, the seminar entitled, "Overview of Research Center of Sustainable Development at UIS." During Dr. Kafarov's visit, he spent time with each student in the group reviewing their research projects and visiting with faculty. We have plans for cooperative research efforts between the two Centers in the near future.

Representatives from **Fluidyn** visited the Center on April 30 and May 1 to offer Fluidyn Computational Fluid Dynamics (CFD) software training to MKOPSC graduate students. Over this two-day course, the students were exposed to different basic scenarios for the software as well as specific situations.



Guo joins Scandpower Risk Management

Dr. Susan (Yuyan) Guo, former Assistant Research Scientist at MKOPSC, joined Scandpower Risk Management this past May. While at the Center, Dr. Guo led a team of students on their academic research as well as on many projects for our sponsors. She helped coordinate many training opportunities for the students and staff, such as the Fluidyn software training. Her expertise and energy will be missed on our team. We wish Dr. Guo great success in her new career!



Honors & Recognition

Lina Saenz, a graduate student in the Mary Kay O'Connor Process Safety Center, Artie McFerrin Department of Chemical Engineering, has been awarded the Eastman Summer Chemical Engineering Graduate Fellowship from the Eastman Chemical Group.

Saenz was selected for the honor based on her excellence in personal achievements, leadership and interest in the chemical process industries. The fellowship will provide Saenz with \$6,600 for her research.

Saenz, who is a second-year graduate student, is studying the N-oxidation of alkyipyridines, and the safety concerns related to this reaction. Saenz's goal is to develop alternatives for an inherently safer reaction by use of thermodynamic and calorimetric studies.

Saenz is conducting her research under the auspices of the Mary Kay O'Connor Process Safety Center, which is directed by Regents Professor M. Sam Mannan. Her process safety group is dedicated to studying different processes, materials and phenomena that represent a hazard in the industry.

"Lina is an overachiever, and she has made excellent contributions to her research field," Mannan said. "Her research focuses on the area of reactive chemicals, specifically on the study of N-oxidation of alkyipyridines. This catalytic reaction is used in the pharmaceutical industry and employs hydrogen peroxide as the oxidizing agent.

"During the short period of time Lina has been at Texas A&M her work has contributed to a fundamental understanding of the hazards and risks of N-oxidation of alkyipyridines. Lina's research will not only solve a need present in this pharmaceutical process, but will also show how adequate assessments of hazardous situations as well as proper identification of the properties of compounds are required to prevent incidents in industrial processes."

While working in the process safety group Saenz has learned how to provide support to the industry in the development of risk assessments and hazards identifications. The Process Safety Center's research areas include reactive chemicals, flammability, aerosols, liquefied natural gas safety, quantitative risk assessment, dust explosion, facility siting and chemical incident data systems.

Eastman fellowships are awarded to promote enrichment, growth and development in students involved in engineering.

Eastman is a Fortune 500 company that manufactures and markets more than 1,200 products that enhance the lives of people around the world. The company provides key differentiated coatings, adhesives, specialty plastics products and is a major supplier of cellulose acetate fibers.



Victor Carreto-Vazquez, a graduate student in the Mary Kay O'Connor Process Safety Center, Artie McFerrin Department of Chemical Engineering has been recognized as part of a team awarded the Journey Champion distinction by BASF Corporation.

Carreto-Vazquez was part of a vinyl resin team that assisted seven of the corporation's facilities in achieving safer operations by identifying flammable dust used at the facilities and helping facilitate transition to a less-flammable variation of the product. Carreto-Vazquez completed an internship with BASF's Applied Chemistry and Chemical Engineering division in Wyandotte, Michigan.

The honor, which is bestowed by BASF's senior vice president of ecology and safety, recognizes employees, leaders and teams who have distinguished themselves through their outstanding work while at BASF.



The Mary Kay O'Connor Process Safety Center (MKOPSC) is offering the following safety education and process safety engineering courses in Fall 2009, via the Petroleum Engineering Department's Distance Learning Program.

These distance learning courses are eligible for academic credit or Continuing Education Units (CEUs). To receive academic credit for the courses, you must be a currently enrolled student at Texas A&M University. The courses also apply towards the Safety Engineering Certificate.

Fall 2009 Offerings

CHEN 321 - SENG 321: Industrial Safety Engineering - Instructor: Dr. Ray Mentzer

Concepts of designing, operating and maintaining optimally safe systems, risk management, economic impact, legislation, performance measurement and accident investigation/analysis; principles and practices in industrial hygiene engineering, fire protection engineering, and introduction to systems safety engineering. Prerequisite: Junior classification.

SENG 422: Fire Protection Engineering - Instructor: Thomas Sturtevant

Fire protection design concepts and considerations for chemical, petrochemical and hydrocarbon processing facilities. Special attention given to fire hazard analysis, fire risk assesment, fire protection features, and emergency response. Specific fire protection design considerations are studied for the various types of facilities and processes. Prerequisite: Instructor approval

CHEN 430 - SENG 430: Risk Analysis in Safety Engineering: - Instructor: Dr. William J. Rogers

Concepts of risk and risk assessment, which uses all available information to provide a foundation for risk-informed and cost-effective engineering practices; examples and exercises are drawn from a variety of engineering areas. Prerequisite: Junior or senior classification.

CHEN 455/655 - SENG 455/655: Chemical Process Safety - Instructor: Dr. Sam Mannan

Applications of engineering principles to process safety and hazards analysis, mitigation, and prevention, with special emphasis on the chemical process industries. This course covers source modeling for leakage rates, dispersion analysis, relief valve sizing, fire and explosion damage analysis, hazards identification, risk analysis, and accident investigations.

To register for a course, contact:

Mary Lu Epps

Texas A&M Petroleum Engineering
3116 TAMU - 407 Richardson Building
College Station, TX 77843-3116
Phone: (979) 458-4297
E-mail: marylu.epps@pe.tamu.edu

**CEUs will be issued through the Mary Kay O'Connor Process Safety Center upon successful completion of the course.*

Distance Learning Objectives

In the future, the Center plans to offer all courses online for the Safety Engineering Program and the Safety Engineering Certificate Program, to teach the knowledge and skills required for safety, health, and environmental engineering.

Also in future plans is the ability to offer the Masters of Engineering in Process Safety and Masters in Safety Engineering programs as distance education programs. The objective of the non-thesis Masters of Engineering in Process Safety (ME-PS) program is to teach the principles and practices of process safety engineering for leadership careers in the process safety. For more information on requirements and prerequisites, please see website at:

<http://psc.tamu.edu/education/safety-engineering-program>

Student Spotlight: Geunwoong Yun

Howdy! My name is Geunwoong. I am a PhD student advised by Dr. Sam Mannan and a research assistant of the Mary Kay O'Connor Process Safety Center (MKOPSC). I attended SungKyunKwan University and received my BS in chemical engineering, and also received an MS degree in mechanical engineering from the YonSei University in the Republic of Korea. Moreover, I obtained an MS degree in chemical engineering from the Texas A&M University (TAMU) in College Station, TX.



I had worked for the Korea Gas Safety Corporation for 9 years as a safety engineer and research scientist for gas related facilities (including LNG terminals) and equipment. At that time, I knew of the high reputation of MKOPSC in process safety area and had a hope to join the group.

When I made a decision to study abroad, I found several universities which had a good reputation in process safety. I prepared several application documents, but first I applied for Dr. Mannan's group in the MKOPSC in the Department of Chemical Engineering at TAMU. After I got the great news that my application was accepted at TAMU, I never applied to the other universities because I believed that the MKOPSC was the best.

While working as a research assistant, I have learned many technical skills and through the advice and guidance of Dr. Mannan, I have realized that these technical skills are basic for a successful professional life. I have also learned that in addition to technical skills, in order to be successful, I need to build up communication and management skills as well.

If I look back at my past three and half years since I joined our Center, I have been happy and achieved both academic contributions and a lifetime network of colleagues and friends. I am very grateful to be a part of our Center consisting of people with a wealth of technical knowledge from diverse ethnic backgrounds.

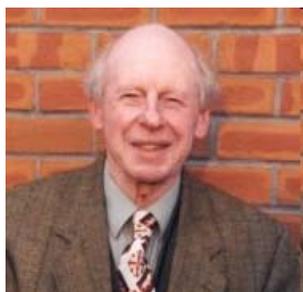
Research: LNG safety study with high expansion foam

Expansion foam is one of the important safety measures to control vapor dispersion and fire suppression. In spite of the significance of expansion foam for spilled LNG control, only few research studies have been done and still many gaps need to be filled.

My research is composed of two parts: field experiments which are difficult to conduct; and the theoretical study. The experimental data will provide clear pictures of the actual phenomena when LNG is released into the atmosphere and expansion foam is applied. This data will be used for the validation of theoretical calculations. The main purpose of this research is to show the foam effectiveness on LNG control and provide background knowledge for engineering guidelines. For example, how deep foam we should have and what are key parameters? In addition, through this research, we can have a more thorough understanding of the impact mechanism of expansion foam on the control of LNG.

Trevor's Corner No.11

The 5th Edition of *What Went Wrong?*



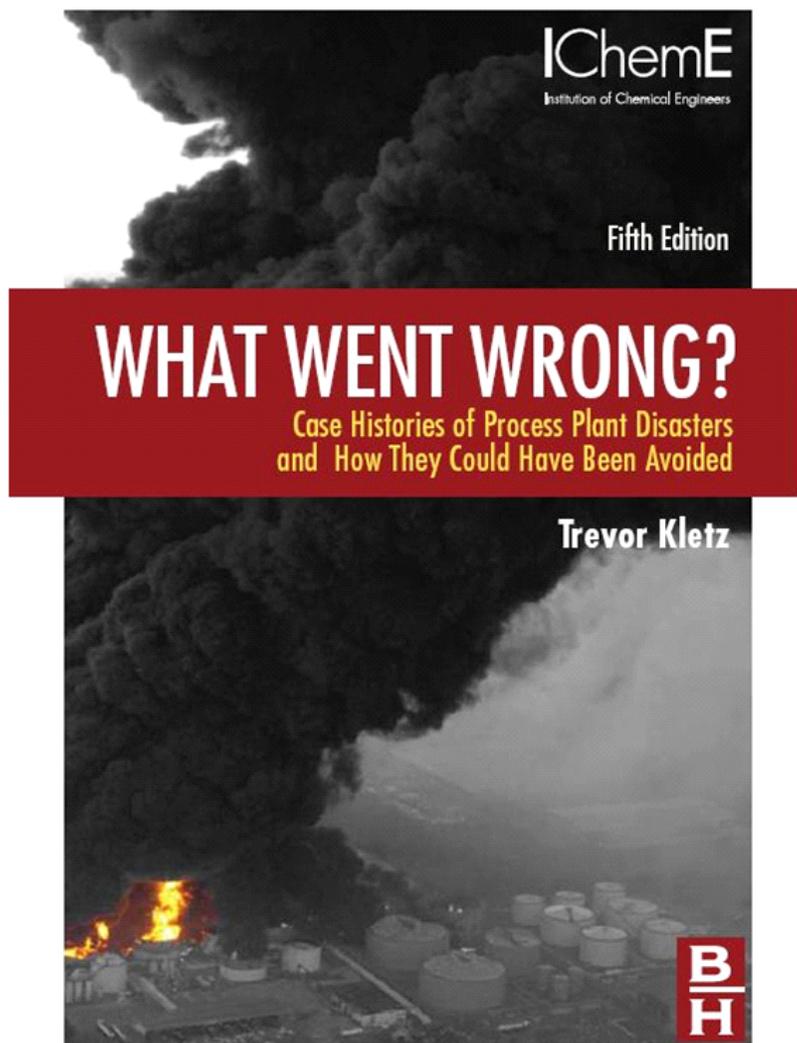
After many years experience in plant operations I was appointed safety adviser to the Heavy Organic Chemicals Division (later called the Petrochemicals Division) of the UK company, Imperial Chemical Industries. My appointment followed a number of serious fires and therefore I was mainly concerned with process hazards rather than those of a mechanical nature.

One of my tasks was to pass on to design, operating and maintenance staff details of accidents that had occurred, in the Company and elsewhere, and the lessons that could be learned from them. After I retired from industry, I published many of the reports in the 1st edition of my book, *What Went Wrong? Case Histories of Process Plant Disasters*. The 5th edition has now been published, with a longer sub-title: *Case Histories of Process Plant Disasters and How They Could Have Been Avoided*.

The new edition is about three times as long as the 1st edition but the extra material is not just “more of the same”. The early editions were mainly concerned with engineering matters. The 5th edition also describes them but, in addition, whenever possible, the new material looks for the underlying or root causes of the accidents, such as weaknesses in organization, “custom and practice”, and culture. These are matters that senior managers should consider even when they are not engineers or scientists.

The book is intended for all who work in industry, especially the chemical, oil and other process industries, and are involved in production, maintenance or design, at any level. It is not just a book for safety professionals; it is intended for all who design, operate or maintain plants, especially process plants, including people at the highest levels. Often the only safety information senior managers or directors get is a periodic summary. They should sample the detail.

The book, published by Elsevier, is already available in the United States. It will be available in Europe on August 5. The cost, for over 600 pages, is 89.95 dollars, 79.95 euros or 54.99 pounds. If it helps you to avoid just one accident, it will be the best bargain you will ever have.



Trevor Kletz

Where Are They Now? *Nir Keren*

My interest in Safety began when I was introduced to the Management and Safety Engineering program at the Ben Gurion University in Beer-Sheva, Israel. In 1996, I decided to pursue a master's degree in that program, six years after I completed my undergraduate studies in Mechanical Engineering at the same institution. During those six years, I served as a maintenance engineer and a maintenance manager in process facilities.

The program of study in the Management and Safety Engineering unit required intensive effort, as there was a need to comprehend knowledge from various and significantly different disciplines. Yet, this interdisciplinary nature of this program of study introduced a fresh breeze into my academic experience. In 1998, I graduated *magna cum laude* with my master's degree.

Shortly after graduating, I accepted an executive position in one of Israel Chemicals' subsidiaries. Approximately a year after I joined this group, we lost one of our employees in an accident. For several months after this accident, I could not come to a firm conclusion that I had "learned a lesson" that would dramatically reduce the likelihood of similar events from recurring. For almost a year I debated with myself whether I could continue serving in my role, knowing that I fell short in learning this lesson. This personal debate led to a turning point in my career. I began an intensive search for an academic institution at which I could pursue Ph.D. studies and later become a researcher and educator in the Safety arena. The search revealed several alternatives in the US, Australia, and the UK. In February 2000, I flew to College Station and met with Dr. Mannan. Shortly after meeting him, I applied for the Interdisciplinary Engineering program, and in January 2001, I "reported to duty" as a graduate student at the Mary Kay O'Connor Process Safety Center. In December 2003, I completed my studies and spent two more years as a research scientist at the center. These were a wonderful five years of prospering and growth that my family and I will always cherish.

In August 2005, I joined the Occupational Safety Engineering program in the Department of Agricultural and Biosystems Engineering at Iowa State University, as an Assistant Professor. My teaching responsibilities at Iowa State University include teaching three courses (System Safety Analysis, Fire Protection and Prevention, Industrial Hygiene) and conducting a Safety laboratory. My disciplinary research is focused in two main areas: (1) harnessing incident databases to enhance loss prevention; and (2) studying safety decision making, the most fundamental element of human safety behavior. In harnessing incident databases, I work on developing tools and studying correlations to support quantitative risk assessments, risk analysis of transportation of hazardous material, and analysis and monitoring effectiveness of regulations and policies. In safety decision making, my interest is in developing naturalistic decision making models. Naturalistic decision making is a school of thought that desires to study decision making in the natural environment of the decision maker and to minimize/eliminate the uncertainties and biases that laboratory studies introduce. Specifically, I am interested in developing predictive models for emergency responders' decision making under a variety of domains, such as environmental constraints, organizational climates and cultures, and personal propensities. To pursue some of the studies in this area, my research team and I are utilizing the facilities in the Virtual Reality Application Center (VRAC) here at Iowa State University. Among the facilities in VRAC is the C6, a computer automated virtual room with the highest resolution in the world (8 times the resolution of an HDTV), where all six walls are projected to establish a highly immersive environment. Currently, we are completing the development of a virtual reality environment to test firefighters' performance under hazardous conditions. The project includes the development of a sophisticated real-time decision capturing algorithm to trace and analyze decision making processes in the virtual environment. Furthermore, we are in the design stage for a virtual process facility to establish an environment for simulations and training of response to emergency scenarios typical in the process industry. My research team includes three Ph.D. and four master's students.



(Cont'd on next page)

MKOPSC Faculty Fellow - Dr. Carl Laird

Carl Laird, assistant professor in the Artie McFerrin Department of Chemical Engineering at Texas A&M University, has joined the Mary Kay O'Connor Process Safety Center as a Faculty Fellow.

“Dr. Laird brings a unique combination of research and teaching skills,” said Sam Mannan, director of the center. “His expertise in large-scale modeling and optimization of nonlinear systems will provide a valuable contribution to the center.”

Laird obtained his undergraduate chemical engineering degree at the University of Alberta in Edmonton, Canada. During his undergraduate studies, Laird worked as an intern process engineer for Husky Oil Ltd. and Chevron Canada. Building off of this experience, he spent five years with Hyprotech Ltd. developing Hysys, a leading simulation package for the process industries.

Laird completed his graduate studies at Carnegie Mellon University under the guidance of Professor Lorenz T. Biegler where his thesis work focused on novel algorithms for solving large-scale optimization problems in the area of homeland security.

“I worked directly with researchers at Sandia National Laboratory where we formulated large-scale inverse problems to help protect water systems against potential contamination,” Laird said.

Working in further collaboration with researchers at the IBM T.J. Watson Research center, Laird completed

the development of a numerical package for the solution of these and other nonlinear optimization problems.

In his short time at Texas A&M, Laird has received two prominent teaching awards, the 2008 Celanese Excellence in Teaching Award and the Outstanding Teacher of the Year Award by the university's student chapter of the American Institute of Chemical Engineers.

“Teaching is essentially the mission of the faculty of this department, and Dr. Laird has excelled at teaching,” said Department Head and Charles D. Holland '53 Professor Michael V. Pishko. “He is a dynamic and outstanding educator.”

In addition to his teaching responsibilities, Laird conducts research focusing on large-scale nonlinear optimization, parameter estimation and parallel computing. He continues work on algorithms as part of an early warning contaminant detection system in municipal drinking water networks. He also is involved in the modeling and optimization of infectious diseases, working to determine the fundamental driving forces affecting the spread of infectious disease.

“I hope to bring our expertise in large-scale modeling and optimization to important problems in safety, sustainability and homeland security,” Laird said.



Nir Keren - Cont'd.

As part of my role as a faculty member, I carry a heavy service load: other than departmental and college level service responsibilities, at the university level, I serve as a faculty senator and a member of the Honorary Degree Committee. On the state level, I am a member of the Board of Directors of the Iowa Occupational Safety and Health Advisory Council. I am also a member of the Advisory Board of the Industrial Hygiene program at the University of Iowa.

On the national level, I am a member of the AIChE Loss Prevention Symposium committee and the CCPS Safety and Chemical Engineering Education subcommittee.

While the circumstances leading to the change in my career could have been more pleasant, this change led me to a fulfilling occupation for which one can only hope.



Dr. Keren and several members of his research team in the C6

Case History Presented by MKOPSC Graduate Student at April 8th Steering Committee Meeting

LPG Fire at Valero–McKee Refinery, February 16, 2007 Presented by Carolina Herrera

On February 16, 2007, a large release of liquid propane from a cracked control station occurred in the Valero's McKee refinery in the town of Sunray, Texas. The formed vapor cloud ignited resulting in a massive fire causing extensive equipment damage, severe injury of 3 employees of the 14 reported injuries, temporarily shutdown of the refinery, and monetary losses exceeding 50 million dollars.

The release occurred in the control station pipe of the propane de-asphalting unit (PDA). Initially, the PDA process was designed so pitch and propane would pre-mix before entering the extraction tower. However, 15 years before this accident the pre-mixing control station was taken out of service by closing a series of valves, creating a dead leg still connected to the process. An object obstructing a block valve let water leak through and accumulate in the idle section of the pipe. A cold front dropped the temperatures below freezing and caused the water to freeze, expand, and fracture the piping. When the temperature rose above the freezing point, ice thawed and released high-pressure liquid propane.

Risks were not properly recognized due to the informal process safety Management of Change (MOC) review used to identify the safest way to decommission the equipment along with the lack of a formal written program to identify and implement winterization programs. In addition, the insufficient fireproofing of structural support steel, and the lack of implementation of remotely operable shut-off valves contributed to the severity of this accident. The accident at the McKee refinery emphasizes the importance of the implementation of appropriate MOC techniques when piping or equipment is taken out of service and the establishment of formal, written winterization programs to assess low point drains and other areas susceptible to water accumulation and freezing.



Case Histories Presented by MKOPSC Graduate Student at June 4th Steering Committee Meeting

Confined Vapor Cloud Explosion at CAI/ARNEL Chemical Plant, Danvers, MA - Nov 22, 2006 Presented by Carmen Osorio

On November 22, 2006, a massive explosion and fire occurred at the CAI/Arnel ink and paint products manufacturing facility in Danvers, MA. This incident left at least 10 people injured and caused the destruction of the entire facility. The blast wave heavily damaged dozens of nearby homes and businesses. The serious consequences forced the fire department to evacuate more than 3,000 residents within a half-mile radius from the facility.

The CSB determined the immediate cause of the accident to be the overheating of 10,000-pounds of a highly flammable mixture in an unventilated building for many hours.

CSB also concluded that it would have been prevented if CAI had conducted a hazard analysis or other systematic review to ensure flammable liquids were safely handled during the manufacturing process. For example, hazard analysis could have identified the need for continuous ventilation, automatic controls and other safeguards such as alarms and automatic shutoffs to prevent human error.

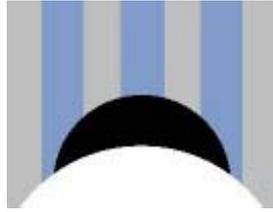
The investigation found that the day before the incident, an operator most likely left open the manual valve inadvertently, which controlled the steam heat to the mixing tank. As the temperature increased, vapor

coming out of the unsealed tank spread throughout the unventilated production area and then ignited from an undetermined source, and exploded.

CSB found that CAI manufacturer did not have automated process controls, alarms, or other safeguards which made it easier for a human error. Furthermore, they did not follow regulations and or appropriate procedures for safe handling of flammable materials. Based on this, CSB recommended that CAI Inc develop a written safety program to manage hazardous process operations, in compliance with the safety regulations.

Furthermore, CBS issued recommendations to the National Fire Protection Association, and the International Code Council to review national fire codes in order to prohibit the heating of flammable liquids in indoor tanks that are unsealed and do not vent to the outside and to require automatic temperature control to prevent overheating. At the same time CSB recommended to the General Court of the Commonwealth of Massachusetts, the Massachusetts Office of Public Safety, and the town of Danvers to require licensing and inspection procedures to improve the safety and oversight of facilities handling hazardous materials.





Mary Kay O'Connor Process Safety Center

2009 INTERNATIONAL SYMPOSIUM Making Safety Second Nature

October 27-28, 2009

**Hilton College Station-Conference Center
College Station, Texas**



Qualifies for 15 PDHs required by Texas Board of Professional Engineers, when taken with the 1 hr Engineering Ethics session immediately following the Symposium. See website for registration information on the Special Session: Engineering Ethics.

See Web site for details and registration information:

<http://psc.tamu.edu/symposia/2009>

Mary Kay O'Connor Process Safety Center

2009 INTERNATIONAL SYMPOSIUM Making Safety Second Nature

Tuesday, October 27, 2009

8:00PM - 9:30AM	8:00AM - Frank P. Lees Memorial Lecture - "Why BP Failed to Learn the Lessons: The Texas City Refinery Explosion," Dr. Andrew Hopkins, Professor of Sociology, Australian National University				
	9:00AM - State of the Center: Research Program, Current Activities, and Future Direction," Dr. Sam Mannan, Director, Mary Kay O'Connor Process Safety Center				
10AM - Noon	Track I	Track II	Track III	Track IV	
	George King, Kathy Shell	Mike Marshall, Marc Levin	Skip Early, Kiran Krishna	Scott Ostrowski, Michela Gentile, Sara Saxena	
	Risk Assessment - I	Reactive Chemicals/ Flammability - I	Process Management for Safety - I	Facility Siting	
	<ul style="list-style-type: none"> ➤ "Screening Atmospheric Relief Devices for Unacceptable Risks," D. Eure, Dow Chemical ➤ "ExSys-LOPA -simplified risk assessment method for typical major hazards scenario encountered in the process industry," A. Markowski, Technical University of Lodz ➤ "Process safety challenges in view of the upcoming hydrogen economy," H. Pasman, MKOPSC ➤ "Applying Risk Assessment To Overpressure Protection System Concerns," N. Faulk, Lloyds 	<ul style="list-style-type: none"> ➤ "Azodicarboxylates: Explosive Properties and Thermal Hazards," A. Berger, BAM Germany ➤ "Secondary decompositions in the N-oxidation of low-order alky-pyridines," L. Saenz, MKOPSC ➤ "Experimental Investigations on Flammability Characteristics of Acetone Aqueous Solution at 150°C and 1 atm," C-M. Shu, National Yunlin University of Science and Technology ➤ "High Temperature Effects on Vessel Integrity," M. Levin, Shell 	<ul style="list-style-type: none"> ➤ "Is Your Organization Ready for Change?," A. Fleming, User Centered Design Services ➤ "One Company's Experience with Process Safety Metrics," T. Welch, BP ➤ "Our People are our Most Important Asset: Making Money Between the Safety Limits," I. Sutton, AMEC ➤ "Prescriptive Safety Requirements in a Goal Setting Environment?," J. Suardin, Shell 	<ul style="list-style-type: none"> ➤ "Land-Use Planning Regulations in France Following the Toulouse Disaster," J. Taveau, Institute for Radiological Protection and Nuclear Safety, France ➤ "A New Approach for Facility Siting by Mapping Risks on a Plant Grid Area and Optimi-zation," S. Jung, MKOPSC ➤ "New API RP 752 Facility Siting Requirements and How They Affect Your Company," J. Alderman, RRS ➤ "Investigation of Different Extended Kalman Filter Implementations," M. Serpas, TAMU Chemical Engineering 	
	Risk Assessment - II	Reactive Chemicals/ Flammability- II	Process Management for Safety - II	Buncefield Incident	
	<ul style="list-style-type: none"> ➤ "Scenario Identification and Evaluation for Layers of Protection Analysis ," K. First, Dow Chemical ➤ "Risk Communications: Websites for Barrier Diagrams and Process Safety," R. Pitblado, DNV ➤ "The Comprehensive Quantitative Assessment of an Offshore Fire Water System," R. Gustafson, Atkins ➤ "A Toxicity Risk Assessment Method for Spill Incidents Involving Volatile Liquid Hydrocarbons and Aqueous Solutions in Enclosed Areas," N. Kazantzis, Worcester Polytechnic Institute 	<ul style="list-style-type: none"> ➤ "Reactive Chemical Hazard Evaluation using CFD Simulation," L. Liu, MKOPSC ➤ "Evaluative Comparison of Two methods for SADT determination (UN H.1 and H.4)," M. Malow, BAM ➤ "Safely Handling Guideline for Organic Peroxides and Inorganic Peroxides by Calorimetric Approaches," C-H. Su, Wu Feng Institute of Technology, Taiwan ➤ "Project Wide Development of a Protective Devices Register," M. Hernandez, Fluor 	<ul style="list-style-type: none"> ➤ "Using Leading Indicators to Continuously Improve QHSE Performance," A. Hilstad, Syntex ➤ "Driving Process Safety Performance," K. Shell, RMT ➤ "Effective Process Safety Auditing Techniques," L. Morrison, BP International Limited ➤ "Teaching process safety: a stand-alone course or a continuous integrating thread throughout a chemical engineering degree?," S. Waldram, TAMU-Qatar 	<ul style="list-style-type: none"> ➤ "A Technical Analysis of the Buncefield Explosion and Fire," M.S. Mannan, MKOPSC ➤ "The UK Buncefield Incident - The View From the 'Middle,' That of a UK Risk Assessment Engineer," I Herbert, ABB ➤ "Analysis of the Buncefield Oil Depot Explosion: Explosion Modeling and Process Safety Perspective," C. Schemel, Packer Engineering ➤ "The Potential for Vapour Cloud Explosions - Lessons from Buncefield," M. Johnson, Advantica 	
	Gas Detection / Dispersion		Case Histories - I		
	<ul style="list-style-type: none"> ➤ "Flashing liquid jets and two-phase droplet dispersion - I. Over- view and model implementation/validation," H. Witlox, DNV ➤ "Flashing liquid jets and two-phase droplet dispersion - II. Scaled experiments for derivation of droplet atomisation correlations," H. Witlox, DNV ➤ "Reliability Considerations in Locating Gas Detectors," R. Deshotels, Fluor ➤ "Using CFD to Optimize Gas Detector Systems in Process Facilities," S. Davis, Gexcon 	<ul style="list-style-type: none"> ➤ "Brine Injection Pump Incident," B. Nalbone ➤ "Case Histories and Lessons Learned - Valero – McKee Refinery Propane Release and Fire," J. Lay, US Dept of Labor ➤ "High Consequence Areas," S. DePaula, US Dept of Transportation ➤ "Review of a Major Chemical Company's Electronic Incident Reporting System: Lessons Learned to Increase its Usefulness," M. Fecke, Exponent 			
	3:30PM - 5:30PM				
	5:30- 7:00PM	Reception			

Mary Kay O'Connor Process Safety Center

2009 INTERNATIONAL SYMPOSIUM Making Safety Second Nature

Wednesday October 28, 2009

8:00PM - 9:30AM	8:00AM - Carolyn Merritt Memorial Tribute Speakers: John Bresland and M. Sam Mannan				
	9:00AM - Overview of DHS Project Research, Dr. Ray Mentzer, Mary Kay O'Connor Process Safety Center 9:20AM - Lamiya Zahin Memorial Safety Scholarship Presentation, Dr. Sam Mannan, Director, Mary Kay O'Connor Process Safety Center				
10AM - Noon	Track I	Track II	Track III	Track IV	
	George King, Kathy Shell	Mike Marshall, Marc Levin	Skip Early, Michela Gentile, Kiran Krishna	Scott Ostrowski, Sara Saxena	
	Risk Assessment - III	LNG - I	Process Management for Safety - III	Explosion - I	
	<ul style="list-style-type: none"> ➤ "Forced Dispersion of LNG Vapor with Water Curtain," M. Rana, MKOPSC ➤ "Using Quantitative Risk Analysis Tools for Early Project Definition Decision Support," I. Shaikh, Lloyds ➤ "Risk Through the Eyes of an Inspector," R. Lee, US Dept. of Transportation ➤ "Beyond-Compliance Uses of HAZOP/LOPA Studies," R. Johnson, Unwin 	<ul style="list-style-type: none"> ➤ "Performance Metrics for Evaluating LNG Vapor Dispersion Models," F. Licari, DOT ➤ "Transient Spreading of LNG on Water," H. Kytomaa, Exponent ➤ "What happens when LNG is released underwater?," P. Raj, TMS ➤ "Absorption Characteristic of LNG as a Function of IR Wavelength," C. Herrera, MKOPSC 	<ul style="list-style-type: none"> ➤ "Dynamic SIL Analysis," P. Goteti, Honeywell ➤ "Overfill Protective Systems - Complex Problem, Simple Solution," A. Summers, SIS-Tech ➤ "Integrating Medium Voltage Switchgear Breakers into a Safety Instrumented Function," D. Grattan, S&B Engineers & Constructors ➤ "Maintaining the Corporate Memory," J. Chosnek, KnowledgeOne 	<ul style="list-style-type: none"> ➤ "Application of Advanced CFD Modeling on VCE and Vapor Dispersion," A. Qiao, DNV ➤ "A Study on the Effect of Trees on Gas Explosions," J. Roar Bakke, Gexcon ➤ "Explosion protection - using the DATABASE CHEMSAFE," M. Molnarne, BAM Germany ➤ "Dust Explosion Risks of Common Food Products," D. Castellanos, MKOPSC 	
	Inherent Safety/ Resilience/LOPA	LNG - II	Human Factors/ Safety Culture	Explosion - II	
	<ul style="list-style-type: none"> ➤ "Develop and Design Inherently Safer Processes and Process Plants," V. Edwards, Aker Solutions ➤ "LOPA Lessons from Past Process Plant Incidents," M. Sawyer, ASC ➤ "Managing Risk - Finding the Optimum Level of Safety," M. Rothschild, Acutech ➤ "Process Hazard Analysis: Study Enhancement," K. Farrell, Invista 	<ul style="list-style-type: none"> ➤ "LNG Trench Dispersion Modeling Using Computational Fluid Dynamics," T. Melton, Quest ➤ "The Effect of Substrate on Vapor Dispersion from an LNG Spill into an Impoundment," F. Gavelli, Exponent ➤ "LNG Vapor Dispersion Consequence Modeling with CFX," R. Qi, MKOPSC ➤ "Design Requirements: A Comparison of Vapour Cloud Explosion Models and the Importance of Properly Assessing Potential Incident Impact," N. Ryder, Packer Engineering 	<ul style="list-style-type: none"> ➤ "Why Bad Things Happen to Good People," W. Mostia, SIS-Tech ➤ "Leading and lagging: The safety climate-unsafe events relationship", S. Payne, TAMU Industrial Psychology ➤ "Causal Factors Analysis to Investigate Information-Rich Events Before Accidents Occur," R. Hartley, Pantex ➤ "CSB's Perspective on Safety Culture and Human Factors as Accident Causation," J. Bresland, CSB 	<ul style="list-style-type: none"> ➤ "A Risk Based Approach to Blast Modeling for the Design of Offshore Installations," G. Mohan, Atkins ➤ "Validation of FLACS for Vapor Dispersion from LNG Spills: Model Evaluation Protocol," O. Hansen, Gexcon ➤ ☺ Dust Explosion Hazard Assessment, Including OSHA Combustible Dust National Emphasis Program , " V. Ebadat , Chilworth Technology, Inc. ➤ "OSHA Combustible Dust NEP Inadequacies," J. Astad, Combustible Dust Policy Institute 	
	Case Histories - II				
	<ul style="list-style-type: none"> ➤ "Common Operations Failure Modes in the Process Industries," P. Bullemer, ASM ➤ "20 Years On-Lessons learned from Piper Alpha the Evolution of Concurrent and Inherently Safe Design," B. Sing, IONIK ➤ "ICI's Contribution to Process Safety," T. Kletz, MKOPSC 				
	5:15 - 6:15PM	Special Session: Engineering Ethics - (Register Separately) Dr. Sam Mannan, Mary Kay O'Connor Process Safety Center			

The Symposium will feature a poster display area, with the main showing at the reception on Tuesday.

Mary Kay O'Connor Process Safety Center 2009 International Symposium

October 27-28, 2009
Hilton Conference Center • College Station, Texas

ON-LINE Registration: <http://psc.tamu.edu/symposia/2009>

This form is for payment by check (*payable to Mary Kay O'Connor Process Safety Center*)

Please Print

Name		
Company		
Mailing Address		
Phone	Fax	E-Mail Address

REGISTRATION FEES: {Symposium registration fee includes refreshments, lunch, handouts and proceedings}

- Received **by Oct 1, 2009- \$495.00** per person • After **Oct. 1, 2009 - \$550.00** per person
- Partner, Sponsor, and Advisor membership level organizations receive 40%, 20%, and 10% discounts, respectively.

*Proceedings **only**, without registration - **\$65.00***

Symposium Registration \$ _____

Ethics Registration \$ _____

Trever Kletz Seminar \$ _____

TOTAL \$ _____

Mail form and check to: Mary Kay O'Connor Process Safety Center, 3122 TAMU, College Station, TX 77843-3122

Cancellation Policy: Cancellations must be received ten working days prior to the symposium to receive a full refund. After that time, there will be a 30% penalty. All refunds will incur a \$25 service charge.

Wednesday, October 28, 2009 • 5:15-6:15PM,
Mary Kay O'Connor Process Safety Center
2009 Engineering Ethics Session
Fee: \$45 (Separate from Symposium registration fee.)

Immediately following the Symposium, SPECIAL SESSION: "Engineering Ethics" will be presented by Dr. Sam Mannan. This session qualifies for one PDH (professional development hour) in the area of professional ethics or roles and responsibilities of professional engineering, as required by the Texas Board of Professional Engineers, RULE §137.17 Continuing Education Program.

Registration is available on-line at:

<http://psc.tamu.edu/symposia/2009>



2009 Continuing Education Schedule

<http://psc.tamu.edu/events/2009-schedule-of-classes>

Date	Class	Instructor	Location
1/15	Inherently Safer Workshop	Mannan	IAH-Houston
2/17– 2/18	Process Hazard Analysis Leadership Training	Early	TTI
2/17– 2/18	Layers of Protection Analysis	Summers	SIS-TECH
2/24– 2/25	Fundamentals of Process Safety Management	Sepeda	SIS-TECH
3/17– 3/19	SIS Implementation	Summers	SIS-TECH
4/7– 4/8	SIL Verification	Summers	SIS-TECH
5/19– 5/20	Best Practices-- Pressure Relief Systems	Aldeeb	TTI
9/15– 9/16	Fundamentals of Process Safety Management	Sepeda	SIS-TECH
9/15– 9/16	Process Hazard Analysis Leadership Training	Early	TTI
9/22– 9/23	Layers of Protection Analysis	Summers	SIS-TECH
10/13 – 10-15	SIS Implementation	Summers	SIS-TECH
11/3– 11/4	SIL Verification	Summers	SIS-TECH
11/17 – 11/18	Best Practices– Pressure Relief Systems	Aldeeb	TTI

Will be offered in 2009

TBA	A Systematic Assessment of Reactive Chemical Hazards	Mannan/Rogers
TBA	Engineering Design Systems	Grossel/Frey

Available upon request

Implementing or Optimizing Your SHE Management Systems	McVaugh
Auditing your SHE Management System	McVaugh
Fundamentals of Loss Prevention	Slye
Inherently Safer Design	Moore
Liquefied Natural Gas	Mannan
Management of Change	Sepeda
What Went Wrong?	Sanders

Locations:

SIS-TECH Solutions - 12621 Featherwood; Houston, TX
 Texas Transportation Institute - 701 N. Post Oak, Suite 430; Houston, TX
 IAH – Bush Intercontinental Airport



Mary Kay O'Connor Process Safety Center Details of Center Consortium Membership and Benefits

1. Levels of Center Consortium Memberships

There are two levels of membership with voting rights regarding the direction of Center programs through representation on the MKOPSC Steering Committee. Operating firms (25+ employees) may become members for a yearly commitment of \$20,000 (*Partner*). Engineering firms (25+ employees) may become members for a yearly commitment of \$10,000 (*Sponsor*). *Partners* have two (2) votes and *sponsors* have one (1) vote and enjoy the benefits listed in the following table. Of course, engineering companies may elect to join the Center Consortium at the *Partner* level if they choose to do so and then enjoy the same benefits as *Partners*.

To fulfill one of the center's missions — provide service to small businesses — a category of *Associate* for annual membership dues of \$5,000 is available to organizations that employ less than 25 employees. In addition, individuals can become individual members for annual dues of \$1000. Associate Members and Individual Members can serve on the Steering Committee as observers (without any voting privileges), and they have access to many of the center's programs, services and activities. Associate and Individual Members may be invited to serve on the MKOPSC Technical Advisory Committee. Because all membership amounts are minimum participation levels companies may opt to increase their membership to a higher level.

A summary of member benefits are summarized in the table below and outlined in detail in Section 2.

Benefits	<i>Partner</i>	<i>Sponsor</i>	<i>Associate</i>	<i>Individual</i>
1. Membership on the Steering Committee of the center	X	X		
2. Facilitated access to pool of skilled graduate students	X	X		
3. Annual report of the center's research and sponsored activities and twice-yearly Research Highlights	X	X		
4. Facilitated access to faculty experts in areas related to process safety and risk management technology	X	X		
5. Discounted fees for symposium, continuing education courses, publications and other services	40% discount	20% discount	10% discount	
6. Symposium registration – one complimentary	X	20% discount	10% discount	
7. Preprints of research reports published by the center	X	X		
8. Free use of computer software developed by the center	X			
9. Database searches	X	50% discount	20% discount	
10. Ask the Expert	X	X	X	
11. Symposium proceedings	X	X	20% discount	
12. Library and information services	X	X	X	X

2. Detailed Benefits of Center Membership

The total funds raised from center consortium dues are dedicated to MS and PhD projects. These projects are selected by vote of the Steering Committee. A subcommittee on projects (consisting of no more than five SC members or appointees) is charged with selecting project proposals to bring to the full steering committee for vote for funding and implementation.

2.1 Membership on the Steering Committee of the Center

Each *Partner* and *Sponsor* organization may place a representative on the Steering Committee of the center. Associate members and individuals may also serve on the Steering Committee as observers, but will not enjoy any voting privileges. The Steering Committee meets at least four times a year on the Texas A&M University campus or other appropriate locations to review the Center's program and discuss research results and direction. This meeting provides Steering Committee members not only an opportunity to influence the research at the center, but also to hear how other companies view critical research issues. Companies choosing the membership at the *Partner* level will have two votes and companies at the *Sponsor* level will have one vote on initiatives brought to the Steering Committee.

2.2 Facilitated Access to Pool of Skilled Graduate Students

The Center supports Texas A&M graduate students working on M.S. and Ph.D. degrees in various fields related to process safety and risk management. In addition, postdoctoral research associates are involved in assisting students. Statistics show that more than half of the graduates and a significant fraction of post-docs go to work for member firms. The Center is the largest pool of high-quality graduate students trained in process safety and risk management technologies in the world. Organizations supporting the center are encouraged to interact and discuss research problems with the students and to consider them for summer and permanent employment. *Partner* level membership will be notified of students ready for internship first followed by *Sponsor* and finally *Associate* level membership.

2.3 Annual Report

The center publishes, for the exclusive use of member firms, an annual report on process safety and risk management research and activities at Texas A&M University. The annual report includes detailed descriptions of progress in all projects performed by the Center regardless of funding source. In addition to the annual report, the center publishes periodically Research Highlights on process safety and risk management issues, technologies and new research initiatives. The Research Highlights include brief but timely summaries, approximately two paragraphs in length, of new developments in each research project. Each summary includes the names and telephone numbers of the researchers involved, and members are encouraged to interact with them directly in areas of mutual interest. Research Highlights also includes a list of publications, a list of students completing degree requirements, and brief reports on other developments of interest.

2.4 Facilitated Access to Faculty Experts in Areas Related to Process Safety and Risk Management Technology

Faculty working in the Mary Kay O'Connor Process Safety Center comes from the departments of Chemical Engineering, Communications and Outreach, Computer Science, Electrical and Computer Engineering, Industrial Engineering, Management Systems and Planning, Mechanical Engineering, Nuclear Engineering and Safety Engineering, and Program Evaluation. They all have outstanding reputations as scientists and engineers, numerous publications, and expertise in areas critical to process safety and risk management. Through previous employment and consulting, they are also familiar with the industrial environment and industrial research. Supporting organizations have access to this pool of faculty for consultation and discussion of technical problems. Supporting organizations are encouraged to establish a close working relationship with faculty and staff of the center, as well as make frequent visits to the center to stay in close contact with the research. Center staff also makes visits to supporting organizations.

2.5 Discounted Fees for Continuing Education Courses, Publications and Other Services

Supporting organizations are given discounted rates for symposium, continuing education courses, publications and other services. The discounted rates are 40, 20 and 10 percent for *Partner*, *Sponsor* and *Associate* members, respectively.

2.6 Symposium Registration

Organizations at the *Operating* level receive one complimentary registration for the annual symposium.

2.7 Preprints of Research Reports Published by the Center

Partner and *Sponsor* level members are provided preprints of research reports originating in the center. In addition, most of the faculty affiliated with the center willingly share reports of related contract research funded directly by other sponsors with member organizations unless the other sponsor prohibits such distribution. Given the fact that many publications do not appear in print until more than a year after submission, supporting organizations are able to take advantage of new developments before they are generally known.

2.8 Use of Computer Software Developed at the Center

Partner members are offered free use of computer software developed at the center. Exception to this occurs when the software is developed specifically for a project, and the contract prohibits the distribution or sale of the software.

2.9 Database Searches

Specific database searches of library reference material, equipment reliability database (under development), and incident database (under development) are available free of cost to *Partner* members and at discounted rates for *Sponsor* and *Associate* members.

2.10 Ask the Expert

“Ask the Expert” privileges are available for *Associate* level and above. “Ask the Expert” is an online form in the *Members Area* of the Web site, that when submitted is received at a centralized location and then directed to the relevant expert for quick response via email.

2.11 Symposium Proceedings

Partner and *Sponsor* organizations are provided access to read-only versions of all symposium proceedings. *Associate* level members are given access at a discounted rate. The Center believes providing the proceedings, along with other Center publications, is a valuable information resource for its members.

2.12 Library and Information Services

Center library checkout privileges are available for all members.

<http://process-safety.tamu.edu>

3. Giving

All unrestricted gifts to the Center are charitable contributions for tax purposes and qualify as income tax deductions to the extent allowable by law. Unrestricted contributions should be made payable to the *Texas A&M Foundation*. The foundation is the university's designated non-profit corporation created for the specific purpose of receiving, managing and disbursing private funds given to benefit the educational programs of Texas A&M. However, annual member payments, requested by December 31 for the following calendar year, are not considered a tax deductible contribution.

The Center also welcomes support of fellowships, equipment grants and sponsored research grants.

A **graduate fellowship** at an annual funding level of \$35,000 per student allows a donor to fund a student during his or her graduate study. Companies making multi-year commitments to provide fellowships for students may host the student on a cooperative program during the period of graduate study.

Sponsored research grants allow a sponsor to directly sponsor a specific project. Usually these projects involve one or more graduate students and faculty. A typical graduate research project supporting one student costs approximately \$75,000 per year.

Donations of equipment, software needed by the center, and books for the Center library are accepted and may be considered as a tax deductible charitable contribution if accompanied by appropriate documentation.

Regardless of the type of sponsorship, the center seeks an interactive research relationship with its sponsors. For a research relationship to provide maximum benefit to the company and the center, it is necessary for the company to take an active role in the direction of the research and in center activities.

Mary Kay O'Connor Process Safety Center Consortium Membership

Organization _____

Contact _____

Address _____

City, State, Zip _____

E-mail Address _____

Company Designee for the Steering Committee

Name

Title

- Partner Level - Consortium Membership fee __ \$20,000
- Sponsor level - Consortium Membership fee __ \$10,000
- Associate level - Consortium Membership fee __ \$5,000
- Individual - Consortium Membership fee __ \$1000

PAYMENT METHOD

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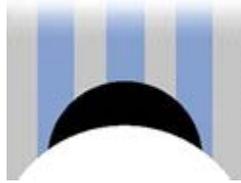
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Mary Kay O'Connor Process Safety Center
Texas A&M University
3122 TAMU
College Station, TX 77843-3122

Phone: 979/845-3489

Fax: 979/458-1493

<http://process-safety.tamu.edu>

CALENDAR

October 26, 2009

Steering Committee Meeting

Mary Kay O'Connor Process Safety Center
Hilton Conference Center, College Station

October 27-28, 2009

2009 SYMPOSIUM

Mary Kay O'Connor Process Safety Center
College Station Hilton Conference Center

October 29, 2009

Technical Advisory Committee Meeting

Mary Kay O'Connor Process Safety Center
Hilton Conference Center, College Station