Approximately 375 people from across the United States, and from the UK, Taiwan, Puerto Rico, Virgin Islands, Japan, Israel, China, and Canada gathered to attend the 10th Annual Symposium of the Mary Kay O’Connor Process Safety Center. The symposium was held October 23-24, 2007 at the Brazos Center in Bryan, TX. The Center celebrated not only the tenth year of successful conferences, but also the 85th birthday of long-time Symposium and Center supporter, Prof. Trevor Kletz. Kletz was the first recipient of the Center’s Merit Award and the inaugural keynote speaker.

This year’s Frank P. Lees Memorial Lecture entitled, “Making the Business Case for Safety” was presented by Dr. Peter C. Gardiner. Gardiner is the president and CEO of the Southern California Safety Institute (SCSI). Mr. William B. Wark, member of the U.S. Chemical Safety and Hazard Investigation Board, gave the second day keynote address entitled “Learning from CSB Investigations.”

The annual Merit and Service awards were presented by Dr. Sam Mannan, Center Director, and Dr. Michael Pishko, Department Head of the Artie McFerrin Department of Chemical Engineering, Texas A&M University. Dr. Hans Pasman, a world renowned process safety expert from The Netherlands was presented the Merit award for his contributions toward the advancement of process safety concepts and technology.

Service Awards were presented to Dr. C. Roland Haden and Mr. Scott Ostrowski for their contributions to the success of the Center and the roles they have played in advancing the mission of the Center. Dr. Haden is the retired Vice Chancellor for Engineering at Texas A&M University, and was Dean of Engineering at the time of the Center’s inception. Scott Ostrowski is with ExxonMobil Chemical Company in Baytown, Texas, and is a member of the Center’s Technical Advisory Committee and Symposium Planning Committee.

Beginning on page six are summaries of the presentations made at the Symposium.
Since our last newsletter, there have been many newsworthy happenings. Rather than go over the highlights and accomplishments in my notes, I will let you read it for yourself.

What I would like to discuss and bring your attention to is my recent trip to Washington, D.C., on Wednesday, December 12, 2007. I traveled, to testify before a House subcommittee citing the potential for acts of terrorism on any of the thousands of chemical processing plants throughout the country and urged Congress to give the Department of Homeland Security permanent and continuing authority to regulate chemical security in the United States. My complete testimony is available on the Mary Kay O’Connor Process Safety Center website. This testimony came as part of a congressional hearing on the “Chemical Facility Anti-Terrorism Act of 2008,” a proposed amendment to the Homeland Security Act of 2002 that provides for the regulation of certain chemical facilities. The subcommittee, chaired by Rep. Sheila Jackson Lee, is part of the larger Committee on Homeland Security that was created by the U.S. House of Representatives in 2002 in the aftermath of September 11, 2001 to provide Congressional oversight over the development of the Department of Homeland Security.

In addressing members of the subcommittee, I said that while many U.S. facilities have voluntarily begun implementing appropriate security measures, I remain concerned that many have not yet adopted such measures. Because of that discrepancy, a regulation that establishes a minimum and level playing field is critical.

In my written testimony, I state:

“The fact is that chemical infrastructure and all components, including the individual sites, supply and delivery systems, were never built with terrorism in mind. Research must be conducted to determine how me might have designed and built the chemical plants and the infrastructure had we considered these threats.”

As vital as regulation of these facilities is, I explained that effective regulation must be science-based and cautioned that the proposed act or any actions resulting from the act should not create unintended consequences, which might increase the opportunities for attacks rather than mitigate them.

Providing an example of such an instance, I detailed a hypothetical substitution of hydrogen fluoride with sulfuric acid for refinery alkylation processes. While sulfuric acid is less toxic than hydrogen fluoride, the amount of sulfuric acid needed to do the same amount of processing is 25 times greater than hydrogen fluoride. Because of that, a change to the less-toxic sulfuric acid would require large storage facilities and increased transportation – both of which could result in greater opportunities for terrorists as compared to a well-managed plant utilizing a smaller amount of hydrogen fluoride.

Among my conclusions I noted that hazardous materials in transit throughout the United States represent a highly visible target with a far greater degree of vulnerability to an act of terrorism than stationary facilities. What’s more, this specific category of hazardous materials is arguably the least prepared to deal with intentionally caused catastrophic scenarios. In addition, I emphasized the inclusion of water processing facilities in the act as important and necessary though not traditionally considered a chemical processing plant.

“As the 9/11 events have shown, terrorists are more likely to use easily available materials to strike at us.”

M. Sam Mannan
Survey on Contractor Safety and Health Audit

In October 2007, a survey of chemical facilities was conducted to assess the status of contractor programs. Eleven (11) facilities participated in this survey. Six questions were asked of each facility and the responses to the survey are shown below. The overall trend shown by the Contractor Audit Survey is positive and shows that the industry is moving towards proactive auditing of contractor programs.

1. Does your facility have anyone whose job function is dedicated to overseeing Contractor health and safety? What role does this person play in the auditing process?
   - 55% answered Yes
   - 36% answered No
   - 9% did not answer

   Of the eleven facilities surveyed, seven said they have a person (or persons) that oversee contractors, and administers the audit process.

2. Does your facility have an audit team established? If so, what type of employees (operations, maintenance or staff) make up the team? How long do they serve on the team?
   - 64% answered Yes
   - 27% answered No
   - 9% did not answer

   Seven facilities answered that they do have an audit team. The teams are made up of operations and maintenance personnel, EHS, purchasing and resident contractors.

3. At what frequency are audits performed on Contractors at your facility?
   - All facilities perform annual audits at minimum on Contractors at their facilities

   The frequency of audits varies greatly, from daily and weekly to annually and every 3-5 years.

4. When audits are performed, is an audit checklist involved to help guide the auditor?
   - 91% answered Yes
   - 9% did not answer

   Most audits are performed using a checklist, such as OSHA PSM checklist, Houston Business Roundtable Contractor Audit protocol, or an audit protocol developed internally.

5. Are audits focused on behavior based safety?
   - 64% answered Yes
   - 27% answered No
   - 9% did not answer

   Generally BBS audits were conducted separately, or if included, the focus of the audit was still contractor safety.

6. How are corrective actions handled and is the information concerning audit findings shared with the Contractors on site?
   - 91% answered Yes
   - 9% did not answer

   At most facilities, the audit findings are shared with contractors, and findings and corrective actions are tracked in an audit tracking system.
Enhanced Enforcement Program (EEP)

This article is a summary and notification of the revised Enhanced Enforcement Program (EEP) program and does not provide specific details of EEP. Please refer to the website for complete details of this program.

The Occupational Safety and Health Administration (OSHA) is revising the Enhanced Enforcement Program (EEP) to focus more closely on employers with a history of safety and health violations. The focus is on agriculture, construction, maritime and general industry employers with previous violations, especially previous willful violations, repeat violations, and failure-to-abate violations. This revised program will take effect January 1, 2008.

According to the OSHA website, the revised EEP Executive Summary states:

This Instruction revises OSHA’s Enhanced Enforcement Program (EEP) to focus on agriculture, construction, maritime, and general industry employers who are subject to enforcement actions that result in enhanced enforcement cases that include follow-up inspections, inspections of other sites, increased company/corporate awareness of OSHA enforcement, enhanced settlement provisions, and federal court enforcement under Section 11(b) of the OSH Act. This Instruction also replaces the March 12, 2003, September 30, 2003 and October 16, 2003 memoranda.

Also noted are the significant changes of this directive:

- Clarifies that Federal Agencies are included in the program.
- Drops the “Priority Enforcement Case (PEC)” terminology.
- Modifies the EEP criteria.
- Clarifies what constitutes OSHA history.
- Provides for the lining-out of establishments on the EEP2 Log.

Background

Former Assistant Secretary, John L. Henshaw, announced this program in his memorandum dated March 12, 2003. This revision, four years after initial implementation, does not change the purpose of the program; however, it increases the focus of enforcement on employers with a history of violations with OSHA. In the revised program, employers with no significant history within 3 years of a serious violation will be removed from the group of cases considered.

Impact for the State

According to the OSHA instruction, states “should consider establishing programs comparable to the Federal Enhanced Enforcement Program to focus appropriate attention on these employers.” Notice of intent is required concerning:

- “whether the State will adopt an Enhanced Enforcement Program, as revised by this instruction
- if so, whether the State’s program will be identical to or different from the Federal EEP; and, whether or not the State adopts its own EEP program,
- how the State will identify and notify its Regional Administrator of multi-state employers that would qualify for action under the Federal EEP; and
- how the State will respond to Federal referrals of EEP worksites.”

Transition

Because the data being collected is significantly different between the Original EEP and the Revised EEP, the National OSHA office collects the Revised EEP data as a separate log called “EEP2 Log.” Any new inspections opened on or after the effective date of the Instruction will follow the Revised EEP protocol.

Please refer to the website provided for specific discussion of criteria, inspection enforcement, and other elements of this program. Full details are available at the website address below:

OSHA Interpretation Letter -1996- on PHAs

The following is a followup to the discussion during the October 2007 MKOPSC Symposium regarding concerns over development of scenarios by the PHA facilitator prior to and outside the PHA team meetings. In 1996, an OSHA interpretation letter addressed some of these concerns. Below is only the portion of the letter related to the topic discussed at the Symposium this fall, which demonstrates that this issue has been a long-term concern.

The interpretation letter dated October 31, 1996, written by John B. Miles, Jr., Director of OSHA’s Directorate of Compliance Programs, reads:

This is in response to your letter of February 6, 1995, addressed to Mr. Roger Clark, former Director of Compliance Programs, regarding the Process Safety Management of Highly Hazardous Chemicals, 29 CFR 1910.119, and process hazard analyses (PHA). Please excuse the delay in our response.

Please find in the following, your specific questions and our responses.

Question 1: Could OSHA find a PHA conducted as described below acceptable?

“The PHA team leader performs the PHA by himself/herself or with the help of other technically knowledgeable people, but not as a team effort. The PHA worksheets are completely filled-in except for the recommendations column. The team leader then brings the results of that effort to a PHA team representing the unit/process under consideration, the team reviews the completed worksheets, and makes the appropriate recommendations.”

Response: Section 1910.119(e)(4) states that the process hazard analysis shall be performed by a team with expertise in engineering and process operations, and the team shall include at least one employee who has experience and the knowledge specific to the process being evaluated. Also, one member of the team must be knowledgeable in the specific process hazard analysis methodology being used.

Your question indicates that the “PHA team leader” performs the PHA, but “not as a team effort.” In that respect, there is no PHA team, and it is inaccurate to state that the person filling in the worksheets is a team leader. This scenario is not consistent with the requirements of the Standard (see preamble at 57 Federal Register at 6378). In addition, your letter does not indicate exactly what information is “filled in” on the worksheets, and therefore, on what basis the PHA team makes recommendations. Please note that the scenario you have described for conducting a PHA would not meet the intent of the standard.

Recent Publications

The Mary Kay O’Connor Process Safety Center would like to give a special thanks to our Symposium Track Chairs, Ms. Kathy Shell with RMT, Mr. Skip Early with Early Consulting, Dr. Marc Levin, with Shell Global Solutions, Mr. George King with The Dow Chemical Company, Mr. Scott Ostrowski with ExxonMobil Chemical Company, and Mr. Roger Banaitis, standing in for Mr. Mike Marshall, both with OSHA.

Mike O’Connor presented, “Data Leads the Way.” In his presentation, Mike discussed solutions to the following questions. Why Do We Need Comprehensive Chemical Incident Data? Why Is It So Difficult to Obtain? What Have We Accomplished? What is the Best Path Forward? He concluded that currently we believe that the ATSDR Hazardous Substance Emergency Events Surveillance (HSEES) system is the best model for systematic data collection. A Roundtable meeting is being held in Washington at the end of November to discuss the merits of expanding the scope and improving the data quality and collection efficiency. The MKOPSC needs to step up its efforts to provide data analysis and to involve industry in improving and utilizing incident data to its full potential. All stakeholders need to work towards improving and utilizing chemical incident data to reduce the effects of chemical releases.

Maureen Orr with the ATSDR gave the presentation entitled “Learning from HSEES: A Vision for National Acute Hazardous Substances Surveillance.” She said, “acute releases of hazardous substances are a significant concern in the U.S. and have been associated with substantial public health impact. Despite numerous attempts by a variety of stakeholders to collect event data, there are gaps in our knowledge of contributing factors, geographic distribution, and resulting health outcomes. Consequently challenges remain in conducting appropriate planning, prevention, and response activities related to such releases. A national acute hazardous substances release surveillance system would lay the basis for addressing these gaps as well as guide the development and evaluation of local, state, and national prevention programs.”

Wanda Welles with the New York Department of Health presented “New York HSEES Data Support Emergency Response, Promote Safety and Protect Public Health.” She stated “Surveillance is an important activity that yields a body of information and provides data that can be used to direct educational and outreach activities in multiple
directions. The New York Hazardous Substances Emergency Events Surveillance (HSEES) Program is one of fourteen state-based programs funded by the Centers for Disease Control and Prevention that collects data on acute releases of non-petroleum hazardous substances and their public health impacts. The data are used to alert public health offices and others to help ensure that the network of persons that needs to be aware of an event is notified and has the available information. These data provide information used to support and enhance employee and responder training, emergency preparedness and public health response.”

Wendy Foslien with Honeywell gave the presentation entitled “Abnormal Situation Management – Effective Automation to Improve Operator Performance.” Wendy said, “An abnormal situation is a disturbance or series of disturbances in a process leading a plant to deviate from a normal operating state. When an abnormal situation develops, the operations team must identify the cause and implement corrective action to resolve the situation.” She discussed some factors influencing human performance, and describe a case study showing that an ASM® style interface can have a measurable improvement on how quickly operators respond to faults and detect events.

Timothy Melton with Quest Consultants presented “A Systematic Method for Modeling Explosion Overpressures.” He said “One task carried out by process safety experts that has received increasing attention in recent years is the building siting study. These studies strive to locate buildings in proximity to petrochemical facilities in places where the risk of occupant injury or building damage is acceptable. Although the studies evaluate potential toxic gas impacts and fire impacts, the most important hazard is often vapor cloud explosion (VCE) overpressures. If the VCE generates damaging levels of overpressure, the possibility of human injury/ death, asset damage, or event escalation becomes a concern. The concern for human injury or death is most often addressed in the form of a building siting study.”

Douglas Ferguson with E. I. DuPont gave the presentation entitled “Applying Consequence Analysis and Facility Siting Methodologies to Process Infrastructure Facilities.” He said, “Federal and State regulations require that consequence and risk analysis studies be conducted for chemical industry facilities that handle highly hazardous materials as defined in the OSHA 1910.119 and EPA RMP documents. The quantitative consequence analyses for these facilities are used to evaluate the potential impact of a variety of accident scenarios during the Process Hazard Analysis process. He presented a proposed methodology for conducting consequence analysis and facility siting activities related to the design and installation of process infrastructure facilities.”

Gustava Silva with Dyadem International gave the presentation “Risk Based Versus Consequence Based Approaches on Facility Siting Study.” He said, “When occupied buildings are located near process facilities, the occupants can be exposed to effects of potential hazards, such as fire, explosion, and toxic materials (per API 752, Management of Hazards Associated with Location of Process Plant Buildings). In order to determine the safe location of an occupied building, it is essential to define what is meant by “safe” location. The term “safe” is very much related to “risk”, which is treated as the inverse of “safe”. The question of “How safe is safe for the occupants” really means, “How much risk is acceptable for the occupants” as it is a known fact that risk cannot be totally eliminated.” He described the basis of both approaches, including the concept of risk tolerance criteria (individual risk versus societal risk), how to quantify risk and consequence correlation (for explosion, fire and releases of toxic and flammable gases) typically used in the industries for facility siting study.

Kay Koslan, with The Dow Chemical Company, gave the presentation entitled “Dow’s Portable Building Practices – An Update.” She said, “Dow’s Portable Building Best Practice has provided employees and contractors on Dow sites with a simplified approach to siting portable buildings. As with many practices, better data and information becomes available, that may require updates to guidance documents.” She gave an update on Dow’s changes to their Best Practice for portable
buildings, including separation distances and an internal checklist form for safely locating portable buildings.

Gregg Kiihne with BASF Corporation presented “Learning from Disaster - Implementing the Lessons Learned from Texas City.” He stated that in early 2007 the Baker Panel issued their report on the Safety Culture found at BP’s US Refineries along with numerous recommendations for not only BP, but also for companies across the chemical and refining industries. A team of process safety professionals recognizing the value of the Baker Panel recommendations, as well as many of those made in the BP and CSB investigation reports, set out to determine, “How can we make sure this doesn’t happen to us?” Kiihne detailed the approach taken for 1) identifying key issues for the organization derived from the investigation reports and creating an awareness of the need for change, 2) evaluating current culture, designs, programs, and practices to identify specific areas for improvement, 3) implementing the improvements identified, and 4) developing programs to sustain the improvements.

Trevor Kletz presented the paper entitled “Don’t Just Pass the Parcel: Accidents That Would Not Have Occurred if Those Involved Had Talked to Each Other.” Trevor discussed the problems arising from the lack of communication between the different groups working on a project and the solutions to avoid them. He said, “To avoid these problems representatives of all the various groups should meet regularly as the project progresses. Each group is then able to suggest changes that will make the design easier for them and can comment on features which will increase their costs. Everyone will gain some knowledge of other groups’ problems.”

Hans Pasman with TNO in The Netherlands presented “Learning from the Past and Knowledge Management: Are We Making Progress?” He said, “Learning from the past is crucial in making progress, certainly when it comes to process safety, nothing is so obvious. Yet, there are obstacles of various nature such as human factors, technical complexities and restraints against knowledge management, and last but not least policy and decision making in view of cost-benefit.” He discussed knowledge and information sharing and how human factors play a role.

Dave Jones with Cameron International gave the presentation entitled, “Addressing the Behavioral Aspects of Human Factors in Process Safety Management.” Jones said, “Process safety management is the application of management systems to the identification, understanding, and control of process hazards to prevent process-related incidents and injuries. PSM performance is manifested in the behaviors of all individuals involved in managing the work, performing the work, and verifying the work for designing, constructing, operating, and maintaining facilities, equipment, and supporting resources and activities. He demonstrated how the ABC Analysis technique can be used to establish a more proactive, preventive culture, and can assist in identifying and removing behavioral barriers to the success of the PSM System, by understanding and modifying both individual and organizational behaviors for PSM.

Kathleen Kas with Rohm and Haas Company presented “Case Studies in Human Factors: When Trust goes Awry.” She discussed examples of how suboptimal consideration of human factors in the design of procedures, equipment, and warehouse storage locations contributed to costly human errors. Also discussed were the results of root cause analyses and practical recommendations to reduce human error.

Keith Farrell gave the presentation entitled “Incident and Evidence Submittal for Court Presentation.” Farrell said, “Whether an event was an accident or incident, the potential to have its ultimate conclusion in civil, state, or federal court is a realistic probability. All information and evidence gathered from the event scene is used to support the corporation investigator’s testimony and to represent the corporation’s position in legal proceedings. Thus, investigators are required to present their information and evidence in an
acceptable manner for a court of law. He discussed the requirements of collection documentation and chain of custody procedures, and presented specific examples for court of law presentation of physical evidence, interviews, and photographs.

**Stephanie Payne** with the Department of Psychology at Texas A&M University presented the paper “Safety Climate: Leading or Lagging Indicator of Safety Outcomes?” Payne said, “A recent meta-analytic study of the safety climate research confirmed positive relationships between safety climate and safety performance (compliance and participation) and negative relationships between safety climate and occupational accidents/injuries (Clarke, 2006a). This study also revealed some important moderators of these relationships including study design, specifically the timing of the measurement of the safety-related variables (i.e., accidents/injuries) relative to the measurement of safety climate with prospective designs yielding stronger relationships than retrospective designs. Building on these empirical findings, we theorize why these differences emerge and how these relationships might be further moderated by the source of the safety-outcome data and/or the time lag between the measure of safety climate and the safety outcomes.” She discussed implications for safety climate research, study design, and climate change.

**Cheryl MacKenzie** with the U.S. Chemical Safety and Hazard Investigation Board presented the paper entitled “Examining Organizational and Safety Culture Causes of the BP Texas City Refinery Explosion.” MacKenzie said “On March 23, 2005, a series of explosions and fires occurred at the BP Texas City refinery during the startup of an isomerization (ISOM) process unit. Fifteen workers were killed and about 180 others were injured. However, the catastrophic incident on March 23rd was not the only major incident at the Texas City refinery. As part of its investigation, CSB learned that over the past 32 years, the BP Texas City refinery has had 39 fatalities. This discovery prompted CSB to investigate the organizational and safety culture precursors that produced the multiple safety system deficiencies that lead to the ISOM incident and the history of major accidents and fatalities at this refinery.” She discussed the organizational and safety culture precursors rooted in the refinery’s history and also showed how these organizational issues extended beyond the ISOM unit and the Texas City refinery to the corporate oversight system of BP Global and to the 1999 merger between BP and Amoco Corporation, where the safety impacts of major organizational change were not effectively reviewed.

**Curt Miller** with Exida LLC presented “Joint PHA & SIL Facilitation – Successful Implementation Steps.” Miller said, “Process Hazard Assessments (PHA) have been very effective in helping the process industry identify both the occupational and functional safety hazards. Since PHA utilize qualitative methods to analyze scenarios, many facilities would turn to other risk management tools to further quantify their safeguards in place. To bridge this qualitative and quantitative gap, semi-quantitative Safety Integrity Level (SIL) processes were instituted in the ISA 84 Functional Safety standards. This resulted in specific SIL targets for Safety Instrumented Functions (SIF) that could be designed and verified. He discussed whether organizations should perform SIL analysis and PHA facilitation in unison or separately.

**Jerry L. Bradshaw** with the Texas A&M University Artie McFerrin Department of Chemical Engineering gave the presentation entitled, “Some Unusual Case Histories from Personal Experience.” Bradshaw said, “It has been my pleasure to have two separate and rewarding careers that have now spanned almost five decades. My first career began in 1960 with Union Carbide Corporation, immediately after graduating from Texas A&M. I am in my second career, Senior Lecturer in the Artie McFerrin Department of Chemical Engineering.” He discussed three incidents from his industrial career, a PVC Accident, an explosion in butadiene recovery unit, and an incident on an olefins unit restart that had an impact on his safety awareness.
Karl Van Scyoc with Det Norske Veritas (U.S.A.), Inc. presented the paper “Rail Ruminations for Process Safety Improvement.” Van Scyoc said, “Process safety practices have undergone multiple refinements over the past few decades, but major accidents continue to occur. Most organizations strive to improve performance by strengthening existing methods or by adopting new and/or different approaches. Central to these continual improvement efforts is the practice of applying lessons learned as a means to drive out potential risk exposures. Often, lessons learned may be transferred from other industries; indeed, high-performing organizations regularly benchmark practices outside of their immediate industry.” He discussed various risk management practices in the Rail Industry, and explored how methods intended for managing passenger and public rail safety may be transferred to drive continual improvement of process safety.

Alfonso Ibarreta with Exponent, Inc. presented the paper entitled “Investigation of the Jahn Foundry and CTA Acoustics Dust Explosions: Similarities and Differences.” Ibarreta said, “The Jahn Foundry in Springfield, Massachusetts and CTA Acoustics in Corbin, Kentucky experienced devastating dust explosions in 1999 and 2003, respectively. At the time, Jahn Foundry was a gray iron casting facility that used phenolic resin powder as a binder for sand castings. CTA Acoustics was a manufacturer of thermal-acoustic insulation that used phenolic resin powder as a binder for fiberglass mats. In both facilities the phenolic resin was able to migrate from the process, accumulate in the facility, and fuel catastrophic dust explosions.” He discussed Exponent’s investigation of the two incidents identifying root causes of the incidents and applicable standards that, if followed, could have prevented the incidents.

Mieko Kumasaki with the National Institute of Occupational Safety presented the paper “A Study of Decomposition of Dioxins using Calcium Oxide.” Kumasaki said, “The dioxins exhausted from garbage incineration into the environment are becoming a significant problem. Current promising countermeasures use calcium oxide (CaO), that can decompose dioxins by agitating and the co-combustion of fly ash and CaO. The decomposition mechanism of dioxins by the technique, however, has not yet been clarified. She discussed the effect of CaO on the decomposition of dioxins.

Marc Levin with Shell Global Solutions, US, gave the presentation “Calorimetric Studies of the Effect of Rust on Species Reactivity.” He said, “The possibility of contaminants contacting certain chemicals can pose a concern for uncontrolled reactivity. Iron oxide is an especially common species in manufacturing equipment. Some anecdotal reports and lab-scale studies regarding the reactivity of species in the presence of rust are available in the open literature. In the current study, the effect of iron oxide on a number of oxygenated hydrocarbons has been examined. In some cases, enhanced reactivity is observed; in others, no impact of the iron oxide is found.”

Nikolaos Kazantzis with Department of Chemical Engineering Worcester Polytechnic Institute presented the paper entitled “Digital Condition Monitoring of Complex (Bio)Chemical Reaction Systems in the Presence of Model Uncertainty: Application to Environmental Health Hazard Monitoring.” He discussed a new approach to the state estimation and condition monitoring problem for complex nonlinear (bio)chemical reaction systems in the presence of model uncertainty. Kazantzis said, “The study and reliable characterization of the dynamic behavior of complex (bio)chemical reaction systems and processes over a wide range of operating conditions is of paramount importance and, very often, critically associated with process safety, as well as other methodological frameworks for chemical risk assessment and management. In such a major scientific endeavor, chemical and environmental process modeling assumes a central role synergistically complementing experimental design practices and protocols, field studies, and empirical approaches. In the fields of
chemical process safety and environmental health risk assessment and management, the steadily increasing use and reliance on models with various degrees of descriptive power and sophistication is broadly recognized.

**Chi-Min Shu** with Process Safety and Disaster Prevention Laboratory, Department of Safety, Health, and Environmental Engineering, National Yunlin University of Science and Technology presented the paper “Runaway Evaluation Dicumyl Peroxide in the Batch Reactor by DSC and VSP2.” Shu said, “Organic peroxides (POs), which exothermically decompose require inherently safer design during preparation, manufacturing, transportation, storage, and even disposal. They can release large amounts of thermal energy and result in high pressure during runaway excursion, leading to fire, explosion or toxic release. Chemical disasters are a severe issue in the chemical industries. Dicumyl peroxide (DCPO) is usually employed as an initiator for polymerization, a source of free radicals, a hardener, and a linking agent. In Asia, due to its unstably reactive nature, DCPO has caused many thermal explosions and runaway reaction incidents in the manufacturing process.” She described the study conducted to analyze the runaway behaviors of DCPO, while adiabatic thermal runaway phenomena were investigated by vent sizing package 2 (VSP2).

**Harold Johnstone** with The Dow Chemical Company gave the presentation entitled “A Management Systems Review of Dow’s Reactive Chemicals Program.” Johnstone discussed Dow’s 2006 Reactive Chemicals program review which was conducted to determine the suitability, adequacy and effectiveness of the Reactive Chemicals program for: ensuring compliance, achieving objectives and targets, improving performance results. The review included the analysis of numerous relevant data sources, identification of areas for improvement, an action plan to implement improvements, and recognition of outstanding performance. The overall conclusion of the review was that Dow’s Reactive Chemicals program is suitable, adequate, and effective.

**Peter N. Lodal** with the Eastman Chemical Company presented the paper “A Systematic Approach to Reactivity Hazards Management.” Lodal said, “Interest in the management of chemical reactivity hazards has increased in recent years. Chemical reactivity hazards management can be one of the most complex and time-consuming process risk management tasks. The Reactivity Management Roundtable (RMR) is a working group of the Center for Chemical Process Safety charged with the development of tools to assist organizations handling or processing hazardous materials with the potential for dangerous reactions. Since 2003, the RMR has been working to develop a systematic approach to reactivity management that can be applied to all levels of processing complexity.” He outlined the RMR efforts to develop this comprehensive framework.

**Maria Papadaki** with the Environmental and Natural Resources Management Department, University of Ioannina in Greece gave the presentation entitled “Isothermal decomposition of hydroxylamine and hydroxylamine nitrate in aqueous solutions in the temperature range 353-400 K.”

**Frank Joop** with Intergraph Corporation presented the paper “Design Safety into Your Plant.” Joop said, “a major concern facing every plant owner is the issue of safety – including safety for plant personnel, the facility, and the environment. One aspect of safety analysis involves HAZOP studies, which in most cases are required by local regulations. In general, HAZOPs are long, tedious, and costly tasks.” He discussed an innovative way to automate the tedious work and make it a part of the design process with which plant owners can easily ensure on a regular basis that the facility is designed soundly and safely, which lowers the risk of accidents and production losses.
Dorothy Kellogg with AcuTech Consulting Group presented the paper “Inherently Safer Chemical Processes – 2nd Edition.” Kellogg said, “The classic reference from CCPS® “Inherently Safer Chemical Processes, A Life Cycle Approach”, 1st Edition, 1996, was updated in 2007. The goal of this book is to influence the future state of chemical process evolution by illustrating and emphasizing the merits of integrating process research, development, and design into a comprehensive process that balances safety, capital, and environmental concerns throughout the life cycle of the process. The authors hope that this book will influence the next generation of engineers and chemists as well as current practitioners and managers in the field of chemical processing.” She described the objectives and additions found in the 2nd Edition.

Jinsong Zhao with the College of Information Science and Technology, Beijing University of Chemical Technology presented the paper “Learning HAZOP Expert System By Case Based Reasoning.” Zhao said, “To improve the learning capability of HAZOP expert systems, a new learning HAZOP expert system called PetroHAZOP has been developed based on case-based reasoning (CBR) that can help automate “non-routine” HAZOP analysis. PetroHAZOP consists of four modules including case base module, CBR engine module, knowledge maintenance module and user graphical interface module.” He discussed the application of PetroHAZOP demonstrated by a case study of industrial processes.

J. Seltzer with BP Operation Canadian Crude presented the paper entitled “Implementing a Major Project PSM Program: A BP Perspective.” He said, “BP is currently working on the largest refinery upgrade project in its corporate history at Whiting, Indiana. The project is essentially a conversion of the refinery from light / medium crude to heavy Canadian oil sands crude. Implementation of a comprehensive PSM program on a project this complex is challenging.” He discussed many of BP’s risk assessment and risk management strategies, some of the project difficulties encountered, and other issues ranging from PHA strategies to site concerns such as control of work.

Georges Melhem with ioMosaic gave the presentation “Selection and Optimization of Isolation Valves for Gas, Liquid, and Multiphase Pipelines.”

Jonathan Pollett with PlantData Technologies presented the paper “Safety considerations for SCADA or DCS Cyber Attacks.” Pollett said, “Because of the increasing threat of cyber security impacting SCADA and DCS systems, there is a risk that a motivated attacker could manipulate SCADA/DCS commands without the consent of the local plant operators. System administrators and plant engineers should start to consider the safety implications of setpoints, open/close commands, and other SCADA/DCS functions being deployed at will from remote, unauthorized locations. SCADA/DCS System Administrators, Plant Foreman, and Plant Engineers should begin to develop Contingency Plans and Action Plans that document the steps that should follow if a SCADA/DCS system is compromised.” He described some SCADA and process control systems attacks and SCADA Security attack scenarios. Recommendations for preparing Contingency Plans and Action Plans in the event of SCADA/DCS system compromise were discussed.

The paper “Fuzzy Logic for Process Safety Analysis” submitted by Adam Markowski, was presented by Sarah Yang with MKOPSC. Fuzzy logic deals with uncertainty and imprecision, and is an efficient tool for problems where knowledge uncertainty may occur. Such situations arise frequently in a quantitative fault and event tree analysis in safety and risk assessment of different processes. The application of the fuzzy sets theory for basic tools used in process safety analysis like fault and event tree which can be further used in the “bow-tie approach” for accident scenario risk assessment were discussed.

Eddie Habibi with PAS gave the presentation entitled ‘Improving Plant Reliability and Safety through Operations Effectiveness Strategy.” Habibi said, “Over the past 25 years, the processing industries have made significant investment leveraging process automation to improve production capacity and product quality. Technologies such as distributed control systems (DCS),
multivariable controls and process historians have delivered considerable value to industry and have become essential requirements for competing in today’s environment.” He discussed an approach to utilizing existing process automation technologies to create an integrated operating environment that enables an operator to be more effective in running a unit safely and reliably.

**Angela Summers** with SIS-Tech Solutions presented the paper “Continuous Improvement in Safety Systems.” Summers “Safe operation requires the identification and implementation of a practical risk reduction strategy that addresses potential process safety incidents. Achieving operating excellence requires the chosen risk reduction strategy to meet or exceed expectations in a cost effective manner. Cost effectiveness is often interpreted by front-line personnel as minimum cost, time, and resources with “minimum” being controlled by today’s budget. Unfortunately, doing more with less generally does not lead to safe or reliable operation and it does not support continuous improvement.” She discussed some of the issues facing owner/operators when attempting to align personnel, procedures, and equipment to achieve cost-effective and safe operating performance.

**Cheryl Qu** with the Texas A & M University Department of Chemical Engineering presented the paper entitled “Process Monitoring Parameter Estimation via Unscented Kalman Filtering.” Qu said, “One important aspect of process safety is detection of abnormal operating conditions. A common approach to this problem is that important states and parameters in a process are monitored and compared against their upper and lower bounds. However, some of these states and most of the parameters cannot be directly measured and instead have to be computed from plant data. This raises the question to what degree the results are affected by the procedure used for computing the values of unmeasured states and parameters.” She discussed a detailed comparison between several state estimation methodologies with a specific emphasis on unscented Kalman filtering, a relatively new technique.

**Adrian Sepeda** with A.L. Sepeda Consulting presented the paper entitled “A Risk Based Maintenance Approach for PSM Facilities.” Sepeda said, “Every PSM regulated manufacturing facility is populated with equipment that requires appropriate maintenance to fulfill its role in manufacturing and to keep the facility operating in a safe and environmentally sound manner. However, not all equipment poses the same risks at failure when compared to those requirements. Therefore, from a risk perspective, not all equipment deserves the same level of maintenance attention. Proper categorization of risks and appropriate levels of maintenance attention help keep the facility operating safely by allocating available resources where and when needed.” He discussed an approach for establishing a hierarchy of maintenance attention based on various equipment failure risks by helping understand the difference between “Mechanical Integrity” and “Reliability” and the risks imposed by failure of either.

**Mark Mason** with DuPont gave the presentation entitled “Control of the MRO Materials Supply Chain....Preventing Materials Mix-ups that Might Lead to Process Safety Incidents.” Mason said, “MRO materials (maintenance, repair and operations materials) comprise engineered parts and components bought in large quantities by manufacturing plants to keep their equipment running. Examples include valves, fasteners, gaskets, pipe fittings etc. Poor quality MRO materials have contributed to a large number of process safety incidents and near misses.” He described the method used by DuPont of managing the MRO materials supply chain.

**Mohamed Saleem** with Saudi Arabian Oil Company (Saudi ARAMCO) presented the paper entitled “Managing Corrosion Challenges in Gas Processing Plants.” Saleem said, “Process industries such as oil, gas and petrochemical plants have critical process equipment. This equipment can experience deterioration to varying extent due to complex operating conditions. In the meantime, optimization of turnarounds preferably by extending the interval with shorter shutdown duration to perform remedial actions is also required to enable plant’s readiness to meet the projected demand.” He discussed the specific integrity issues in a gas processing plant’s point of view, limitations with the conventional
techniques and the innovative approaches adopted for integrity management including the successful deployment of advanced nondestructive examination (NDE) corrosion mapping technology.

Susan Mitchell with ExxonMobil Chemical Company presented the paper entitled “Safe Limits for Dispersion of Vapor and Liquid Releases from Atmospheric Safety Relief Devices.” Mitchell said, “Questions about the use of atmospheric venting, especially from safety devices prompted a desire to evaluate atmospheric relief and dispersion characteristics in greater detail. A study was undertaken to determine the safe limits for the dispersion of flammable clouds formed from releases from atmospheric safety relief devices.” She discussed the goals and objectives, and the results of the study undertaken to determine safe limits for simulated atmospheric releases of hydrocarbons in any phase.

Steve Arendt with ABS Consulting gave the presentation entitled “Developing Process Safety Metrics - A Systematic Approach.” Arendt discussed the efforts being made to define process safety metrics and an industry consensus.

Tim Overton with The Dow Chemical Company presented “Status of the CCPS Process Safety Metric Project.” Overton discussed how the CCPS PS Metrics Project was initiated, recommendations which have been made to date, and the schedule of developments for completing the project.

Filippo Gavelli with Exponent gave the presentation entitled “Modeling of LNG Spills into Trenches.” Gavelli said, “Federal regulations for the siting of onshore LNG receiving terminals require that all LNG transfer areas be provided with means to collect the spill and direct it to a containment location. This is generally accomplished by placing trenches underneath all piping and equipment areas, and by sizing and sloping the trenches so that a design spill at any location will be contained by the trench and directed into a properly sized sump. In the event of a spill into a trench, part of the LNG flowing towards the sump will vaporize and thus generate a vapor cloud, which will be dispersed by the wind in the same manner as the vapor cloud generated by a spill into a containment area. Federal regulations do not explicitly require the vapor cloud dispersion from an LNG trench to be modeled, nor do they provide a method for performing said calculation.” He discussed Exponent’s FERC approved solution method of modeling liquid flow along the trench, quantifying time-dependent vapor generation rate, and using CFD to model dispersion of LNG vapor cloud. Case studies were presented, that represent calculations recently submitted to and approved by FERC, to demonstrate the application of the solution method for vapor dispersion from LNG spills into trenches.

Ben Poblete with Lloyd’s Register Americas, Inc., presented “The Inherent Safe Design of an Offshore Installation – A Leap of Faith.” He discussed the risk and integrity management strategies during the conceptual and detailed engineering design of an offshore installation. He said, “This work is to provide a high-level, simplified and life-cycle perspective to the inherent safe design (ISD) methodology adopted by the offshore oil & gas industry, and to provide the offshore industry with other alternative strategies for risk, integrity and corrosion management efforts during the application of the ISD approach during the design of a facility.”

Jaffee Suardin and Ben Cormier with the Mary Kay O’Connor Process Safety Center gave the presentation entitled “LNG Pool Fire Modeling Workshop Results.”
Distance Learning Safety Courses

The Mary Kay O’Connor Process Safety Center (MKOPSC) has a history of outreach and an established record of safety education through its continuing education program. Recently, the Center has received numerous inquiries from the U.S. and abroad about the availability of web-based safety courses. Because of the continually growing interest in safety education in general and of process safety engineering in particular, two courses are being offered in Spring 2008, via the Petroleum Engineering Department’s Distance Learning Program.

**Process Safety Engineering**  
--- CHEN 455 - SENG 455

and

**Engineering Risk Analysis**  
--- CHEN 489/689

Because these distance-learning courses are hosted by the Petroleum Engineering Department, TAMU students interested in registering for this course should communicate with Sarah Buckingham (sarah.buckingham@pe.tamu.edu 979-845-9385).

**CEUs** will be issued through the Mary Kay O’Connor Process Safety Center upon successful completion of the course. To register for a course for Continuing Education Units (CEUs), 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

A link to the course syllabus is available on the Petroleum Engineering Courses web page:  
http://www.pe.tamu.edu/DL_Program/Courses.html under the Fall 2008A course listings.

**Distance Learning Objectives**

The Center plans to offer online all courses of the interdisciplinary Safety Engineering Program and the Safety Engineering Certificate Program, which is administered by the Center to teach the knowledge and skills required for safety, health, and environmental engineering. The required knowledge and expertise includes hazard identification and characterization needed for risk assessment, risk reduction, and risk management of engineering systems. The need for risk analysis is increasing together with continual growth in system complexity and elevation of standards for safer and more environmentally compatible engineering systems.

In addition to the online safety courses, the Masters of Engineering in Process Safety and Masters in Safety Engineering programs will be offered 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 industry. The ME-PS program prerequisite is a Bachelor Degree in any engineering discipline and consists of 24 hours of required courses, 6 hours of elective courses, and 3 hours of directed studies. Included also is a written project report for a total of 33 course hours of engineering applications with integration of safety principles, safety practices, and case studies.
Mary Kay O’Connor Process Safety Center
Faculty Fellows

Dr. Rayford G. Anthony
Chemical Engineering

Dr. Debjyoti Banerjee
Mechanical Engineering

Dr. Mindy E. Bergman
Industrial Psychology

Dr. Zhengdong Cheng
Chemical Engineering

Dr. Mahmoud El-halwagi
Chemical Engineering

Dr. Juergen Hahn
Chemical Engineering

Dr. Kenneth R. Hall
Chemical Engineering

Dr. Michael B. Hall
Chemistry

Dr. Carl Laird
Chemical Engineering

Dr. Simon W. North
Chemistry

Dr. Stephanie C. Payne
Industrial Psychology

Dr. Victor M. Ugaz
Chemical Engineering
Call for Papers

MAKING SAFETY SECOND NATURE - International Symposium

WCOGI 2008: World Conference on Safety of Oil and Gas Industry

October 28-29, 2008

Sponsored by
Mary Kay O’Connor Process Safety Center
and
Korea Gas Safety Corporation (KGS)

- Case Studies – Histories, Lessons Learned, Databases
- Inherently Safer Processes – New Processes, Existing Plants, Man – Machine Interface
- Human Factors – Engineering, Behavioral Safety, Human Error
- Management for Process Safety – PS Metrics and Benchmarking, PS Engineering, PSM components, PS training, PSM with limited resources, Innovative strategies for improvement,
- Accident Investigation
- Safety Culture – Relationship to high consequence/low probability events
- Facility Siting – Personnel Siting
- LNG & LPG – Design, Experiment Evaluation, Consequence Analysis, Mitigation, Research needs, Regulations, Safety
- Risk Assessment, Analysis and Management
- Reactive Chemistry – Predicting Reactivity, Role of Contaminants, Catalysts and Inhibitors, Case Histories, Experimental Methods
- Equipment Integrity – Design for Maintenance, Maintenance Hazard Analysis, Corrosion Monitoring
- Material Property and Assessment Including NDT
- Process Hazard Analysis, Consequence Modeling
- Reliability Analysis & Mechanical Integrity
- Fire and Explosion Hazards, Prevention and Mitigation of Fire/Explosion
- Safety Topics on Alternative Energy Processes Including Hydrogen & Fuel Cell
- Fire Protection Engineering
- Transportation Risk Assessment Including Pipelines
- Emergency Response Planning
- Safety Standards, Codes, and Regulations

Abstracts are due no later than March 3, 2008

Send abstracts to Dr. Sam Mannan, e-mail: mannan@tamu.edu
Abstracts submitted for consideration for WCOGI, may be sent to Dr. Sam Mannan (above) or to Dr. Kyo-Shik Park, e-mail: kspark@kgs.or.kr

Additional information is available at: http://process-safety.tamu.edu
Exhibition space is available. For further information on exhibition space, contact Ms. Donna Startz (donnas@tamu.edu) (979) 845-3489.
### February

<table>
<thead>
<tr>
<th>Dates</th>
<th>Course Title</th>
<th>Time</th>
<th>Fee</th>
<th>Instructor(s)</th>
<th>Location</th>
<th>CEUs</th>
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<tbody>
<tr>
<td>19-20</td>
<td>Process Hazard Analysis Leadership Training</td>
<td>8:30am - 4:30pm</td>
<td>$495/$550</td>
<td>William (Skip) Early</td>
<td>Houston</td>
<td>1.4</td>
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<tr>
<td>26-27</td>
<td>Best Practices - Pressure Relief Systems</td>
<td>8:30am - 4:30pm</td>
<td>$495/$550</td>
<td>Tom Bevilacqua &amp; John Burgess</td>
<td>HESS Club, Houston</td>
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<th>Location</th>
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<tr>
<td>5-6</td>
<td>Layer of Protection Analysis</td>
<td>8:30am - 4:30pm</td>
<td>$495/$550</td>
<td>Angela E. Summers</td>
<td>SIS-TECH</td>
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<tr>
<td>18-20</td>
<td>Safety Instrumented Systems Implementation</td>
<td>8:30am - 4:30pm</td>
<td>$695/$750</td>
<td>Angela E. Summers</td>
<td>SIS-TECH</td>
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<tr>
<td>26-27</td>
<td>Auditing Your SHE Management System</td>
<td>8:30am - 4:30pm</td>
<td>$495/$550</td>
<td>Jack McVaugh</td>
<td>Houston</td>
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<td>TBD</td>
<td>Fundamentals of Process Safety Management</td>
<td>8:30am - 4:30pm</td>
<td>$495/$550</td>
<td>Adrian Sepeda</td>
<td>OSHA-Mesquite</td>
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<td>20-21</td>
<td>A Systematic Assessment of Reactive Chemical Hazards</td>
<td>8:30am - 4:30pm</td>
<td>$495/$550</td>
<td>Sam Mannan &amp; Bill Rogers</td>
<td>Houston</td>
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<th>Location</th>
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<td>A Systematic Assessment of Reactive Chemical Hazards</td>
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<th>Location</th>
<th>CEUs</th>
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<tr>
<td>16-17</td>
<td>Process Hazard Analysis Leadership Training</td>
<td>8:30am - 4:30pm</td>
<td>$495/$550</td>
<td>William (Skip) Early</td>
<td>Houston</td>
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<tr>
<td>23-24</td>
<td>Fundamentals of Process Safety Management</td>
<td>8:30am - 4:30pm</td>
<td>$495/$550</td>
<td>Adrian Sepeda</td>
<td>Houston</td>
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### December

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<th>Location</th>
<th>CEUs</th>
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<tbody>
<tr>
<td>2-3</td>
<td>Auditing Your SHE Management System</td>
<td>8:30am - 4:30pm</td>
<td>$495/$550</td>
<td>Jack McVaugh</td>
<td>Houston</td>
<td>1.4</td>
</tr>
</tbody>
</table>

### Registration Fees

**Early Registration (4 weeks prior)**

Contact: 979-458-1863 • 979-458-0422 (fax) • mary-cass@tamu.edu

[http://psc.che.tamu.edu/education](http://psc.che.tamu.edu/education)

**Other Course Offerings**

Available by Request and On-Site
# Mary Kay O’Connor Process Safety Center
## Continuing Education Registration Form

<table>
<thead>
<tr>
<th>Last Name</th>
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<tr>
<th>Telephone</th>
<th>Fax</th>
<th>E-Mail Address*</th>
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</thead>
</table>

## COURSE TITLE | COURSE DATE | FEE
---|---|---

## CANCELLATION & REFUND POLICY

1) If the course is cancelled for any reason, we will provide a 100% refund or the student can transfer their registration fee to the next offering of the same course, or to a different course.

2) If the student cannot attend the course, they may have a substitute attend. Cancellations must be received ten working days prior to the start of the course to receive a refund. After that time, there will be a 30% penalty. All refunds will incur a $25 service charge. The Center will not be responsible for any costs and/or expenses incurred by the registrant when a class is cancelled.

*Email addresses received via this registration form will be added to our email distribution list unless otherwise noted.

## Registration and Fees:

**To register online go to:** [http://www.texasonline.state.tx.us/NASApp/tamu/ODEManager](http://www.texasonline.state.tx.us/NASApp/tamu/ODEManager)

and select courses offered by the Texas Engineering Experiment Station and then you will be linked to the site listing all our our courses. Follow the instructions and be sure to wait for a confirmation that your registration was received before exiting the site.

Early registration is 4 weeks prior to course date. See individual classes for fee, (based on course duration).

Circle one: MC Visa AmEx

Total $__________________

CC#____________________ Exp. _____

Card Holder______________________________

Please send registration form and check (made payable to the Mary Kay O’Connor Process Safety Center) or fax registration if paying by credit card (American Express, Diners Club, MasterCard, or Visa) to:

Mary Kay O’Connor Process Safety Center
Attention: Mary Cass
Texas A&M University
College Station, TX 77843-3122
Phone: 979/458-1863 Fax: 979/458-0422
Contact:
Donna Startz
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 28-29, 2008
2008 SYMPOSIUM
Mary Kay O’Connor Process Safety Center
Texas A&M University

Information about Center Membership can be found at:
http://process-safety.tamu.edu/membership/

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College Station, Texas, USA, December 2007