The Mary Kay O’Connor Process Safety Center hosted the 2002 Annual Symposium on October 29-30, 2002 at the Reed Arena in College Station. This was the 5th in the series of successful symposiums hosted annually by the Center. Symposium attendees came from all over the United States as well as from overseas, some as far way as from United Kingdom, Finland, Denmark, Netherlands, and Japan.

Dr. Sam Mannan, Center Director, opened the Symposium by welcoming the attendees. He read an eulogy for Jim Makris who died recently in a tragic accident. Dr. Mannan led the Symposium in observing a one-minute silence for prayer and reflection for Jim Makris.

Mannan also presented the “State of the Center” address. He said, “The Center continues to make major progress in advancing its education, research, and service mission.” He gave a summary of Center activities.

Dr. Trevor Kletz presented the inaugural “Frank P. Lees Memorial Lecture” on the first morning of the Symposium. His paper summarized examples of equipment that cannot do what we want it to do, either because it defies the laws of science or has other unforeseen faults.

Ms. Carolyn Merritt, Chairman and CEO of the United States Chemical Safety and Hazard Investigation Board gave the keynote speech on the second day of the Symposium. Ms. Merritt spoke about the CSB recommendations on reactive chemicals and gave an update on other CSB activities. She challenged the audience to establish a business case for safety.

The papers presented at the Symposium represented a unique combination of practical applications and findings from research advances.

Mr. John Ferris with the Chemical Emergency Preparedness and Prevention Office of the U.S. Environmental Protection Agency presented a paper entitled, “Risk Management Program: Current Issues and Updates”. He discussed the current issues being addressed by EPA’s Risk Management Program under 112(r) of the Clean Air Act including Third Party Audits, Site Security/Counter Terrorism efforts, Use of Inherently Safer Technology, Public Disclosure of Information, and findings with the review of Risk Management Plan submissions.
Recent events have focused a lot of attention on two quite important issues with regard to process safety. They are “Inherent Safety” and “Reactive Chemicals.” Both are very important issues and progress must be made in each area if advances are to be made with regard to process safety performance. However, we must tread with caution and make sure that good science based approaches are utilized in developing whatever plans may be necessary on a nation-wide basis. Otherwise we run the risk of unintended consequences. I and others at the Center have argued the merits of both these subjects and the potential pitfalls associated with developing implementation programs.

With regard to inherent safety, the Center published a White Paper entitled, “Challenges in Implementing Inherent Safety Principles in New and Existing Chemical Processes.” This paper defines inherent safety and contrasts it with more traditional approaches to safety. It illustrates through analogies with common household examples the challenges faced in evaluating and implementing inherently safer designs. The first challenge is simply to measure the degree of inherent safety in a way that allows comparisons of alternative designs, which may or may not increase safety or may simply redistribute the risk. The second is that because inherent safety is an intrinsic feature of a design, it is best implemented early in the design of a process plant, while the US has a huge base of installed process plants and little new construction. Thirdly, in developing inherently safer designs, there are significant technical challenges that require research and development efforts with limited short-term economic incentives. These challenges make regulation of inherent safety very difficult. We believe that a coordinated long-term effort involving government, industry, and academia is essential to develop and implement inherently safer designs. A similar approach has shown success in related areas such as green chemistry, energy conservation, and sustainable development.

With regard to the reactive chemicals issue, the Center provided to the U.S. Chemical Safety and Hazard Investigation Board (CSB) written comments entitled, “Challenges of Regulating or Implementing a Reactive Chemicals Hazard Management Program.” These comments were provided during the Public Meeting held by the CSB on September 17, 2002, in Houston, Texas. Reactive chemicals represent significant hazards and have contributed to a large number of incidents resulting in fatalities, injuries, and property losses. However, the CSB study and other information available in the open literature lead us to conclude that a majority of the reactive chemical incidents occurred because the owner/operator of the facility did not make use of the information easily available in the literature. In a smaller fraction of the incidents, the owner/operator did not have sufficient knowledge of the process chemistry involved. The Center document provides a discussion of the difficulties associated with regulating reactive chemicals. Recommendations are provided on a reasonable path forward with regard to addressing reactive chemical hazard management.

In both of the issues discussed above, I believe we have an opportunity to make major strides in developing and implementing useful programs that contribute to the improvement of safety performance. We must also be mindful of all good-science based approaches and try our best to avoid unintended consequences. Hard copies or electronic copies of the “White Paper on Inherent Safety” and the “Comments to the CSB on Reactive Chemicals” can be obtained by contacting the Center.

M. Sam Mannan
The Mary Kay O'Connor Process Safety Center’s Merit Award recognizes an individual who has made significant contributions to the advancement of education, research, or service activities related to process safety concepts and/or technologies. The contributions or accomplishments leading to the annual Merit Award need not be associated with the Center but must fit within the central theme of the Center, i.e., Making Safety Second Nature. In establishing the Merit Award, the Steering Committee underscored the importance of promoting and recognizing significant contributions and accomplishments of practitioners and researchers worldwide. According to Steering Committee Member Michael O’Connor, “Accomplishments in process safety must be recognized and promoted so that practitioners and researchers not only feel excited and committed to the new developments, but also the recognition will help disseminate and publicize the ideas and work accomplished by the individual receiving the recognition. The celebration of process safety accomplishments will hopefully be another catalyst in improving process safety in the process industries.”

The Service Award established by the Steering Committee honors and recognizes individuals who have contributed directly to the success of the Center and have played a significant role in advancing the mission of the Center. Nominations for either Award should be sent to the Center Director by April 30 each year. Based upon the nominations received, the Steering Committee makes the final selection. Awards are presented during the general session of the Annual Symposium.

Dr. Sam Mannan, Director of the Mary Kay O’Connor Process Safety Center presented the 2002 Merit and Service Awards during the opening session of the 2002 Symposium on October 29, 2002.

The 2002 Merit Award was presented to Dr. Isadore (Irv) Rosenthal. Dr. Rosenthal was employed at Rohm and Haas for 38 years in a variety of research, development, new business ventures and corporate staff positions. For the last 13 years of his career at Rohm and Haas, Dr. Rosenthal served as Corporate Director of Safety, Health, Environmental Affairs and Product Integrity. In this position, he was involved in the company’s program to control hazards and risks in both the products the company sold and in its facilities around the world. After his retirement from Rohm and Haas in 1990, Dr. Rosenthal joined the Wharton Risk Management and Decisions Processes Center as a Senior Research Fellow. His areas of research were focused on the management of risks associated with low probability-high consequence industrial accidents, market based alternatives to government regulation of industrial risks and the methodology of risk assessment. President Clinton’s nomination of Dr. Rosenthal to a five-year position as a member of the U.S. Chemical Safety and Hazard Investigation Board was confirmed by the Senate and he joined the Agency in November 1998. In presenting the Merit Award Dr. Mannan said that, “By selecting Dr. Rosenthal for this award, the Steering Committee is recognizing a lifetime of commitment and hard work for chemical safety and risk management. We hope that the recognition of his accomplishments will further disseminate and publicize his ideas and work.”

The 2002 Service Award was presented to Dr. Vic Edwards. Dr. Edwards is Process Director for Aker Kvaerner, where he leads process engineering, environmental engineering, and process safety management for the engineering projects for DuPont sites on the US Gulf Coast. His primary activity during the past nineteen years has been more than 100 DuPont projects. During this period, he has received three awards from DuPont for excellence in engineering design and two more DuPont awards for safety and environmental excellence. In 1998, Kvaerner named Dr. Edwards Employee of the Year. Dr. Edwards received his baccalaureate degree in chemical engineering from Rice University and his Ph. D. from the University of California at Berkeley. He is a member of the Technical Advisory Committee of the Mary Kay O’Connor Process Safety Center and has been instrumental in providing significant input and assistance for numerous technical proposals and research projects. In presenting the Service Award Dr. Mannan said that, “Dr. Vic Edwards has given of his time, advice, and support freely to the Center. We are pleased today to recognize his contributions and accomplishments.”
Christina Sposato graduated from Texas A&M University in December 2000 with an MS in Chemical Engineering. She received a BS in Mathematics and Chemistry from the University of Nebraska – Lincoln. At Texas A & M University she studied under Dr. Mannan at the Mary Kay O’Connor Process Safety Center. She used the fluid dynamic software, FLUENT, to model turbulent releases of silane impinged by plates and cylinders. Her thesis modeled the flammable volume as a plate or cylinder obstructed the turbulent jet of silane.

After graduating, Christina accepted a position with Intel Corporation in Albuquerque, NM. She spent her first year in the company’s Rotational Engineers Program. This is a special program open to select engineers, which allows them to work four-month rotations in three different areas before their final place. Her first rotation was in process engineering in the lithography department where she audited and matched equipment. Her second rotation was installing and qualifying new equipment. Her third rotation was in yield, where she analyzed data to determine which equipment produced the fastest chips. When she finished her three rotations, Christina final placed in process engineering with the lithography department where she is an equipment owner. She is responsible for day to day sustaining, equipment upgrades, process transfers, etc. The education and experience she received from Texas A&M University prepared her for an exciting career at Intel. She learned how important communication, safety, and quality are for high volume manufacturing at Intel.

Christina said, “the education and experience I received from Texas A&M University prepared me for an exciting career at Intel.”
RECENT PUBLICATIONS


The Mary Kay O’Connor Process Safety Center has unveiled its 2003 continuing education catalog of process safety and risk assessment courses. The 2003 catalog features the addition of several new courses in addition to the existing popular courses. A schedule of courses from the 2003 catalog is provided in page 7. Please contact the Center if you need the complete catalog.

On many occasions, companies have requested that a continuing education course be tailored to their needs and be offered specifically for their employees or a particular work group. Onsite courses can be made available and have proven to be very successful. The instructor travels to the facility thus eliminating travel time and costs for the facility employees. In addition, the short course is tailored to the specific needs of the facility. The opportunity presents a win-win situation where the course is tailored to the specific company needs, the instructor travels to the facility location, and can teach to an audience as small as eight or up to 20. For more information and contract arrangements for an onsite course, please contact Ms. Mary Cass at (979) 458-1863 or by e-mail at mary-cass@tamu.edu.

### Mary Kay O’Connor Process Safety Center
Continuing Education Registration Form

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**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.

**Registration and Fees:**

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

Circle one: [ ] American Express [ ] Diner's Club [ ] MasterCard [ ] Visa

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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
3574 TAMU
College Station, TX 77843-3574
Phone: (979) 458-1863    Fax: (979) 458-0422
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<td>25 · What Went Wrong: Learning from Chemical Plant Accidents - Roy E. Sanders</td>
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<td>4 - 5 · Best Practices: Pressure Relief Systems - Pat Berwanger</td>
<td>1 - 2 · Systematic Assessment of Reactive Chemical Hazards - Sam Mannan and Bill Rogers</td>
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<td>8-10 · Safety Instrumented Systems Implementation</td>
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<td>Angela E. Summers</td>
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<td>25-26 · Special Topics in Behavioral Safety for Process Industries - Thomas Burns</td>
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<td>27-28 · Coaching to Meet the Press and Other Hostile Audiences - Judy Hoffman</td>
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<td>9 - 10 · Special Topics in Behavioral Safety for Process Industries - Thomas Burns</td>
<td>7 - 8 · Inherently Safer Design - Dennis Hendershot</td>
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<td>23-24 · Root Cause Incident Investigation - Jack Philley</td>
<td>7 - 8 · Process Hazard Analysis Leadership Training - William (Skip) Early</td>
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<td>30-10/1 · Management of Change - Harry West</td>
<td>14-15 · Process Safety Management - Adrian L. Sepeda</td>
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<td>4 - 6 · Safety Instrumented Systems Implementation (Covering ISA8401 and IEC 61511 Regulations) - Angola E. Summers</td>
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<td>18-19 · Siting - Addressing the OSHA PSM and EPA RMP Requirements - Adrian L. Sepeda</td>
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Locations:
IBT Facility, Houston, TX -or- Great Southwest Equestrian Center (GSWEC), Katy, TX

All classes run: 9:00AM - 4:00PM

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

For more information, contact Mary Cass at 979-458-1863 or mary-cass@tamu.edu

http://process-safety.tamu.edu
CALL FOR PAPERS
Making Safety Second Nature

INTERNATIONAL SYMPOSIUM
October 28-29, 2003
Sponsored by
Mary Kay O’Connor Process Safety Center
Chemical Engineering Division, Texas A&M University System

Topical Areas - This symposium focuses on present and future areas of research and activity at the Center

- **Equipment Integrity and Reliability** – Inspection, Testing, Prediction
- **Risk Assessment** – Quantitative Analysis, Case Studies, Reliability Data
- **Reactive Chemicals** – Predicting Reactivity, Role of Contaminants, Catalysts and Inhibitors, Case Histories, Experimental Methods
- **Consequence Modeling** - Aerosol Formation, Rain-Out, Flammability, CFD, Explosions, Heat Transfer
- **Learning from Incidents** – Databases, Investigations, Trends, Causes, and Patterns, Case Histories
- **Inherent Safety** – Measuring, Design Methods, Case Studies, Design for Terrorism
- **Management for Process Safety** – Benchmarking, Indicators of Plant Health, PSM, Information Systems, Project Engineering
- **Process Control** – Abnormal Situations, Detection and Recovery, Safety Instrumented Systems
- **Regulatory Issues** – RMP, PSM, Chemical Security Act, Reactive Chemicals
- **Chemical Plant Security** – ACC Guidelines, War time Experience

Abstracts are due no later than March 1, 2003
Send abstracts to Dr. Sam Mannan, e-mail: mannan@tamu.edu
(979) 862-3985, FAX (979) 458-1493
Chemical Engineering Department, Texas A&M University
College Station, Texas 77843-3574

Additional information available on internet at [http://process-safety.tamu.edu](http://process-safety.tamu.edu)

Exhibition space for displaying equipment, software, and materials is available. For further information on exhibition space, contact Ms. Donna Startz (donnas@tamu.edu) (979) 845-3489.
TAMU to Offer Online Registration and Payment for Continuing Education

By the end of the year, Texas A&M will join the ranks of e-commerce sites around the world, but instead of music or books, students will be browsing, registering, and paying for continuing education courses online.

Administrators at Texas A&M consider e-commerce to be one of the key components of a 21st century continuing education system. With the college degree being the basic qualification for employment, competence—not just credentials—means more than ever to the US workforce. Members of A&M expect increasing demand for applications of the university’s ongoing, cutting-edge research in a business-oriented continuing education program. A&M’s web site will offer one easy clearinghouse for registration, and payment of continuing education courses.

Texas A&M’s Mary Kay O’Connor Process Safety Center already offers off-campus continuing education courses in Houston. Elizabeth Tebeaux, Director of the Office of Distance Education at Texas A&M, sees continuing education by distance as a major growth area for the university. “We have ten graduate programs available by distance, and departments hosting these programs are looking for ways to package key modules of these programs for continuing education delivered over distance. With flexible delivery, companies and students can benefit.”

According to Tebeaux, working adults place a high value on easy access when “shopping” for the supplemental knowledge needed to keep current and competitive in their fields. “That’s why, over time, you will see more education available off-campus in formats that are convenient to the student, such as on-site classes at companies, interactive video, and web-based instruction.”

Communication technology from the last decade has given companies and individuals greater choice about how and when they access continuing education. Web-based instruction in particular allows students to access coursework when they have time to pursue it.

Planners at Texas A&M expect that individuals will use the proposed website to find, register, and pay for courses, while college departments will continue to work with companies to develop programs tailored to meet their needs.

“TAMU has not been a major player in the continuing education market, but that is changing,” Tebeaux says. “This university is moving to meet the new demand for life-long, continuing education.”

(Symposium, Continued from Page 1)

Mr. G.B. DeWolf with the URS Corporation presented a paper entitled, “Process Safety Management in the Pipeline Industry: Parallels and Differences between the Pipeline Integrity Management (IMP) Rule of the Office of Pipeline Safety and the PSM/RMP Approach for Process Facilities”. He said, in 2001 the federal Office of Pipeline Safety promulgated its Pipeline Integrity Management Rule for hazardous liquid pipelines. A similar rule for gas pipelines is due in 2002. These rules derive from formal risk management initiatives of both the pipeline industry and the regulators beginning of the early to mid-1990s. The initiatives and resulting rules built on many of the process safety and risk management concepts and frameworks of the process industries, as modified for pipelines. Looking closely at the parallels and the differences is an interesting study of how the technical, public and industry-specific requirements affect the types of regulations, supporting management system frameworks and the technical activities for improving hazardous materials process safety.

Mr. Dave A. Moore with the AcuTech Consulting Group of Chemetica, Inc. presented the paper entitled, “Experiences in the Regulation of Inherent Safety’. Moore said inherent safety is a worthwhile process risk management strategy to employ and efforts to implement inherently safer strategies should be given
first priority, as it is feasible. But regulating the use of inherent safety is proving to be challenging as evidenced by the experiences to date of industrial companies who are under inherently safer requirements as part of the Contra Costa County, California, Industrial Safety Ordinance (ISO).

**Mr. Hiroshi Sumida** with the Toyo Engineering Corporation in Japan presented the paper entitled, “A Framework for Designing Independent Protection Layer (IPL) Implementing Process Hazard Analysis to Process Safety Design”. Sumida proposed a framework of systematic process safety evaluation, design and operation management using the IDEF0 activity model, so that all the inputs, outputs, controls, and mechanisms to achieve particular activities in designing safety can be expressed explicitly. He said the current safety design seems to be done using heuristics and experiences of process designers and safety engineers. Because of this, the quality of safety design is heavily dependent on the expertise of those engineers.

**Dr. Angela Summers** with SIS-TECH Solutions presented the paper entitled, “Introduction to Layer of Protection Analysis”. Summers said layers of protection analysis (LOPA) is a semi-quantitative methodology that can be used to identify safeguards that meet the independent protection layer (IPL) criteria established by CCPS in 1993. While IPLs are extrinsic safety systems, they can be active or passive systems, as long as they meet certain criteria regarding specificity, independence, dependability, and auditability. Summers said that LOPA is not just another hazard assessment or risk assessment tool. It is an engineering tool used to ensure that process risk is successfully mitigated to an acceptable level.

**Dr. Jerry Havens** of the Chemical Hazards Research Center at the University of Arkansas presented the paper entitled, “Modeling Aerosol Rainout — Effect of Droplet Mass Transfer”. He said the AIChE Center for Chemical Process Safety coordinated research efforts aimed at characterizing and predicting the behavior of aerosols during accidental releases. Field tests designed to be used for validation of a predictive model (RELEASE) showed that aerosol rainout was a significant factor under the test conditions. In addition to summarizing the RELEASE model and the data from the field test, Johnson and Woodward corrected the measured aerosol rainout to account for the experimental conditions. In his paper, Spicer proposed an alternate description of the jet expansion zone that predicted larger initial aerosol drop diameters and resultant larger fraction rainout than had been previously predicted with RELEASE.

**Mr. Kiran Krishna** of the Mary Kay O’Connor Process Safety Center presented the paper entitled, “The Use of Aerosol Formation, Flammability, and Explosion Information for Heat Transfer Fluid Selection”. Krishna said the devastating consequences of aerosol/mist explosions have been widely documented, and there are currently efforts to understand the mechanisms of the formation and explosion of such aerosols. Krishna presented a novel scheme to integrate the knowledge of heat-transfer fluid aerosol formation from leaks in process equipment into the selection of heat transfer fluids during the design process.

**Mr. Gregory Alvarado** of The Equity Engineering Group, Inc. presented the paper entitled, “API RP 579 and Application in the Refining and Petrochemical Industries”. He said the API Fitness for Service Recommended Practice is an evergreen document that is continually updated and improved by a committee of industry professionals. It was originally created because most codes, including the ASME and API design codes do not address the fact that equipment degrades while in-service and that deficiencies due to degradation or from original fabrication may be found during subsequent inspections. Fitness-For-Service (FFS) assessments are quantitative engineering evaluations that are performed to demonstrate the structural integrity of an in-service component containing a flaw or damage. API 579 provides guidance for conducting FFS assessments using methodologies specifically prepared for equipment in the refining and petrochemical industry.
Mr. John Alderman of Risk, Reliability and Safety Engineering presented the paper entitled, “Implementing API RP 580 Risk Based Inspection”. Alderman said API RP 580 Risk-Based Inspection was recently issued in the spring of 2002. This recommended practice provides the basic elements for developing and implementing a Risk-based Inspection (RBI) program. He provided an introduction to the background and benefits of RBI as a tool for improving equipment reliability and managing asset integrity. He also covered the elements, data, and resources necessary to implement a risk-based inspection program and how risk-based inspection fits into an overall plant mechanical integrity program.

Mr. Joel Krueger of BP America Inc. presented the paper entitled, “A Practical Approach to Fire Hazard Analysis for Offshore Structures”. Krueger said offshore quantitative risk assessments have historically been very complex and costly. However, fire hazard analysis (FHA) can be used to determine an optimum design and a performance standard developed that also achieve risk reductions. As a result, companies are now recognizing that performing fire hazard analysis on new and existing offshore facilities is simply good business practice. He used recent experience to outline a practical approach to fire hazard analysis and fire hazard management for deep-water structures and included discussions from the June 2002 International Workshop for Fire Loading and Response.

Mr. Ben F. Harrison of ABS Consulting, Inc. presented the paper entitled, “Blast Resistant Modular Building for the Petroleum and Chemical Processing Industry”. Harrison said there exists a need for blast resistant yet portable buildings to protect personnel temporarily assigned duties within explosively hazardous areas. Several companies have designed products to meet this need. The buildings are similar in design and construction to steel shipping containers but they are larger in scale, are much stronger, and are intended to be occupied within hazardous areas. He described blast performance, structural siting issues, and presented different applications of blast resistant modular buildings that have been installed at various facilities.

Mr. David Moore of the AcuTech Consulting Group of Chemetica, Inc. presented a paper entitled, “A Simplified Risk-Based Approach for Analyzing Human Factors”. Moore said human factors issues are critically important to process safety performance, and approaches are available to manage these risks. But most process safety management programs do not formally address human factors as of this time. Human factors for PSM is seen as a very confusing topic by most engineers and managers, and so we see little action in this area. There a lack of guidance available in the literature as to how human factors should be addressed. He outlined an employee-centered team approach that is an extension of the PHA element of PSM, is simple, and provides a risk-based framework for addressing the issues.

Mr. Tom Beveilacqua with Berwanger, Inc. presented the paper “Non-Conformance of Existing Pressure Relief Systems With Recommended Practices: A Statistical Analysis”. Beveilacqua presented a statistical analysis showing that the pressure relief systems on nearly half of the equipment in the oil, gas, and chemical industries lack adequate overpressure protection as defined by recognized and generally accepted good engineering practices. He said this analysis is based on data collected from a large number of government mandated (per OSHA 1910.119) pressure relief system design audits performed by an independent contractor. The vast majority of these deviations from good practice were not identified during conventional process hazard analyses (PHAs) performed on these same facilities. Most of the units had also been designed by reputable design firms. Beveilacqua concluded that, as a practical matter, conventional PHA methods are ineffective tools for evaluating pressure relief systems; and also that the pressure relief system design process could be improved.

Ms. Kathy Pearson of Rohm and Haas Texas presented the paper entitled, “Preview of Updated CCPS Incident Investigation Guidelines”. Pearson said since the original incident investigation guidelines were published in 1992 by the Center for Chemical Process
Safety (CCPS), significant changes have taken place in the performance expectations and incident investigation practices used in the chemical process industry. The CCPS has undertaken a project to update the original guidelines to incorporate a stronger focus on root cause identification. Expectations of government regulators have significantly increased since 1992 as demonstrated by the Chemical Safety Board root cause investigations. Many organizations have modified their internal investigation management systems to respond to these new standards. Pearson highlighted the significant changes to the CCPS investigation guidelines as well as recent industry practices.

Mr. Mike Bearrow of Data Systems & Solutions presented the paper entitled, “Benefits of Automating Process Safety Management (PSM) and Integrating with Operating Procedures and Drawings”. Bearrow said many corporations are currently making production and compliance decisions using paper-based systems, Excel spreadsheets and Access databases. The complexity of tackling issues such as Management of Change (MOC) workflow and ensuring that corrective actions and pre-startup safety reviews occur in a timely manner may present a formidable challenge in a process plant. While Excel spreadsheets and Access databases are standard desktop solutions, it is difficult to get information systems (IS) personnel to support these custom applications due to poor documentation. There are also issues to address such as poor performance when there is a lot of data or too many users, lack of security, high costs for maintenance, and the risk that intellectual property will be lost when personnel turnover occurs.

Mr. Roy E. Sanders of PPG Industries, Inc. presented the paper entitled, “Designs that Lacked Inherent Safety: Case Histories”. Sanders said in many cases, the fundamentals of Inherently Safer Design were not fully appreciated in the initial design (or re-design). He reviewed two cases involving the basic element of plant layout to minimize property damages and injury. Simple physical separation could have reduced the losses. He also reviewed a case history that occurred in a bulk chemical terminal tank farm that highlighted designs, which allowed incompatible chemicals to react, create a fire and a lingering toxic gas release. The combination of these chemicals caused equipment damage in one case and a threat to the public in another case. He concluded with case histories involving poor piping design or poorly identified piping systems, which needlessly resulted in expensive repairs. Sanders said that exercising the principles of Inherent Safety would have reduced the severity and perhaps the opportunity of these events.

Mr. Wael Abouamin of DNV presented the paper entitled, “Simultaneously Improving Safety Awareness, Safety Attitudes, and Business Results”. Abouamin said achieving acceptable business results is a priority for all facilities (industrial, chemical, process, etc). Based on this premise, a facility with poor economic performance will also be more likely to under-invest in safety activities. That said, reaching economic goals while maintaining satisfactory safety levels can sometimes be a challenge. He described techniques that were used to evaluate risks at a facility, focusing on major accidents.

Mr. Ian Sutton of Sutton and Associates presented the paper entitled, “Warning Flags Over Your Organization Or: How Lucky Are You Feeling Today?” Sutton said for the last twenty years managers in the process industries have been under seemingly relentless pressure to cut costs, increase production, implement new initiatives, install new technology and reduce overhead. While such efforts may lead to improvements in profitability, many of these managers are concerned about what they long-term effects are particularly with regard to safety and environmental impact. The transition from safe to unsafe can never be as certain as the knowledge that a gale is off-shore. Nevertheless, there are indicators that a plant may have reached the point where a Warning Flag ought to be raised. Moreover, the transition from safe to unsafe operation is likely to be gradual; and can sneak up on an organization. Sutton provided some thoughts and suggestions as to how that point may be
recognized, and discussed how the well-established techniques of process safety management can be adapted to help lower some of the flags.

**Dr. Calvin D. Jaeger** with Security Systems and Technology Center of Sandia National Laboratories presented the paper entitled “Chemical Facility Vulnerability Assessment Project”. Jaeger said Sandia National Laboratories, under the direction of the Office of Science and Technology, National Institute of Justice, is conducting the Chemical Facility Vulnerability Assessment (CFVA) project. The primary objective of this project is to develop, test and validate a vulnerability assessment methodology (VAM) for determining the security of chemical facilities (VAM-CFSM) against terrorist or criminal attacks. The project also included a report to the Department of Justice for Congress that in addition to describing the VAM-CFSM also addressed general observations related to security practices, threats and risks at chemical facilities and chemical transport.

**Mr. David Belonger**, a consultant for the Center for Chemical Process Safety, presented the paper “Guidelines for Analyzing and Managing the Security Vulnerability of Fixed Chemical Sites”. Belonger said throughout the industrial age, and particularly since the mid-1980’s, engineers and the public have recognized that hazardous materials can destroy lives and property if handled improperly. Significant progress has been made in improving the process safety performance, resulting in fewer accidents and lessened consequences of these accidents. All progress notwithstanding, fires, explosions, and toxic exposures still result from or cause hazardous material releases many times per year. In practically all instances, these releases are accidental. Preventable, surely, but never, or hardly ever, have releases been caused intentionally with thought to harm. Since September 11, 2001, however, we have become increasingly aware that global terrorists view the industries that use or manufacture hazardous materials as potential weapons. He described a multi-corporate effort, coordinated with government agencies, to develop methods and tools to integrate process safety and security. The result incorporates and builds on the best practices, policy, and strategic thinking of more than 20 companies, trade associations, and government agencies. The resulting guidelines for process safety and security, and plans for future efforts were discussed.

**Mr. William A. Anderson** of Winston & Strawn presented the paper entitled, “Right-to-Know, or Blueprint for Terror?” Anderson said the terrorist attacks of September 11, 2001, reignited the debate over the public’s right to know about the use and potential release of chemicals near communities. Public disclosure of information on chemical handling and releases is viewed by many as a key tool to reducing and avoiding hazards. He highlighted the tension created by the policy justifications behind the community’s right to know and the government’s need to limit access to sensitive RMP information. First, he examined current law - e.g., FOIA, EPCRA, and Section 112(r) - and the underlying policies favoring disclosure. Second, the paper analyzed proposals within the federal government to restrict access to Section 112(r) and EPCRA information for the sake of national and site security and the policy rationale supporting these proposals. Finally, he suggested means to reconcile these two policies so that the appropriate public has access to information for which it has a compelling need and the government controls the dissemination of sensitive information. Anderson also suggested steps that industry should take to protect its own sensitive RMP information, using “lessons learned” from experience with information and facility security in the nuclear power industry.

**Dr. Steven D. Emerson** of Emerson Technical Analysis and **LCDR John Nadeau** of the US Coast Guard presented the paper entitled, “A Coastal Perspective on Security”. They examined security issues from the unique perspective of our nation’s coastlines and associated infra-structure. The paper surveyed ongoing efforts to secure offshore shipping lanes, as well as the trans-portion systems and huge capital investments on the narrow strip of land intersecting with
coastal waters. They recounted the extraordinary demands recently placed on the Coast Guard, port authorities and other agencies charged with offshore security. New federal requirements such as port assessments continue to be mandated, while solutions to funding are still unfolding.

**Dr. Jai P. Gupta** of the Mary Kay O’Connor Process Safety Center presented the paper entitled, “Some Thoughts on Measuring Inherent Safety”. Gupta said Inherently Safer Design (ISD) concepts have been with us for over two decades since their elaboration by Trevor Kletz. Interest has really taken off globally since the early nineties after several major mishaps occurred during the eighties (Bhopal, Mexico city, Piper-alfa, Philips Petroleum, to name a few). Academic and industrial research personnel have been actively involved into devising inherently safer ways of production. The regulatory bodies have also shown deep interest since ISD makes the production safer and hence their tasks easier. Research funding has also been forthcoming for new developments as well as for demonstration projects. A natural question that arises is as to how to measure ISD characteristics of a process? Several researchers have worked on this. Many of the proposed methods are very elegant, yet too involved for easy adoption by the industry which is scared of yet another safety analysis regime. In a recent survey, companies desired a rather simple method to measure ISD. Simplification is also an important characteristic of ISD. It is therefore desirable to have a simple ISD measurement procedure.

**Ms. Michela Gentile** with the Mary Kay O’Connor Process Safety Center presented the paper entitled “Inherent Safety Index For Transportation Of Chemicals”. Gentile said Inherent Safety can be understood as the absence or reduction of hazards (which implies lower risk) rather than low risk reached by add-on protective barriers. While the methodologies for risk analysis are well developed and understood, the evaluation of inherent safety is still not based on systematic procedures and depends on the assessment of subjective principles. The behavior of a chemical substance is one of the most important sources of hazard in a chemical process due to its intrinsic chemical and thermodynamic properties. When these substances are raw materials or sub-products (waste) they must be transported to/from the chemical facility, and this activity extends the chemical hazards from the processing plant to the community. Therefore, to obtain a general evaluation of the inherent safety level of a chemical plant, it is necessary to consider the hazards due to transportation of chemicals and treat these as an additional “property” of the substance. Gentile presented an overview of a novel inherent safety index based on fuzzy logic, which is useful to evaluate the inherent safety level of a plant.

**Mr. Mike Moosemiller** with DNV (USA), Inc. presented the paper entitled, “Inherent Safety of Dikes Against Catastrophic Failure of Storage Tanks”. Moosemiller said it is industry practice to provide passive containment (dikes) of storage tank equivalent to 110% of the capacity of the tank. This standard is sufficient for containment of small to moderate leaks. However, it is generally inadequate to contain a catastrophic failure, which can form a wave that simply washes over the side of (or through) a dike wall. The 110% standard has generally served industry well, since the likelihood of a catastrophic tank failure is very low historically. However, concerns over terrorist attacks, and adoption of principles such as “inherent safety”, have brought the catastrophic tank failure case back onto the “radar screen” of chemical risk management.

**Mr. Gary Staton** with E. I. du Pont de Nemours & Co. presented the paper entitled, “Integrating Supply Chain and Facility Risk Analyses For Improved Business Decisions”. Staton said Typically, business supply chain risks are managed separately from fixed facility risks. However, where significant fixed site risk reduction can negatively impact a supply chain, a study that addresses both the supply chain and fixed facility risk can be done to help the business integrate all available information into the decision process. To assure a comprehensive risk analysis, a supply chain risk study should include rare/high consequence events, as does the fixed site study. Staton presented a study for a
facility that imports, stores, and consumes large volumes of a highly toxic material, and is located in a densely populated area. He described the methods used to analyze risks and identify risk reduction opportunities for the facility and the supply chain. The business team integrates the results of this study with other information to make better decisions.

Dr. Sanjeev Mohindra with TIAX LLC presented the paper entitled, “Probabilistic Fault Tree Analysis”. Mohindra said any system failure model contains at least two sources of uncertainty; modeling uncertainty, and parametric uncertainty. One of the main causes of parametric uncertainty is the underlying data evaluation uncertainty. Very often failure data for events is not available and engineering estimates are used. The engineering estimate (expert estimates) of component reliability parameters often results in extreme data uncertainty. While there exist importance measures to evaluate the individual contribution of component failures to the overall system failure, they fail to provide information about the overall uncertainty at the system level.

Mr. Jack McCavit with Celanese Chemicals presented the paper entitled, “Celanese Risk Assessment/Risk Management Process in PHA’s”. McCavit said Celanese uses a Risk Assessment/Risk Management (RA/RM) process as an integral part of its PHA process. The RA/RM process is used when consequences of an identified scenario are high. If the consequences are high, a frequency is determined. When the consequences and frequency are known, a risk matrix is used to determine the appropriate response. He described the use of the RA/RM process in process hazard analyses.

Dr. Marc E. Levin with Shell Global Solutions (U.S.) presented the paper entitled “The Reactivity of Ethylene Oxide In Contact With Iron Oxide Fines as Measured by Adiabatic Calorimetry”. Levin said uncontrolled reactions of ethylene oxide have led to a number of events in ethylene oxide purification units resulting in equipment failure or even explosions. One such occurrence at a facility in Seadrift, Texas led to an intensive investigation into the chemistry responsible for the incident. Union Carbide found that specific iron oxide deposits, most notably the gamma phase of Fe$_2$O$_3$, react with ethylene oxide at relatively low temperatures and, under circumstances enabling self-heating, can lead to ethylene oxide decomposition. The relative ranking of the reactivity of other forms of iron oxide was also reported. He presented a study that has also investigated the reactivity of ethylene oxide with a variety of iron oxides in an adiabatic environment. The study demonstrates that vapor-phase ethylene oxide at essentially ambient temperature can react with g-Fe$_2$O$_3$, resulting in a significant temperature excursion. He discussed reaction with more standard forms of iron oxides have been examined as well and the resultant temperature and pressure behavior of these ethylene oxide–iron oxide combinations.

Mr. Abdulrehman Aldeeb of the Mary Kay O’Connor Process Safety Center presented a paper entitled, “Evaluation of Styrene-Acrylonitrile Copolymerization Thermal Stability and Runaway”. Aldeeb said that the evaluation of thermal stability and runaway behavior of any exothermic chemical reaction is of great importance to the design and operation of chemical processes. The evaluation process should be based on a thorough investigation of the reaction chemistry including reaction pathways, thermodynamic and kinetic parameters. When addressing the reactivity hazards of any reaction, the dominant pathway(s) should be identified. Identifying the main reaction pathway under certain conditions will lead to a better thermodynamic and kinetic characterization. Aldeeb evaluated the Styrene-acrylonitrile copolymerization reaction for its thermal stability and runaway behavior. Traditional thermal analysis techniques (calorimetric analysis) will be joined with computational quantum chemistry methods and empirical thermodynamic-energy correlations. Reaction pathways will be suggested according to the theoretical approach and verified by the experimental analysis. The results of this analysis will be compared to literature data for this system.

Dr. Sima Chervin of Eastman Kodak Company presented the paper entitled, “Method for Estimating Decomposition Characteristics of
Energetic Chemicals”. Chervin said experimental data (DSC, ARC) on decomposition characteristics of approximately four hundred chemicals representing various classes of energetic materials were summarized by chemical class and statistically analyzed. Average decomposition characteristics, such as energy of decomposition and decomposition onset temperature were determined for chemical classes containing the following energetic groups: nitro, nitroso, N-oxide, oxime, hydroxylamine, tetrazole, azide, triazene, triazole, diazo, azo, hydrazine, and perchlorate. Additional statistical information for each chemical class, such as the number of chemicals analyzed, the ranges, and the standard deviations for the decomposition parameters analyzed are presented. For chemical classes containing an energetic group attached to an aromatic ring, the presence and position of another substituting group in the ring can influence the decomposition onset temperature significantly. The list of activating and deactivating functional groups and the positions in the ring where the strongest activation or the weakest deactivation occurs are summarized. A method for estimating decomposition parameters of new chemicals without performing testing was recommended.

Ms. Deana M. Manassaram with the Division of Health Studies/Epidemiology and Surveillance Branch of the Agency for Toxic Substances and Disease Registry presented the paper entitled “Description of Hazardous Substances Events in the Manufacturing of Chemicals and Allied Products”. Manassaram said this report describes events involving the acute release of hazardous substances reported to the Hazardous Substances Emergency Events Surveillance (HSEES) system for 1993–2000. HSEES, a surveillance system maintained by the Agency for Toxic Substances and Disease Registry (ATSDR), collects data on the industries/services associated with events. This analysis focuses on fixed-facility events that occurred during the manufacturing of chemicals and allied products (i.e. categorized according to the 1990 Industrial Classification System (ICS) of the U.S. Bureau of the Census). This is the most frequently reported industry category in the surveillance system, with over 12,000 events (28% of all events and 35% of fixed-facility events). Further classification found that the majority (71%) of these events involved the manufacturing of industrial and miscellaneous chemicals (ICS code 192), and 21% plastics, synthetics, and resins (ICS code 180. A total of 2,676 persons reported injuries in 307 fixed-facility events. Most of the injured persons were employees (42%), followed by the general public (38%), students (15%), and responders (5%). Thirty-five percent of all injured persons and 46% of all injured employees had respiratory symptoms. Releases frequently occurred in processing vessels, and the majority were due to equipment failure. A review of the data indicates that manufacturers of chemicals and allied products could help reduce morbidity and mortality by taking preventive actions such as performing regular maintenance of processing equipment, encouraging employees to wear respiratory protection, and educating the public on what to do in the event of a release from these facilities.

Mr. Steve F. Smolen of Solutia, Inc. presented the paper entitled, “Sharing Industry Safety – A Model from the HCN Industry Safety Conference”. Smolen stated in 1983, DuPont sponsored the HCN Transportation and Safety Seminar. Attendees were representatives from hydrogen cyanide producers, shippers, and users from around the world. This was the beginning of the HCN Industry Safety Conference. Each year since 1983 the conference has been held and incidents are shared. Special presentations are also made on HCN safety related topics. The Conference Board realized that although conference presentations are published for attendees, the information often remains unknown or unavailable to others from their respective companies. The “world’s experts” on hydrogen cyanide are also retiring and some of the experience and knowledge is being lost. Finally, a review of incidents over the last 20 years indicated our industry is not learning from the experiences of others. Not only are the same types of accidents are happening, but the personnel involved are often experienced. The HCN Industry Safety Conference
entered into a contract with Mary Kay O’Connor Process Safety Center (MKOPSC) to address these needs. The goal was to improve availability of presentations from the conference, increase safety communication between member companies, and maintain a confidential database of hydrogen cyanide incidents.

Dr. Harry H. West of the Mary Kay O’Connor Process Safety Center presented the paper entitled, “Use of Failure Rate and Human Error Databases to Develop Safety Metrics and Performance Measurement Systems”. Application of process safety databases for risk reduction and loss prevention in the chemical industry is currently in its embryonic stage. The American Institute of Chemical Engineers, Center of Chemical Process Safety developed a protocol for establishing process equipment reliability databases by integrating, aggregating, and processing other generic data sources. West said that earlier research indicates the potential for relational chemical process safety databases for improvements in equipment reliability by setting the generic mean failure rate as a goal to strive for, rather than benchmark performances. The objective of the current research is to develop a model that will employ private (single facility) and generic databases applications, benchmarking processes, task-based performance evaluations, and Revise - Define changes – Redesign – Analyze - Implement (R-D-R-A-I) methodology. The novelty of this model is the effective combination of these elements toward broad performance measurements. In addition, this methodology will make establishment of a continuous improvement process for process safety performance.

Mr. Gary Staton with E. I. du Pont de Nemours & Co. presented the paper entitled, “Quantitative Risk Analysis of a Complex Chemical Process and Utilizing the Results for Risk Reduction Decisions”. Staton said in DuPont, a broad range of qualitative and quantitative methodologies are employed to understand and reduce risks from hazardous operations. Most businesses are required, by regulations or standards, to conduct consequence analyses to determine the impacts of releases. Such analyses allow a business to make only limited risk reduction decisions. A consequence analysis, using a limited set of scenarios, is focused on providing the extent of toxic/flammable impact without considering the likelihood of the events happening. Therefore, decisions to reduce the consequences of the extremely rare but catastrophic accidents can be very costly and difficult to implement. A quantitative risk analysis (QRA) that addresses all types of accident scenarios, their expected frequencies, location of populations, and frequencies of weather conditions occurring, can identify the events that contribute to the majority of the risk. Once a baseline QRA is completed for a facility, it can also be used to determine the impact of process and operational changes to reduce the risk. By conducting QRAs for several facilities, using a consistent set of assumptions, a business can identify the primary contributors to overall risk. Additionally, based on the cost of the various improvements, decisions can be made to maximize the risk reduction benefits for limited availability of resources. Staton provided details on a study conducted across a global business in DuPont to understand and cost-effectively reduce risks.

Mr. Arlyn H. Poppen of 3M Industrial Markets Group presented the paper entitled, “Quantitative Process Risk Screening Tool”. Poppen stated that management of hazardous chemicals used in industry has been a major concern of citizens and government regulators for many years. A broad variety of regulations have been promulgated in many countries covering all phases of hazardous chemical use from development through manufacturing, transportation, end use, and the final disposal or treatment of hazardous waste. Although specific regulations and requirements vary from country to country, there is an overall expectation that industry has a general duty to identify risks from hazardous chemicals which are posed to employees and the communities surrounding industrial facilities, to manage processes safely so as to prevent the release of hazardous chemicals into the environment, and to have appropriate emergency plans in place to deal with any releases which might occur. A variety of
methods and techniques have been developed to analyze processes for potential hazards that they present. These methods vary from quite simple and qualitative to very complex and detailed, sometimes analyzing individual components in the process and control systems to determine the probability and effect of failure. Some government regulations specify which methods must be used under certain circumstances. In other circumstances, the selection and application of methods for hazard assessment is left to industry.

Mr. David W. Johnson with Quest Consultants Inc. presented the paper entitled, “The Importance of Multiphase and Multicomponent Modeling in Consequence and Risk Analysis”. Johnson said the ability to accurately predict the consequences of a hazardous fluid release is dependent on three things: the knowledge of the modeler, the quality of the model that is used, and the quality of the input parameters. One of the most difficult problems in consequence modeling is the prediction of post-release multiphase behavior, especially when a multicomponent mixture is involved. Releases from gas/oil wells often fit this description. The wellstream will produce a light crude oil and a gas stream when flashed into a separator. If accidentally released to the atmosphere, the gas, aerosol, and liquid fractions rarely match the phase separations in the separator, or the expectations of the modeler. And, since the wellstream has a wide range of hydrocarbon components, the need to accurately predict the multicomponent behavior becomes more important. Over the years, modelers have used several “rules of thumb” to provide the source term input parameters for modeling multiphase/multicomponent releases and subsequent dispersion. These modeling assumptions can lead to hazard predictions that are very different from reality. The biggest problem with rules of thumb is their inability to account for thermodynamics; thus, they cannot approximate the phase splits and composition changes that do occur.

Mr. Giby Joseph with the U.S. Chemical Safety and Hazard Investigation Board presented the paper entitled, “Recent Reactive Incidents and Fundamental Concepts That Can Help prevent Them”. Joseph said most chemicals are reactive under the right conditions. Reactivity — tendency of substances to undergo chemical change — is a highly desirable characteristic because it allows a variety of chemical products to be made under relatively moderate process conditions, saving time and money. Safely conducting chemical reactions is a core competency of the chemical manufacturing industry. However, chemical reactions can rapidly release large quantities of heat, energy, and gaseous byproducts. Uncontrolled reactions have led to serious explosions, fires, and toxic emissions. The impacts may be severe in terms of death and injury to people, damage to physical property, and effects on the environment. This paper highlights six reactive incidents that caused widespread impacts. They are representative of reactive incidents identified by United States Chemical Safety and Hazard Investigation Board (CSB) — during its hazard investigation into reactive hazard management — and illustrate the diversity of reactive hazards. These and other incidents across the United States underscore the need to improve the management of reactive hazards. Joseph discussed some fundamental concepts that aid in preventing reactive incidents.

Mr. Yusaku Iwata of the National Research Institute of Fire and Disaster presented the paper entitled, “Decomposition of Hydroxylamine/Water Solution added Iron Ion”. Iwata discussed the decomposition hazards of hydroxylamine (HA)/water solution with and without the addition of the iron ion. Tests were conducted to obtain information about the decomposition hazards of HA/water solution following the United Nations recommendations on transport of dangerous goods. The decomposition hazards on the basis of thermal stability and the intensity of the thermal decomposition were also covered.

Mr. Sanjeev R. Saraf of the Mary Kay O’Connor Process Safety Center presented the paper entitled, “Using Screening Test Data to Classify Reactive Chemicals Hazards”. Saraf said the evaluation of reactive hazards is necessary for the safe working of the chemical process industries.
An integral aspect of reactive hazard testing is the screening of chemicals to focus experimental efforts on the more hazardous chemicals. Screening is often performed using a Differential Scanning Calorimeter (DSC) or the Reactive System Screening Tool (RSST). The study of chemical compatibility highlights the need for efficient screening techniques, since a large number of experiments must be performed at a reasonable cost and in a short period of time. Saraf presented chemical compatibility data measured using the RSST for di-ter-butyl peroxide (DTBP) in a variety of organic solvents. Analysis of the data with regard to the solvent functional groups was generalized to extend the measured data to compounds for which data are unavailable. Further, he proposed a classification for reactive chemicals that can serve as a guideline for selecting compositions for detailed testing.

**Mr. Dinesh Govind** with Qatar Petroleum presented the paper entitled “Fitting Safety In Project Engineering”. Govind stated that recent trends and developments have resulted in great changes to engineering approach in the process industries. A number of factors are involved in these changes. More severe process operating conditions, increase in energy stored in process, limitations in space, stringent environmental regulations, diversification in material selection, day to day developments in electronics, communications, automation and computerization are some of the factors that have influenced the thinking process of management. The process industries have always been concerned with the safety, operability and reliability of their plants. The effect of scale, depth and pace of technology is to increase the size of the hazards, to make their control more difficult and to reduce the chance of learning by trial and error. High technology systems are particularly demanding in terms of formal management organizations, engineering, procedures, standards and codes of practice, and of competent persons.

**Mr. Bill Effron** with Risk, Reliability and Safety Engineering presented the paper entitled, “Practical Applications Approach to Design, Development and Implementation of an Integrated Management System”. Effron said the introduction of quality, risk, safety and environmental management philosophies has significantly changed the industry’s view of company organization and controlling processes. Quality, Risk, Safety, Health and Environmental programs and systems, such as ISO/ QS 9000, ISO 14000, Process Safety, and Risk Management are impacting the way industry will meet the challenges of safety and environmental risks and the needs of the customer in the future.

**Mr. Steve J. Brouillard** with ConocoPhillips presented the paper entitled, “Lessons Learned From Implementation of Safety Management Systems in a Multinational Company”. He described the development of corporate standards and the intricate methods used to permeate these standards on a common basis throughout the corporation spread over several continents and many countries. Brouillard provided interesting anecdotal information about overcoming cultural, linguistic, and regulatory barriers.

**Mr. Scott W. Ostrowski** with the ExxonMobil Chemical Company and **Mr. Mark Roberts** with the Mary Kay O’Connor Process Safety Center presented the paper entitled, “Prevention and Suppression of Metal Packing Fires”. Structured packing has been widely used because of large surface area that makes possible columns with high capacity and efficiency. The large surface area also contributes to fire hazards because of hydrocarbon deposits that can easily combust and promote combustion of the thin metal packing materials. Materials of high surface area that can fuel fires include reactive metals, such as titanium, and materials that are not considered combustible, such as stainless steel. Column design and material selection for packing construction was discussed together with employee training and practices for safe column maintenance and operations. Methods and agents for suppression of metal fires were presented. Guidance for prevention and suppression of metal fires is related to incidents involving packing fires in columns.
CALENNDAR

Tuesday, March 18, 2003
Executive Forum Meeting
Great Southwest Equestrian Center
Katy, TX

Wednesday, March 19, 2003
Technical Advisory Committee Meeting
Great Southwest Equestrian Center
Katy, TX

October 28-29, 2003
2003 Symposium

INFORMATION

Mary Kay O'Connor Process Safety Center
Texas A&M University
College Station, Texas 77843-3574

Phone (979) 845-3489  ·  Fax (979) 458-1493
E-mail donnas@tamu.edu
URL: http://process-safety.tamu.edu

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