
Approximately 300 people from industry, academia, and government agencies attended the first time symposium, some coming from as far away as Japan, Singapore and the United Kingdom. Dr. Sam Mannan, Director of the Center, said, “This important event was a great success because of the significance of process safety issues in all aspects of plant operation and maintenance. The success of the symposium clearly demonstrates the confidence and support of the Centers’ programs and activities by the stakeholders.”

Dr. Trevor Kletz

The welcoming address was given by Dr. Ray Anthony, C.D. Holland Professor and Department Head of Chemical Engineering at Texas A&M University. Attendees enjoyed a keynote address by Dr. Trevor Kletz. Dr. Kletz, who joined the process industry in 1944, provided an informative and thought provoking look at the history of safety management in his presentation titled “Making Safety Second Nature.” Dr. Kletz said, “There is a welcomed interest today in safety management systems but we must not forget their limitations. All that a system can do is harness the knowledge and experience of people. If knowledge and experience have been downsized away the system is an empty shell. Knowledge and experience without a system will achieve less than their full potential. Without knowledge and experience a system will achieve nothing.”

Mr. Jim Makris

Mr. Jim Makris, Director of the Chemical Emergency Preparedness and Prevention Office of the US Environmental Protection Agency delivered the keynote.

(Continued on page 15)
The Center welcomes Huntsman Corporation as one of the supporting members. Ms. Carol Treibel, Vice President of Chemicals at Huntsman Corporation presented Dr. Ray Anthony, Chemical Engineering Department Head and Dr. Sam Mannan, Director of the Mary Kay O’Connor Process Safety Center, with a check representing 1998 membership dues.

The Center is also pleased to welcome Japan Energy Corporation as a new member. Mr. Ichiro Miyamoto, General Manager of the Environment and Safety Department, presented Dr. Anthony and Dr. Mannan with a check for 1998 membership dues. Others who have joined the Center recently include BASF Corporation, Ashland Chemical Company, and Celanese.

I am also very excited and pleased to inform you that the Center has established a Software Laboratory. The objectives for establishing the Software Laboratory are three-fold. First, the software and computer models can be used by students taking Process Safety courses to solve real-world problems. Second, graduate students can use the programs for research and analysis. Finally, the laboratory also serves a useful purpose for industry visits and Continuing Education courses. At present, the following software donated by various companies is available:

- PlantSafe from Geosphere Emergency Response Systems
- Canary from Quest Consultants
- MockingBird from Warren-Forthought, Inc.
- ChemScreen from APEX Safety Engineers

The Center is in the process of acquiring other software for the software laboratory. Brief summaries of each software’s capabilities will be provided in the next newsletter. We appreciate the generosity of each company for providing the Center with their respective software.

We are also indebted to the following organizations for cosponsoring the 1998 Annual Symposium. Without the support and financial assistance of these organizations, the Symposium would definitely not have been such a huge success.

- AcuTech, Inc.
- American Institute of Chemical Engineers, South Texas Section
- Arthur D. Little, Inc.
- Chemical Emergency Preparedness and Prevention Office, USEPA
- General Physics Corporation
- McDermott, Will & Emery
- Quest Consultants, Inc.
- RMT, Inc.
- Warren-Forthought, Inc.
The Steering Committee of the Mary Kay O’Connor Process Safety Center established two awards, the Merit Award and Service Award, which were presented for the first time at the 1998 Annual Symposium.

The 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 are not required to be associated with the Center, but must fit within the Center’s mission, “Making Safety Second Nature.” The award is meant to underscore the importance of promoting and recognizing significant contributions and accomplishments of practitioners and researchers worldwide.

The Merit Award was presented to Dr. Trevor Kletz for his extensive contributions and teachings in process safety.

“Dr. Kletz has devoted a lifetime towards promoting, developing and teaching process safety concepts to practitioners, researchers and students. We hope that recognition of his accomplishments will further disseminate and publicize his ideas and work. The celebration of his process safety accomplishments will hopefully be another catalyst in improving process safety in the process industries,” said Dr. Sam Mannan, Director of the Center.

The Service Award was established by the Steering Committee to honor and recognize individuals who have contributed directly to the success of the Center and have played a significant role in advancing the Center’s mission.

The Service Award was presented to Dr. Ron Darby, Founding Director of the Center and Professor at Texas A&M University.

“Dr. Darby was instrumental in getting many programs started at the Center. He continues to play a very important and vital role in the education and research activities. We are pleased to recognize his contributions and accomplishments,” said Dr. Mannan.
Abstract

From the 1960s onwards the chemical and oil industries developed and used a number of new safety techniques which, in time, became second nature to those who used them. They included the use of QRA for deciding priorities, Hazop and audits for identifying problems, inherently safer design for avoiding hazards, and more thorough investigation of incidents for identifying underlying causes. However, it has not yet become second nature to remember the accidents of the past and the actions needed to prevent them happening again.

I joined industry in 1944 and moved to production in 1952. Then, and for at least 15 years afterwards, safety was a non-technical subject that could be left to arts graduates and elderly foremen. There was concern that people should not be hurt - great attention was paid to the lost-time accident rate - but there was no realization that it was a subject worthy of systematic study by experienced technologists.

This view changed at the end of the 1960s. A new generation of plants had been built, operating at higher temperatures and pressures and containing larger inventories of hazardous chemicals; the result was a series of fires and explosions and a worsening fatal accident rate.

As a result in 1968, I was appointed one of the company’s first technical safety advisers, an unusual appointment at the time for someone with my experience, and if the reason for my appointment had not been so obvious I would have wondered what I had done wrong. I and my colleagues tried to apply to safety the same sort of systematic thinking that we applied in our other professional work. We developed some new ideas and techniques and adopted others. A common feature of them, realized only in retrospect, was that they were more than mere problem-solving techniques. Once people had got used to these new concepts and used them a few times they began to look at a whole range of problems in a different way.

Quantitative Risk Assessment (QRA)

I realized as soon as I was appointed, that we could not do everything at once. Some problems had to be left alone, at least for the time being. We needed a rational and defensible method of deciding priorities. The method we used, whenever practicable, was to compare the risk to life from the various hazards to which employees were exposed. To do this we had to set a target or criterion: risks above the target were to be reduced as matter of priority; those below could be left alone, at least for the time being. We called the technique hazard analysis or Hazan but today it is better known as risk assessment or QRA.

Our openness about risks which we intended to ignore, at least for the present, surprised some of my American friends. Our approach was accepted in the UK because our law has long recognized that we cannot do everything possible to prevent accidents. We are required to do only what is reasonably practicable, weighing in the balance the cost of prevention, in money, time and trouble, and comparing it with the size of the risk. If there is a gross disproportion between them, the risk being insignificant in relation to the cost, removal of the risk is considered to be not "reasonably practicable". I hope I am not being unfair to OSHA when I say that their attitude at the time seemed to be, "If an accident is possible, prevent it. Don’t tell me it is unlikely to occur, small in its effects and expensive to remove; just remove it".
Hazard Identification

Once we started to use QRA, we soon realized that the biggest source of error was not in the QRA itself but in a failure to foresee all the hazards or all the ways in which they can occur. We were estimating the probability and consequences of the hazards we recognized with ever greater accuracy while possibly ignoring greater hazards. We realized that it was little use carrying out a QRA until we had systematically tried to identify the hazards by a hazard and operability study or Hazop, a technique developed in ICI in 1963.

Those who have taken part in Hazops are never quite the same again. They learn to look more critically at designs and proposals and to see some of the things that might go wrong. No individual alone can carry out a Hazop, the technique depends on interactions between the members of the team, but those who have experience of them have an increased awareness of possible pitfalls in design.

The explosion at Flixborough in 1974, when 28 people were killed and the plant destroyed, drew attention to the unforeseen results of plant modifications, often quite simple ones, and many companies have introduced control procedures. However, accidents still occur, all too often, because the procedures are not always followed. People are still inclined to say, "It's only a minor change, just an extra valve, what could possibly go wrong?" Too late, they discover that it isolated a vessel from its relief valve or leaked and contaminated a product.

If Safety Isn’t Second Nature

What can we do if our colleagues do not use these techniques I have discussed? We can:

- Suggest that they try them and see if they find them helpful?
- Publicize case histories, preferably local, of the successful application of hazop, QRA, inherently safer design etc.
- Get your senior managers to encourage their use.

Inherently Safer Design

From 1968 to 1974 my colleagues and I concentrated on the technical hazards and left ‘hard hat’ safety to others. However, we all shared the view that plants were made safer by adding on protective equipment or procedures, from hard hats to complex interlocks. This changed after the explosion at Flixborough. The leak and explosion were so large and the results so serious because the unit, a stage in the manufacture of nylon, contained a large inventory of flammable hydrocarbon. It contained so much because only about 6 percent of the feedstock was reacted per pass, the rest getting a free ride, in fact, many free rides, and having to be recovered and recycled. If the inventory could be reduced then the hazard would be removed or reduced. The plant would be safer, not because we had added on protective equipment which might fail or be neglected but because we had removed or reduced the hazard; the plant would be inherently safer.

Reducing the inventory in the Flixborough process is not easy and the only company that tried to do so soon abandoned the work as they could foresee no need for a new plant. However, there were many other examples of the successful introduction of inherently safer designs, notably the latest process for the manufacture of nitroglycerine. We set out to advocate these designs and in 1984 Bhopal drew attention again to the desirability of doing so. The material that leaked and killed over 2000 people was not a product or raw material but an intermediate. It was convenient to store it but not essential to do so, a point missed by most commentators.

No change with which I have been associated is more fundamental that this one. Whenever possible we should avoid or remove hazards rather than keep them under control. We should keep lambs rather than lions. There has been real progress but it has been nothing like as rapid as in the case of QRA or Hazop. The changes necessary - the realization that inherently safer designs are possible and a deliberate systematic search for them in the early stages of design - are so fundamental that they cannot occur quickly. They need the active involvement of senior people, most of whom are still unfamiliar with the concept. Those who have grasped the concept and put it into practice never look at plant designs in the same way again. For them protective equipment and procedures and analysis of them by QRA is a second best, to be followed only when an inherently safer design is impracticable. Before we spend time estimating the size of a hazard we should ask if it could be removed.
Continuing Education Short Courses for Process Safety

The Mary Kay O’Connor Process Safety Center is pleased to offer continuing education courses in process safety. The Center is committed to increasing knowledge and awareness of process hazards and safety for all sectors of society, especially those in the chemical process industry. Our courses are attractive for many reasons:

- The courses have been developed and are taught in collaboration with industry experts.
- The courses are very convenient to attend. The classes are offered during afternoon and early evening hours (3PM to 7PM) making it very convenient for plant workers. At present, the courses are being held in two locations (Pasadena and Galveston).
- Special arrangements can be made to offer any of the courses at your particular facility. Please contact our office to set up a class date and time.
- Continuing education units (CEU) credits are provided for all our courses. In addition, structured series of courses are available for specializations such as process safety management, risk management, process hazard analysis, incident investigation, consequence analysis, etc.

Our vision is to educate and train process industry personnel in order to minimize losses through safer processes, equipment, procedures and management strategies.

Information concerning our Continuing Education program is available at our website located at: http://process-safety.tamu.edu

If you would like a catalog of courses offered or need further information, please call (409)845-3489 or e-mail: donnas@tamu.edu

1998 Process Plant Safety Symposium in Houston

The Process Plant Safety Symposium will be held at the Sheraton Astrodome Hotel in Houston, Texas on October 26-27, 1998. The symposium is sponsored by the American Institute of Chemical Engineers, South Texas Section.

Keynote speaker for the first day of the symposium will be retired US astronaut Mike Mullane. He will discuss “Lessons from the Challenger Disaster.” The second keynote speaker is Steve Mason with the US Environmental Protection Agency. His presentation is titled “Implementation and Enforcement of the US EPA’s RMP Rule.”

To register to attend the symposium, please call (281) 578-3272 or (409)845-3489. Symposium information is available on the Web at http://process-safety.tamu.edu

If you have a product or service to offer to Engineering Professionals and would like to have an exhibit at the symposium, please contact the Exhibit Chair, Mr. Stan Rubashkin at (281) 862-4881.
**Center Receives PPG Quality Recognition**

The Director and the Steering Committee of the Mary Kay O’Connor Process Safety Center was given their “Quality Recognition” by the PPG Process Safety Quality Leadership Team. They were recognized for their untiring dedication to envision, create, nourish and implement a highly successful “Beyond Regulatory Compliance: Making Safety Second Nature” Symposium.

Mr. Ronnie LeBlanc of PPG Industries, Inc. Process Safety Quality Leadership Team said, “The symposium was extremely impressive by every measurement and standard of quality. An outstanding job was done in encouraging exchange of ideas on Process Safety amongst individuals in academia, industry, regulators, and the general public.”

**Dr. James C. Rock**, director of the *Texas Occupational Health and Safety Institute*, was featured as one of the ten most influential industrial hygienists in the May 1998 issue of *Occupational Hazards*, the magazine of safety, health and environmental management.

Dr. Rock was one of only two academic professionals selected for the honor, which acknowledges the top ten men and women tackling the tough issues facing industrial hygiene practitioners. Dr. Rock supervises the graduate curriculum in industrial hygiene and the undergraduate system safety engineering program in the Department of Nuclear Engineering at Texas A&M University.

The *Occupational Health and Safety Institute* is a part of the Texas Engineering Experiment Station, a member of the Texas A&M University System.

Dr. Rock is the current president of the American Industrial Hygiene Association (AIHA.) His year-long term runs to June 1999. *Occupational Hazards* said, “As the incoming leader of the largest industrial hygiene association in the world [AIHA], Dr. Rock’s position provides him automatic entry into the ranks of the 10 most influential industrial hygienists. Dr. Rock will deal as AIHA president with a host of issues revolving around a global economy and its effect on industrial hygiene practitioners.”

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**A&M Professional Makes Top 10 List**

The Director and the Steering Committee of the Mary Kay O’Connor Process Safety Center was given their “Quality Recognition” by the PPG Process Safety Quality Leadership Team. They were recognized for their untiring dedication to envision, create, nourish and implement a highly successful “Beyond Regulatory Compliance: Making Safety Second Nature” Symposium.

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Dr. Ray Bowen, President of Texas A&M University addressed the attendees of the 1998 Annual Symposium of the Mary Kay O’Connor Process Safety Center. In addition to extending a cordial welcome to the attendees, Dr. Bowen said, “we must do all possible to ensure maximum safety in the petrochemical, refining, and oil and gas industries—fields that are of vital importance to the Texas economy. Process safety is an area in which the resources and technical know-how of the Texas A&M University researchers can be brought to bear positive and fruitful changes.”

Dr. C. Roland Haden

Dr. Haden said, “The Texas Engineering Experiment Station is a state agency which is responsible for promotion of and propagation of results of Engineering and related research done directly and by its 14 members institutions. It is also the vehicle for administration of this research, as well as over a dozen industrial consortia. This organizational structure adds to the potential of the Mary Kay O’Connor Process Safety Center and provides the opportunity to disseminate and spread the work of the Center throughout many industry groups.”

Dr. Roland Haden

PARADIGM SHIFT IS ESSENTIAL TO IMPROVING PROCESS SAFETY

Dr. Sam Mannan presented a paper entitled “New Challenges in Chemical Engineering: Integrating Process Safety into Chemical Engineering Education and Research,” at the 1998 Annual Symposium of the Mary Kay O’Connor Process Safety Center. Dr. Mannan said, “The job description of chemical engineers has changed dramatically over the past several years. Universities must adapt to this change and respond to the needs of their student-clients. The Mary Kay O’Connor Process Safety Center at Texas A&M University has been established to produce engineers and practitioners trained in process safety, to provide the chemical processing industry with the research base needed to compete successfully in the rapidly growing chemical processing industry, and to provide an independent process safety resource for academia, government, and the world-wide chemical processing industries.”

“One goal of the Center is to be a catalyst for the process industry to develop and maintain a culture in which safety is second nature in all activities and operations. This safety awareness culture can be accomplished gradually through the research, education, service, and training programs of the Center.”

(Continued on page 15)
The Executive Forum of the Mary Kay O’Connor Process Safety Center met on March 29, 1998 in the Board Room of the College Station Hilton. The forum members discussed process safety issues impacting the industry.

In general, the meeting participants agreed that while there is a need for a lot more work in the fields of process safety and risk management, it is also true that significant progress has been made in recent years. Industry’s programs and the commitment of senior management has been critical in moving process safety issues to the forefront. In addition, many industry/government sponsored programs have also been beneficial in increasing awareness. For example, OSHA’s Voluntary Protection Program promotes employee involvement in aspects of process safety. For many in the industry, zero fatalities and zero releases is the minimum acceptable goal.

Nevertheless, there are still many areas where major effort is needed to improve the safety and loss prevention record of the industry. One of these challenges can be categorized as the education, training, and knowledge-base of fresh engineers as well as mid-level managers.

Regarding fresh engineers, a major dilemma in the United States is that industry requires every engineer to have some background and exposure to process safety problems. However, it is not a requirement for receiving a university’s engineering degree. In contrast, in the United Kingdom, every chemical engineer is required to enroll in certain coursework on loss prevention. This is not an elective, but a core requirement. Thus, chemical engineers graduating from UK universities have a very good understanding of the need and impact of HAZOPs and other fundamentals of process safety and loss prevention and can quickly become an active contributing participant.

As far as mid-level managers are concerned, there is an opinion that these managers did not receive training in the areas of safety and loss prevention. Another opinion is that these mid-managers tend to accept a higher level of risk based on a more generous opinion on how people can make mistakes. They are not considering the number of ways a person can incorrectly do an action. Their own ego, through their experience (comfort level), tends to put blinders on them.

There is definite significance and importance of industry involvement in programs such as the Mary Kay O’Connor Process Safety Center. The Center can not only shift the paradigm in how process safety is perceived but can also be a catalyst to encourage students and researchers involved in process safety. The students will not get involved in process safety education and research unless there is a definite career path. Industry is orchestrating the paradigm shift, because of their changing preferences in hiring practices, by favoring graduating engineers who have received a comprehensive education where process safety is deeply integrated into the curriculum.

The full report of the proceedings of the Executive Forum has been published as a white paper entitled, “Impact Issues in Process Safety and Risk Management.” Printed copies are available by contacting the Center. The complete white paper is also available on the Center Website.

The Executive Forum was followed by the two-day Symposium. The Technical Advisory Committee (TAC) of the Center met the day after the Symposium on April 1, 1998. The TAC took the Executive Forum input and the Symposium Forum ideas as input in their deliberations to develop recommendations for the programs and activities of the Center. Printed copies of the TAC recommendations are available by contacting the Center. The complete TAC recommendations are also available on the Center Website.
PAPERS PRESENTED AT ANNUAL SYMPOSIUM REPRESENT STATE-OF-THE-ART ON A WIDE SPECTRUM OF ISSUES

Papers presented at the 1998 Annual Symposium of the Mary Kay O’Connor Process Safety Center represented state-of-the-art technology on a wide spectrum of issues.

**Dr. John Baldwin** of Texas A&M University presented his work on, “Impact of Data Exchange Standards on Maintainability of Process Units.” Dr. Baldwin said, “Over the last decade a number of new standards for data exchange have been initiated in Europe, the U.S., and Japan. Of particular interest to the process industries are the Application Protocols (AP’s) under ISO 10303 (STEP, a standard for product data exchange). The AP’s under STEP that are focused on the process industries address the exchange of data generated at any time during the life cycle of a process unit on activities that are taking place either at the same time or later in the life cycle. These efforts hold the potential of greatly improving the communication of data generated during design for use during the operation of process units. This paper will summarize significant worldwide activities highlighting their potential impact on maintainability.”

**Mr. Ken T. Bond** of Shell Oil Company presented a thought-provoking paper on, “ISA and IEC Standards - How are They Impacting the Process Industry.” Mr. Bond said, “Over the past several years, representatives from the process industries have worked together to develop standards on Safety Instrumented Systems. Two of these standards have recently been accepted by ANSI as USA National Standards (ANSI/ISA S84.01 and ANSI/ISA S91.01). In addition to these USA National Standards, there is presently a world wide effort to develop International Standards on this same subject (IEC 61508 and IEC 61511).”

**Dr. John Baldwin**

**Ms. Lisa Bendixen** of Arthur D. Little, Inc. presented her work on, “Risk Assessment for Chemical Sensitivity Analysis.” Ms. Bendixen said, “One critical area of uncertainty in toxic risk assessment studies is human dose-response relationships, particularly for acute exposures. Probit equations are lacking/questionable for many materials and the use of ERPG levels as a surrogate for acute exposures is often excessively conservative when exposure times are on the orders of minutes—particularly when the impact of concern is a very severe injury or a fatality. To address these issues, Arthur D. Little estimates severe-impact exposure levels for 10 and 30 minute exposures and also uses sensitivity analyses. These sensitivity analyses apply different exposure factors for indoor and outdoor populations, and also use a range of vulnerability factors to address the variabilities within any given population. Comparisons to risk levels estimated using ERPG levels both help to meet regulatory expectations and to place the results in perspective.”

**Mr. Ken Bond**

**Mr. John Czerwinski** of Brown & Root, Inc. presented a synopsis of their research entitled, “Tangential Radiographic Testing.” Mr. Czerwinski said, “Ultrasonic inspection is a common method for measurement of wall thickness on pipes and vessels. In its normal application, only a small portion of the surface is inspected, which may miss major defects. Also the technique is normally not sensitive to defects such as pitting. As an alternative, tangential radiography provides a more complete and accurate picture of the metal thickness and defects.” He described the basic
methodology of the technique, and then focused on a number of examples that showed the value of tangential radiography.

Mr. Ray French of Exxon Chemical Company presented his work on, “Inherent Safety, Health and Environmental (SHE) Reviews.” Mr. French said, “How can an organization institutionalize the inherent safety process? To help accomplish this objective Exxon Chemical has developed an Inherent Safety, Health & Environment (SHE) Review process to be carried out at various stages of new product/process development and project execution. A synergistic team (chemist, safety engineer, process designer, industrial hygienist and appropriate others) is employed to identify hazards and make suggestions to eliminate them by incorporating Inherent SHE. The first review should be carried out at the chemistry development stage of new product or process research. Industrial hygiene participation is very important in order to understand relative acute and chronic health hazards of all materials employed in the process including alternatives. The chemist is responsible for defining both desired and undesired reactions that are involved including the potential for runaway reactions and decompositions. A second Inherent SHE Review is scheduled during the design basis development stage of the project execution process. The focus of this review is on improving the Inherent SHE of the design through such things as hazardous material inventory reduction, reduced pressures/temperatures, simplification of the process and elimination of equipment. A third review takes place when Inherent SHE considerations are looked at during the HAZOP review. This is conducted when Process & Instrument Drawings are available. Changes during this stage of the project execution process are more difficult as they increasingly impact cost and schedule. A fourth timing of Inherent SHE reviews is also encouraged on existing facilities to identify improvement opportunities for the site and for future projects. Requirements for Inherent SHE Reviews are included in Exxon Chemical’s Operations Integrity Management Practices (OIMP), the Project Execution Process (PXP), and Product Innovation Process (PIP). Inherent SHE principles are also incorporated into our design and engineering practices. A one-day in house workshop has been developed to teach potential members of Inherent SHE Review teams about Inherent SHE and the review process.”

Dr. Irv Rosenthal of the Risk and Decision Processes Center of the University of Pennsylvania and Dr. Lyse D. Helsing of the US Environmental Protection Agency presented their work on, “Epidemiological Studies of Chemical Accidents Using EPA's 5-Year Accident History Data Base.” They said, “Epidemiological studies have made major contributions to the understanding and prevention of human disease. They are particularly valuable in regard to discovering the risk factors associated with low probability - high consequence diseases with a complex etiology. In many cases, once such factors are uncovered, preventive measures can be taken to reduce their contribution to the risk that the disease will manifest itself. Major accidental releases of chemicals are also low probability - high consequence events and also often have a complex etiology. However, there has not been a significant application of epidemiological techniques in regard to major accidental chemical releases. In large part this is because a suitable database on the incidence of such events has not existed, a situation which will be remedied when the EPA 5-year Accident History database becomes available.” Drs. Rosenthal and Helsing further discussed how epidemiological studies using the five-year accident history data can be used to uncover predictors (risk factors) and underlying causes of major accidental chemical releases.

Dr. Irv Rosenthal and Dr. Lyse Helsing

Drs. Irv Rosenthal and Lyse D. Helsing also presented their work on, “Applicability of the OECD Dictionary/Thesaurus of Risk Assessment of Chemical Accidents.” They described the ongoing EPA-OECD project whose goal is to improve understanding and communications in regard to the application of risk assessment processes to accidental chemical releases. The project involves constructing a Risk Assessment Dictionary/Thesaurus (Risk Thesaurus). The Risk
Thesaurus’s approach to capturing and conveying the intended meaning of an entry is to decompose the risk assessment process into its component process ‘Elements’ which are then described in operational language, i.e., no use of ‘terms of art’. The person entering an item selects from the Risk Thesaurus those process steps (sub-Elements and Descriptors) that capture his intended meaning.

Mr. Dennis Hendershot

Mr. Dennis C. Hendershot of Rohm and Haas Company presented a paper on, “Impact of Basic Process Chemistry Issues on Process Safety.” Mr. Hendershot said, “The greatest opportunities for development of an inherently safety chemical manufacturing process occur at the earliest stages of research and development in the selection of the chemical synthesis route for the product. Research and development chemists need to be aware of the safety, health, and environmental (SHE) consequences that their early decisions will have on the ultimate SHE characteristics of a commercial manufacturing plant. Inherent SHE characteristics of manufacturing process options must be measured and evaluated at an early stage in development, and these characteristics must be included in the route selection decision process. Tools for characterizing understanding inherent SHE early in process development will be discussed, along with some examples of the potential benefits of inherently safer chemical synthesis routes.”

Dr. C.D. Holland

Dr. Charles D. Holland, President of The Texas Institute for Advancement of Chemical Technology and Professor Emeritus of Texas A&M University presented a paper on, “Chlorine in Perspective.” Dr. Holland said, “Public concerns about chlorine and chlorinated chemicals were first aroused by Rachel Carson in 1962 with the publication of her book Silent Spring in which the uses of DDT and other chlorinated pesticides were attacked. Attacks on chlorine and chlorinated chemicals have continued at varying levels of intensity over the intervening years. Two opposing positions have been taken by various groups with respect to the use of chlorine and chlorinated chemicals. One approach is to take action against chlorine and the entire class of chlorinated chemicals on the basis of both real and perceived risks and without regard for either economic impacts or the loss of known benefits of the targeted class of chemicals. The other approach is to judge each chemical on a chemical-by-chemical basis – considering the scientific data on toxicity and adverse effects as well as the risks and benefits of each chemical.”

Dr. Walter B. Howard, a well-known Process Safety Consultant presented his paper on, “Research Needs for Process Safety Technology.” Dr. Howard emphasized the need for much more process safety research and said, “Much process safety technology has been developed through the years and now serves as the basis for preset day design standards for process safety in the process industries. This has come about through carefully executed research. Much of this research has had to be done on large scale in order to fully develop and test the technology for dependable correlations necessary to establish design bases. Especially noteworthy are the design guides now available for minimizing hazards of sudden high pressure development by uncontrolled combustion inside process equipment and inside industry buildings. Very extensive large scale research was necessary for developing these design guides. Despite the process safety technology and design standards available today, much more is yet needed. As in the past, development of the necessary technology will ion some cases require large scale research.” Dr. Howard further said that some of the major research needs in three areas, are as follows:
Mr. Melhem also discussed an integrated approach for the systematic evaluation of thermal hazards and effective scaleup and usage of data for safe process design and operation.

Mr. David Moore

Mr. David Moore of AcuTech, Inc. presented a paper on “Expert Systems in Emergency Response.” Mr. Moore said, “Expert systems can be effectively used for emergency planning and response. Rules can be developed that comprise the appropriate response to either preplanned site-specific, credible, incident scenarios or general incidents at the facility. This allows responders with less experience to make better decisions than they otherwise would make without the involvement of a “human expert. An expert system can not only assist with making critical emergency response and incident management decisions, but can also coordinate and automate emergency notifications, track and log actions being taken, and integrate P&IDs and other network data. Having an interactive expert system as a resource and a tool allows emergency information and procedures, and the knowledge and experience of emergency response experts to be captured for easy access and use by all personnel at a facility.”

Mr. Ian Nimmo

Mr. Ian Nimmo of Honeywell, Inc. presented a paper entitled, “A New Training Strategy: Design

Exothermic runaway reactions, Uncontrolled combustion, and miscellaneous research needs.

Ms. Sarah Taylor and Mr. John McIntosh

Mr. John McIntosh and Ms. Sarah Taylor of Proctor and Gamble presented their work on, “Incident Database and Macroanalysis to Help Set Safety Direction.” Their paper describes the framework of an incident database and how incident data can be used to help set safety direction. It includes history, database design, and data collection and utilization. Examples illustrate how macroanalysis of incidents revealed inherently weak systems. These systems suffered disproportionate losses. Analyzing data from incident investigations improved the understanding of the risks associated with the processes. In partnership with the product category, corporate process safety organizations initiated equipment design modifications and procedural changes. These changes significantly reduced both the likelihood and consequences of incidents. Mr. McIntosh and Ms. Taylor said, “Databases offer an effective option for managing large amounts of information. Used to study process safety trends and underlying causes of incidents, databases can be powerful and effective risk management tools. Macroanalysis of incident data can reveal process safety weaknesses and help risk managers determine where to focus effort and resources.”

Mr. Georges Melhem of Arthur D. Little, Inc. presented his paper on, “Systematic Evaluation of Chemical Reaction Hazards.” He said, “Effective thermal hazard evaluation requires an integrated approach to assessment of chemical reactivity. A variety of theoretical and experimental methods can be used to determine the thermal stability of specific compounds or reactive systems. Notwithstanding this, recurrent problems occur with materials and/or reactions which are known to be inherently unstable. Correct application of physical tests and interpretation of output data is essential for effective thermal hazard evaluation.”
Mr. Roy Sanders of PPG Industries, Inc. presented a paper entitled, “A View of What We Do - Making Process Safety Second Nature.” Mr. Sanders said, “In the last decade many World-Class Chemical Plants have focused on a mission of: not getting anyone hurt, of protecting the environment and being a low cost producer. In the early 1990s, numerous organizations struggled to incorporate all the requirements of the U.S. Occupational Safety and Health (OSHA) Process Safety Management (PSM) Standard. While increased protection of the worker was the focus of the PSM standard, enhanced preservation of the environment was a bonus and for the far-sighted companies who effectively complied, the bottom line is now better supported. The rewards are now in sight for those corporations who accepted the challenge by using this performance-based standards to judiciously provide expensive resources to correct past oversights and provide a system to keep information current. Good access to key information is paramount in any well-run organization. Many locations developed or improved extensive electronic data bases. The OSHA required updated P&ID s, the comprehensive Process Hazard Analysis effort, and the well-documented Operating Procedures can succeed to provide needed information in a chemical plant’s decision process. The substantial efforts to provide a stronger Mechanical Integrity program reduces the risks of incidents and a rigorous Management of Change system helps keep information current.”
Symposium (Continued from page 1)
address for the second day. Mr. Makris emphasized the need for an evaluation project that allows everybody to be part of the process. A single program, company, or government agency can not by itself improve chemical safety. Mr. Makris said, “I don’t believe that EPA’s risk management planning rule by itself is going to make chemical safety improve. Nor do I believe the action of a single enlightened CEO is going to make the overall chemical safety statistics improve. I don’t believe CMA’s Responsible Care® program is going to make things improve on its own. And I don’t believe the wonderful work of CCPS by itself is going to improve chemical safety. And I don’t think the myriad of state laws, and there are a lot of state laws, some states have simply taken the risk management planning program regulations and adopted them. I don’t think those state’s actions themselves are going to make a significant or at least unique improvement. It is going to be all of us. It is going to be a worker who works better. A plant manager who makes sure instructions are current. I also believe that it is important that all of us share in trying to get to the goal. I believe that a place like the Mary Kay O’Connor Process Safety Center can play a key role in developing a model to make this happen.”

Dr. Kletz’s paper, Mr. Makris’ paper, and the other papers presented at the symposium, can be found on the Mary Kay O’Connor Process Safety Center website at http://process-safety.tamu.edu.

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“In addition, changes in the engineering curriculum are required not only to offer process safety engineering in separate and focused courses, but also to integrate process safety into the syllabi of other core courses such as thermodynamics, transport phenomena and heat transfer. Finally, graduate research projects at the M.S. and Ph.D. level in which the thesis/dissertation focuses upon solving process safety-related problems is critical to the advancement and understanding of process safety problems and issues.”

“The extent of the problem is illustrated by the fact that because of industry initiatives and regulatory requirements, process safety engineering and associated technologies have become an essential feature of all chemical processing design and operations. However, almost all universities lack effective teaching and research programs to support the needs of industry. This situation can be changed only by putting in motion a cycle that irrevocably changes the paradigm. For example, we could produce several chemical engineering Ph.D.s per year with specialization in process safety engineering, who would then go on to teach in their engineering disciplines at other universities or conduct research of benefit in solving process safety problems. Thus, the courses they might teach (including classical engineering courses) would contain a comprehensive approach which would include consideration of all process safety issues. In addition, their research would definitely include the solution of many process safety problems.”

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1998 CALENDAR

1998 Process Plant Safety Symposium  
American Institute of Chemical Engineers-South Texas Section  
October 26-27 • Sheraton Astrodome Hotel • Houston, TX

Technical Advisory Committee of the  
Mary Kay O’Connor Process Safety Center  
October 28, 1998 • Sheraton Astrodome Hotel • Houston, TX