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TEXAS A&M ENGINEERING EXPERIMENT STATION

Process Safety – A Key Element for Sustainable Manufacturing

Dr. M. Sam Mannan, PE, CSP, DHC
Regents Professor and Director
Holder of T. Michael O'Connor Chair I

U.S. NSF-China NSF Workshop
on Sustainable Manufacturing
Wuhan, China, 03/14/2014

Artie McFerrin Department of CHEMICAL ENGINEERING | TEXAS A&M ENGINEERING

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Biographical Sketch

- **M. Sam Mannan**
  - Ph.D., PE, CSP, DHC
  - Vice President, RMT, Inc.
  - Regents Professor and Director, Mary Kay O'Connor Process Safety Center, Department of Chemical Engineering, Texas A&M University
  - Co-author of "Guidelines for Safe Process Operations and Maintenance" (CCPS, AICHE)
  - Editor of "Lees' Loss Prevention in the Process Industries" 3rd and 4th Edition
  - 197 peer-reviewed journal publications, 4 books, 7 book chapters, 200 proceedings papers, 14 major report, 208 technical meeting presentations
  - Written and oral testimonies to United States Senate, United States House of Representatives

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MKOPSC

- Established in 1995, named after Mary Kay O'Connor
- Vision – Making Safety Second Nature
- High points
  - Improve safety in process industries
  - Provide good science based counsel
  - Develop and disseminate best practices
  - Provide benchmarking
  - Conduct research
- Offered 56 courses
- 53 current students; 88 Alumni; 5,000 Trainees
- Funding
  - Endowment, Contract projects, Consortium funding, Continuing Education

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Research Areas

- Safety Culture
- Inherently Safer Design
- Reactive Chemicals
- Micro-Calorimeter System
- Integration of Safety Issues in Optimizing Solvents
- Computer-Aided Fault Tree Synthesis for QRA
- Facility Siting & Layout
- Infrared Optical Imaging for Gas Detection & Visualization
- Resilient Engineering Design
- **Process Sustainability Studies**

Process Safety

- Process Safety
  - Involved in everyday engineering procedure
    - Interacted with chemical process technology, mechanical and process design, process control
  - Closely linked with sustainable development
    - Safe use of chemicals leads to healthier economy and higher living standard
    - Unsafe use of chemicals threatens lives, businesses and even world
  - A relatively young and evolving field
    - Has been mainly based on tragic events
    - Needs joint efforts from industry, government, academic and other stakeholders

Engineering for Sustainable Development

- Engineering for Sustainable Development (ESD)
  - An integrated systems approach
    - Aims to balance between satisfying current stakeholder's requirements without compromising the ability of future generations to meet their needs
  - A multi-criteria decision making process
    - Economic, ecological, social, safety, health requirements
  - Many challenges
    - Ill-defined criteria, scarcity of information, lack of process-specific data, lack of metrics, need to satisfy multiple decision makers
  - Three major steps
    - Life Cycle Assessment (LCA) of the process
    - Generation of non-dominating alternatives
    - Selecting the most sustainable process by employing an analytic hierarchical selection process

Point Research Projects for Collaboration

- **Hazardous phenomena: gas explosion, dust explosion, reactive chemistry**
- **Inherently Safer Design**
- **Risk management including consequence analysis**
- **Failure of complex systems**
- **Safety device and technology improvement**

Summary and Conclusions

- **Making Safety Second Nature**
  - Translation: Fewer Incidents and Ultimate Realization of Zero-Incident Vision
- **Safety, like success, is a journey…**

  To have success, you must have teamwork and participation from everybody on a sustained basis. The same is true for safety.
- **Provide programs which will forever change the paradigm**
- **Importance of Industry Support and Impact on Industry**

Making Safety Second Nature

Questions & Comments

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