PROCESS SAFETY

Increased complexity of operations and greater societal scrutiny make process safety management even more important

Process safety focuses on the control of hazards and risks associated with highly hazardous processes. These processes involve chemicals, where process incidents or failures may result in fatalities, injuries, exposures, fires, explosions, chemical releases, spills, structural collapses, equipment malfunctions, and other consequences.

Process safety management (PSM) refers to the integrated management of interrelated activities required to manage process safety risks. It involves the use of systems and principles to continuously identify hazards, assess risks, and control hazards associated with high-risk processes. PSM is also important for responding to and recovering from process-related incidents.

When new processes are being introduced or when there are changes to a process, hazards, risks, and control measures need to be revalidated. PSM is important for many types of industries, and examples include oil & gas, energy generation, manufacturing, mining, food & beverage, pharmaceutical, chemical, pulp & paper, construction, and others.

An effective PSM system can not only help avoid incidents; it is key to ensuring efficient, reliable and robust operations. Process safety events are low frequency but high consequences events. Many organisations may not experience such events and hence may not focus on process safety improvement, even if they do understand the hazards of the process.

According to Mr. Mukesh Kumar Surana, Ex Chairman & Managing Director, Hindustan Petroleum Corporation Ltd., the importance of PSMcannot be overstressed. "Industrial processes are more complex than ever before, and there is increased public awareness of what we do in the industry," he cautioned while speaking at the inaugural session of the '8th Global Summit on Process Safety' organised by the Centre for Chemical Process Safety (CCPS), US, part of the American Institute of Chemical Engineers.

In his view, despite root cause analysis, regulations, etc. process accidents still happen in the industry. "Are we not learning from our mistakes; or do we need a different prism to view the accidents of the past?" he asked.

Inauguration

Dwelling on the Bhopal gas tragedy, 40 years ago, caused by the leakage of methyl isocyanate (MIC), an intermediate in a pesticide manufacturing process, which need not have been stored, Mr. Surana wondered "whether convenience is taking precedence over need?"

While formalised learnings are now available on process safety, Mr. Surana cautioned that these will not lead us to zero incidents. "New processes are more complex – using extreme conditions of operations, increased automation, and complex machinery. Efforts of man-machine interface needs to be significantly improved, and there is a need to proactively determine what can go wrong and mitigate the impacts."

He also stated that progressive risk reduction is vital even for older plants built before newer standards were introduced.

'Beware of complacency'

Mr. Shakeel Kadri, Executive Director & CEO, CCPS, highlighted the evolution of the organisation, which was started a few months after the Bhopal gas tragedy. Though founded in the US, it has global scope and mission, and more than 50% of its membership (284 companies from 48 countries) is outside of the US. "Our vision is a world without process safety incidents, and we needthe help of industry to achieve this goal."

Warning against complacency, Mr. Kadri pointed to several obstacles to building a robust process safety culture in an organisation including ineffective risk assessments of systems; reversing burden of proof when evaluating safety

Contents Index to Advertisers Index to Products Advertised

Mr. Shakeel Kadri

of operations; not permitting employees to speak freely of their safety concerns; and failure to learn and apply learnings.

"There is nothing is more important than safety – not production, sales or profits. CEO is the Chief Safety Officer," Mr. Kadri quipped, noting that the value of a human life value is the same everywhere. "Risk is not zero – but it can be minimized. Leaders must commit to identify and minimize hazards and risks or get out of the business. They must instil courage in the team to bring the bad news," he added.

Safety – not a priority, but a value

Dr. Fawaz Bitar, Senior Vice President of Safety, Health, Environment and Carbon, BP, also noted that while checks and safety processes are important, they can lull the management into complacency. "By taking false comfort that all is well, we can become desensitized to danger and normalize risks. Major consequences arise when this complacency coincides with economic pressures and forces cost cuttings," he warned.

Stressing the importance of leadership when it comes to safety, Dr. Bitar noted that "board room and control rooms must both understand the risks." Safety, he added, cannot be a priority, as "priorities can change.""It needs to be a value."

The industry, he added, still suffers an average of five fatal process safety incidents per year. "This is not a low probability, and in many others, we just got lucky, and an adverse impact did not occur."

'Systems need to be robust, but simple'

Mr. Sanjiv Singh, Head – Group Manufacturing Services, Reliance Industries Ltd., noted that the petroleum, refining and petrochemical industries are seeing a sea change in the way plants are designed and operated. Stressing the need to build plants right, with emphasis on systems and procedures for safe operations, he noted that even as the industry moves towards machine-driven operations "there will still be times when human interventions will be needed.""Systems need to be robust but still remain simple."

'Psychological safety important to get to the answers needed'

Mr. Stephen Klejs, Executive Director, US Chemical Safety & Hazard Investigation Board (CSB), dwelt on the role of the investigation agency, which aims to go beyond determining the traditional root cause of accidents it investigates. "We ask questions at the systems level and what led to the failure. From tragedy we draw knowledge to improve safety for all."

He stressed the need for providing psychological safety to employees, in order to fully investigate an incident. "Psychological safety is important to get to the answer needed, not the one you want to hear."

Mr. Kadri also stressed the significant need to improve psychological safety."Operational leaders lack courage to speak up or confront issues with dissenting views," he stated.

Role of leadership

Mr. Yatendra Lodha, Group Head – Safety & Operational Risk, Reliance Industries Ltd., observed that effective leadership is not about compliance but a commitment to build a strong operating culture incorporating safety. "The greatest risk to process safety is thinking it won't happen to us. Root causes have not changed over the years."

Mr. Kadri noted that leaders are not becoming confidence builders. "Many leaders are not knowledgeable and are playing on the surface."

Reasons for incidents

According to Mr. Kadri, one of the major reasons for process safety events is asset integrity, which needs to significantly improvement – especially piping and interlocks.

Another reason is the lack of transparent communication between leaders who are directing to do the right thing and leaders who are doing things right. "Leaders are not celebrating the 'reds'(adverse events) and challenging the 'greens' (the good results). Incident root causes are not fixing management system failures, and the accident investigation process needs improvement," he observed.

Mr. Surana pointed to a root cause analysis of safety incidents in the Indian oil & gas industry in last five years, which revealed that 70% was due to human factors, 13% was hardware related, 9% systems related and 7% due other causes.

"In human causes, the key issue was safety culture and leadership & competency assurance, as the industry uses contract labour in a significant way.In process causes, gaps in hazard identification and risk assessment, asset integrity management, management of safety barriers and operational discipline were key reasons."

Emerging risks in the industry, he

Mr. Surana

added, will stem from their increasing complexity, and the transient work force employed.

Mr. Surana also noted that an objective assessment of safety culture maturity in the organisation is lacking in India. "It is a tough job to create a sense of vulnerability without scaring the staff."

Ageing of assets and demographic changes – twin challenges

Mr. Srinivasan Ramabhadran, Managing Director, Asia Pacific, dss+, a company spun-off from DuPont Sustainable Solutions, pointed to the ageing of assets in the oil & gas, refining and petrochemical industries, as well as of the work force in these industries.

The statistics seem to support these trends. According to a recent Marsh report, 43% of incidents can be attributed to mechanical or asset integrity, which could be linked to aging assets. At the same time, demographic changes for some industries, such as retirement rates as high as 40% of experienced workers in the next 3-5 years, can reduce capability to run and maintain safe operations.

Even as the lost time injury rates in the process industries have fallen and improvements in overall safety performance is evident, spikes in fatalities and major releases continue to occur. "Though there is an awareness of risks and controls, there is lack of alignment on the big risks and appropriate controls," he noted."We cannot operate as we did in the past."

Mr. Ramabhadran called upon senior management to visibly demonstrate commitment to process safety down the organisation, and called for independent verification of critical risks and controls.

Challenges facing SMEs

Later speaking to *Chemical Weekly* on the sidelines of the event, Mr. Ramabhadran, admitted that the challenges facing the small and medium (SMEs) chemical manufacturers in India are very different from that of large companies, and will need appropriate approaches and solutions.

dss+ is addressing this challenge by rephrasing the problem to the identification of top-risks and the critical controls needed to tackle each of them. "We are asking them to address these controls to ensure that they will work efficiently when needed. More and more companies are responding favourably to this approach."

Mr. Ramabhadran also noted that owner-driven companies are responsive to the reasoning that process safety and reliability go hand-in-hand, and that there is a strong business case for investing in safety. He also stressed the need to create a conducive environment of reporting and added that while every company seems to have the right intent, this needs to progress to commitment. The consultancy, which now has about 150 experts in India, is scaling up and expects to double head-count in the next two years.

14 key elements of Process Safety Management (PSM) programmes

	Element	Description
1	Process Safety Information	Employers must develop written safety information before conducting a Process Hazard Analysis.
2	Process Hazard Analysis	Employers must identify, evaluate, and control hazardous processes.
3	Operating Procedures	Employers must develop and implement written operating procedures.
4	Incident Investigation	Thorough investigations must be completed anytime there is an incident associated to the process.
5	Management of Change	Changes to a process must be evaluated to determine if there will be any impacts on the health and safety of employees.
6	Mechanical Integrity	Process equipment must be designed and installed correctly.
7	Employee Participation	The employer must involve workers in PSM programs.
8	Trade Secrets	Employers must provide all information necessary to comply with PSM standards, regardless of the trade secret status of the information.
9	Compliance Audits	Audits must be conducted and reported at reasonable intervals.
10	Training	Employers must train employees on hazards and procedures.
11	Contractors	All contractors working on or near highly hazardous chemicals must be trained on emergency procedures and other relevant aspects of the PSM programme.
12	Hot Work	Hot work permits must be issued for any hot work operations taking place near the process.
13	Pre-Startup Safety Review (PSSR)	The PSSR must be conducted for new and modified facilities before operations can begin.
14	Emergency Planning and Response	Employees must be trained on emergency planning and response procedures.