



Why do incidents keep on happening or what are common lessons learned from incidents? A lot of progress has been made with respect to development and implementation of regulation by various government agencies; development and implementation of process safety programs and activities by industry; and changes in curriculum, continuing education courses and training outreach by educational organizations. However, it seems that incidents keep on occurring, and even more of a concern is that incidents with similar or same root causes keep on occurring. Dr. Trevor Kletz once said following an incident, “Don’t worry about conducting an investigation, I have an investigation report from an earlier incident in my files, I will send it to you.” As I visit plants and industry organizations throughout the world and analyze incidents that have occurred, I am led to believe that Trevor Kletz, to no one’s surprises, was quiet correct. The question though is, “what are the systemic causes behind the *status quo* regarding the regular occurrence of incidents?” As I analyze this question from a fundamental point of view, I keep coming back to the following three systemic causal factors – **competence, enforcement, and failure to learn.**

COMPETENCE or lack thereof, in understanding and executing various tasks and activities relevant to process safety is essential for implementing effective process safety programs and improving process safety performance. Time and again, I have had the opportunity of seeing process safety programs that are sub-par or conducted by personnel who do not have the appropriate competence, with regard to education, training and experience. This is not to say that there are not any competent personnel at all. There are, but the fact remains that there are significant number of personnel (both in the regulatory community and the regulated community), who would not meet the level of competence needed to execute the tasks effectively. Outcome of this lack of competency include ineffective process hazard analysis (PHA), deficient compliance audits, or robust incident investigations conducted by personnel chosen without an established competence criteria, education, experiences, and training.

Competence extends to everyone involved in the development, implementation, execution, review and management of process safety programs, both within the regulatory authority, as well as the regulated community. This would then include leaders (all the way up to the Chairman/CEO, board of directors, and senior executives), managers and supervisors, front-line supervisors, engineers, and operators.

With regard to developing and maintaining **competency**, there are significant roles as well for the government as well as the universities. Government regulations must encourage, implement, and enforce competence programs for their employees, managers, and leaders and expect the same in industry activities. This may require development of job-specific training needs matrix, focused training and certification programs, and policies and procedures for evaluating training outcomes and overall employee competency. As an example of a pro-active “leadership competency” training program, consider a large multi-national chemical company requiring a 90-day completing review period followed by an intensive one-day evaluation, before the leader is allowed to execute any duties relevant to the leader position. Similarly, companies can and should require completion of training and certification appropriate to all job description before the employee is allowed to execute any process safety activities. Of course, none of this is effective without competency evaluations and reviews of the training program. All audit findings and incident investigation findings must be correlated with any deficiencies in competency needs.

Universities have a prominent role in assuring **competency**. Curriculum changes must be implemented to take into account the changing role (e.g., process safety and risk management responsibilities) of their graduates. Universities must also make their contribution in developing and providing regular continuing education, training programs, and certification standards.

ENFORCEMENT of existing laws and regulations is another essential component for ensuring progress in process safety performance. It goes without saying that the need for revised regulations and/or new regulations should be reviewed periodically. However, new or revised regulations should not be considered if it is known that stringent and competent enforcement of existing regulations are sufficient to accomplish the objectives.

Quiet often post-incident investigations have revealed that competent and regular compliance and **enforcement** program could have most likely prevented the incident. A classic example is the West Fertilizer incident in West, Texas. The Occupational Safety and Health Administration regulation (29 CFR 1910.109) clearly spells out requirements for storing ammonium nitrate. Amongst other things, the regulation states:

“Ammonium nitrate shall be stored in a separate building or shall be separated by approved type firewalls of not less than 1 hour fire-resistance rating from storage of organic...”

If West Fertilizer had complied with these requirements the incident would most likely not have occurred. With reference to **enforcement**, OSHA had inspected the West facility the last time 28 years before the incident, and did not issue any citations pertaining to ammonium nitrate operations.

With regard to enforcement in the industry context, it infers a clear and effective approach towards operational discipline. Operational discipline can be summarized as follows:

- 1) policies, programs, and procedures based on a well-thought approach to operations and risk management.
- 2) A program for effective audits and inspections to maintain operational discipline.
- and 3) key performance indicators to assess and track operational discipline.

FAILURE TO LEARN from incidents is a major impediment in improving process safety performance. This factor has been highlighted by many practitioners and researchers including Andrew Hopkins. It seems to me as I look at various incidents around the world, the same lessons are learned from incidents over and over again, and then are promptly forgotten. In fact, the problem is even more insidious and multi-faceted that includes factors such as:

Lack of proper incident and near-miss reporting. This is still a continuing problem because of legal, organizational, and cultural issues. The safety culture aspect that is a significant deterrent is the practice of some organizations to assign blame to employees based on incident investigation findings. Other issues that are deterrents are clear definition and understanding of near-misses, and consequence-based incident reporting only.

Not all incidents or near-misses are investigated. The decision to investigate incidents is overwhelmingly based on actual consequences only. Potential consequences, particularly if the circumstances had been different (*e.g.*, different wind direction, presence of employees in a certain area) are very rarely considered when determining the need for an investigation or the depth and extent of the investigation.

Quiet often the investigation team does not represent the appropriate diversity and depth of expertise needed. For example, an incident involving a unique alloy should include someone on the team with knowledge about the alloy but also operational experience with the application and use of that alloy.

Lack of depth of investigation and determination of root cause(s). Quiet often the investigation is superficial at best and fails to identify the root cause(s) and lessons learned. Furthermore, the incident investigation report does not identify or clarify specific changes or improvements to management systems that would present recurrence of the incident as well as similar such incidents. For example, with regard to the incident involving the alloy mentioned above, a potential recommendation should clearly outline changes to the management system that would prevent such incidents involving alloys.

Incident investigations that identify human error as root cause serve no useful purpose at all. To quote Trevor Kletz that is akin to concluding that, “falls occur because of gravity.” Instead, incident investigations should focus on finding causes that would prevent that human error or the system should have sufficient redundancy to operate safely within the organizational/societal risk tolerance criteria.

The incident investigation report should also include descriptions of things that worked well particularly if some design feature, equipment or procedure was the reason the incident ended up being a near-miss. Similarly design features, equipment, or procedures that helped in preventing the escalation of the incident should also be described. These are also lessons learned that can help to continue to improve process safety performance.

The findings from incident investigation reports should be implemented or resolved as soon as reasonably practicable. If a finding is not implemented, proper documentation based on engineering and safety analysis should be developed and approved by the appropriate management level.

Most incident investigation reports are not properly disseminated. In fact, many incident investigation reports, findings, and lessons learned are not even disseminated through the organization itself, let alone outside the organization. True gains in process safety performance can be made when the incident information including root cause(s) and lessons learned are widely shared throughout the industry. In fact, government regulators should find ways to incentivize the wide sharing of incident information, root cause(s), and lessons learned. Educational organizations should also use this information in improving and/or augmenting their course and curriculum content.

Organizations should find effective means for overcoming problems related to knowledge retention specifically related to lessons learned from incident investigations. This can be accomplished by incorporating the lessons learned into design documents, operating procedures, and training documents/programs. In fact, all relevant case histories should be included in regular training programs as well as refresher training.

With regard to learning from incidents, it is not only important to learn from incidents that occur at one’s own site, but also learn from incidents that occur company-wide, and in the rest of the industry. In fact, companies with good safety culture, have systems in place to learn from all of above mentioned incidents, and also have make a conscious effort to learn from incidents from outside their industry as well (e.g., lessons learned regarding failures in safety culture and management systems from the Columbia shuttle incident are quite applicable to the process industry as well).

The final characteristic of a learning organization is one which has a management system in place to capture and integrate the lessons learned into design and engineering standards. Appropriate changes should also be made to operating procedures, training programs, management of change program, emergency response program, and any other element of the process safety management system or other management systems.

As we make our journey towards improvement in process safety performance and zero incidents, it is my sincere hope that we try to pay due attention to improving on these three factors – **competence, enforcement, and failure to learn.**

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