

Process Safety vs. Personal Safety: Can't We Get Along with One?

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Introduction

The word "safety" is general in nature. This is used in different forms for different aspects, e.g., home safety, road safety, process safety, personal safety, and many more. However, coming to industry side and in particular to the oil & gas sector, two forms of safety are prominent and have significant impact in the business cycle, which are process safety and personal safety.

Occupational (personal or personnel) safety is what is thought of when most people hear the word "safety." They think of trips, falls, struck against and the use of PPE. Traditionally, in the industry, focus of "safety" has been assumed to be totally described by the personal safety and related injury rates. If you ask any organization about their safety performance, the answer almost always was a statement of their incident rates which consists of injury frequency rates (IFR), lost time rates (LTR), total recordable incident rate, etc.

It is particularly important to distinguish between process safety and occupational safety. The Baker Panel report, written following the explosion at BP's Texas City refinery in 2005, stated,

With respect to personal safety, that focus evidently was effective. BP's executive management, however, mistakenly believed that injury rates, such as days away from work, case frequency and recordable injury frequency, were indicators of acceptable process safety performance. While executive management understood that the outputs BP tracked to monitor safety were the same as those that the industry generally monitored, it was not until after the Texas City incident that management understood that those metrics do not correlate with the state of process safety.

While personal (personnel) or occupational safety is very important, it does not completely cover the scope of "safety," only recently has it been recognized that process safety performance is not well described by IFR or LTR.

The oil & gas industry continues to encounter new horizons and environmental pressures that are changing and challenging day after day. Significantly, environmental and safety performance is becoming one of the corporate values, especially as the oil and gas industry plays a key role in addressing some of most important HSE issues of present and future times. The oil & gas industry therefore needs better tools to capture and share its HSE performance.

Personal Safety

The definition of safety is the state of being safe, the condition of being protected against different kinds of hazards or being free from the different consequences, viz. failure, damage, incident or any other event which could be considered non-desirable.

Personal safety can be defined/refers to the freedom from physical harm and threat of physical harm. A hazard which affects personal safety of human beings/individuals does not have any control on the processing activity of a plant/facility/an industry. Typically, personal safety hazards give rise to incidents (or incidents) such as slips, trips, collisions, falls, crushing, struck against, motor vehicle incidents, etc.

Personal safety hazards result in incidents that are not in a large scale at once (unlike in process safety incidents). However, they tend to pile up one after another if the corrective actions are not implemented from incident investigation recommendations. The incident/incident statistics of an organization tend to reflect how well it is managing (personal) safety hazards rather than process safety hazards. In other words personal safety hazards, if not managed properly, can be termed as "high likelihood with low consequence incidents."

These personal safety hazards can be effectively controlled and managed by conducting effective and quality safety inspections and compliance thereafter. Even further, these are primarily resulted from unsafe human behaviors (either by way of doing unsafe act or keeping unsafe condition) which can be tackled/managed by behavior-based safety techniques. Performance with respect of personal safety and its related hazards can be effectively managed by creating good safety culture across the organization through which reporting of personal safety leading indicators such as near-miss incidents, unsafe (or hazardous) conditions and an excellent system of investigation of these and compliance with recommendations thereafter.

This issue of personal safety was described in an excellent way by Heinrich. The Heinrich triangle states that in a workplace, for every single incident that results into major injury, there are 29 incidents that cause minor injuries and 300 incidents that cause no injuries. Most root causes are common for most incidents; hence, addressing the bottom part of the triangle, i.e., incidents that cause no injuries, can prevent incidents that cause injuries.

The same topic of addressing personal safety and its hazards was also explained by Frank E. Bird through Birds' Triangle, which states that for one serious injury incident to happen, there

are 10 minor injuries, 30 minor property damage incidents, and 600 near-miss incidents or no injury/no damage incidents to occur.

The lessons from the above triangles will remain relevant as long as organizations continue to focus to have robust safety performance in terms of achieving excellent incident statistics, i.e., not having lost time incident (or lost workday case) and various frequency or incident rates.

Process Safety

Process safety focuses on major incident hazards associated with release of energy, chemicals or other hazardous substances. This can be simply defined as a process integrating the three main pillar stones, i.e., design, operation and maintenance. In other words, this can be explained as sound designing of the operating plant/facility, safe operation and proper maintenance.

The process safety hazards stand in stark contrast from personal safety hazards, because the former focuses on the hazards that are primarily likely to result in process incidents (either near-miss process safety incidents or major incidents), viz. uncontrolled hydrocarbon releases followed by fire/explosion, challenging the integrity of the equipment in the operating facilities which affect larger number of personnel. These hazards arise from the processing activity in which a facility/plant is engaged. In other terms, the process safety hazards, if not managed properly, can be termed as “low likelihood with (very) high consequence” incidents.

In order to manage process safety, a systematic approach supported with robust system of handling process safety management shall be implemented. The effectiveness of process safety management and its implementation lies in choosing the correct key performance indicators (KPIs) to meet the particular organization’s process activity.

Process Safety vs. Personal Safety

Good personal safety does not ensure good process safety; however good process safety, integrated with effective personal safety management, ensures good safety performance of an organization. While there is much in common, such as a good safety culture and attitude, good process safety performance requires a thorough understanding of the specific process safety hazards associated with the chemicals being handled or stored, and the process operations being carried out in a particular plant/facility.

Effective leadership (integrated with accountability and commitment) of a particular organization depends upon making best decisions at right time in the full knowledge of the input of various factors that will lead to successful outcome. In order to have dedicated focus on process safety management (PSM), the following questions may be utilized to check whether right information is obtained by the management to take the best decisions:

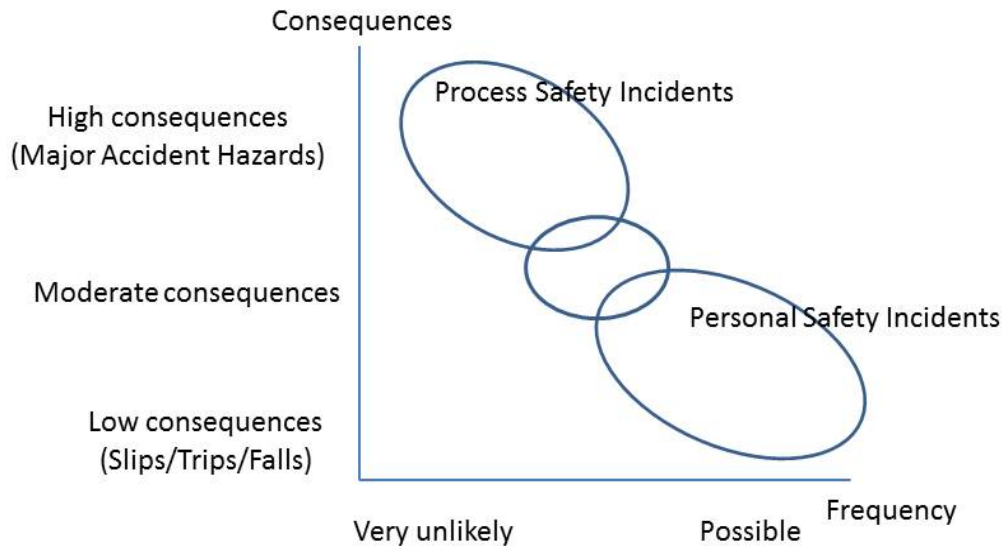
1. Are major hazard risks identified and control measures implemented and reviewed at regular intervals?
2. Does the organization’s safety performance is mainly on incident and injury rates?
3. Does the organization have an exclusive process safety management system and its related key performance indicators?

4. Does the organization focus only on personal safety and its related audits, not on PSM audits as well?
5. Does the management always expect the status of KPIs to always be good/acceptable or do any mechanisms exist for review or bottom-up reporting?
6. Do the chosen PSM KPIs really focus on major hazards risks/areas?
7. Do the facilities/plants undergo process hazard analysis at regular/specified intervals?
8. If an organization does benchmarking exercise for safety performance, is process safety performance/KPI part of this exercise?

Though it is believed to be understood that all organizations (in particular oil & gas industry or major hazard industry) have its own safety management systems focusing aggressively on occupational (personal) safety in order not to achieve world class safety performance with respect of incident/injury rates and related statistics; however this will not influence process safety performance.

For any industry, in particular for an oil & gas industry, process safety is crucial and vital, which is essentially required to be managed to eliminate catastrophic incidents; hence, process safety has become a challenging issue in an HSE perspective. This must be implemented effectively, apart from personal safety. An effective PSM demands a holistic and systematic approach for improving operational and process safety throughout the whole project life cycle, from design and construction through operation and maintenance to decommissioning.

A simple illustration considering the frequency and consequence(s) of personal safety hazards (incidents) and process safety hazards (incidents) is provided below.



Case Studies

Though a number of examples/real past scenarios can be quoted, efforts shall be in place to distinguish incidents resulted from process safety hazards and personal safety hazards. However, all such personal safety hazards, if we look from the root causes, can be addressed/managed through a process (not to be related with any chemical or oil & gas process) holistic view.

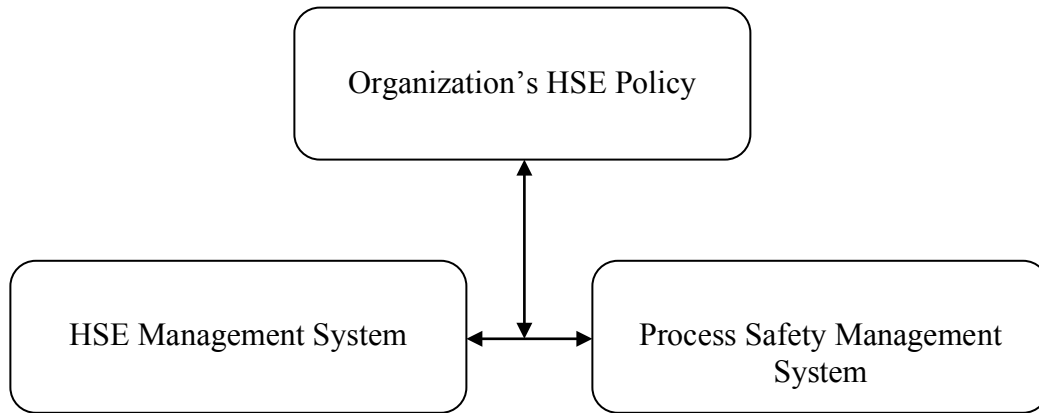
Few examples are given below (for information) distinguishing personal & process safety incidents.

Process Safety Incident(s)	Personal Safety Incident(s)
Major incidents in the past – <ul style="list-style-type: none"> ▪ BP Texas City Refinery Incident on 23rd March, 2005. ▪ Piper Alpha incident ▪ Flixborough incident ▪ Many more eye-opening incidents in the past 	One employee was injured (with minor pain in the back) while walking on the wet floor caused by mopping activities early in the morning.
Bhopal Gas Tragedy incident that occurred in 1984	One lost time injury resulted from motor vehicle incident.
Failure of safety critical equipment resulted in major hydrocarbon release	Fatal incident resulted from falling from height for not having fall protection program
Poor execution of management of change resulted into hydrocarbon fire incident	Hand injury resulted from crushing activity

HSE Management System

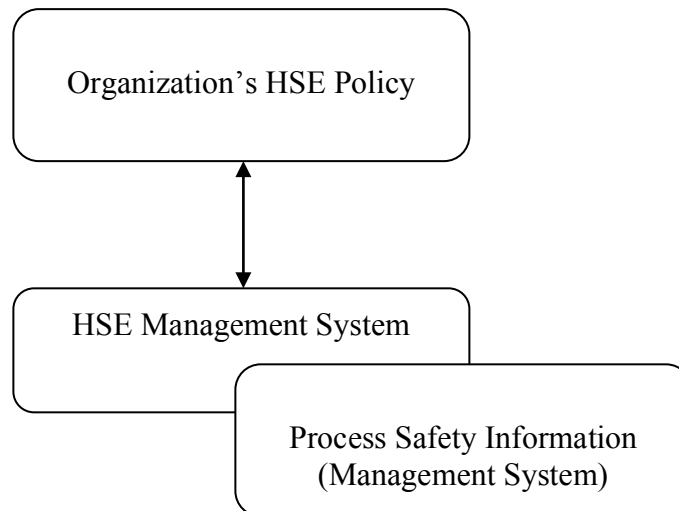
Every organization has its own independent HSE management system. Some organizations' safety management system focus on personal safety and have a dedicated system for process safety management (PSM) and some have one integrated system with a clear focus on both personal safety as well as process safety. In either of the systems, the objective of every organization is to eliminate incidents (either personal hazard incidents or major hazard incidents-process safety hazard incidents). Systems shall be developed, implemented and reviewed at periodic intervals to ensure continual performance exists.

As an example, following structure can be referred how organizations implement PSM and HSE management system.



Example 1

Some elements of the HSE management system, as well as process safety management system, may coincide; hence efforts must be in place to make the procedures which, in turn, can be easily applied while focusing during implementation.



Example 2

The above two examples are for information purpose only; however, the model and system that best suits one particular organization should be made and implemented.

Four Ps Approach

The HSE management system of an organization (including both process safety management and personal safety management) can be effectively drafted and implemented in a systematic way. Though performance indicators (KPIs) are important tools to evaluate and monitor overall performance; however, emphasis must be given in choosing the indicators consisting of four Ps – people, plant, processes and performance, rather concentrating on the indicators on last P, i.e.,

performance. It is suggested that every organization shall have its own long term strategy representing a mind map to deliver zero incidents are based on the four foundation pillars of:

- People
- Process
- Plant
- Performance

Broadly, the above four indicators are explained briefly as detailed below in Figure-1. The various elements of Process Safety (Management) and Personal Safety can be further explained through different procedures and key performance indicators shall be chosen on basis of ‘risk based approach’.

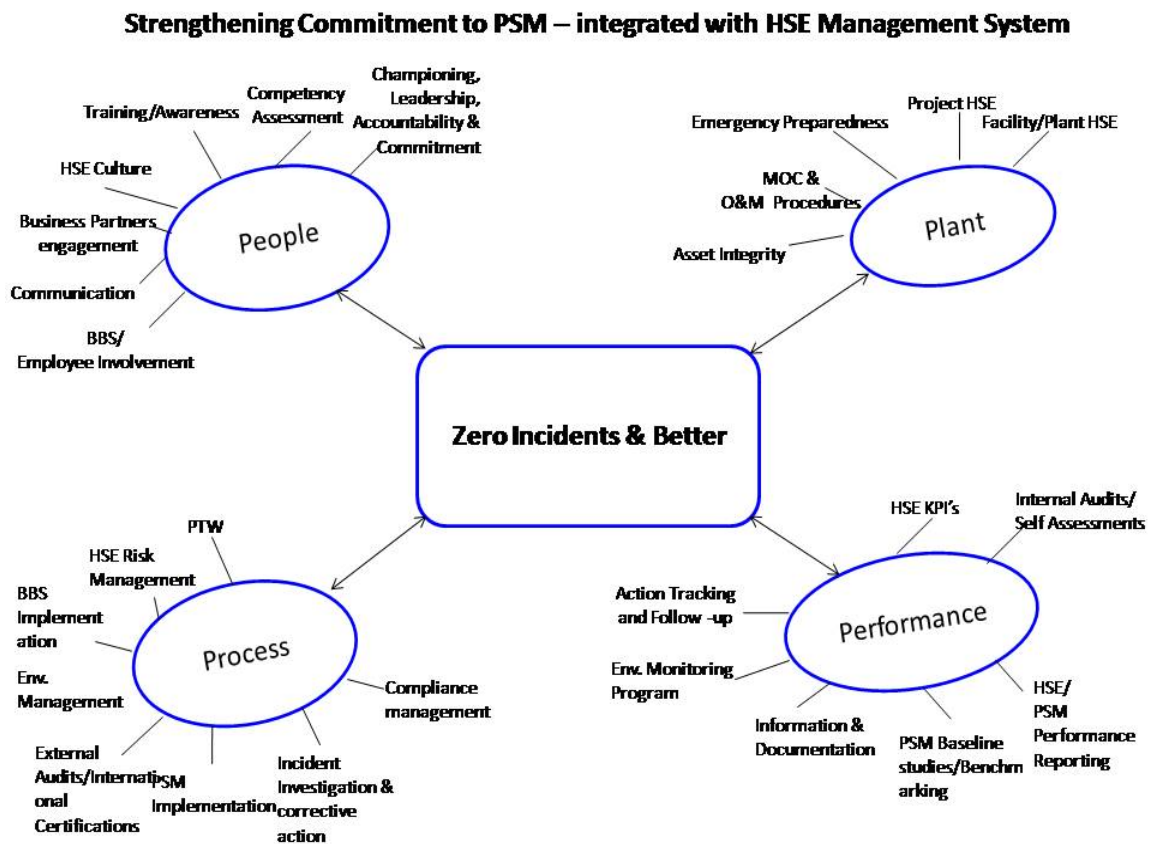


Figure 1. Four Ps Approach

Advantage of BBS Approach

There has been a substantial consideration of BBS (behavioral-based safety) approaches over the past few years. They are based on the principle that a significant proportion of incidents are primarily caused by the behavior of workers. Although these behaviors may be largely the result of various factors; however, it has been shown that changing behaviors first is more effective.

These BBS approaches, if well designed by involving employees, not only can reduce personal safety incidents, but also help in eliminating unsafe behaviors related to process safety hazards. Heinrich's triangle can be extended to process safety management addressing BBS approaches. Care shall be taken in designing a BBS system to address the unsafe or at-risk behaviors leading to process safety hazards.

Key Performance Indicators (KPI's)

We must all agree that right programs and indicators shall be chosen in order to implement the system (through translating into various guidelines, instructions and procedures as well as to monitoring performance). Though many organizations try to encapsulate process safety management (PSM) and personal safety under different elements, indicators may be different. Each organization may choose indicators depending upon various factors. A few broad elements are given below for the management of both process safety as well as personal safety. to give a broader outlook /holistic view of various activities of the oil & gas industry, not necessarily in the same order of the elements). These may be expanded, considering the operations of a particular industry/facility/plant. Leading as well as lagging indicators shall be chosen accordingly for each of those elements in order to measure the performance effectively:

- Leadership, Commitment & Accountability
- Protective Systems
- Competency Assessment
- Management of Change (MOC)
- Facility/Plant Operating Procedures & Maintenance:
 - Facility/Plant Design
 - Permit to Work
 - Emergency Arrangements
 - Information and Documentation
 - Hazards & Risk Management
 - Incident Investigation & Prevention
 - Employee Involvement
 - Audits & Continual Improvement
- Incident Statistics
 - Lagging – Fatal cases, fatal accident rate, lost workday cases, lost time injury frequency, severity rate-personal safety as well as process safety, total recordable injury frequency – personal safety as well as process safety, total count of process safety incidents, and so on.
 - Leading – Near-miss/hazardous (unsafe) conditions incidents (personal safety as well as process safety) reported and closed, number of recommendations from behavioral tools implemented/closed, and so on.

Way Forward

Organizations should ensure that there is appropriate balance between identifying personal safety hazards and process safety hazards. Both these are practically achieved by ensuring the appropriate safety programs and relevant key performance indicators are chosen, leading

(proactive) as well as lagging (reactive). Due to the fact that personal safety incidents are greater likelihood than process safety incidents, it is quite evident from the history and experience that organizations should be convinced to put more focus on such cases, but it is equally important that the management should give equal importance to process safety management. Systems shall be defined in such a way that a near-miss incident with respect to process safety shall be encouraged to be reported and there be compliance with recommendations thereafter.

Conclusion

Oil & gas industries (and every industry as a whole) manage safety (in a broader way HSE) in a systematic way to prevent incidents. Process safety should be integrated with occupational (personal) safety, though both are different can be implemented in a systematic way to prevent catastrophes as well as personal safety incidents. We cannot eliminate/give less attention to either of the safety systems. To succeed in eliminating incidents as well as unsafe behavior(s), organization(s) shall focus on a holistic view, giving emphasis and focus based on a risk-based approach. Though the hazards are quite different from each other, the management of personal safety and process safety has some similarities and differences. It is important to understand that an organization should focus in toto, by not letting down (or giving lesser importance) one system over another. Robust systems must be in place to manage both and all possible actions shall be implemented to let the workforce understand that both process safety, as well as personal safety, are equally important to the success of an organization.

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