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PSM Lite?

What process safety management programs are needed at non-PSM sites?

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Abstract

We all agree on the common stance that no one in any industry desires the occurrence of an accident. This belief is a common premise no matter what respective industry one may work in or for. A serious fire, a permanent injury, toxic release or the fatality of an employee or owner can cause the loss of profit, reputation or even an entire business. Even if you are not a facility or small company that manages Highly Hazardous Chemicals and happen to fall under the OSHA Process Safety Management or EPA Risk Management Program, you still want to prevent such losses. One may not have a major budget to implement extravagantly structured safety, health and compliance management systems that may bring success but are very expensive to maintain for smaller or midsize facilities. [3] You do, however, need to understand your risks and apply recognized EHS measures to mitigate and manage those risks.

The OSHA PSM regulatory standard prescribes fourteen explicit elements that are required to be in place for manufacturing facilities that fall under the standard. To many smaller or mid-sized, moderately regulated (or non-regulated) manufacturing sites, OSHAs PSM standard might not be a logical or realistic fit unless you are in a facility that works with or around highly hazardous chemicals (HHCs) [5]. However, it would be a very tremendous mistake to think that there are no parts of the OSHA PSM standard or guideline that do not apply to these in some way, shape or form. In addition, many if not most, of the activities performed by maintenance, construction and engineering groups at small non-regulated or non-chemical facilities are governed and regulated by the same industry codes and standards required for larger OSHA PSM facilities. The only real difference may be in the level and degree of risk, documentation and resources required to maintain the programs. However, in the eyes of this presenter, it wouldn't be a bad practice to document your activities as if you were under the watchful eyes of OSHA through a PSM program **[**6].

Introduction

OSHA's PSM standard covers the management of Hazards associated with Highly Hazardous Chemicals (HHC) and established requirements for an integrated and comprehensive management program that involves technologies and management practices. There is a likely possibility that even though some of the facilities in your company are not subject to the OSHA PSM standard, you are required to follow an industry, national code or consensus standard in addition to some international quality initiative (RCMS, ISO). It is also important to state that even though not all your facilities fall under the OSHA PSM Standard, your facilities will be expected to employ and maintain a minimum standard of care and utilize best practices within the industry (i.e. RAGAGEP) [6]. Some examples of such standards, codes and practices include API, ASME and NFPA. All of which require extensive and 'auditable' documentation. Many organizations have instituted customized integrated PSM Lite Management Programs for Process Safety.

In summary, through the combination of demonstrated experiences within industry, recent OSHA inspections, industry publication and learnings from Major Process Safety Incidents, there are at least five primary Process Safety Management elements and four fundamental Process Safety Pillars that are essential to even non- OSHA PSM sites. [6][3]. For the sake of this abstract the focus of this topic will be toward non-PSM and/or non-chemical small and mid-size facilities.

Sugar dust explosion-- Imperial Sugar Plant - Savannah GA (Feb. 2008) • 14 workers killed Facility Destroyed

Jahn Foundry Springfield, MA February 26,1999 3 Dead 9 Iniured

Ammonium Nitrate explosion in West Texas in April 2013.

15 killed and 260 injured.

Explosions and fire at a hazardous waste facility forced the evacuation of approximately 16,000 residents from Apex, North Carolina, on October 5, 2006.

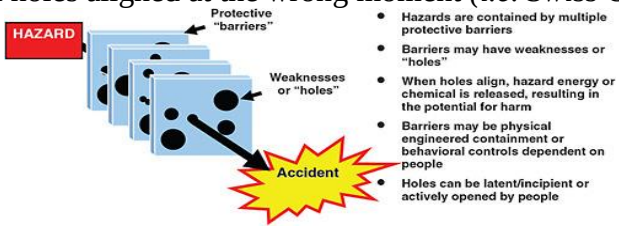
Figure 1: Major Process Safety Incidents at Non-Chemical or Non PSM Facilities. [14,CSB]

Dust, Ammonium Nitrate, Sugar and Hazardous Waste Incidents, what do these incidents have in common ?

Answer: They were Not PSM Facilities but had no (or lacking) essential Safety Management Systems and a deficient safety culture [3, CSB]

Overview:

As stated earlier, the type, structure, or size of any industrial facility within your organization makes no difference. We all agree that major process accidents are not acceptable. If we look at how these major accidents occur, it is often the usual norm for these events to encompass multiple contributing causes and a small number of root causes. In most cases, it involves a chain of events triggered by some initiating event or a series of process failures and/or systems with gaps and holes aligned at the wrong moment *(i.e. Swiss Cheese)*.



In other words, something goes wrong somewhere, equipment or system failure, management system failure and/or a human error which leads to an unacceptable catastrophic event (i.e. explosion, toxic release). These types of accidents are *typically* synonymous with the Petrochemical or Oil and Gas Industries since these industries consist of larger facilities and are typically governed by the OSHA PSM Standard.

However, as statistics indicate, these major incidents occur in other industries such as the food, Pharmaceutical, Hazardous Waste and Agriculture facilities as evidenced in Figure 1. For instance, the CSB (Chemical Safety Board) identified 281 combustible dust incidents in the US between 1980 and 2005 that killed 119 workers and injured 718, and extensively damaged industrial facilities [3] [CSB]. These facilities typically have relatively smaller manufacturing facilities as compared, on average, to the Petrochemical or Oil & Gas Facilities. In addition, there is no explicit or specific requirement for these facilities to implement an OSHA PSM program and in some instances, there is no comprehensive federal OSHA standard aimed at controlling the risk of catastrophic events (i.e. explosions) in these types of general industries (i.e. Dusts).

Are these Statistics Acceptable? [3]

- Over the last 20-30 years (Average)

- Ammonia Releases: 60 per year
- Dust Explosions: 10 per year
- Pharmaceutical Explosions 10-15 per year

As we stated numerous times, we stand on the common ground in that catastrophic events in any industry are not acceptable however, what is the remedy? The next two important questions on the table for this presenter are: Is a full Process Safety Management (PSM) program the answer for non-Chemical and/or non-PSM facilities? Is Regulatory Compliance enough?

Professionals and Professional Organizations alike will attest to the fact that PSM may not be fully understood or digestible by most *"non-chemical"* manufacturers. For instance, such statements as; a) "We make food, not chemicals", "We don't have highly hazardous chemicals on site", c) "We are a Waste facility and we comply with EPA Guidelines" or d) "Ammonium Nitrate is not listed as a PSM Chemical" come to mind [1][3][7]. We first begin with focusing on the challenges and barriers in place for these organizations.

Obstacles and Challenges for Small and Non-PSM facilities:

Limited Resources

The implementation of the full spectrum of requirements from the Process Safety Management (PSM) to small or mid-size facilities requires significantly more organizational energy and resources from a smaller pool of individuals. This can substantially overwhelm the existing and available resources of a small or mid-sized chemical plant or other small business that utilizes chemicals in smaller quantities. Small, and in many cases, mid-sized organizations do not have the technological expertise and manpower resources of larger organizations which limits their ability to implement a complete and effective PSM Program [3][4] especially when there may be no requirement to implement such an enormous program.

Sustainability, Value and Miss-match

Since many smaller or mid-sized non-PSM or non-chemical facilities do not always have the know-how, information or resources needed to develop and implement a Process Safety Management program, many organizations reach out to external resources. Many of these organizations attempted to implement a safety and health program (i.e. PSM like programs) by asking for suggestions on program techniques and procedure from the government agencies (i.e. OSHA VPP or voluntary compliance assistance programs) or from other larger companies (i.e. DuPont). In a lot instances, these programs were eventually unsuccessful and unsustainable because they: a) Were not suited for the structure, resources and size of the organization or b) they were not based on or did not truly address the true risks of the smaller and/or non-chemical facilities. [3][4]. Even with resources to outsource expertise, most small and mid-sized facilities have had difficulty in demonstrating the value of a full PSM program in their operations especially where regulatory requirements can be hazy and vague. These facilities are reluctant, and simply not able to maintain such programs from an organizational standpoint. Solutions should be aimed towards a customization and integration of: a) practical written Safety Management Program and standards tailored and pertinent to their organization or facility, b) healthy organizational safety culture, and c) programs and systems based on plausible risks and hazards to a specific organization, instead of trying to force fit a standardized large scale and/or expensive program. [3] to these smaller non-PSM and/or non-chemical facilities.

Potential Solution:

In fact, for small or mid-sized facilities and organizations, including non-chemical industrial entities, this presenter suggests a Risk Based PSM Lite approach. Based on documented shared experiences, major industry accidents, demonstrated industry success and industry research and publication, there are four (4) key fundamental (philosophical) pillars of a Risk Based Process Safety Management Program [2] and five of the OSHA PSM Elements that are essential for any healthy Process Safety Management System no matter what industry or no matter the size of the facility. Now with increased size, industry type and complexity of the facility these basic requirements increase and become more intricate without question. However, for the sake of this abstract, I will focus on the core basic requirements for smaller and/or non-chemical facilities. This also does not absolve any facility from basic regulatory compliance requirements (i.e. Hazard Communication, Environmental).

Four (4) key fundamental Pillars of a Safety Management Program:

The premise of the RBPS approach is for organizations, regardless of size or industry, to build and operate a more effective process safety management system (risk-based) that is custom-fit for their organization. (CCPS) [2].

1. **Leadership Commitment and Culture**: No matter the organization, leadership sets the organizational tone. If one can identify one successful organization, I can show great leadership. The safest companies have leaders that truly understand the concept of ssafety. As stated in the book "Guidelines for Risk-Based Safety"; 'Effective safety leaders share common practices such as vision, credibility, communication, collaboration, feedback, action orientation and accountability. What leaders demonstrate, emphasize and reinforce determines how people respond to events, how they make decisions and whether they carry out the organization's objectives'. Once the organization truly believes in the leadership commitment, there is complete buy-in throughout the organization. There is no substitute for Management Commitment to safety in any organization. [6]
2. **Hazard Recognition, Evaluation, and Control:**
   When asked, most people on the street would say is this is what a safety program is all about. This involves proactive hazard recognition in terms of environment (the surroundings of the workers), the people doing the work, equipment/materials used in the work process, and processes/practices themselves. As eloquently stated, 'Organizations that understand hazards and risk are better able to allocate limited resources in the most effective manner.' [2] [18]. These organizations are more likely than not set up for success.

Examples and results of small organizations not understanding Risks

Small Non PSM Chemical Company: Concept Sciences wanted to be the first (and only) company to produce Hydroxylamine Freebase in the United States. The freebase is formed by removing the salt with an acid to leave the simple hydroxylamine. This compound is very unstable. On February 19, 1999 during the very first batch the employees lost control of the process. The employees **had no knowledge of the dangers of this compound**, so they continued trying to regain control of the process. Within minutes, the material decomposed explosively leaving 5 dead, 13 injured and a 30-foot diameter crater in the ground.

Small Non PSM Company: At 1:33 pm on December 19, 2007, an explosion and fire destroyed T2 Laboratories, Inc. (T2), a very small chemical manufacturer on the north side of Jacksonville, Florida. The explosion, which was felt and heard 15 miles away in downtown Jacksonville, killed four T2 employees, including a co-owner. It injured 32, including four T2 employees and 28 members of the public at surrounding businesses. Among other factors, **the employees had no knowledge of the dangers of this compound**

3. **Documented and Effective Management Systems:**
This means a structure and system that is specifically constructed for your organization that captures, in writing, processes by which the organization accomplishes safety and health such as the following [2] [18]

a) manages the process within safe limits and manages change effectively
b) maintains the integrity of the processes and equipment
c) Conducts Investigation and Root Cause analyses
d) Identification and Management of Hazards (i.e. exposures, emergencies, fires etc.)

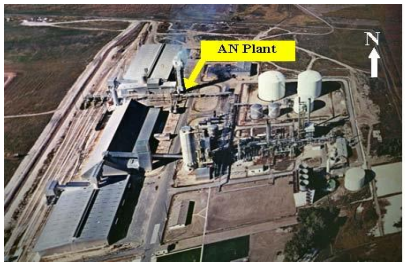
4. Learning from experience

'Involves proactive measures such as monitoring, auditing, metrics, education, training and acting on internal and external sources of information'. [2] This pillar is about taking best practices, lessons learned from incidents, training audits, metrics and converting them to best practices and continuous improvements within the organization. [2] [18] [16]

These Four Fundamental Pillars are applicable to any Small Non-PSM or Non-Chemical facility in Multiple of Industries

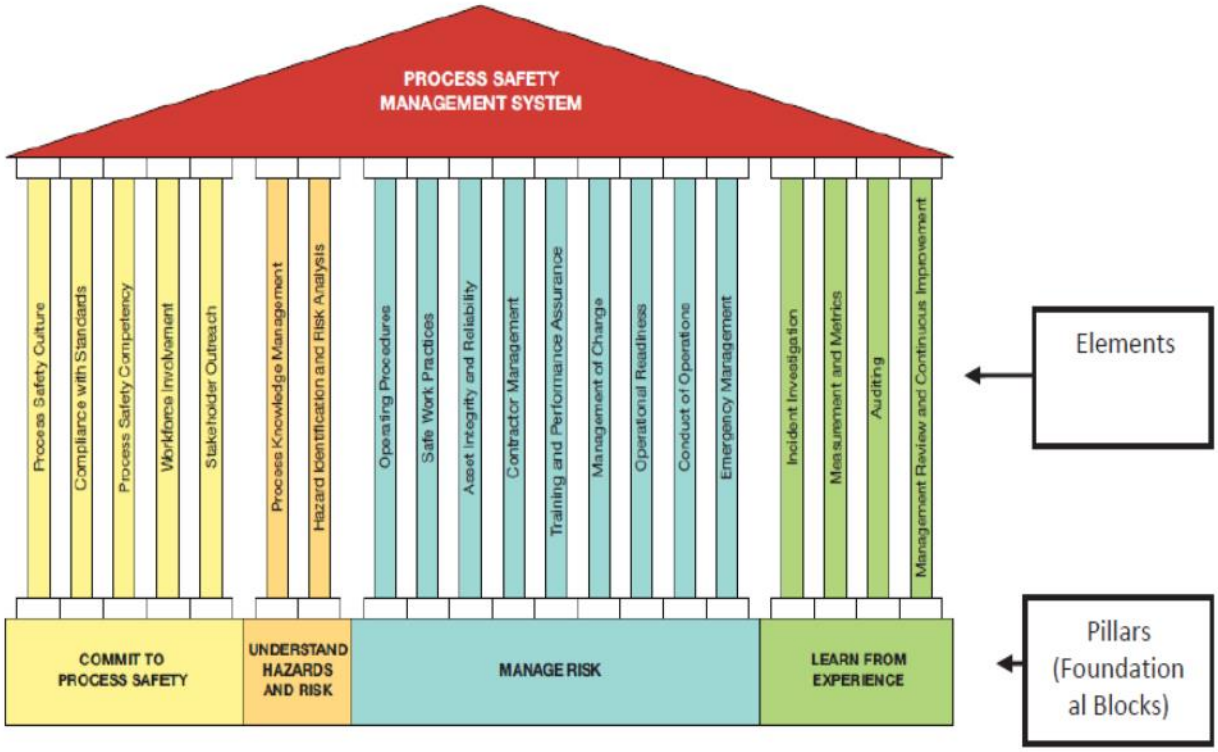
Small Non-PSM Chemical Plant

Small Dust Handling Facility



Ammonium Nitrate Facility (Non-PSM)

Figure 2: Pillars (Foundational Blocks) and associated Elements that constitute sound Safety Management System [2]

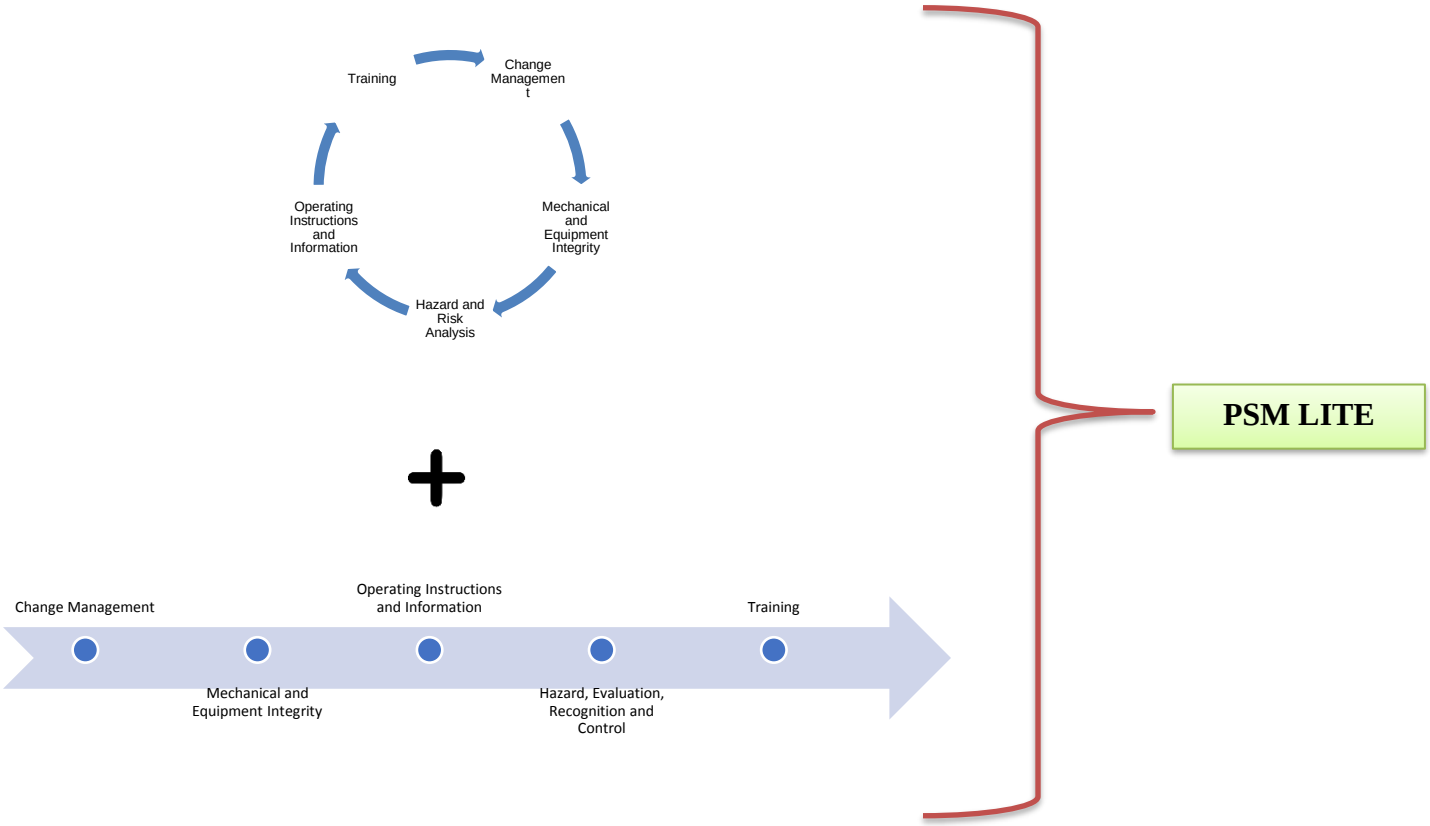


The RBPS strategic approach, as stated in the Guidelines for Risk Based Process Safety, is founded on the principle that the organization examines its risks to the full understanding of the organization and captures these risks in documentation, training and programs. The implementation of practices and measures to manage and mitigate these risks are fundamentally based on: [2]

- Process Knowledge and the level and degree of risk
- Resources available vs resources required (practical approach) and address the gaps
- The safety culture and tone of the organization, what is required, what brings value and what is missing

WHAT ARE THE ESSENTIAL ELEMENTS FOR PSM LITE?

We must reiterate and completely understand that the Pillars mentioned above serve as the foundation for any Health Process Safety Management program regardless of size. There are still essential elements that must be in place to support and exemplify the fundamental pillars of a successful Process Safety Management Program. However smaller, mid-sized and/or non-chemical facilities may have a large amount of work and responsibilities distributed over a smaller mass of individuals. This structure often presents significant challenges and difficulties in the implementation of any comprehensive Process Safety Management programs. There are just simply not enough hours in a day and not enough people to handle the plans, procedures, assessments and other activities. In most cases, the difficulty associated with lack of resources and the lack of industry- specific guidance documents, training, and hazards information leads to either compliance or process deficiencies. The question on the table, is what are the primary basic essential components of a Safety and Management Program that are essential, at a minimum, for a *PSM Lite* Program?



Primary basic essential components do not necessarily apply only if we refer to figure 2 and all the elements within. There are those elements that are secondary. Now, one may even suggest that there are other primary elements such as contractor management, emergency response or auditing. This presenter is suggesting that for small or mid-sized non-PSM facilities or non-Chemical facilities, the four fundamental pillars plus the five essential process safety elements are the minimum basis for a healthy Process Safety Management program. For instance, one cannot have an emergency response program until you have identified all the risks first (Hazard, Evaluation, Recognition & control). One cannot have an auditing program until the operating procedures and instructions are in place for the organization.

Change Management System:

Process or Facility Change	Possible Impact
Building addition	Choice of insulation material may change combustibility of building
Building renovation	Existing fire divisions may be compromised
Installing new equipment	Increase of fire/explosion hazard; existing fire protection systems may not be designed for this type of hazard
Storing new product in distribution warehouse	Existing fire protection systems may not be designed for this new commodity
Change of packaging material or type of pallet used	Possible change of commodity classification of the stored goods, resulting in inadequate fire protection systems
New raw material	Different fire and explosion behavior, such as combustible dusts, flammable liquids, thermally unstable materials, incompatibility of materials, etc.
Change of supplier	Dependency on single source supplier
Employee attrition	Loss of vital experience in a team

Figure 3: Examples of Possible changes requiring change management in a large or small facility

The concept of change management (in the sense of maintaining plant safety when changes occur) has been a critical part of the risk management philosophy in the petroleum, chemical and nuclear power industries for decades due to the severe hazards present [15]. However, property losses are not limited to these industries and the non-chemical industry is equally challenged to safely manage changes (i.e. recent Dust Explosion Incidents). A management of change systems helps to ensure that hazards associated with a change are identified and controlled. Where changes are undertaken in an unstructured way, new hazards may not be recognized and the increase in risk unnoticed. Hazards and risk can relate to assets and to an increased potential for an interruption to operation continuity. [15] [17]

First, to manage proposed changes, a systematic procedure should be established and implemented. Second, ensure that this system is structured to identify changes before they are implemented. It is also important that this system determines if the planned change is a significant change, which needs to be carefully evaluated and managed, or a minor change, that has no further impact on a site's overall loss control /safety concept. [15] [17]

Mechanical Integrity:

Mechanical Integrity is an essential element of an efficient process and a safe, cost-effective facility. Furthermore, OSHA's PSM Standard (29 CFR 1910.119[j]) requires it. However, for decades Mechanical Integrity has been a leading cause of OSHA citations. One of the single biggest misconceptions is that it only applies to major chemical facilities. The second misconception is that it only applies to the act of preventative maintenance. It also applies to the network of people and record-keeping practices that support maintenance programs large or small. MI activities encompass the entire lifecycle of the covered equipment, including engineering, construction and spare parts, not just the ongoing maintenance activities. [10] [14] [7][8]

RAGAGEP: Applies to Big and Small; chemical and non-chemical

The PSM standard does not define RAGAGEP, even though it uses or implies the term in three places within the OSHA PSM Standard. Recognized and Generally Accepted Good Engineering Practices (RAGAGEP) are specifically referenced standards that serve as the basis for engineering, operation, or maintenance activities and are themselves based on established codes, standards, published technical reports, or recommended practices or similar documents. RAGAGEP detail generally approved ways to perform specific engineering, inspection, or mechanical integrity activities, such as fabricating a vessel, inspecting a storage tank, or servicing a relief valve." It is more important to understand where, and how, RAGAGEP applies, to your facility whether large or small or chemical or non-chemical. [7][8]

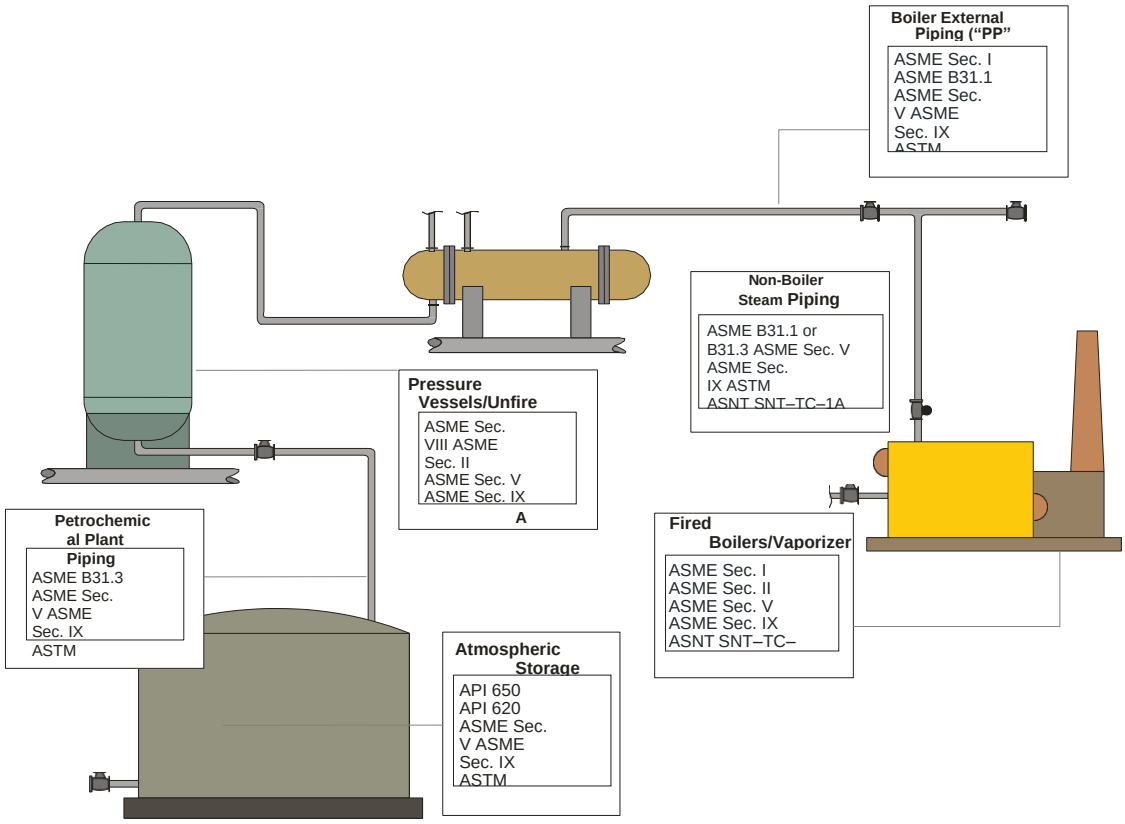


Figure 4: Examples of RAGAGEP for Equipment [7][8] [10] [11]

Operating Procedures and Instructions:

Operating procedures go together with process safety information. It is important for individuals from any organization to have a clear understanding of the process in all modes of operation (i.e. startup, shutdown, normal) In so many times or instances there are audit findings or incidents where deficiencies point to incorrect or updated information in operating procedures or there are no procedures for all modes of operation. For instance, companies may have good procedures for operating within safe limits, but as soon as the process begins to deviate, there is often inadequate guidance on what steps are to be taken by the individuals in this mode of operation. An additional and modern-day challenge posed by increasing operational complexity, increasing retirement group and a shortage of skilled labor must be approached in a structured way to make small and mid-sized process plants more efficient and safe. Incorrect or outdated procedures—or even a poor understanding of operating procedures—can lead to incidents resulting in fatality, equipment damage, production loss, poor public image, and litigation. [19] [1]

Procedural operations are effective when they are: easy to understand, revised regularly, with proper management of change, encompass accurate process information (PSI) and are quickly accessible when needed. The time spent in investing in operating procedures can be justified most often through reduced downtime, consistency and higher production yields. [19] [1]

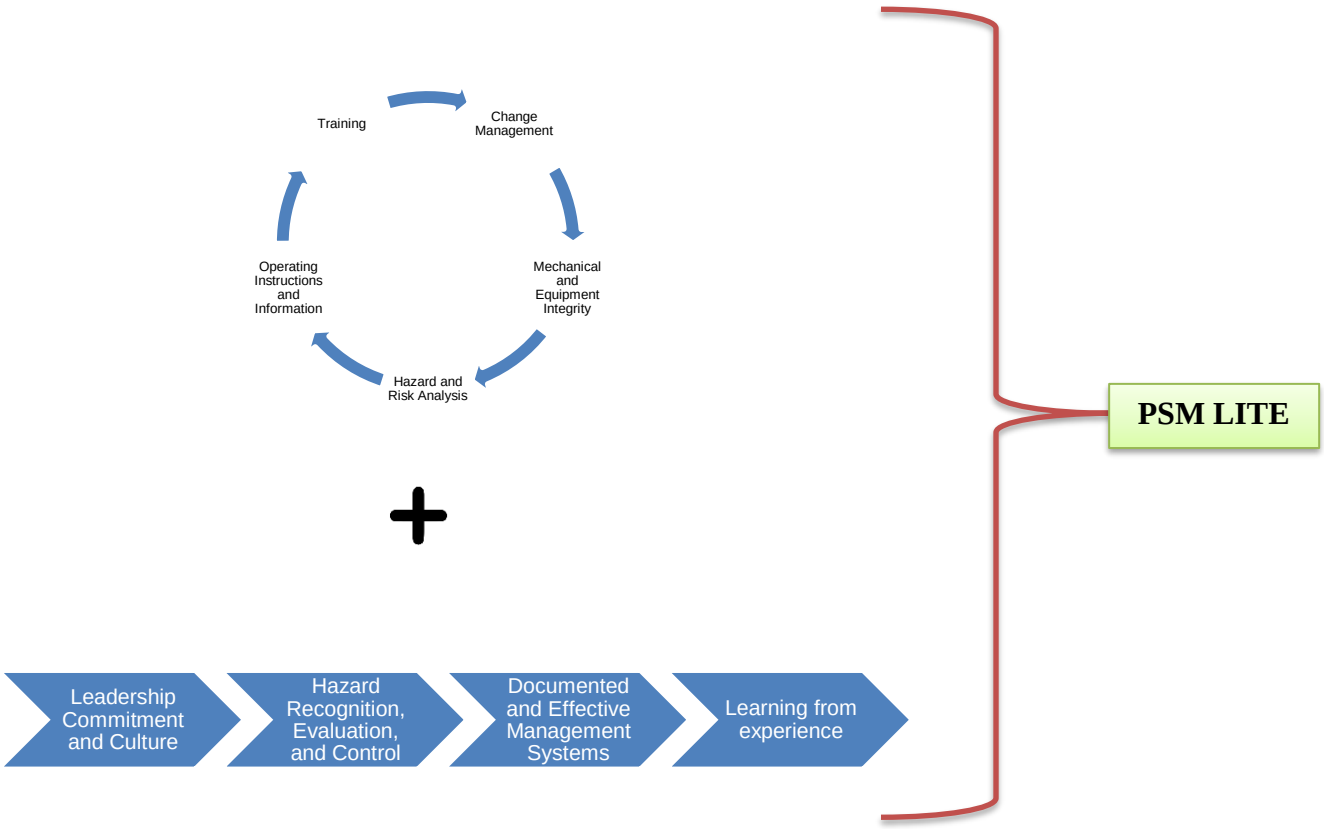
Hazard Recognition, Evaluation and Control (Hazard Analysis):

This element is key and core to any health and safety program. When asked, most people would quickly conclude that this is the crux of a process safety program. It is a term that is comprehensive, subjective, qualitative and quantitative. It encompasses all activities involved in identifying hazards and evaluating risks at facilities, throughout their life cycle, to make certain that risks to employees, the public, or the environment are consistently controlled within the organization's risk tolerance. [1] This involves proactive hazard recognition in terms of environment (the surroundings of the workers), the people doing the work, equipment/materials used in the work process, and processes/practices themselves. A formal "Job Hazard Analysis", "Job Safety Analysis" or "Process Hazard Analysis" assists with the process and is an integral basis to many of the other elements listed in Figure 2. Once hazards have been identified and prioritized, they must be controlled. The generally industry accepted hierarchy of controls is elimination/substitution, engineering controls, administrative controls and personal protective equipment. The earlier in the life cycle that effective risk analysis is performed, the more cost effective the future safe operation of the process or activity is likely to be. [1]

Training and Education:

Having a training system in place for new and current employees is imperative and crucial in any facility. The training is about the 'What' and 'How' in any organization and the education is about the 'Why'. Both training and education are not mutually exclusive and they are equally as important. This includes permanent, temporary and even contracted employees. However, this element is as much about continuous communication and total understanding of *Processes or Equipment Knowledge* as it is about simple training and education especially in this current environment of a reduced skilled labor pool. It is extremely important that the inherent technical and operational knowledge of any organization, including its hazards, design and operational know-how, must be retained and continuously passed on to new technicians, operators, and/or specialists in any organization large or small.

Conclusions:



As mentioned earlier, the reduced volume of people in a small to mid-sized non-chemical and/or non-PSM Facility contributes to the difficulty of implementing an effective process safety program. In most cases, the difficulty is associated with lack of resources and the lack of industry-chemical specific guidance documents, training, and hazard information. The term 'PSM Lite' is used to characterize those primary essential elements, as identified in Figure 1 and explicitly outlined in the OSHA PSM standard, that are essential for the efficiency and success of any organization but allow small and mid-sized companies and facilities to customize a program that is not a burden for the organization to maintain yet set the organization up for Process Safety Success.

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