

## **White Paper**

### **Quality Management System influences for Process Safety Management**

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#### **Introduction**

The deficiencies in refineries described by Mr. Jordan Barab, Deputy Assistant Secretary (OSHA)<sup>1</sup>, informs of the need to review the safety management techniques employed in refineries and chemical plants. He presents the following findings as they are reported from OSHA's inspections;

1. Ineffective process safety management systems without a workplace safety culture, which is critical for the success in preventing catastrophic events.
2. Lack of mechanical Integrity due to unperformed inspections or tests and the correction of such deficiencies in a timely manner
3. Failure to document compliance with Recognized and Generally Accepted Good Engineering Practices to keep process safety information up to date, and to document the design of emergency pressure relief systems.
4. Failure to establish and follow procedures for key operating phases, such as emergency shutdowns, and using inaccurate or out-of-date procedures.
5. Inadequate address of OSHA communications and Process Hazards Analysis findings and recommendations. This includes the lack of attention to human factors and facility (work cabins and the like) sitings.
6. Current measurements do not adequately meet the status of performance, having regard for the misleading series 300 logs that are submitted.

Mr. Barab's appeal to the NPRA suggests the industry is looking for a solution to improve and support the Process Safety Management (PSM) regulations

(1910.119)<sup>2</sup> to enhance Safety Management within the Refinery industry. From inception in 1993 to new efforts made with the National Emphasis Program (NEP)<sup>3</sup> additional regulations in 2007; successful results were not realized. Process Safety Management needs a third look.

The fact the expressed findings thrived, suggests the issues lie at the core in operating the PSM. The premise that the PSM is presently a best practice<sup>4</sup> should be examined.

### **About the PSM**

A successful approach to managing the safety domain does not lie in the PSM as it is presently practiced – since, the regulations or laws are not structured within the context of a Management System, as the characteristics of Management Systems are understood. The PSM with the NEP is formatted as a requirement to be managed, but is not in itself a management system. Technical skills, know-how and content alone do not make a management system.

A close look at Mr. Barab's comments informs on the reasons for the existing performance. The reasons are the absence of management attributes such as control, organizing, tracking and follow-up, resulting in the ineffective execution of the technical duties. It is against this background that techniques of systematic management are discussed, in order to promote the successful experiences of discrete manufacturing that realizes zero defects or six-sigma outcomes. The techniques delivering these outcomes are now known as Quality Management, which has a traceable history<sup>5</sup>, with its main highlighted period instigated by Edward Deming and developed in the Toyota Production System.

The PSM, though promoted as a management system, does not contain these techniques. Adopting the techniques can facilitate the improvement of the PSM to obtain comparable Quality Management results.

A management process of control, assurances and improvement (definition of Quality Management Systems<sup>6</sup>) can support the PSM activities to attain zero non-conformances and incidents. The techniques used in discrete manufacturing and application are described below in the AS 9100 Quality Management Standard<sup>7</sup>.

QMS Requirement	QMS Characteristics	Discrete manufacturing management technique
Control	1. Error proofing 2. Copy Exact	1. Product realization, First article inspection 2. Locked in production process for repeatability: same tools, same machines, same method of manufacture
Control	Manages degradation to avoid failure or defects	Statistical Process Control
Assurance	A technique to manage or predict the outcome through on-going measurement or monitoring	In-process inspection / monitoring
Assurance	Standardization, repeatability and details of manufacturing requirements	Traveler
Improvement to meet objectives	Corrective Actions	Root Cause, hazard analysis reassessment – mitigation and verification of effectiveness of corrective action

The QMS characteristics are absent from the PSM. This is an indication that the PSM is not a management system, as is currently recognized within the Quality Management domain. Organizations are unable to manage their Safety Management System based only on the PSM and NEP regulatory requirements. The attributes of Quality Management Systems are required for an effective PSM.

### **Missing QMS attributes**

With the advent of the ISO series of Management Standards since the year 2000 (PSM released in 1993), we have come to recognize that a management system is based on the Deming Cycle of Plan, Do, Check and Act (PDCA)<sup>8</sup>; inclusive of the QMS characteristics. The system of Standards is designed to meet planned objectives / targets through the control of procedures. When they are not met,

improvements are made by way of corrective actions, when the 'check' reveals that the objectives / targets were not met. The following are the main characteristics of the PSM that needs to be addressed, to bring it up to par with the Management Standards.

1. Corrective actions 1910.119(m)(5)

The best practice employed in corrective actions, requires a root cause analysis to be completed. This directs the appropriate corrective action by finding the root cause of the incident or non-conformance. Root cause requirement is not in the PSM, although the NEP does ask for 'factors that contributed to the incident'. Root Cause analysis has specific rules such as '5 whys'. In the PSM the corrective action is triggered only when there is an incident; and all that is required is its documentation. The need for demonstrating effectiveness is not a requirement with the PSM.

2. Update of hazard analysis 1910.119(e) (6)

Five years is the designated regulatory period to revisit the hazard analysis (risk) for updates and revalidation. On the occurrence of a non-conformance / incident within the five year period– the corrective action is repeating the practice that resulted in the incident / non-conformance in the first place. There seems to be no link between each non-conformance / corrective actions and a review of the hazard analysis. If there is, it is not clearly spelt out.

3. Document Control and Distribution (not mentioned in PSM)

The PSM in many clauses requests documentation. However when there are improvements due to hazard analysis re-assessments – how are the changes made in a controlled manner and distributed with respect to the paperwork? Additionally, how are they distributed for future training and records of such

training maintained? If mitigation revisions are unable to be implemented in a timely manner due to the logistics of approvals and distribution for changing out manuals and checklists; there will be reoccurrences of the same issues. The PSM does not take the revision changes and new training requirements into consideration.

#### 4 Inspection and testing 1910.119(j) (4)

Inspection and test are snapshots and the mentioned 'monitoring' is described as being used for detection 1910.119(e) (3) (iii) and controls 910.119(j) (1) (v). The impression is that the monitoring is not used to manage trends in the operations to predict degradation of the processes including mechanical integrity, in which case it is known as condition monitoring. Typically it seems that the monitoring is at the point of failure for alerts and alarms, whereas in the quality management scenario, it is the trending towards the upper and lower control points that allows any degradation to be addressed before failure.

#### 5 Quality assurances 1910.119(j) (6)

This is the prime evidence in the differences in thinking since the development of the PSM and current industry practice. The PSM description in the stated clause refers to Quality Assurance in terms of proper installation of equipment and fabrication, albeit, after completion of the tasks. Quality Assurance as is practiced by ISO and ANSI Standards, is the strategy to ensure the outcome meets specifications the first time, without error. The differences in definition, speak to the performance concerns, expressed by Mr. Barab

The five points above demonstrate that the PSM can look towards the techniques of the present day Management Standards, as the means to evolve completely as a management tool.

Environmental (ISO 14001) and Occupational Health and Safety ANSI / AIHA Z10 or OSHAS 18001 are Safety Management Standards based on the Deming Cycle. These standards facilitate the QMS requirements of control and assurances for an intended income based on the plan of the PDCA. The need for improvements is triggered when a non-conformance or incident occurs or is trending to critical limits. This indicates the control and assurances were not effective. The root cause is determined and the associated hazard is re-analyzed for improvement towards an effective corrective action to ensure there is no reoccurrence of the incident or non-conformance. Consequently the plan is modified and tighter controls and assurances are the result of the further mitigation. Additionally, any of the following reasons<sup>9</sup> requires a further hazard analysis:

- The addition of new commodities or product lines to the location.
- A change of manufacturing location for existing products.
- The introduction of significant new equipment or process changes.
- Consideration of changes relative to safety, critical, or reliability characteristics.
- Significant changes in the organizational structure or the introduction of alternative processes, methods by contractors and suppliers
- Consideration of maintenance practices which can result in harm to property or individuals if not addressed

The hazard analysis, through the Hierarchy of Controls, is a living dynamic document to support the mitigation required for each risk even after the original assessment. For as long as the operations exist, hazard analysis is an on-going exercise. Compare the impact of every five years update of the hazard analysis

required by the PSM regulations, to the immediacy of addressing each and every non-conformance / incident or for any of the changes mentioned above.

The PSM management system shortcomings can be addressed by Safety Standards with Quality Management characteristics. The PSM and the Standards are closely associated. The features of the Standards are applicable to the PSM as it currently exists. Current PSM practices can be infused with QMS characteristics to be compliant with the Safety Management Standards.

### **Morphing the PSM into a PDCA Standards based Management System**

ISO 14001 Environmental Safety Management and ANSI /AIHA Z10 (OSHAS 18001) Occupational Health and Safety (SHE) Management are integrateable for taking the existing Process Management System to the next level of management. The clauses of both Standards are formatted as Plan, Do, Check and Act. HAZOP is used for risk assessment when explored through the Hierarchy of Controls, in order to facilitate the Plan of the PDCA per the standards. This strengthens the PSM overall performance. The PSM practitioners are able to discern the respective tasks when using the PDCA Template, as their activities fall into the specific buckets of the Plan (objectives and procedures) Do (assured, controlled and standardized delivery), Check (Compare the results with the planned objectives) and Corrective Action (when the plan is not met)

### **The Challenges**

In Quality Management there is direct responsibility by the production department for the product outcome and is generally the focus of the organization. It is questionable whether a deployed PSM rises to the same prominence, although without proper management, harm to and wastage of resources affects the production output.

The challenge is to deliver the QMS attributes within the PSM where it is needed.

Bear in mind that if even the hazard analysis inaccurately produces a plan, it is only

on the confidence that the prescribed tasks are delivered as planned, that the analysis can be accurately reassessed. Therefore, there must be assurances that the delivery is as intended by the Plan. It is then the delivery or the 'do' that must be strengthened to avoid the following challenges of the current practice:

### Control

- Delivering a detailed planned checklist at the point of application
- The means to accurately monitor degradation trends before failure
- Documents being available in a timely manner for training and subsequent use by every one

### Standardization

- Repeatability of delivery every time for the same procedure

### Assurance

- Avoiding tasks with out-dated checklists
- Tasks not completed at the prescribed time
- Training not completed to revisioned checklists
- The means to control changes and timely distribution across the system
- Attention brought to management when targets not met or inaccurately trended data

### Corrective Action

- Opportunity for Improvement missed, when non-conformances do not have their hazards re-assessed or root cause analysed, in order to drive a corrective action, which in turn adjusts the plan

### **Shecentral.net**

Shecentral.net is unlike any other software, as it contains QMS management characteristics, as it is embedded with the respective Standards' clauses to support and be interactive within the operations. For example, if any line item task within the checklist, is changed, the system does not allow use of the handheld until persons are trained. Utilizing this type of QMS interactivity throughout, shecentral.net resolves these challenges of controls, assurances and improvements. It delivers the requirements at the point of application to provide the prescribed information, every time. Simultaneously, compliance to laws and International and National Standards is achieved. The point is, Shecentral.net software maintains operational compliance, as senior management is informed of every infraction or non-conformance that threatens the operations. Moreover, management can rest assured that they are informed of every late instance of conducting the activity, every corrective action and they also know, every eligible person has to be trained to conduct the new practice, as a result of a corrective action. In other words, shecentral.net provides the means for traceability, as it error proofs and provides assurances that any plan (of the PDCA) shall deliver the intended outcome by way of the handheld. Through the shecentral.net embedded electronic tool, Quality Management Systems deliver the operational PSM that Mr. Barab envisages. It is only when the controls of an electronic QMS is in place that the PSM can lay claims of being a 'best practice'. Shecentral.net provides the mechanics to solve the issues raised by Mr. Barab, as the handheld controls engender a risk averse environment, as more 'tech savvy' youths replace an aging work force.

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<sup>1</sup> National Petrochemical and Refiners Association, National Safety Conference, San Antonio, Texas Wednesday, May 19, 2010

<sup>2</sup> OSHA 1910.111 Process Safety Management of Highly Hazardous Chemicals 1993

<sup>3</sup> OSHA Directive CPL 03-00-004 - Petroleum Refinery Process Safety Management National Emphasis Program (Date: 06/07/2007)

<sup>4</sup> ABB Engineering Service Event 'Process Safety Management Best Practice'

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- <sup>5</sup> J van Loon. Quality Management: Quality Assurance, Quality Control, Quality Improvement [Internet]. Version 10. Knol. 2009 Sep 17. Available from: <http://knol.google.com/k/j-van-loon/quality-management/133q5jnxzsxwt/2>
- <sup>6</sup> J van Loon. Quality Management: Quality Assurance, Quality Control, Quality Improvement [Internet]. Version 10. Knol. 2009 Sep 17. Available from: <http://knol.google.com/k/j-van-loon/quality-management/133q5jnxzsxwt/2>
- <sup>7</sup> AS 9100 Clauses 7.1, 8.2.4, 8.5.2
- <sup>8</sup> ISO 9001
- <sup>9</sup> ANSI/AIHA Z10 5.1.2