

INTRODUCING AND USING PROCESS SAFETY PERFORMANCE INDICATORS

HSSE Performance Indicators

**Ashley Haslett, EPC-UK plc
Ben Williams, EPC United Kingdom plc/ EPC Groupe**

ABSTRACT:

Over the last 2-3 years, EPC-UK has identified a need, with benefits to be gained in segregating occupational health and safety from process safety. While many of the systems are now part of the Process Safety Management system that had previously resided in the Occupational Health & Safety Management system, it has been recognised that the hazards, risks and consequences of Process Safety are of a different complexity and magnitude to warrant particular focus by those that own and manage those risks.

The Process Safety Management system is diverse and is critical to managing the major accident hazards. The senior management require an assurance that the system is operating as intended, and if it isn't, they need to be made aware of where issues are occurring. They cannot become overwhelmed by the volume of data that is being generated and recorded on each of the processes, but Process Safety Performance Indicators are in effect, a dashboard of crucial leading and lagging indicators at a high level to provide that assurance. Evidence collected by the Health & Safety Executive in the UK has indicated that using S.P.I.'s has;

- (i) Increased assurance in risk management and protected reputation
- (ii) Demonstrated suitability of risk control systems
- (iii) Avoided discovering weakness through costly incidents
- (iv) Stopped collecting and reporting on performance information that was no longer relevant, thereby saving costs
- (iv) Made better use of collecting information already collected for other purposes.

This presentation will illustrate how PSPI's were developed and are applied within EPC-UK.

INDEX

Abstract	Page 1
Index	Page 2
Introduction	Page 3
Process Safety Management	Page 4 & 5
Process Safety Performance Indicators	Page 6
Using PSPI's in EPC-UK	Page 7 & 8
Summary	Page 9
References	Page 9

INTRODUCTION

Safety Performance Indicators are a means of ensuring that a Process Safety Management System is operating as it is intended, within the designed operating envelope. They are more commonly termed Process Safety Performance Indicators or abbreviated to PSPI's. Before expanding on the concept of PSPI's, it is important to understand what Process Safety is to avoid any misconception that PSPI's are occupational health & safety KPI's by another name. They aren't. Occupational health and safety KPI's such as "Number of Safe Working Days" have no bearing on process safety. Most organisations in the past have failed to recognise the difference between the two, with some being world leaders in occupational health & safety and suffering a major accident on a global media scale before learning that lesson.

Process Safety can be considered separate from occupational health and safety, or it can be effectively managed within an overall safety management system. It is however essential to recognise that process safety is different to occupational health and safety by virtue of the nature of the hazards and the very significant difference in the severity and consequences. They are on a different scale to that of occupational health and safety. Occupational health and safety incidents are typified by high frequency and more often than not, low severity. Conversely, process safety incidents are low frequency events but with very high severity consequences. While the measurement of occupational health and safety performance is important, if put into the context with the level of risk experienced within the explosives industry, Process Safety is critical for individuals, the company, the community within which operations exist and the industry globally. Failures of process safety have the capability to create multiple fatalities, with a greater degree of certainty of doing so should specific circumstances arise. Whereas in occupational incidents, the outcome or severity is more often determined by luck. It is likely that many unsafe conditions and unsafe acts will combine to result in an accident, the outcome of which could range from many potential near miss incidents, some of which may result in injury. Lessons can be learnt from the many near misses, providing the opportunity for lessons to be applied, preventing similar incidents in the future. With process safety, near misses are much less frequent, so the opportunity to learn from experience, preventing major accidents is less.

PROCESS SAFETY MANAGEMENT

EPC-UK have chosen to create a specific Process Safety Management System in order that the elements of that system are distinct and in many cases given special status to emphasize the importance of it to the persons actively engaged in it. An example is "Safety Critical Equipment". This is process equipment that due to the energy input or potentially created that in the event of a single failure could lead to a major accident. A major accident is one that could result in 5 or more fatalities, major asset loss and/or environmental damage. Process safety is also distinct in that it is "owned" by line management whereas occupational health and safety can often be perceived as a shared responsibility between line management and the safety functional.

For any process to operate safely, it must have identified the major hazards and established the barriers that safeguard the major hazards in all of the conditions under which they might arise. Taking an example of a mixer of hazardous substances that when blended will create an explosive. The explosive material will be sensitive to friction, impact, static and heat. The barriers that may have been established could relate to the original design and construction of the mixer such that friction isn't created, the material is transferred in such a manner under procedure that impact is minimised, earthing arrangements prevent static and the temperature is monitored with a visual and audible alarm and automatic cut-out fitted. All of these barriers had been confirmed as working effectively on the day of commissioning, but how does the senior management gain confidence that all of those barriers continue to operate as intended 5 years later. In reality, the design may have needed to be modified 2 years and one month after commissioning. A new Operator was employed 3 years and 6 months after the commissioning, but was he made aware of impact on the explosives? The Maintenance Department had to refurbish the mixer after 3 years and 10 months, but the earthing arrangements weren't tested to confirm that it was fully earthed. Finally, after 4 years and 22 days, the temperature sensor on the mixer was removed from its pocket as it kept alarming and shutting the process down. As a senior manager in your organisation today, how do you know any, or all of these type of instances haven't occurred. What is there in place to indicate to you that all is not as it should be? Within this industry, we must all work under a "healthy unease" as not to do so is to become complacent. We don't and can't know everything, but we have a duty to have the systems in place that inform us of circumstances such as those outlined.

In the example given, the appropriate systems that would need to be established could include the following;

- (i) A Management of Change procedure ensuring that no modifications are made to safety critical equipment from the original design without going through an appropriate risk assessment, approval and testing prior to re-commissioning.
- (ii) Training and competence assessment of operators, ensuring procedures accurately reflect how the tasks are to be carried out, that the operator is trained to carry out the task in accordance with the procedure, at regular intervals, ensuring that the task is carried as the procedure states and changes to the procedure are discussed and fully considered by all relevant parties prior to it being re-issued and the Operators re-trained and checked compliant in it.
- (iii) Including within the Permit to Work sign off that the continuity of the earthing arrangements have been confirmed and that earthing arrangements are included within the Maintenance Department safety critical checks.
- (iv) Establishing frequent routine trips and alarm checks based on risk. Those trips and alarms seen to be essential for the process may be tested daily or weekly, with lessor critical trips being monthly, quarterly or annually. A Safety Impairment procedure would also create a system whereby any safety critical equipment becoming defective must be notified to senior management immediately.

PROCESS SAFETY PERFORMANCE INDICATORS

To establish a system to monitor the effectiveness of the barriers, leading and lagging indicators should be established for each. The leading indicator incorporates information that confirms actions that prevent an incident from occurring are being done. Lagging indicators provide a measure of the “after event” incidents. Examples for the above could be as follows;

Management of Change

Leading Indicator – Target = Zero%

- (i) % of instances in last 12 months when a Management of Change should have been raised and wasn't (identified through audit of MoC)

Lagging Indicator – Target = Zero

- (ii) No. of incidents in last 12 months when near miss or injury / damage occurred due to Management of Change error or omission.

Competence

Leading Indicator – Target = Zero

- (i) Number of Job Cycle Checks scheduled but not conducted

Lagging Indicator – Target = Zero

- (ii) Number of incidents that have occurred in last 12 months when competence has been identified as an Immediate, Intermediation or Root Cause.

Permit to Work

Leading Indicator – Target = 100%

- (i) % of Permit to work certificates adequately specified and undertaken (sample basis only)

Lagging Indicator – Target = Zero

- (ii) Number of incidents arising in last 12 months from permit to work failures

Trips & Alarms

Leading Indicator – Target = 100%

- (i) % of trips and alarm checks completed in month

Lagging Indicator – Target = Zero

- (ii) Number of trips and alarms that have failed to operate as intended

USING PROCESS SAFETY PERFORMANCE INDICATORS IN EPC-UK

The PSPI system would normally not have more than 8 elements, with a leading and lagging indicator for each. The data feeding into these high level indicators could potentially run to 100's per month. Senior management to have visibility at the highest level, with the capability to drill down to the detail to confirm the accuracy of the information being displayed.

PSPI's within EPC-UK where derived from the obligations to submit a SEVESO Safety Report. This entailed a detailed analysis of each hazardous process being operated including Hazard and Operability Studies, Process Risk Assessment and Major Accident Scenarios. The circumstance of each major accident was considered and the contributory factors identified. What could go wrong on each process, what controls are in place to prevent the identified variances, how are those variances prevented and how do we know they shall operate as intended are the questions that need to be answered. The controls considered are not only physical such as indication, calibration and trips and alarms, but all aspects of the Process Safety Management System bringing in human factors, competence, emergency preparedness and audits as examples. Guidance on developing PSPI's was obtained through using the documents referenced at the end of this Paper.

Initially introduced to EPC-UK in 2012, the PSPI's have been developed and refined over the interim period. They are not complete at this stage, but evolving. The elements below have been identified as relevant to our processes and would contribute to the PSPI system, however management systems and reporting arrangements have not been progressed sufficiently to introduce all of these at this stage. There are also more than 8 individual elements which could result in combining some in the background.

- 1 Trips and Alarms
- 2 Control of Contractors
- 3 Permit to Work
- 4 Inspection & Maintenance
- 5 Basis of Safety
- 6 Operating Procedures
- 7 Training & Competence
- 8 Communication
- 9 Emergency Preparedness
- 10 Management of Change

Process Safety is similar to occupational health and safety in that to be effective, it must be led from the top. Process Safety Leadership is fundamental to process safety and PSPI's. What gets measured gets attention.

The importance of PSPI's are recognised in EPC-UK with them being monitored at various management levels in monthly and quarterly cycles. The presentation is done simply in an Microsoft Excel format with conditional formatting applied to display the data in either "green" or "red" cells to immediately indicate whether they are inside or outside of the tolerance set.

2013 EPC-UK PROCESS SAFETY PERFORMANCE INDICATORS DASHBOARD							
September				September			
		RCW	BI			RCW	BI
Trips & alarms				Basis of Safety			
Leading Indicator	% of trips and alarm checks completed in month	100	100	Leading Indicator	% of housekeeping audits completed in period	100%	91%
Lagging Indicator	Number of trips and alarms that have failed to operate as intended	0	0	Lagging Indicator	Number of incidents occurring in last 12 months involving basis of safety	0	0
Control of Contractors				Operating procedures			
Leading Indicator	% of Control of Contractor certificates adequately specified and applied (sample)	100	100	Leading Indicator	% of specified operating procedures not reviewed within last 2 years	0	0
Lagging Indicator	Number of incidents arising in the last 12 months from control of contractor failures	0	0	Lagging Indicator	Number of incidents occurring due to inaccurate operating procedures	0	0
Permit to Work				Emergency preparedness			
Leading Indicator	% of Permit to work certificates adequately specified and undertaken (sample basis)	100	102	Leading Indicator	% of emergency equipment checks completed in period	100%	100%
Lagging Indicator	Number of incidents arising in last 12 months from permit to work failures	0	0	Lagging Indicator	Number of incidents reported in last month when safety critical emergency equipment has been defective and removed from service	0	0
Inspection & Maintenance							
Leading Indicator	% of safety critical checks completed within period	100	100				
Lagging Indicator	Number of unexpected loss of containment incidents in last 12 months	0	0				

SUMMARY

PSPI's can be used to cascade and influence all work undertaken on site by ensuring adherence and continuous improvement to the Process Safety Management System, with 360 degree feedback at all levels of the business. For PSPI's to operate and be used to provide the assurance that they are designed to fulfil, the elements that provide the data must be operating effectively. While all are subject to a Process Safety Audit Schedule and annual Review, the significance of the Process Safety Management system must be understood at all levels throughout the organisation. It is in everyone's interest to ensure that issues occurring are identified and appropriate steps taken to rectify them at the earliest opportunity. The consequences of not doing so are too severe to consider otherwise.

REFERENCES

- (1) Developing Process Safety Indicators – A Step by Step Guide, HSG254, HSE Books, ISBN 0 7176 6180 6
- (2) Key Process Safety Performance Indicators – A short guide for Directors and CEO's
- (3) Process Safety Performance Indicators – PSPI's (March & McLellan Companies)
- (4) Process Safety – Recommended Practice in Key Performance Indicators, Report No. 456, November 2011, OGP International Association of Oil and Gas Producers