SAFETY PERFORMANCE INDICATORS FOR THE EXPLOSIVES INDUSTRY

A Report on an Initiative to Create a Database of Safety Performance Indicators (SPIs) in the UK

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INTRODUCTION

In July 2011, a group was formed comprising representatives from the major UK explosives industry participants; Chemring, BAE Systems, AWE, Roxel, EPC, Qinetiq, Orica, the Ministry of Defence and the UK regulator (HSE) to share experiences and current practice in the use of Safety Performance Indicators (SPIs). The group also met representatives from the oil and gas and electrical distribution industries to gain a wider view.

Their aim was not to produce new guidance or research; there is plenty of that about already there is plenty of that about already (OECD, HSG254, CCPS, Step Change in Safety, API, EPSC etc.).

A more interesting question is; what works?

Their aim, therefore, was to gather and publish a database of real examples as a means of encouraging wider adoption of SPIs. A business that has a performance issue can look through the examples and try to spot an indicator that might work for them. If necessary, the provider of the entry can be contacted for further information on their experiences and challenges.

SOME TERMS AND DEFINITIONS

Safety performance indicators

The OECD (2008) came up with a useful definition: *"The term safety performance indicators is used to provide observable measures that provide insights into the concept of safety, which is inherently difficult to measure"*

Leading v lagging

Leading indicators measure activities that prevent incidents whereas lagging indicators tend to measure the frequency of incidents or the consequence. Leading and lagging indicators are both important though leading indicators tend to be more varied and often less accurate. However, some can be argued to be either, like, for example, near misses and so this debate was avoided and the SPIs that were collected have not be categorised this way.

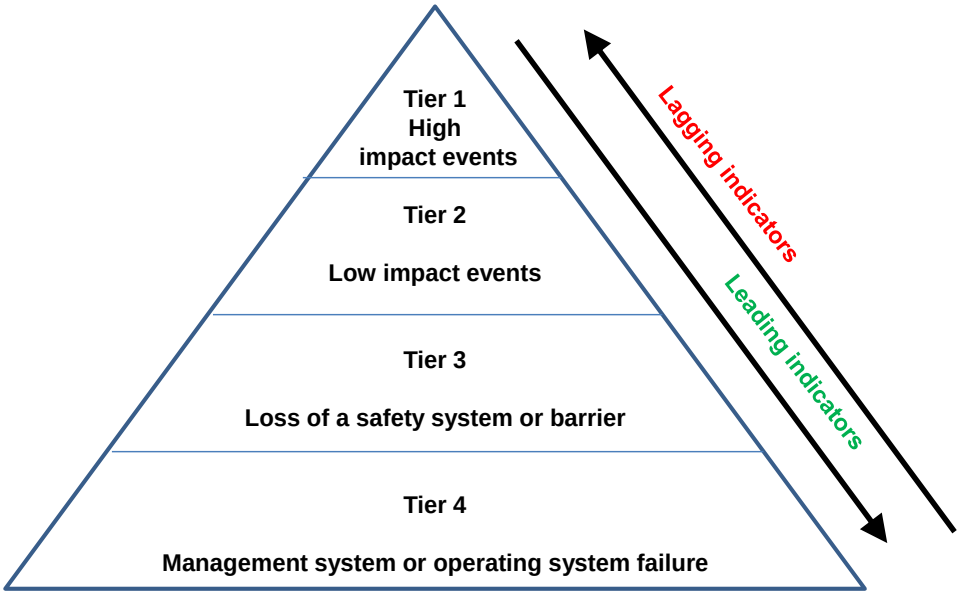
Process safety v Personal (or occupational) safety

Safety is commonly measured using workforce injury statistics (e.g. lost time incidents) but these imply nothing about how well process safety is being managed. Major hazards tend to have high consequence, low frequency events. An airline that had an excellent personal safety record amongst its baggage handlers, ticketing staff or maintenance personnel would not use this data to judge that the aircraft was safe to fly.

From the Baker report:

> *Personal safety hazards give rise to incidents such as slips, falls and strains that primarily affect one worker for each occurrence. Process safety hazards give rise to major accidents involving the release of energy or potentially dangerous materials, or both, which can result in multiple injuries and fatalities as well as substantial economic, property and environmental damage.*

The American Petroleum Institute (API) in their API 754 Recommenced Practice provided this useful model of process safety indicators in which lagging indicators tend to be at the top of the pyramid and leading indicators tend to be towards the bottom:



In a major hazard industry something is needed that demonstrates that the planned prevention and consequence barriers are in place and are working. SPIs must provide assurance that major hazards are being managed.

We therefore wanted to be sure to get as many ***process*** safety indicators as possible.

COLLECTING THE INDICATORS

The Stakeholder Forum participants ranged in size and scope of operations; and included multinational PLCs, UK subsidiaries of international groups and government organisations.

All the participants were at a different level of understanding and implementation of safety performance indicators, although all companies had safety management systems in place.

Previous work has been carried out within the explosives sector (Threlfall 2012, HSE 2010, Sugden 2009 & Ferguson 2008) and other industries (Lauder 2012, Beale 2009, HSE 2006, 2011a, 2011b, IAEA 2000)

The group held several sessions each focusing in on one of the following subject areas; leadership, culture, process safety, competence, audit and compliance. The team collected all indicators in use in participant companies and others that representatives were aware of.

We recorded 135 different indicators and the following noted for each in an Excel spread sheet:

- The SPI;
- The organisation using it;
- Background;
- What it is measuring;
- Typical sources of data;
- The status of the SPI (new, embedded or discontinued);
- Frequency of reporting;
- The amount of effort required to produce the report;
- Target stakeholders;
- Method of presentation;
- Does this indicator influence the actions of target stakeholders?
- How easy is it for senior management to influence the indicator;
- Safety and other business benefits;
- Problems or challenges.

We chose Excel rather than something more advanced to ensure that the information was accessible to all sizes of organisation.

The maturity of the indicators varies. Some have been recently introduced and their value not proven and there are others that have stood the test of time.

The group considered the amount of effort required to collect the data, the ease of verification (during an audit for instance) and the impact on management when presented. They had to be credible, compelling and drive improvement.

The spread sheet looks like this:

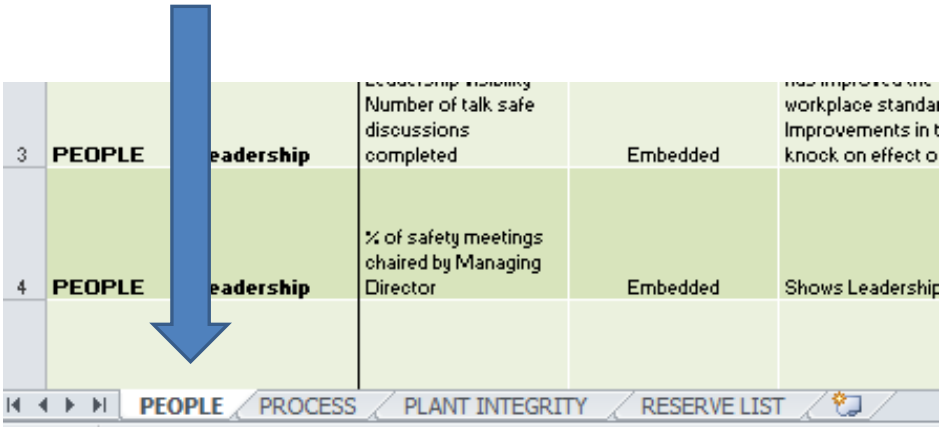
SPI RE: PEOPLE, PROCESS OR PLANT INTEGRITY	SPI CATEGORY	SPI	STATUS OF SPI (Select new, embedded or discontinued)	SAFETY BENEFITS AND OTHER BUSINESS BENEFITS	PROBLEMS OR CHALLENGES	BACKGROUND/CONTEXT	TYPICAL SOURCES OF DATA	HOW MUCH EFFORT IS REQUIRED TO PRODUCE THE REPORT? (Select Easy = Fully automated, Medium = semi-automated, Difficult = data manipulation and consultation required)	HOW IS THE DATA PRESENTED TO MANAGEMENT?	HOW EASY IS IT FOR SENIOR MANANGEMENT TO INFLUENCE THE INDICATOR?
PEOPLE	Leadership	Number of senior executive tours completed (leadership visibility)	Embedded	1.Demonstrates to the workforce that the directors are interested and care. 2.Promotes an understanding of the workplace issues to the . Direotors. 3.Improves communication and trust. 4. Directors can challenge the standards and promote improvement in the workplace. Improved communication and trust helps all aspects of the business	The challenge lies with the management team having sufficient time to undertake the inspections, audits and visits.	This is about completion of one monthly workplace visit, audit or inspection by each director. The visibility, leadership and standard setting delivered by senior management through programmed workplace visits, inspections and audits.	Directors contacted monthly	Contacting each director monthly. Medium	Number of inspections, visits and audits to programme with a traffic light	Requires complete commitment of directors
PEOPLE	Leadership	Leadership visibility- Number of talk safe discussions completed	Embedded	There are about 1200 'talk safe' discussions at the workplace recorded per month. This has improved the safety culture and workplace standards. Improvements in the safety culture have a knock on effect on quality.	Difficult as it requires extensive training programme and a large commitment Keeping the programme going and the safety discussions to a high enough quality Each person undertaking the talk safe discussion will spend 4 to 8 hours per month.	This is about completion of 4 talk safe discussions monthly by directors, managers, supervisors and other personnel. 300 people have been trained to undertake discussions at the workplace on how safety can be improved through individual ownership and responsibility for themselves and others.	Individual enters discussion on a data base.	Report collation very little once data base set up. Easy	Balanced scorecard with numbers and traffic lights. Periodic reports on the type of safety issues discussed. Listing of the 300 participants and their 'talk safe discussions' to programme	Easy
PEOPLE	Leadership	% of safety meetings chaired by Managing Director	Embedded	Shows Leadership and commitment	None	MD should chair all safety meetings to demonstrate commitment	Minutes of meetings	Easy	Traffic lights and charts	Easy
						This measures management				

Some of the 135 SPIs were very specific to an organisation, were difficult to manage, had overlap or were of less value. However, we did not want to lose this information and so these were placed into a 'Reserve List'.

The remaining 80 SPIs are organised into separate sheets within Excel as follows:

- People (leadership, resources, culture, training and competence);
- Processes (incident reporting, audits, procedures, risk assessments, alarms, contractor safety, emergency preparedness, management of change, permits to work, waste, etc.);
- Plant Integrity (planned and reactive maintenance, workplace inspections, safety critical equipment identification).

The Excel tabs look like this:



EXAMPLES FROM THE DATABASE

People

Leadership

Senior management (Executive level) safety engagement is being measured at several sites, by auditing workplace visits or delivery of 'toolbox' safety talks against a target set by the board. The quality and effectiveness of these visits is very hard to assess, it must also be supported by active promotion of a process safety throughout the organization.

At a local management / supervisory level measurement of 'safety action' close out against action raised during inspections, is used widely across many participants.

Safety Culture

Determining the workplace safety culture through employee surveys or observational studies has proved very difficult and can be very subjective (employee short term dissatisfaction). Some of the larger organisations in the forum have used Pulse type surveys and the HSL / HSE Safety Climate tool questionnaire approach.

Training and Competence

There were very many attempts to find suitable measures, with over twenty options being explored. Monitoring training attendance and 'knowledge' is relatively easy! Measuring competence and attitude is very difficult. Most companies had a variety of measures for SHE training attendance (operators) and SHE training delivered (management). Where suitable HR resource is available then an audit of operators training record against assigned job responsibilities and activities can be done.

Process

Near Miss Reporting

Near miss reporting was one of the few measures with universal appeal and existing recording systems, as a key source of information from the 'bottom' of the accident pyramid. This acts as a very powerful leading indicator however the Forum found that where targets for the number of reports have been set then this can generate trivial reports that obscure more serious incidents.

The Near Miss reporting system can also be mined to help root cause analysis, and where past accident studies have identified common causes these can be reported separately.
Recording Lost Time Accidents (LTAs) and Accident Frequency Rates acts as a Lagging indicator, the reliance on accident data in the past has distracted organisations from fundamental issues of process safety (Baker (2007).

At the level between Near Miss and Minor Incidents – Loss of Containment incidents were selected to add detail to near miss reporting. Where a process involves hazardous materials then a loss of containment is a very common precursor to a major accident.

Risk Assessments

The maintenance of a RA review schedule with indicators based on the meeting a required number or proportion of reviews was another 'universal' indicator. The terminology and the management systems differed between participants, depending on their access to database and document management systems.

Where forum participants had the resource (and technical knowledge) available then RA 'quality' was measured in addition. The maintenance of 'suitable and sufficient' risk assessments is a legislative requirement so an established process is in place for all companies involved in the forum.

Contractor Safety

Only two companies have defined indicators for the performance of contractor safety both rely on an audit scheme by the companies of the contractors. One company reaches a safety performance score by observation of adherence to method statements in the workplace and the other measures incidents with contractors as causal factor. Checks are also made of a contractor's safety certification and equipment.

Emergency Preparedness

Although not an accident prevention barrier, the quality and rapidity of emergency response can mitigate incidents and prevent escalation. Several companies have indicators based on adherence to exercise schedule for fire and evacuation response.

Management of Change

The development of SPIs around Management of Change was judged difficult by all the participants. All relied on an audit of the process, however this is post process so a lagging indicator and also resource intensive. Can we find a way to bring it forward to a leading indicator?

Permits to Work

The performance of the permitting system is assessed by an audit review of permits in place or after 'completion'. As with all the measures that rely on collecting data through audits and inspection this requires a significant input of time by competent assessors. It is also a backward looking lagging indicator.

Plant Integrity

Where the Forum companies maintained a database PPM management system this provided a rich source of data for developing metrics. Outstanding tasks and overdue priority (safety critical) items provide a simple measure. Service and calibration schedules for instruments are also a useful leading indicator, plant control and alarms need accurate inputs to function correctly.

Several companies run campaign or batch type processes where pre-run / pre-operation inspection scores can be used instead of a PPM schedule.

The performance of the PPM system may also be monitored through such availability measures such as Time to Repair, Lost time or Breakdown rate. Maintenance is one of the most hazardous operations and is a contributory factor to many accidents, unplanned and emergency maintenance more so.

The explosives industry has been through phases of expansion and contraction in the past, and in general is operating ageing plant across a shrinking number of sites. The management ageing plant is central to maintaining safe operation; alongside PPM the use of NDT inspection to determine integrity of assets can provide very valuable indicators. Where an asset has an expected rate of change for integrity (e.g. wall thickness or vibration) NDT results can feed directly into a graphical plot of results (change over time), out of tolerance results can be seen immediately.

DISCUSSION

We discovered that:

- Leading indicators are harder to collect – they can take a lot of time and effort;
- It is very difficult for an external group; for example, corporate auditors, to verify SPI data;
- Setting targets for lagging SPIs is a problem. It is a little easier for leading indicators (but harder to verify that target performance has been achieved);
- It is more difficult to implement SPIs around ‘people’ issues;
- The amount of resource required for SPI implementation and data collection is significant and therefore it is important to implement those that provide the greatest impact.

We discussed the possibility of having one or two common indicators that could be collected and reported by each business to provide the basis for benchmarking and comparison but, at the time of writing, this has not progressed.

SUMMARY

The purpose of this exercise was not to prescribe SPIs; it is for the individual company to consider what might work best for them.

We aimed to:

- Provide the explosives industry with a database and thereby inform the practical implementation of SPIs;
- Encourage wider adoption of SPIs among industry.

When considering the adoption of a set of PSPI the following should be taken into account:

- Do you collect this data (or something similar) already?
- Who collects the data – is it independent?
- How and by whom can the SPIs be influenced?

The choice of SPIs may need to change over time, either because the indicator stays persistently healthy (not a good sign) or the activities across the organisation change. All the participants found difficulties with setting and monitoring some SPIs, especially for human factors.

The data base is freely available and can be obtained from a group participant company or from the UK HSE Explosives Industry SPI Web Community site.

The group continues on a correspondence basis and would welcome additions, corrections or observations.

ACKNOWLEDGEMENTS

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