

Application of performance indicators in the explosives sectors

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Application of performance indicators in the explosives sectors

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Performance Indicators are increasingly being used in a range of environments as an aid to identifying and resolving safety and operational issues. Recent incident investigations and guidance promote enhancements to the indicator regimes to ensure that a balanced approach is adopted that enables organisations to monitor both the sustained use of management controls and the effectiveness of those controls in maintaining safety.

The Health and Safety Executive (HSE) commissioned this report to:

- identify the extent to which the concept of dual assurance is understood and applied within a sample industry;
- identify industry representatives' opinion in relation to potential indicators that would correlate with the Major Hazard Performance Indicator Framework proposed by HSL; and
- identify a process that can be used to exemplify HSE guidance HSG254 in the derivation of key performance indicators in the explosives industry.

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The views expressed in their responses are the opinions of their employees in relation to specific questions. They do not necessarily reflect the policy or performance of their organisations.

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EXECUTIVE SUMMARY

Performance Indicators are increasingly being used in a range of environments as an aid to identifying and resolving safety and operational issues. Recent incident investigations and guidance promote enhancements to the indicator regimes to ensure that a balanced approach is adopted that enables organisations to monitor both the sustained use of management controls and the effectiveness of those controls in maintaining safety. The Health and Safety Executive (HSE) commissioned this report to:

- Identify the extent to which the concept of dual assurance is understood and applied within a sample industry;
- Identify industry representatives' opinion in relation to potential indicators that would correlate with the Major Hazard Performance Indicator Framework proposed by HSL;
- Identify a process that can be used to exemplify HSE guidance HSG254 in the derivation of key performance indicators in the explosives industry.

Main Findings

In order to establish the current status of industry application and opinion, a questionnaire-based approach was developed and completed by the participating organisations during site-specific workshops attended by HSE and Health and Safety Laboratory (HSL) personnel.

The approach taken by the participating organisations supports the concept highlighted in HSG254, that key performance indicators should promote activity to attain success. All organisations had considered performance indicators and presented systems for the capture and monitoring of performance with varying degrees of sophistication, depth and spread of cover.

All organisations reported that as much of their activity was based on discrete batch processes the most significant areas of vulnerability revolved around the competence and attitude of those undertaking safety critical activity.

The explosives industry, as a licensed industry, has well defined requirements and a reasonable level of regulatory attention. The study team observed that considerable difficulty was encountered in the determination of targets for leading indicator elements: for most of the activities undertaken, anything less than 100% was considered unacceptable and was generally managed to resolution within very short timescales.

Recommendations

Explosives industry organisations should make use of HSG254 in order to ensure that they have suitable indicators in place. The indicators postulated in this report may provide additional assistance to other, similar organisations.

Work to develop a sector specific example should be considered by HSE. This should build on the examples and indicators identified in this study and use a scenario that encapsulates the types of activities common to a large number of the organisations (e.g. transportation and storage of explosives).

A number of areas of the questionnaire need minor refinement to enable its use within other organisations and sectors as a means to assist in the development of indicators. It is recommended that this be undertaken to aid a common understanding of the question intent and remove any ambiguity before any wider distribution is undertaken.

1 INTRODUCTION

Performance Indicators are increasingly being used in a range of environments as an aid to identifying and resolving safety and operational issues. Recent incident investigations and guidance promote enhancements to the indicator regimes to ensure that a balanced approach is adopted that enables organisations to monitor both the sustained use of management controls and the effectiveness of those controls in maintaining safety. This is known as dual assurance. Further information on this concept is provided in HSE's guidance on process indicators HSG254.

This project was commissioned jointly between the major hazards strategic programme board and the Explosives Inspectorate of HSE. The purpose of this small study was to:

- Identify the extent to which the concept of dual assurance is understood and applied within a sample industry;
- Identify industry representatives' opinion in relation to potential indicators that would correlate with the Major Hazard Performance Indicator Framework proposed by HSL;
- Identify a process that can be used to exemplify HSE guidance HSG254 in the derivation of key performance indicators in the explosives industry.

The work takes forward elements of previous HSL research (Birkbeck and Ferguson 2006, Sugden et al 2006 and Keeley 2005) and compliments existing work being undertaken by the Explosives Inspectorate and the Explosives Industry Forum to improve the use of performance indicators across the sector.

2 METHODOLOGY

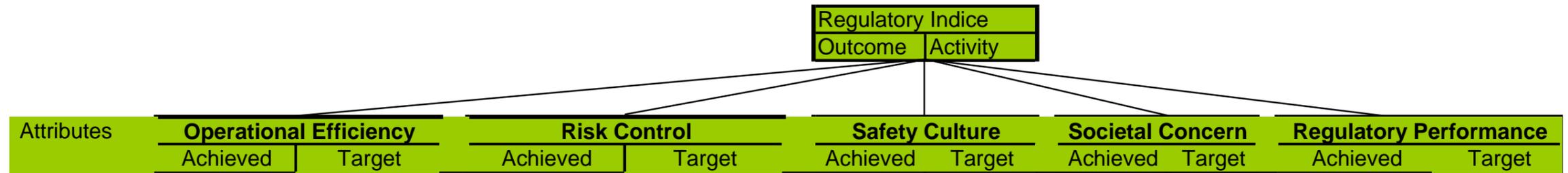
In order to establish the type and extent of indicators currently in place within industry a range of issues were explored through a questionnaire based approach. The guidance document HSG254 was used to guide the development of the project. The stages the guidance recommends in relation to the derivation of performance indicators are as follows:

| | |
|--|--|
| Decide the scope of the measurement system. Consider what can go wrong and where | Select the organisational level |
| | Identify the scope of the measurement system: <ul style="list-style-type: none"> ▪ Identify incident scenarios – what can go wrong? ▪ Identify the immediate causes of hazard scenarios ▪ Review performance and non-conformances |
| Identify the risk control systems in place to prevent a major accident. Decide on the outcomes for each and set a lagging indicator | What risk control systems are in place? |
| | Describe the outcome |
| | Set a lagging indicator |
| | Follow up derivations from the outcome |
| Identify the critical elements of each risk control system (i.e. those actions or processes which must function correctly to deliver the outcomes) and set leading indicators | What are the most important parts of the risk control system? |
| | Set leading indicators |
| | Set tolerances |
| | Follow up derivations from tolerances |
| Establish the data collection and reporting system | Collect information – ensure information/unit of measurement is available or can be established |
| | Decide on presentation format |
| Review | Review performance of the process management system |
| | Review the scope of the indicators |
| | Review the tolerances |

The questionnaire is therefore structured around the early stages of the process:

- Determining the scope of the indicators;
- Identifying the important control systems/ areas;
- Providing an indication of the lagging indicators that are in place, based on the desired outcome (this is often compliance with relevant regulation); and
- Evaluating potential leading and lagging indicators based on the degree of usefulness to the organisation.

Having established a framework for the derivation of major hazard performance indicators in an earlier project (Birkbeck and Ferguson 2006) a suite of potential measures was developed. These indicators were grouped according to the framework components under the “low risk” and “operational efficiency” categories. Figure 1 details this framework.



Top Level

Operational Efficiency and Risk Control Attribute Indicators

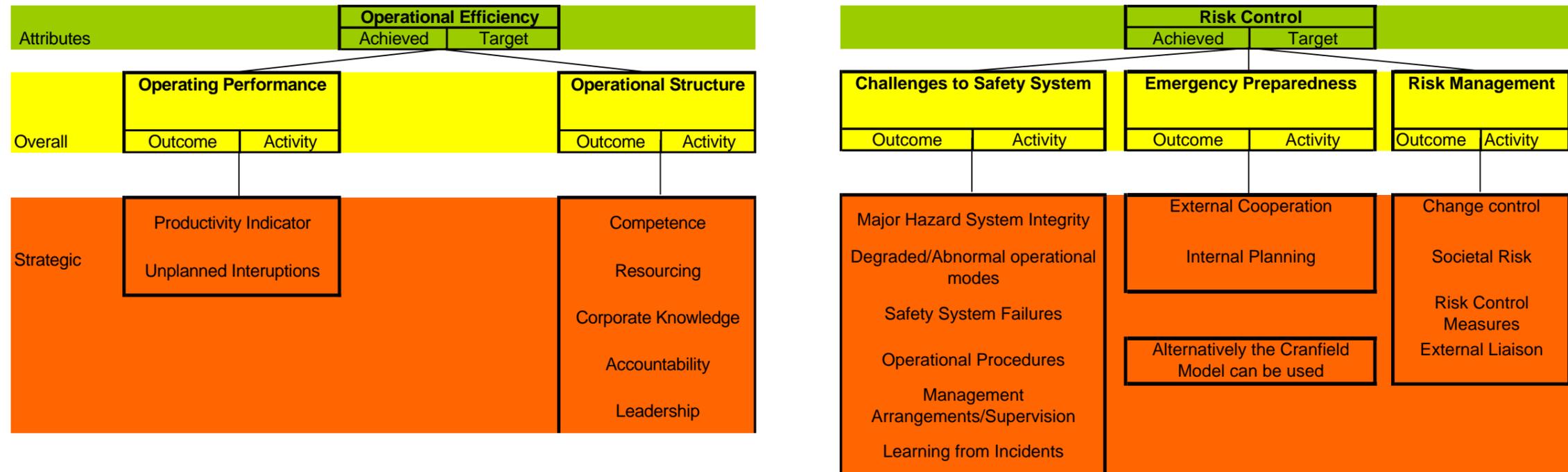


Figure 1 Performance Indicator Framework as proposed by Birkbeck and Ferguson (2006)

These areas were studied and a number of indicators were elucidated using the literature from the previous study, Birkbeck and Ferguson (2006). In this study the potential indicators were incorporated into a Microsoft Excel based question set together with a rating scale based on two factors.

These factors were:

- The ease of collecting the data that would underpin the indicator; and
- The degree of usefulness the indicator would have in relation to the management of safety performance within the organisation at a site level.

It was decided that, by deriving indicators and then asking organisations to evaluate them provided a means to establish whether it is feasible to utilise common indicators within the major hazard performance indicator framework. If this was possible then it would facilitate benchmarking within the industry sector.

In addition to the indicator evaluation, a number of generic questions were used to identify and rank the risk control areas in terms of the vulnerability and criticality of the system. This correlates with the approach recommended by HSE (2006) for devising indicators. The questions were intended to explore the risk management controls from a ‘Swiss cheese model’ (defence in depth) perspective as detailed in Figure 2.

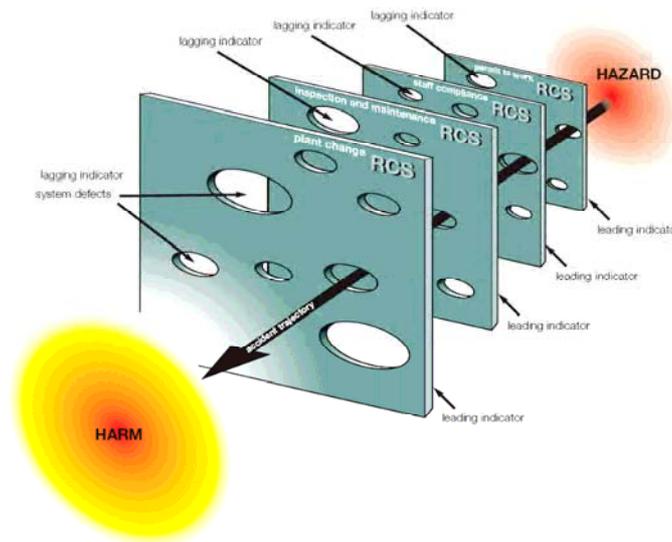


Figure 2 Reason's model of accident causation

A copy of the questionnaire developed is provided in Appendix 1.

It did not prove practicable to pilot or 'test' the questionnaire prior to distribution to the volunteer organisations. Because of this, arrangements were made to run through the questionnaire on site with each organisation to ensure that the questionnaire was completed consistently and so that any issues with the construction of the questionnaire could be identified. A member of the HSL project team visited each of the volunteer sites to facilitate completion of the questionnaire. For three of the visits, the responsible HSE site inspector also attended the meetings. For two visits the Operational Policy Inspector for explosives was also in attendance.

Whilst the volunteer organisations selected are part of the explosives sector and operate under a licensing system, they all undertake a different range of activities. These activities broadly include:

- Transporting explosives to and from the site;
- Filling of explosives articles;
- Mixing of explosive substances;
- Research and development of explosives; and
- Storage of completed explosive products.

An evaluation of the completed questionnaires in relation to the performance indicators is provided in Appendix 2. The responses are deliberately not attributable to the individual companies.

3 RESULTS

3.1 RISK CONTROLS AND CURRENT PERFORMANCE MEASURES

The first part of the questionnaire provided an overview of the type of control systems in place together with an indication of the degree of importance they have in relation to directly preventing a multiple fatality accident event.

It should be noted that the results are the opinion of the parties completing the questionnaire. As such they do not necessarily reflect the views of the organisations and have not been subject to any inspection to validate the opinions put forward.

As the questionnaire is designed for use in more than one industry sector and the focus of this trial has been the explosives sector, the initial questions provided a similar response from all parties.

3.1.1 Questions 1 and 2 – What best describes your industry?

Most respondents reported explosive manipulation, storage and transportation as an aspect of their activity. Production of very limited amounts was reported for one organisation. All of these activities are regulated by HSE as part of a licensing arrangement. This results in a range of control measures that are mandated on the organisation including:

- Where explosives can be stored;
- Control of the amount stored in any specific location;
- The emergency arrangements; and
- The position of the operation in relation to residential areas.

All of these act to reduce the risk presented by the site and its activities.

3.1.2 Question 3 – What are the main hazards controlled?

All respondents, as expected, reported explosion. One respondent suggested fire as an additional hazard although this would often form a precursor or consequential element to a major accident scenario at the site. No further analysis of this issue was considered necessary.

3.1.3 Question 4 – Rank the importance of the following controls in relation to major hazard risk

The wording of this question seemed to cause some confusion among respondents. The key concern being that all of the controls can be perceived to be of critical importance because they all form part of the risk control system. The intent of the question was to define how critical the control was in relation to the immediate control of a hazard (i.e. how close to the harm the barrier is using Reason's model) and the vulnerability of the management system to deterioration. As the questionnaire was discussed with each organisation, it was possible to revise the relative importance.

The questionnaire will be redesigned to convey this message and to encourage a ranking in order from 1 – 10 to allow the relative importance of each control to be identified more easily.

The responses produced a fairly consistent trend. All respondents considered that operational procedures were of critical importance, again reflecting the dependence of the activities on the competence and complicity of operators. The **operational procedures** were complimented by a number of other areas: **risk assessment, employee attitude and leadership**. All of these areas were recorded by the respondents as either critical or highly important and were often qualified with statements such as “[there is an emphasis on] *the importance of doing things right*” and the “*attitude towards procedure/terms of reference*” were recorded in relation to employee attitude. “*Identification of departures and need to stop*”, “[leadership is] *important for culture*” and “[there is] *vulnerability around delegation, ownership and conflicting interests*” were comments recorded that reflected the need for effective **leadership** in influencing employee attitude, especially in relation to compliance with operational procedures.

Communication was considered to be critical/highly important for two organisations but less so for the others, although one of these organisations suggested that leadership communication was highly important.

Control of Contractors is often reported as an area of concern in other major hazard areas with significant vulnerability and potential for major hazard incidents (e.g. Hatfield in the railway sector). Most of the organisations used contractors in non-critical activities and one organisation reported that their own employees cleared areas of any explosives before contractors were permitted to commence work. One organisation reported vulnerabilities around the use of agency workers, especially in relation to perception of risk and compliance with operational procedures.

Effective **emergency arrangements** are a Control of Major Accident Hazards (COMAH) regulation requirement, reflecting the importance attached to them. However, because of this recognition and the associated regulatory oversight, the risk control arrangements were not considered by any organisation to be especially vulnerable. This is an observation that can be argued for several of the control areas but was especially relevant here.

The adequacy of arrangements and the level of compliance was undertaken using **audits** and reviews of varying nature in each of the organisations. Some organisations reported its importance in relation to ensuring “supervisory resilience”. This was considered important in maintaining a positive safety culture and reinforcing leadership. A number of organisations reported that senior managers undertake a number of audits thus providing both visibility and a review of systems in place at all levels in the organisation.

Identification of potential vulnerabilities in the safety management system

Difficulty was reported by the participants in relation to the degree of specificity associated with each of the organisation’s processes. The organisations involved reported that they often operated bespoke batch processes on an infrequent basis. Discussions held during the onsite workshops explored the implications of this in order to attempt to identify vulnerabilities in the system. As mentioned previously, all organisations reported that their high degree of dependence on operational procedures meant that competence and compliance was a key area. This was especially important due to the variety of processes used. It would therefore be reasonable to infer that, using the HSE guidance (HSE, 2006) this area should focus on the identification of the efficacy and efficiency of these arrangements.

Potential areas for performance indicator development

The completion of the questionnaire initiated a wider discussion on a number of occasions. From this it was possible to gain some insight into the safety management system and any potential vulnerability that was perceived. The following diagram summarises the main findings of this question and reflects where the risk controls were considered to be most critical, and potentially most vulnerable. The diagram is based on Reason's model of resilience from a 2006 presentation. The concept of resilience correlates well with the approach in HSG254, i.e. the sustained management of the vulnerabilities of the critical major hazard controls allows the interface between the management system and the operating environment to be effective in maintaining the safety of the organisation and mitigate the effects of any incident i.e. providing resilience.

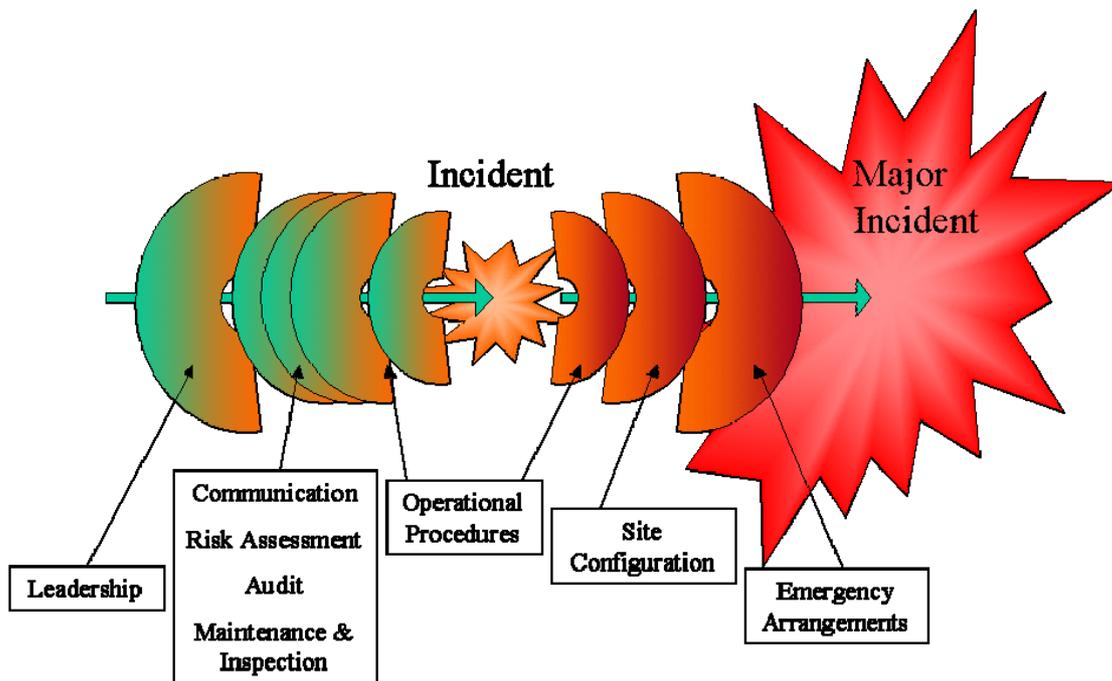


Figure 3 Diagrammatic representation of the criticality of risk controls systems

Based on the responses to question 4, it is considered that the key areas that merit consideration in relation to the development of performance indicators in the explosives industry would be:

- Design, operational and other procedures (processes);
- Maintenance and inspection ;
- Leadership;
- Employee attitude;
- Change control;
- Control of contractors; and
- Audit

The principal areas for consideration in developing key performance indicators would be operational procedures and employee attitude as they were considered to be critical to sustained safety performance and offer the greatest potential for unidentified degradation over a period of time (i.e. are most vulnerable). These are discussed in further detail later in the report.

What is clear from the visits and the surveys is the fact that the competency of the individuals is key, in terms of complying with operational and inspection/maintenance procedures, in relation to the development of improved controls and in the identification of scenarios where operational procedures had the potential to lead to undesirable consequences.

3.1.4 Questions 5 and 6, Leading and Lagging Safety Performance Indicators that are in place

The purpose of these questions was to explore what information is collected by organisations in relation to performance indicators and how often the data is collected/reviewed in order to identify trends.

General Observations:

One of the organisations used a hierarchical system, similar in structure to that described in Birkbeck and Ferguson (2006). Each area of risk control was related to an accountable person and a procedure. Performance criteria were set for each area and reporting requirements put in place. A traffic light system enabled issues to be quickly identified from a summary screen and traced through to the relevant owner and procedure. It was considered that this approach offered an effective means to identify trends and to quickly establish where the causes of any potential problems are occurring. Other organisations use a balanced scorecard approach to report performance information to directors.

The approach of one organisation is worth noting as it offers a potentially effective approach to the 'sampling' of the control areas to enable a regular, ongoing review of the efficacy and efficiency of control measures. This organisation uses an audit type approach, using a predetermined plan to identify the area to be covered and with what level of frequency/depth but does not specify when the audit will be undertaken. It was our understanding that the plan was not widely distributed and therefore an area of the organisation could not predict when they would be reviewed. Participation by all in the area being reviewed is encouraged and is designed to identify where deficiencies in the control area are arising. Complementing this process are a number of unannounced monitoring and inspection regimes including: compliance verification, housekeeping and operational safety. These utilise plans to sample control areas from a more formal perspective. This approach can potentially provide data on the arrangements that are in place: however, to gain the greatest benefit it is important to ensure that the areas targeted are correctly identified as critical and vulnerable before they were utilised in key performance indicators for the organisation.

Operational Procedures:

All but one organisation reported using both leading and lagging indicators to monitor compliance with operational procedures. Reviews of leading indicators were mainly undertaken against a predetermined plan to evaluate compliance and also review the suitability of the procedures to ensure they provided the optimal method of work. This was considered to present good practice and reflected an understanding of where the system was potentially most vulnerable. The methods of obtaining leading indicator data usually involved an audit/inspection against a predefined plan that determined what areas would be looked at to ensure adequate coverage over a six or twelve month cycle. Types of leading indicators used were: compliance verification plans completed; safety, health and environmental inspections undertaken against plan; and unannounced inspections/monitoring completed against a predetermined plan. The outcomes of many of the activities were reviewed on a monthly basis

using a hierarchical approach. A number of the organisations reported that they were in the process of, or already had, implemented a competence management framework.

In relation to lagging indicators, a number of approaches were used: the most common being the review of accidents, incidents and near misses which presented a mechanism to establish root causes and any underlying trends. One organisation reported that it assessed the adequacy of investigations to ensure that investigations were completed to sufficient quality, thus ensuring that the causation data was sufficiently robust to enable adverse trends in relation to operational procedures to be identified. Some organisations reported that abnormal/unusual occurrences were also reviewed to provide more data and to act as an early identification of any reduction in the adequacy of a control area. The use of lagging indicators relying on incidents/unusual occurrences was observed as the means of establishing trends in the efficacy of a number of control areas. Most organisations considered that they had a positive reporting culture that ensured the majority of incidents/occurrences were reported. Review of lagging indicators for operational procedure efficacy was usually undertaken on a monthly basis.

The approach observed by the organisations seems to support the concept highlighted in HSG254 that key performance indicators should promote activity to attain success. Success in relation to this area would be compliance with procedures but with sufficient competence exhibited to recognise when the procedure is creating a hazard and stop activities in a safe manner until the situation is resolved. This success criterion also incorporates the employee attitude and leadership control areas.

Instrumentation and Alarms:

It was reported by most organisations that inspections were undertaken on a weekly basis against a defined plan and that these were monitored and reviewed on a regular (weekly/monthly) basis. Efficacy of the instrumentation and alarm systems was undertaken using the abnormal occurrence/near miss reporting systems. The other organisations did not regularly review this aspect because of the nature of equipment used. No organisation reported separately reviewing the number of faults identified on inspection although this would not be surprising given the relatively low importance reported for this area in question 4 due to the batch process operations used and the high degree of inherent manual intervention.

Change control:

All organisations reported the use of a change control process to assess the implications of operational and engineering change. A number of approaches were used to monitor this area from a leading indicator perspective. Two organisations used specific audits to determine where any changes had been undertaken without the change being assessed using a change control process. Another organisation reported that corrective action requests were reviewed to determine whether a change control procedure had been followed: they stated that a measure of the number of changes planned and assessed prior to change was monitored. This was considered to represent good practice as it encouraged behaviours towards the achievement of success (changes formally assessed) and permitted any potential degradation (or increasing demand for change control) to be identified, investigated and appropriately resolved.

Considerable difficulty was reported in monitoring the efficacy of controls in this area, the main issue being how to efficiently monitor whether any changes have occurred without following a change control process (as this would require audits/inspections of all processes on a regular basis). One organisation reported using their abnormal event/unusual occurrence system to identify where change management was a contributory element to any incident. This was considered to compliment the leading indicators without requiring additional data collection.

Maintenance and Inspection:

These control areas received a large variety of approaches to measurement. Leading indicators were drawn out from ad hoc audits, monitoring preventative maintenance and inspection undertaken against a predefined plan and number of maintenance activities completed within agreed timescales. Lagging indicators generally identified where failures had occurred either due to an incident or where corrective maintenance was required as a consequence of inspection (although the number of unresolved corrective maintenance issues could be considered to be a leading indicator). One organisation reported monitoring the numbers of unresolved maintenance issues.

Analysis of reliability data was used to determine both operational performance and assurance of safety within one organisation although they did not use the data to create key performance indicators at the time of completing the questionnaire.

Emergency Arrangements:

Testing of emergency arrangements is a requirement for Top Tier sites as part of the COMAH regime. Most leading indicators focused on ensuring that exercises were completed on time. Testing of on-site emergency arrangements is only a requirement for top tier COMAH sites, although some other sites do have emergency plans that are tested. Monitoring and review was between monthly and quarterly.

The adequacy of the arrangements was reviewed post exercise in all organisations but one organisation reported the use of pass criteria. This involved identifying the number and nature of deficiencies and subjectively evaluating them. Based on this an exercise would either be classed as having passed or failed. In the event of the latter corrective action is undertaken to resolve the issue. As with other good performance indicators, this approach provided an impetus to meet a defined objective (i.e. strive to a predetermined successful outcome) and also allowed any degradation in performance to be easily identified.

Communication:

Responses to this question for this area revealed that the term 'communication' was ambiguous. One organisation took it to mean the onsite communication arrangements whereas others considered it to be an element of a positive safety culture through either two-way communication between employees through the organisation or provision of information from the top down. The question was intended to explore the arrangements for monitoring communication between management and employees to facilitate sharing of knowledge and providing clear guidance on what is expected of those undertaking safety critical activities. Given the reliance of the participating organisations on compliance with (and hence competency to follow) operational procedures it would be considered as an important area for monitoring.

This was reflected in the fact that most organisations reported using leading indicators to monitor this area. These indicators included: the percentage attending safety meetings, the percentage response to urgent safety communications or the number of toolbox talks undertaken against a predefined plan.

All respondents identified difficulties in determining the quality of communication and consider this to be an important area, worth exploring in more detail.

Lagging indicators were considered by a number of the respondents to be covered in the incident reporting process.

Permit to Work:

A number of organisations reported that they had the potential to capture indicator data in relation to the permit to work system (for example using data to re-accredit contractors). Most organisations undertook spot checks/unannounced monitoring for competence management. The data was not used as a performance indicator. This area could be regarded as being potentially vulnerable, given the observation that most organisations utilise a batch process it was argued that there is little likelihood of 'live' maintenance being undertaken and hence attracting major hazard risk scenarios. It is noted that in other high hazard industries there have been reported degradations in the control of contractors in permit to work scenarios often as a result of cost reduction exercises resulting in an increased incentive to 'cut corners'. These "violations" are likely to be detected using a reporting system. Further work in this area may be desirable.

Control of Contractors:

Two organisations considered this to be an area of some importance but that it was very unlikely that contractors would be permitted to undertake activities that had major hazard potential. Contractors' performance was monitored against contractual requirements that included safety. Another organisation reported that a quarterly review of contractors performance against a range of criteria was undertaken as part of the contracts management process. These included reviews of safety related issues such as breaches of permit to work systems and near miss events. No organisation reported using specific performance indicators, reflecting the finding that this area was not considered as being particularly vulnerable because of the nature of work undertaken and the level of monitoring in place to assess contractual compliance. The other organisations reported that contractors were subject to the same arrangements as for direct employees. One organisation reported that testing work is undertaken jointly on occasion. This activity is managed on a case-by-case basis and is subject to individual risk assessments and controls.

It may be desirable to review the arrangements for monitoring contractor performance over a period of time to identify whether this control area does reflect organisations opinion.

Leadership:

All organisations reported that they considered leadership an important part of their organisations' safety culture. One organisation utilised specific audits by senior management as a means to demonstrate positive leadership. Indicators were used to ensure that the audits were completed against a predefined plan on a monthly basis. One organisation undertook senior management 'tool box' talks on a monthly basis; the activity was monitored and performance indicators were used to ensure that they were undertaken. Both organisations reported difficulty over the issue of how the quality of such briefing was best measured.

One organisation reported including leadership elements within the safety training profile; completion of the training was monitored.

There was no overall agreement over an indicator that would be considered useful in this area although further indicators may be identified from current HSL research into safety culture indicators.

Employee Attitude:

As reported earlier in this report many organisations viewed this area as being important in supporting compliance with operational procedures in what is a compliance dependent activity; it is potentially one of the most vulnerable. It was surprising to note that only one organisation collected and reviewed data on a regular basis. All other respondents collected lagging indicators on six monthly to annual basis, often as part of a wider opinion survey.

It may be possible to use performance indicators to monitor activities undertaken to enhance employee attitude as well as review the nature of employees' attitude. Further work will be required to identify how this may be undertaken and to provide a proposed approach.

Risk Assessment:

Leading indicators tended to monitor the number of risk assessments reviewed/revised within prescribed time limits. A number of the organisations also monitored the competence levels of those undertaking risk assessments. Most organisations reported monitoring the implementation of any changes that the risk assessment identified although the data was not used as a performance indicator. One organisation reported monitoring the numbers of incidents/irregularities where the risk assessment was subsequently found to be deficient.

Audit:

Most organisations reported monitoring audits undertaken against a predefined plan. A number subsequently monitored the implementation of corrective actions. No organisation reported that any trend analysis was undertaken to provide lagging indicators or any indication of the effectiveness of the audit regime.

3.1.5 Question 7: Target Setting

The explosives industry, as a licensed industry, has well defined requirements and a reasonable level of regulatory attention. The study team observed that considerable difficulty was encountered in the determination of targets for leading indicator elements: for most of the activities undertaken, anything less than 100% was considered unacceptable and was generally managed to resolution within very short timescales. The study team postulated that an indicator could be devised that monitored the number of corrective actions (from investigations, risk assessment and audits) closed out in an agreed timescale.

3.2 REVIEW OF POTENTIAL PERFORMANCE INDICATORS

The general results of the combined questionnaires are discussed below, in relation to the framework attribute level areas.

- Low Risk / Risk Control;
- Positive Safety Culture; and
- Operational Efficiency.

The responses of each organisation were collated and used to compare which indicators were considered to offer the most value and/or the least amount of effort. Where possible, suites of indicators were identified that provide dual assurance (i.e. that the measures are in place and are operating as would be desirable to meet an overall goal, such as low risk, efficient operation or positive safety culture).

The results are presented in the appendix.

3.2.1 Low Risk / Risk Control

This attribute defines a goal of operation with low risk. Success in relation to this attribute would be achieved through, for example: the implementation of an effective (and efficient) safety management process that minimises abnormal, degraded and emergency situations but also responds effectively to mitigate the risk presented if a hazard is realised (emergency planning). Most safety performance indicators currently fall into this category as they measure the realisation of a hazard (lagging indicators) or events that had the potential to give rise to a major hazard.

Indicators were identified in a number of areas of the low risk attribute: system integrity, operational procedures, change control, emergency preparedness, degraded/abnormal modes of operation, control of contractors and safety system failures.

System Integrity:

Reliability achieved against that expected was identified as a useful indicator and could act as a useful lagging indicator. Some organisations reported that data would be difficult to identify. It may compliment indicators identifying the level of inspection / preventative maintenance that is being achieved against a plan. Some organisations stated that the nature of the operation and the age of the equipment make it difficult to establish the expected reliability. Other complimentary indicators included the “proportion of plant replaced/overhauled within the manufacturer’s recommended timeframe” and the proportion of time spent undertaking unplanned repairs. Whilst the majority of organisations thought these useful indicators the degree of difficulty in obtaining the data was reported as not being readily available.

Operational Procedures:

The following indicators were identified by most respondents as being relatively easily collected and useful:

- Proportion of those personnel receiving formal training on time;
- Proportion of safety critical controls (identified from the risk assessment) without formal procedures in place; and

- Proportion of safety critical control measures reviewed within designated timescales.

The following indicator was identified by all respondents as being useful but a number considered that it was not easily collected:

- Number of identified violations of procedures.

These responses correlate well with the importance reported to be placed on these areas by the participating organisations. The three indicators (mentioned above) complement each other and provide a means to monitor that the control measures and procedures can be reviewed before the realisation of any latent failure in the management system and that persons applying the procedures are in receipt of formal, competence based training within prescribed time periods. The continued efficacy of these two facets (of ensuring the low risk attribute, right control measures, applied properly) is evaluated by the violations of procedures indicator (the third measure identified).

Degraded/Abnormal Modes of Operation:

The majority of organisations reported that planning and training for degraded/abnormal operating modes was important. The majority of organisations considered that the following indicators were easily obtained and useful indicators:

- Planned degraded/abnormal training activity (completed formal training against training activity planned); and
- Number of reviews of operating procedures (completed against planned).

Both of these indicators are leading indicators. The indicator “proportion of time spent in degraded/abnormal operating modes” is useful but does not correlate as an indicator of the efficacy of the previous indicators. A better lagging indicator may be “number of near misses/procedural errors occurring during degraded modes of operation”.

Safety System Failures:

Given the nature of the activity undertaken in the explosives sector (discrete and batch processes) this area was not considered to be very vulnerable by a number of the organisations. However all but one respondent considered that the following indicators could be relatively easily implemented and that they would be of benefit to the organisation:

- Safety critical system maintenance undertaken against those planned;
- Safety critical system inspections undertaken against those planned; and
- Number of inspections identifying a safety critical fault against number of inspections undertaken.

Again these three indicators are mutually complimentary, offering dual assurance that necessary activities are being undertaken and that any deficiencies are identified through the reporting of safety critical faults.

Change Control:

One indicator was identified in relation to this area:

- Proportion of incidents occurring in areas where change has occurred.

This was considered to be a sensible approach considering that most organisations audited whether changes had been adequately managed. This indicator provides an interim monitor to identify if the change process is performing adequately. Given the compliance with operational procedures and the potential for these to be revised without the change being assessed it may be desirable to use a quarterly audit to identify where unevaluated changes have been made. This indicator was identified in relation to communication of risk control measures and was considered to be relatively easy to monitor, and of benefit.

Emergency Preparedness:

One indicator was identified by all respondents to be relatively easy to capture data and be beneficial to the management of major hazard risk:

- Proportion of recommendations implemented following internal review.

This potential indicator reflects the fact that there are a number of formal requirements (such as for COMAH Top Tier Sites) that influence the periodicity of exercises. One area considered to be potentially vulnerable to degradation by the respondents was the implementation of any corrective actions identified by exercise or by audit. This indicator supports the monitoring of such actions and would, therefore, act to promote timely implementation of remedial actions.

Control of Contractors:

This area was not considered to be a major area of concern, as the level of subcontracting of safety critical activities was not considered to be a significant cause for concern. The following indicators were considered useful and capable of being captured:

- Proportion of risk review meetings undertaken with external organisations (completed against planned); and
- Proportion of incidents attributable to external organisation.

The following measure was considered to be useful, but not all organisations considered it easy to identify:

- Proportion of safety critical tasks undertaken by an external organisation.

It may be a useful measure in that any trend analysis of the data would identify where a shift in the level of safety critical outsourcing has occurred and aid decisions on any revisions required to the management system.

3.2.2 Positive Safety Culture

This area is still being considered in separate work being undertaken by HSL. At the time of this study a detailed suite of indicators was not available. However a number of examples were raised in response to part 1 of the questionnaire and will be considered in the parallel project. Two areas were identified where there was some scope for developing indicators: learning from accidents and communication of risk control measures.

Learning from incidents:

Both of these indicators were considered to provide useful information and were relatively easy to collect data in relation to:

- Proportion of incidents for which a management review has been undertaken; and
- Proportion of incident inquiry recommendations implemented within agreed timescales.

Risk Control Measure Communication:

Both of these indicators were considered to provide useful information and were relatively easy to collect data in relation to:

- Proportion of procedures communicated to staff within designated timescales;
- Attendance at toolbox talks; and
- Number of non-compliances with risk controls identified during audit.

These indicators are considered to drive positive behaviour as it promotes communication within the line management structure and also the identification and resolution of non-compliances, especially if an unannounced audit regime is used. One area where these indicators are weak is in establishing the quality of the communication. It was considered that this and issues such as an understanding of the required process may be correlated to the level of non-compliances identified, especially if reviews of those non-compliances were appropriately analysed and trends identified.

3.2.3 Operational Efficiency

The proportion of staff in safety critical posts that are considered competent was considered to be a useful indicator by all organisations but was not easily captured. This is a good indicator as it permits an analysis of the level of safety critical activity being undertaken and the competence of those undertaking those activities. It also drives a positive behaviour of:

“having competent staff in safety critical positions”.

A number of organisations reported that the indicator “proportion of roles for which a safety responsibility statement has been provided” was also considered to be useful to establish a clear understanding of what is expected at all levels of safety related roles within an organisation but is not easily collected. Its use as a process indicator is not considered to be ideal as it is likely to form part of the audit process and therefore subject to annual review.

Whilst the proportion of delivered output against planned output was considered by the majority of organisations to be very easy to collect there was no consensus on the value of collecting such information for safety purposes. Similar opinions were observed for staff turnover and succession planning. Both of these areas were considered to be relatively easy to collect but only the succession-planning indicator was considered to offer useful information to the majority of organisations.

The majority of the organisations reported that the “proportion of safety tours/tool box talks conducted by senior management (against planned number)” was both useful and easily collected. This category overlaps with potential indicators for the safety culture attribute.

On a similar theme, three of the organisations reported that the frequency of safety related communication was a useful measure but no consensus was apparent on the ease of collection. Two organisations reported that this would be easy to collect and two indicated that it was more difficult. One issue raised in relation to the ease of collection was that the quality of any communication was difficult to elucidate. The use of a complimentary indicator (such as changes in the number of near misses) may assist in determining whether the communication is being effective. This approach could, as a minimum, enable any problem areas to be identified for appropriate management attention.

4 CONCLUSIONS

The conclusions are presented in accordance with the relevant steps considered useful in the establishment and implementation of risk control measures. Overall it is considered that the HSE guidance in HSG254 can be applied to the Explosives Industry. There are however perceived limitations in relation to the setting of targets. This is because of the perception that absolute compliance is required within the Explosives Sector, i.e. anything less than 100% would not be tolerated.

Identifying Risk Control Systems in place

All of the organisations had a good appreciation of the risk controls in place and an appreciation of the relative importance of the measures based on their criticality and their vulnerability to decline over time.

Defining what success looks like

Based on the established understanding of the risk controls, it was possible to elucidate the key elements of the management system that were critical to the success of the activities being undertaken. For the organisations taking part in this study, success centred around having competent staff who complied to carefully considered operational procedures. These procedures must be appropriate and reviewed in a timely manner to ensure the continued assurance of safety.

Other areas such as emergency preparedness and maintenance and inspection were considered as important areas but were often subject to detailed statutory requirements and were therefore considered to be less vulnerable to decline.

Identifying/Establishing Appropriate Indicators

A variety of monitoring systems and a large number of indicators were observed. The concept of a dual assurance approach was observed in a number of the organisations although this was not the consequence of any explicit requirement. A number of indicators were identified from the pre-derived lists and were considered to be useful and the data relatively easily collected. Many of these correlated with the potential vulnerabilities that had been identified and promoted activities that would contribute to a successful attribute such as positive safety culture, low risk or operational efficiency.

Target Setting

This is an area that potentially gives rise to the greatest difficulty in implementing the HSG254 guidance. All organisations noted that for most circumstances, anything less than 100% compliance is not acceptable. Further work may identify potential target setting arrangements. However in this study there was insufficient scope to adequately research this area. Further work with one or more of the volunteer organisations may be desirable to establish targets for indicators of performance that are separate from license or regulatory conditions.

Construct of the Questionnaire

A number of areas of the questionnaire need minor refinement to enable its use within other organisations and sectors as a means to assist in the development of indicators. These were noted within the relevant questionnaires and amendments will be made accordingly. The key revisions relate to ensuring that the intent of the question is consistently understood.

5 RECOMMENDATIONS

Explosives industry organisations should utilise HSG254 in order to assure themselves that they have a suitable range of indicators in place. The indicators postulated in this report may provide additional assistance. The range of indicators chosen should ensure that:

- Successful management outcomes are defined;
- Complimentary leading and lagging indicators are used to monitor the delivery of those outcomes;
- The indicators are capable of identifying degradation in areas that present significant major hazard risk and are vulnerable; and
- The indicators are meaningful for those using them.

Work to develop a sector specific example should be considered by HSE. This should build on the examples and indicators identified in this study and use a hypothetical scenario that encapsulates the types of activities common to a large number of the organisations (e.g. transportation and storage of explosives).

A number of areas of the questionnaire need minor refinement. It is recommended that this be undertaken to aid a common understanding of the question intent and remove any ambiguity before any wider study is undertaken.

6 REFERENCES

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APPENDIX 1 BLANK QUESTIONNAIRE

Preliminary Questions

Q1

Q2

Q3

Q4

| Please rank the importance that you attach to the following controls in relation to major hazard risk? | Critical | Highly Important | Important | Not Important |
|---|----------|------------------|-----------|---------------|
| Operational Procedures | | | | |
| Instrumentation and Alarms | | | | |
| Change Control | | | | |
| Maintenance | | | | |
| Inspection | | | | |
| Emergency Arrangements | | | | |
| Communication | | | | |
| Design of safety critical equipment (ie equipment whose failure will lead directly to a multiple fatality accident) | | | | |
| Permit to Work / Control of Contractors | | | | |
| Age of Safety Critical Components | | | | |
| Leadership | | | | |
| Employee Attitude | | | | |
| Risk Assessment | | | | |
| Audit | | | | |
| Commisioning | | | | |

Q5

| Do you have safety performance indicators that measure whether the controls are in place in relation to the following factors (do you have leading indicators). If so how often is the data collected? | No Data Collected | Weekly | Monthly | Quarterly | Every 6-12 months | Examples if available |
|--|-------------------|--------|---------|-----------|-------------------|-----------------------|
| Operational Procedures | | | | | | |
| Instrumentation and Alarms | | | | | | |
| Change Control | | | | | | |
| Maintenance | | | | | | |
| Inspection | | | | | | |
| Emergency Arrangements | | | | | | |
| Communication | | | | | | |
| Design of safety critical equipment (ie equipment whose failure will lead directly to a multiple fatality accident) | | | | | | |
| Permit to Work / Control of Contractors | | | | | | |
| Age of Safety Critical Components | | | | | | |
| Leadership | | | | | | |
| Employee Attitude | | | | | | |
| Risk Assessment | | | | | | |
| Audit | | | | | | |
| Commissioning | | | | | | |
| | | | | | | |

Q6

| Do you have safety performance indicators that measure whether the controls are effective. If so how often is the data collected? | | | | | | |
|---|-------------------|--------|---------|-----------|-------------------|-----------------------|
| | No Data Collected | Weekly | Monthly | Quarterly | Every 6-12 months | Examples if available |
| Operational Procedures | | | | | | |
| Instrumentation and Alarms | | | | | | |
| Change Control | | | | | | |
| Maintenance | | | | | | |
| Inspection | | | | | | |
| Emergency Arrangements | | | | | | |
| Communication | | | | | | |
| Design of safety critical equipment (ie equipment whose failure will lead directly to a multiple fatality accident) | | | | | | |
| Permit to Work / Control of Contractors | | | | | | |
| Age of Safety Critical Components | | | | | | |
| Leadership | | | | | | |
| Employee Attitude | | | | | | |
| Risk Assessment | | | | | | |
| Audit | | | | | | |
| Commissioning | | | | | | |

Q7

| Do you set targets for the following indicators? If so, who sets them, reviews them and how often | Leading Indicators (See Question Q5) | | | | Lagging Indicators (See Question Q6) | | | |
|---|--------------------------------------|-------------------------------|-------------------------------|-------------------------------|--------------------------------------|-------------------------------|-------------------------------|-------------------------------|
| | Are targets set | Reviewed by | Reviewed by | Frequency | Are targets set | Reviewed by | Reviewed by | Frequency |
| Operational Procedures | <input type="checkbox"/> | <input type="text" value=""/> | <input type="text" value=""/> | <input type="text" value=""/> | <input type="checkbox"/> | <input type="text" value=""/> | <input type="text" value=""/> | <input type="text" value=""/> |
| Instrumentation and Alarms | <input type="checkbox"/> | n | n | n | <input type="checkbox"/> | n | n | n |
| Change Control | <input type="checkbox"/> | n | n | n | <input type="checkbox"/> | n | n | n |
| Maintenance | <input type="checkbox"/> | n | n | n | <input type="checkbox"/> | n | n | n |
| Inspection | <input type="checkbox"/> | n | n | n | <input type="checkbox"/> | n | n | n |
| Emergency Arrangements | <input type="checkbox"/> | n | n | n | <input type="checkbox"/> | n | n | n |
| Communication | <input type="checkbox"/> | n | n | n | <input type="checkbox"/> | n | n | n |
| Design of safety critical equipment (ie equipment whose failure will lead directly to a multiple fatality accident) | <input type="checkbox"/> | n | n | n | <input type="checkbox"/> | n | n | n |
| Permit to Work / Control of Contractors | <input type="checkbox"/> | n | n | n | <input type="checkbox"/> | n | n | n |
| Age of Safety Critical Components | <input type="checkbox"/> | n | n | n | <input type="checkbox"/> | n | n | n |
| Leadership | <input type="checkbox"/> | n | n | n | <input type="checkbox"/> | n | n | n |
| Employee Attitude | <input type="checkbox"/> | n | n | n | <input type="checkbox"/> | n | n | n |
| Risk Assessment | <input type="checkbox"/> | n | n | n | <input type="checkbox"/> | n | n | n |
| Audit | <input type="checkbox"/> | n | n | n | <input type="checkbox"/> | n | n | n |
| Commissioning | <input type="checkbox"/> | <input type="text" value=""/> | <input type="text" value=""/> | <input type="text" value=""/> | <input type="checkbox"/> | <input type="text" value=""/> | <input type="text" value=""/> | <input type="text" value=""/> |

APPENDIX 2 - INDICATOR EVALUATION TABLES

Key to Table

| Shading | Meaning |
|----------------|---|
| Green | Concurrence by all respondents that indicator data is easy to capture/useful |
| Yellow | Concurrence by two or three respondents – analysed on an individual basis in the report |
| Red | Concurrence that data is not useful |

| For each of the following indicators, please rate: | The ease of application to your organisation (on a scale of 1 to 5, one being very easy, 5 being difficult) | | | | How useful are, or would the indicators be to your organisation (on a scale of 1 to 5, 1 being not very useful, 5 being very useful) | | | |
|--|---|---|---|---|--|--|---|---|
| Attribute 1 - Efficient Operation | | | | | | | | |
| <p>It has long been accepted that good safety underpins good business and vice versa; this concept forms a part of the Health and Safety Commission's strategy. The operational efficiency attribute embraces this philosophy. If an organisation is operating efficiently then the associated pressures of degraded working, procedural violations and fatigue are reduced. It offers, therefore, opportunity to identify latent failures in the management system at a point anterior to any challenge on the risk control system and also the potential for conflicting objectives to be identified. This attribute takes into account a range of issues such as organisational stability, competence, succession planning, leadership and communication. All of these factors have an influence on the efficiency with which a business operates but also identify the potential for departures from normal operation thus creating a challenge to the safety management system.</p> <p>Potential Overall and Strategic Indicators would include:</p> <ul style="list-style-type: none"> ▪ Operating Performance ▪ Operational Structure | | | | | | | | |
| Operating Performance - to monitor that the organisation is effectively controlling its operation not experiencing excessive operational disruption that may impact on major hazard risk. | | | | | | | | |
| Proportion/Percentage of delivered output against planned output | 3 | 1 | 1 | 1 | 1 | 1 for safety, 5 for manufacturing (depending on cause) | 3 | 5 |
| Number of unplanned interruptions per period (e.g. per hour) of operation | 3 | 4 | 1 | 2 | 2 | 1 - unreliable | 3 | 5 |
| Operational Structure - to monitor the stability of the organisations structure | | | | | | | | |
| Proportion of staff in safety critical posts who are complying with the competence management system requirements | 5 | 2 | 1 | 3 | 5 | 5 | 5 | 4 |
| Proportion of staff in safety critical posts | 3 | 2 | 1 | 4 | 1, 5 if competent staff in post | 1 | 5 | 4 |
| Staff turnover rate | 1 | 2 | 2 | 1 | 3 | 3 | 5 | 5 |
| Proportion of staff within 5 years of retirement without succession plans in place | 4 | 1 | 1 | 1 | 4 | 3 with key staff | 5 | 5 |
| Proportion of roles for which a safety responsibility statement has been provided | 4 (not centrally collected, but working on this) | 1 | 1 | 3 | 4 | 5 | 5 | 5 |
| Proportion of safety critical roles covered by the competence management system | 5 | 1 | 1 | 4 | 5 | 4 | 5 | 5 |
| Frequency of safety related communication | 1 | 1 | 4 | 3 | 2 | 5 | 5 | 5 |
| Proportion of safety tours/tool box talks conducted by senior management (against planned number) | 1 | 1 | 1 | 1 | 3 | 5 | 5 | 5 |

| For each of the following indicators, please rate: | The ease of application to your organisation (on a scale of 1 to 5, one being very easy, 5 being difficult) | | | | How useful are, or would the indicators be to your organisation (on a scale of 1 to 5, 1 being not very useful, 5 being very useful) | | | |
|---|---|---|--|---|--|---|--|---|
| Attribute 2 Low risk | | | | | | | | |
| This attribute defines a goal of operation with low risk. Success in relation to this attribute would be achieved through the implementation of an effective (and efficient) safety management process that minimises abnormal, degraded and emergency situations but also responds effectively to mitigate the risk presented if a hazard is realised (emergency planning). Most safety performance indicators currently fall into this category as they measure either the realisation of a hazard (outcome indicators) or the implementation of a risk control system (activity measures). | | | | | | | | |
| Major Hazard System Integrity – to monitor that the appropriate arrangements are in place to maintain the integrity of safety critical plant and premises | | | | | | | | |
| Reliability data for aspects of safety critical plant and infrastructure - achieved reliability against expected reliability | 2 | 5 | 1 | 5 | 5 | 1 | 5 | 5 |
| Proportion of resource allocated to safety critical activities (can be headcount or financial allocation) | 4 | 4 | 1 - for headcount, more difficult for proportion of time spent undertaking SC activities (4) | 4 | 1 | 2 | 5 - for headcount in terms of managing resource, 2 for measure of safety | 4 |
| Proportion of plant replaced/overhauled within manufacturer's recommended timeframe | 2 | 4 | 2 | 3 | 5 | 1 | 4 | 5 |
| Percentage of time spent undertaking unplanned repairs | 2 | 2 | 3 | 3 | 4 | 4 | 3 | 5 |
| Proportion of non-consumable plant safety critical components considered to require replacement within 12 months | 2 | 2 | 1 - because not many areas to cover | 3 | 1 (as proportion) | 5 | 2 | 5 |
| Operational Procedures - to monitor the number, complexity and interdependence of the procedures considered necessary to adequately control the risk presented by the major hazards associated with the industry. | | | | | | | | |
| Proportion of personnel (including contractors) undertaking major hazard safety critical activities | 3 | 4 | 1 | 3 | 1 | | 5 | 4 |
| Proportion of those personnel receiving formal training on time | 2 | 2 | 2 | 2 | 5 | 4 | 5 | 5 |
| Proportion of safety critical controls (identified from the risk assessment) without formal procedure | 2 | 1 | 1 | 4 | 5 | 2 | 5 | 5 |
| Proportion of safety critical control measures reviewed within designated timescales | 2 | 2 | 1 | 4 | 5 | 4 | 5 | 5 |
| Number of identified violations of procedures (egg permit to work systems) | 1 | 5 | 1 | 3 | 5 | 5 | 5 | 5 |

| For each of the following indicators, please rate: | The ease of application to your organisation (on a scale of 1 to 5, one being very easy, 5 being difficult) | | | | How useful are, or would the indicators be to your organisation (on a scale of 1 to 5, 1 being not very useful, 5 being very useful) | | | |
|--|---|---|---|---|--|---|---|---|
| <p>Degraded / Abnormal Operation - To identify circumstances when the safety system has been utilised to deal with degraded and abnormal operating environments and the level of organisational competence available to respond to these challenges. This measure is partially related to operational efficiency and is important as the nature of the operation is different to that normally encountered and hence creates greater potential for a system failure. Examples of events that would be reported would include: flammable liquid transfer outside of a bund, unplanned use of a reduced number of storage tanks or loss of one of a pair of ventilation fans.</p> | | | | | | | | |
| Planned degraded/abnormal training activity (completed formal training against training activity planned) | 2 | 1 | 1 | 4 | 5 | 1 | 5 | 5 |
| Number of reviews of operating procedures (completed against planned) | 1 | 1 | 1 | 2 | 4 | | 3 | 5 |
| Number of planning meetings held/planned | 1 | 1 | Not considered relevant due to low level of degrade ops | 2 | 5 (work deconfliction etc) | 1 | | 4 |
| Percentage of organisations affected that attend planning meetings | 1 | | Not considered relevant due to low level of degrade ops | 2 | 5 | | | 4 |
| Proportion of time spent in degraded/abnormal operating modes | 1 (if we wanted to measure it, no history) | | Not considered relevant due to low level of degrade ops | 3 | 5 | | | 5 |
| <p>Safety System Failures - To identify the frequency and duration of a major hazard related safety critical system becoming unexpectedly unavailable; and to provide an indication of the systems in place to minimise the failure of a safety critical system on demand.</p> | | | | | | | | |
| Safety critical system maintenance undertaken/planned | 2 | 1 | 1 | 5 | 5 | 5 | 5 | 5 |
| Safety critical system inspections undertaken/planned | 2 | 1 | 1 | 5 | 5 | 5 | 5 | 5 |
| Number of inspections identifying a safety critical fault against number of inspections undertaken | 2 | 1 | 2 | 3 | 5 | 5 | 5 | 4 |
| Number of demands placed on safety critical system per period measured (e.g. number of Train Protection and Warning System Activations) | 3 | 1 | 4 | 5 | 5 | 1 | 5 | 3 |
| Number of fail to danger incidents recorded (e.g. false readings) | 2 | | 1 | 5 | 4 | | 5 | 5 |

| For each of the following indicators, please rate: | The ease of application to your organisation (on a scale of 1 to 5, one being very easy, 5 being difficult) | | | | How useful are, or would the indicators be to your organisation (on a scale of 1 to 5, 1 being not very useful, 5 being very useful) | | | |
|---|---|---|---|---|--|---|---|---|
| Management Arrangements/Supervision - to identify that suitable management/supervisory arrangements are in place to adequately control contractors and in-house personnel who are undertaking safety critical activities. | | | | | | | | |
| Proportion of contractor hours/total hours spent on safety critical activities | 4 | 4 | 5 | 2 | 2 | 1 | 2 | 5 |
| Number of review meetings per contractor per period | 2 | 2 | 1 | 2 | 3 | 1 | 5 | 5 |
| Number of safety critical supervisory posts filled/planned | 4 | 2 | 1 | 3 | 4 | 4 | 3 | 5 |
| Number of permit to work violations per contractor hour | 2 | 5 | 1 | 3 | 3 | 3 | 4 | 5 |
| Proportion of accidents/near misses attributable to lack of adequate supervision (especially violations) | 1 | 1 | 3 | 3 | 5 | 5 | 5 | 5 |
| Learning from Incidents - Good practice and safety legislation require risks that are reasonably foreseeable to be controlled. An effective means of achieving this is by reviewing previous incidents to identify areas for improvement and then implementing those in order to prevent a similar accident occurring. | | | | | | | | |
| Proportion of risk assessment reviewed against planned | 1 | 1 | 1 | 3 | 3 | 5 | 5 | 5 |
| Proportion of incidents for which a management review has been undertaken | 1 | 1 | 1 | 2 | 4 | 5 | 5 | 4 |
| Proportion of major industry events which are reviewed | 1 public; 5 not public domain / sub justice | 5 | 4 | 3 | 4 | 5 | 2 | 4 |
| Proportion of accident/incidents identifying root causes | 1 | 1 | 1 | 4 | 3 | 5 | 5 | 5 |
| Proportion of incident inquiry recommendations implemented within agreed timescales, three monthly update; and | 1 | 1 | 2 | 3 | 4 | 5 | 4 | 5 |
| Number of accidents/incidents with major hazard potential normalised by an activity derived output figure (e.g. per 10,000 man-hours of operation) or by number of hours of major hazard process operation, monthly update. | 4 | 1 | 2 - Done at Corporate level (near misses of note) | 3 | 4 | 5 | 5 | 5 |
| Emergency Preparedness | | | | | | | | |
| Internal Planning - To evaluate the preparedness of an organisation to mitigate the effects of a major accident through the creation, implementation and review of emergency plans. | | | | | | | | |
| Proportion of plans reviewed within designated timescales | 1 | 1 | 1 | 3 | 3 | 5 | 5 | 5 |
| Proportion of recommendations implemented following internal review | 1 | 1 | 1 | 2 | 4 | 5 | 5 | 5 |

| For each of the following indicators, please rate: | The ease of application to your organisation (on a scale of 1 to 5, one being very easy, 5 being difficult) | | | | How useful are, or would the indicators be to your organisation (on a scale of 1 to 5, 1 being not very useful, 5 being very useful) | | | |
|---|---|---|---|---|--|---|----------------|---|
| | | | | | | | | |
| Proportion of staff hours devoted to emergency response training | 2 | 2 | 2 | 2 | 2 | 4 | 4 | 5 |
| Number of 'table top' exercises completed against those planned | 1 | 1 | 1 | 2 | 3 | 5 | 5 | 5 |
| Proportion of internal exercises completed against those planned | 1 | 1 | 1 | 2 | 3 | 5 | 5 | 5 |
| External Cooperation - to ensure that adequate arrangements are in place with external parties to mitigate the implications of a major accident. | | | | | | | | |
| Number of planning meetings completed against planned | 1 | 1 | 1 | 2 | 1 | 5 | 5 | 4 |
| Average number of identified external stakeholders in attendance against those invited per meeting planned | 1 | 1 | 1 | 1 | 2 | 5 | 5 | 5 |
| Number of emergency exercise review meetings undertaken against emergency exercises planned | 1 | 1 | 1 | 1 | 3 | 5 | 5 | 5 |
| Number of emergency exercises completed against planned | 1 | 1 | 1 | 1 | 3 | 5 | 5 | 5 |
| Number of deficiencies identified during exercises | 1 | 1 | 1 | 2 | 4 | 5 | 3 | 5 |
| Change Control - To monitor the arrangements in place to safely manage changes to organisational arrangements, premises and plant. | | | | | | | | |
| Proportion of changes in organisational structure made without documented evaluation of risk and identification of controls | 5 | 3 | 4 | 4 | 3 | 5 | 5 | 5 |
| Proportion of changes in plant configuration made without documented evaluation of risk and identification of controls | 5 | 3 | 3 | 5 | 4 | 5 | 4 | 5 |
| Proportion of incidents occurring in areas where change has occurred | 2 | 2 | 2 | 2 | 4 | 5 | 5 | 5 |
| Societal Risk - To ensure that the risk presented by the location of the plant is mitigated in the event of an accident through liaison with local planning authorities. | | | | | | | | |
| Proportion of planning application reviews completed against submitted | 2 | 2 | 1 | 2 | 3 | 4 | 2 | 4 |
| Proportion of liaison meetings undertaken against planned | 1 | 2 | 1 | 2 | 2 | 4 | 3 | 4 |
| Assessed risk to local population using a recognised societal risk technique | 2 | 2 | | 1 | 2 (as forced to apply consequence mitigation for explosives) | 4 | Not applicable | 5 |

| For each of the following indicators, please rate: | The ease of application to your organisation (on a scale of 1 to 5, one being very easy, 5 being difficult) | | | | How useful are, or would the indicators be to your organisation (on a scale of 1 to 5, 1 being not very useful, 5 being very useful) | | | |
|--|---|---|---|---|--|---|---|---|
| Risk Control Measures - to demonstrate that risk control measures are in place and reviewed within designated timescales | | | | | | | | |
| Proportion of major hazard risk controls reviewed for adequacy within allocated timescales against those planned | 2 | 1 | 1 | 4 | 3 | 5 | 5 | 5 |
| Proportion of audits completed against planned | 1 | 1 | 1 | 3 | 3 | 5 | 5 | 5 |
| Proportion of procedures communicated to staff within designated timescales | 2 | 1 | 1 | 3 | 4 | 5 | 5 | 5 |
| Proportion of staff competent in major risk evaluation and control procedures | 2 | 2 | 1 | 3 | 1 | 5 | 5 | 5 |
| Number of non-compliances with risk controls identified during audit | 2 | 2 | 1 | 3 | 4 | 5 | 5 | 5 |
| External Liaison - To ensure that interfaces with other organisations involved in the prevention of major accidents are appropriately managed | | | | | | | | |
| Proportion of safety critical tasks that are undertaken by an external organisation | 2 | 1 | 3 | 3 | 2 | 1 | 2 | 5 |
| Proportion of risk review meetings undertaken with external organisations (completed against planned) | 1 | 1 | 2 | 2 | 2 | 1 | 2 | 5 |
| Proportion of incidents attributable to external organisation | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 5 |

Application of performance indicators in the explosives sectors

Performance Indicators are increasingly being used in a range of environments as an aid to identifying and resolving safety and operational issues. Recent incident investigations and guidance promote enhancements to the indicator regimes to ensure that a balanced approach is adopted that enables organisations to monitor both the sustained use of management controls and the effectiveness of those controls in maintaining safety.

The Health and Safety Executive (HSE) commissioned this report to:

- identify the extent to which the concept of dual assurance is understood and applied within a sample industry;
- identify industry representatives' opinion in relation to potential indicators that would correlate with the Major Hazard Performance Indicator Framework proposed by HSL; and
- identify a process that can be used to exemplify HSE guidance HSG254 in the derivation of key performance indicators in the explosives industry.

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