Safety performance indicators

Health, safety and environment metrics in loss prevention – part 1

Carson, P.A.* and Snowden, D.**
*Quality Director, Intertek 4-Front Research
**UK Quality, Safety, Health and Environment Manager, Intertek

Summary

Companies have moral and legal obligations to avoid harm to their employees, visitors and to the environment. There are also sound business reasons for avoiding accidents. A substantial return on investment can be realised by improvements to health, safety and environmental performance which may also result in enhanced organisational productivity and financial performance. As with any other company activity therefore HSE performance-related activities need to be *measured*.

Metrics are measures of performance of a SHE activity or programme which can steer performance of health and well-being of a worker or organisation. They should be meaningful, relevant, repeatable, simple, well-defined, comparable, economical to collect, timely, and they should facilitate trend analysis for intra and inter department/site comparison. Lagging indicators remain of value for highlighting opportunities and priorities for improvement, determining trends, confirming effectiveness of interventions, and satisfying regulatory requirements. More useful proactive 'leading' indicators can be obtained from such as near-miss investigations, site inspections, risk assessments, safety meetings, safety audits.

The paper describes the development and use of KPIs in a service company outside mainstream production and major accident hazards and explains how this measurement culture will greatly assist in the future identification of sites that require additional resource or support.

Keywords: Key performance indicators; Leading indicators; Lagging indicators

Introduction

Companies have moral and legal obligations to avoid harm to their employees, visitors and to the environment. There are also sound business reasons for avoiding accidents. For example, indirect costs of accidents such as time devoted to investigating and reporting, lost production, introduction of corrective measures, additional training, increased insurance premiums, asset repair/replacement, fines, adverse impact on staff morale, etc can far exceed direct costs. A substantial return on investment can be realised by improvements to health, safety and environmental performance which may also result in enhanced organisational productivity and financial performance. As with any other company activity therefore HSE performance-related activities need to be *measured*.

Whilst UK standards in occupational health and safety are comparatively high, achievements have plateauxed with combined incidence of injury and ill-health rates static at 2004 levels and with economic impacts to society of £20 billion per annum. In order to re-energise the UK engagement with health and safety the Health and Safety Executive have launched a new strategy and will *measure* the success of combined efforts of all stakeholders in meeting the objectives.[1]

Health, safety and environment metrics

Health, safety and environmental management tactics are entering an age with greater reliance on proactive measurement against targets. Currently, use of the tool is spasmodic and can be considered to be still in the development stage and certainly not universally applied. During 2009 local HSE inspectors are increasingly raising the status of indicators during their normal interventions with, for example, major accident hazard sites.

In the present context metrics are measures of performance of a SHE activity or programme which can steer performance of health and well-being of a worker or organisation. Metrics are used to monitor performance of existing programmes or to measure the effect of change (for example, processes, procedures, organisations, funding). Although a single set of high-level, cross-section indicators may eventually be developed[2] current strategies rely on bespoke systems to reflect diversity, especially within SMEs.

Metrics should drive an appropriate action in line with company objectives. They should be meaningful, relevant, repeatable, simple, well-defined, comparable, economical to collect, timely, and they should facilitate trend analysis for intra and inter department/site comparison.

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Traditional 'lagging' indicators include fatalities, accident frequency rates, lost time accidents rates, compensations, etc which amount to monitoring company failures. Also, data on for example lost-time incident rates are poor indicators of how well major hazard risks are controlled; companies with high standards of personal injury incident rates have experienced major disasters.[3] Thus, the traditional Heinrich's dictum[4] is less reliable as a predictor of the pattern of chemical process accidents.

Nevertheless, lagging indicators remain of value for highlighting opportunities and priorities for improvement, determining trends, confirming effectiveness of interventions, and satisfying regulatory requirements. More useful proactive 'leading' indicators can be obtained from such as near-miss investigations, site inspections, risk assessments, safety meetings, safety audits (Table 1).

These indicators promote line-management involvement and active participation, and help to foster desired HSE cultures[5] including empowerment, team work, no blame culture, ownership of safety by workforce, voluntary reporting e.g. near misses. They should measure the effectiveness of the Safety Management/Process Safety Management system and target areas for continuous improvement.

One of the three main lessons from the 2000 incidents at Grangemouth was for companies to develop key performance indicators (KPIs) for major hazards to ensure process safety performance is monitored and reported against these parameters.[3] Several years later, however, the final report into the Buncefield incident (in which huge fires in 23 large fuel storage tanks resulted in extensive damage to the depot and surrounding area with an estimated total quantifiable cost of £1 billion) was still calling for the sector and Competent Authority to agree on a system of leading and lagging performance indicators for process safety performance[6]. The HSE and industry continue to develop such metrics.[7] Process safety performance indicators are also being developed for emergency preparedness[8] and for the off-shore industry.[9] An attempt to use near miss incidents with high potential for more significant adverse consequences as a leading indicator has been described[10]. The use of performance indicators in managing the risks of organisational downsizing are also important.[11] The reader is referred elsewhere[12–23] for more detailed discussion of key performance indicators, process safety performance indicators, and management culture.

Selecting the most appropriate metrics first requires a strategic plan with associated KPIs linked to activities (as exemplified by Table 2 for the process industry) or company goals, and not just provided to satisfy unsubstantiated stakeholder requests. Development and trialling of an in-house set of prototype indicators may take up to six months. The ultimate goal (lagging indicator) of zero occupational fatalities, injuries, illness, days lost and adverse environmental impacts requires an active programme of continuous improvement, individual accountability, and demonstrable leadership to provide measurable stepwise changes in the desired direction.

Table 1: Selected metrics

Lagging indicators
Fatalities
Injuries (e.g. number of work-related illnesses or injuries per 100 employees, resulting ≥1 days absence from work/year)
Absenteeism due to work activities (number of days absent)
Number of fines/prosecutions
Number of claims
Number of worker/neighbourhood complaints
Number of unacceptable emissions to the environment
Leading indicators
Number of inspections
% accidents/incidents/near misses investigated
Number of hazards identified
Number of risk assessments
Number of safety meetings
% attendance at safety meetings
Number of people contravening instructions, work-permits
Number of training courses not completed within specified timeframe
% employees trained
Environmental (biological) monitoring data outside action limits
Number of relevant case histories studied
Number of tool box studies
Number of near miss reports
Number of outstanding corrective and preventative actions reported from audits
Ratio of first-aid events: more serious recordable injuries
Time between reporting of incident and investigation
Number of spills of hazardous materials
Energy consumption
Quantity of waste
Number of HSE awards (internal and external)

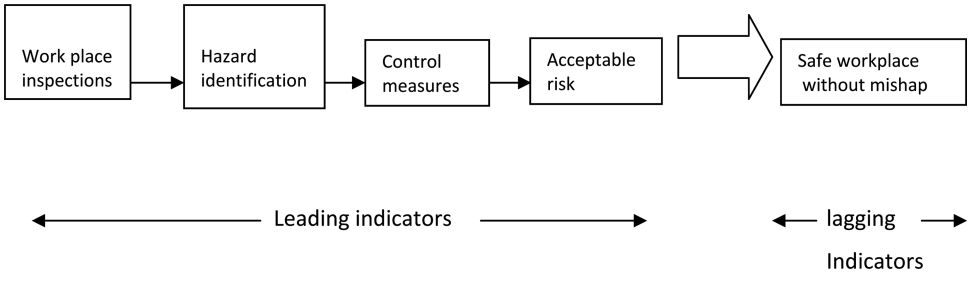

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Table 2: Examples of process safety performance indicators[after 24]

Activity	Lagging indicator	Leading indicator
Bulk tank overfilling	No. times tank overfilled	No. times ullage checks not done correctly prior to transfer No. times inspection and maintenance of tank gauging system not carried out to agreed frequency.
Leaks from pumps	No. detectable leaks from pumps due to seal failure.	No. of product pump vibration checks carried out on schedule No. remedial actions raised following vibration monitoring which are not completed on time
Loss of containment from lines, valves, pumps, filters	No. leaks of flammable liquid	No. Times leaks not isolated immediately they are reported No. times job request does not adequately describe scope
Permit to work(PTW)	No. of adverse incidents/ deviations from PTW/ attributable to PTW.	No. times isolations not done correctly No. times de-isolations not done timely, in correct sequence, or done completely.

It is unlikely that use of a single set of KPIs will be helpful; strategies should combine leading (measure what is being done) with lagging (measuring the effectiveness) indicators. Underperformance detected from several parameters is commonly indicative of other underlying weaknesses such as the management system, management commitment, management engagement with staff, employee motivation/empowerment, etc which may need addressing before improvements in HSE performance can be realised.

Case history

Here, we describe briefly the development and use of KPIs in a service company outside mainstream production and major accident hazards. The company is a leading international provider of quality and safety services including auditing, inspection, testing, quality assurance and certification. The customer base includes building, cargo scanning, cosmetics, electronics, food, heating, petroleum, pharmaceuticals, textiles, and toys. They operate a global network of more than 1,000 laboratories and offices and employ over 23,000 people in more than 100 countries around the world.

The UK company comprises approximately 45 sites and a total of 1500 staff.

Overall the company is not considered to be a high-risk industry and history demonstrates the accident/incident rate to be low, with most reported incidents representing near misses. Nevertheless, management took the view that in order to maintain high HSE standards a programme of continuous improvement was to be introduced. One of the challenges in identifying a meaningful strategy is that site functions are quite diverse and represent different hazards and levels of risk. As a result, simply utilising 'lagging' indicators such as accident/incident rates to target improvements is too limiting in its scope as it would not be a 'like with like' comparison within the organisation.

It was decided to attempt to assess overall safety culture as the differentiator and this is to be accomplished by means of a two-stage process. The first, a management-driven stage, was to ensure each site developed a measureable 'acceptable' management culture based on a combination of management tactics, and the second, a staff-participation stage, will be to introduce factors to measure the effectiveness of the culture on SHE performance and staff awareness/buy-in. Here we report on stage 1 which was initially limited to those 29 sites that had been fully integrated into the company management system for a 'lead in' period as an attempt to include the more-recently introduced sites would have distorted the relative ratings.

Stage 1

During the last two years senior management and the central HSE department concentrated on development of KPIs targeted at raising local management awareness of SHE issues and measuring management culture across all sites. Key tactics were to establish base-lines, such as:

- setting a minimum level of fire awareness and manual handling by setting a target for *all* employees to undergo a standard training programme.
- developing a policy for staff to receive training to a standard recognised by IOSH and for safety 'representatives' to undergo qualification to IOSH 'Managing Safely'. Once qualified, safety representatives and trained first-aiders are to be paid for their added responsibilities.
- sites to conduct at least four safety meetings per year to formally consult with staff.
- sites to conduct monthly safety inspections and frequent tool box sessions when relevant issues require discussion.
- all sites to promote reporting of near miss incidents and their investigation to identify and implement preventive actions.
- sites to report to the UK HSE manager alerts from the literature of relevant incidents from which the company can learn lessons.

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- Management to report site performance to the UK HSE manager on a monthly basis who in turn will compile data and report quarterly to the UK Safety Committee that includes senior management representatives from all divisions.
- the UK HSE manager to coordinate an annual audit program to include each site, grading findings as major (e.g. regulatory violations), minor, or observations.

To establish an initial site score, reactive factors such as issues identified during audit, weighted for significance, were then assigned a negative value. These were then balanced with proactive measures such as near-miss reporting, in order to assign a cultural rating to each site. This then builds as the data accumulated over a defined period and other metrics were factored in either as positives (for example, safety meetings over and above the minimum requirements or submissions that contribute to group learning, tool box talks), or negatives (such as failure to steward training, or timely close-out of mandatory actions). It was important that the exact mechanism was not published to the participating sites so that the factors contributing to the ratings were not manipulated.

Figure 1 illustrates the overview of total management culture (in effect commitment) at each site at the end of 2008; it does not reflect the hazards at sites. Interestingly, the worst performing site showed the highest staff turnover and was also one of the poorest business performers over the same period despite attempts to raise standards. Significantly, changes in management staff at two of the lower rated sites has already brought about a demonstrable improvement in culture.

For sites lying below the baseline the target is to continue to improve on the 2008 rating using the stage 1 indicators as in these cases the management culture still requires strengthening before further progress can be made. For sites that have already achieved the arbitrary baseline the 2009 target is to maintain their status, however this now requires the introduction of stage 2 indicators, such as demonstration of staff participation, which is to be factored into the positives such as the level of near miss reporting. In this way the overall measure should evolve into a true site safety culture that cannot be completely management driven and it should reflect the commitment of the whole workforce to improvement.

Conclusion

There is confidence within the company that this measurement of culture will greatly assist in identifying sites that require additional resource or support. However it is recognised that for this to continue to form a representative measure it will require continued evolution of the contributing factors as the landscape changes. Progress is published on a quarterly basis and this encourages the management and workforce alike at each site to question why they are rated as they are and to focus on initiatives to improve. Moving forwards, management at sites with lower than expected cultural ratings will be invited to report in person to the UK Safety Committee on their performance and on the improvement initiatives they intend to introduce. Incentives are also being considered for the higher rated sites although 'top of the table' performance is not necessarily the primary objective and perhaps the best lessons will be learned from those that achieve the greatest improvement and this should become clear when progress on stage 2 is reported in Part 2.

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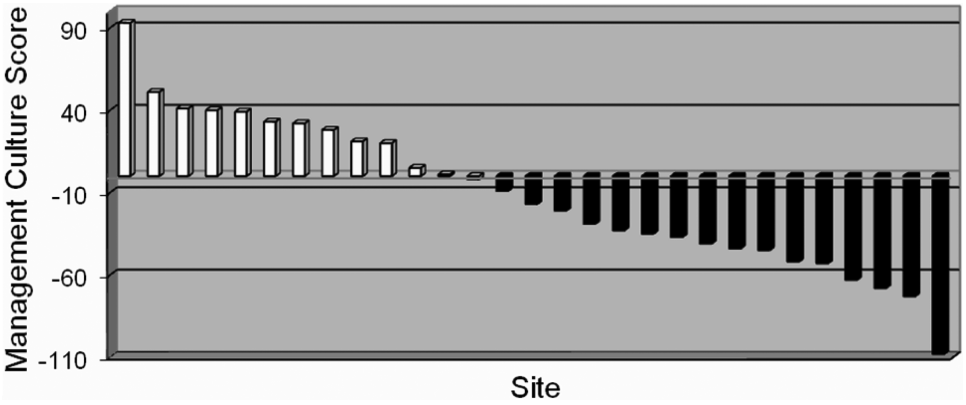

Figure 1: Site safety culture year end 2008
Note: Culture scores should be developed in-house to reflect local strategies and tactics. In the present case the score = 2007 points total – 2008 audit points – NC's not closed out by target (%/10) + 2008 near misses + (safety alerts forwarded X 5) + Feb training completion (%/10) + upgraded/optional fire/manual handling training (%/10) + audit improvement (%/10) + safety meetings/toolbox talks above the minimum requirement.

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Letter

Two incidents were described in the February issue of LPB (211) and recommendations were made to reduce the probability of further ruptures. Both incidents occurred as the result of excavations, which are the major cause of leaks from underground pipes. I suggest two further actions:

When I worked at ICI we agreed that any future ethylene pipes would be installed deeper than the maximum depth attainable by the equipment used by almost all trenching machinery. This would not prevent all ruptures but would greatly reduce their probability.

Other companies have insisted that contractors who are excavating to install new pipes or examine old ones should be provided with metal detectors so that they can detect existing pipes. If the pipes are not made of iron, then an iron wire is laid on top of them when they are installed.

Trevor Kletz

I refer to the article by myself and colleagues entitled *Handling of reactive chemical wastes – a review* which was published in the December edition of LPB.

Readers should note the following developments:

- The research project referred to, which gives information on the limitations of Dewar flasks for compatibility testing, has been completed and is available on the HSE web-site (http://www.hse.gov.uk/research/rrhtm/rr710.htm);
- HSE, in liaison with the Environment Agency, has published interim guidance on compatibility testing for the waste treatment industry (see http://www.hse.gov.uk/chemicals/waste-stream.pdf);
- The Environment Agency is sponsoring further guidance for the waste treatment industry on compatibility testing, which HSE is also contributing to;
- HSE, with input from the EA, is preparing further guidance for the chemical industry on safe mixing of chemical wastes in both tanks and tankers. This will be available for external circulation in the next few months.

Janet Etchells

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