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Effective Occupational Health and Safety Performance Measurements

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Abstract

Achieving excellent OHS performance involves more than avoiding injuries, ill health and accident. However measurement of occupational health and safety (OHS) performance is not easy to construct due to the various dimensions being measured and the dynamic nature of OHS issues. Most organization measure OHS performance statistically by the number of accidents, days lost, injury rates and accident costs. Statistical methods may indicate the nature, frequency and severity of injury, or may identified the problem areas but they are not sufficient measurement tools as they reveal OHS performance in the past and do not reflect the current status of OHS management nor predict the possible occurrence of accident and there are also problems of incorrect or underreporting. Organizations must identify and use other measures that reflect the organizations' true initiatives and behaviors, which promote well being and safe performance. Proactive OHS metrics may include behavior-based indicators, safety culture, management involvement, employee empowerment, employee perception survey, safety audits and root cause analysis. These measurements when use together with accident and injury rates statistics will indicate the overall performance of OHS and give directions for OHS management improvement. This paper looks at performance measurement system for OHS improvement. A literature review on effective OHS performance measurement is presented and a framework for OHS performance measurement is described and followed by a discussion on the use of other metrics that motivate change rather than describe past performance of occupational health and safety management.

Keywords: Occupational Health And Safety, Performance Measurement, Safety And Health Management

Introduction

A safe and healthy workplace is an injury and illness free workplace. The prevention of errors and accidents was for many years the primary goal of safety promotion, and investigation of direct causes of accidents was the most important means of achieving this goal [1]. Safety is assured by providing: (1) plant or equipment which is 'fit for purpose'; (2) systems and procedures for operation and maintenance of plant, and management of all associated activities; and (3) people who are competent to operate the plant and equipment and to implement the systems and procedures [2]. Providing these inputs to a safety management system will prevent injuries, illnesses, and damages.

The use of performance measurements to initiate continuous improvement in health and safety appears to lag behind the level used for core business activities such as accounting, marketing and engineering [3,4]. In measuring safety performance the number of harm or loss that occurs is used as a direct measure [2,3] and safety success has always been measured by how many million hours work without lost time injury and awards are given to those organizations with low injury rate statistics [5]. However there are many arguments that disagree on the sole use of injury rates as metrics for OHS performance [1,3,6,7]. A review of the literatures on performance measurement in health and safety highlighted the limitations inherent in the use of injury outcome data as the primary measure [5,6,7,8,9,10,11]. Incident and injury rates are important, but they are not always useful for OHS improvement [7,9]. Furthermore they are not accurate indicators of overall workplace safety and they can give a very distorted view of actual plant safety performance. There are many cases where accidents caused injuries to the nearby public but not the plants' workers. Therefore these plants safety records were untarnished [12]. There are also other incidents involving fires but no human injury. Again these incidents did not affect the injury rate of the plants.

A reduction in the rate of lost-time injuries does not tell how well hazards are being managed. Without excellent investigation of causes, incident rates tell us that there is a problem, but they do not tell us what the problem is. If there are no incidents to investigate, no data will be available to assist in guiding performance improvement [2,5,7]. Furthermore definitions of recordable accidents do not include near-miss events that cause no injury but may foretell very serious future problems if not corrected [13]. For operations where they may be potential for severe accidents, the likelihood for such an event must be extremely low. This means that the absence of very unlikely events is not, in itself, a sufficient indicator of good safety management. Using accident statistics can also encourage under-reporting of accidents, as workers may not report an accident for fear of being reprimanded for compromising the safety performance of the workplace [3]. Injuries, illnesses, and losses should be measured, but they are not the only indicators of OHS performance and nor are they feedback for occupational health and safety management system (OHSMS) effectiveness [10, 13].

Measuring safety performance poses a continuous problem, as most safety managers are not sure on how to determine the effectiveness of the safety programs and safety management systems. How can safety and health performance be quantifiably measured in ways similar to how an organization's other performance (i.e. production and sales) are measured? A proper measure of OHS performance is crucial for effective OHS management. 'What gets measured gets done' and 'You cannot manage what you do not measure' describe why measurement system is necessary for performance monitoring and improvement [2,6]. Measurements help to identify priorities; determine the level of efforts to be put forth; facilitate sound decisions and judgments; allow comparisons with preceding or others' performance; and evaluate actual to planned performance. The effectiveness of these measurements is generally linked to a complex set of factors, tangible and intangible, technical and human, among which a trade-off between expected benefits and corresponding costs must be identified [14]. The measurements and indicators are used to analyze trends, help management in making decisions on which areas to focus and to successfully implement continuous improvement strategies.

Principles Of Effective Performance Measurement Systems

Measurement is a key management activity. It provides information that can be used by decision-makers to monitor and improve performance, and to allocate resources effectively [15]. Performance measurement (PM) indicates where the organisation is progressing towards achieving its goals and communicates to the employees, matters that are important for the achievement of these goals [16]. Cupello [17] provides four purposes of measuring performance i.e. planning, screening, control and diagnosing. Planning measures look at whether the organisation is achieving its strategic planning. Control measures are measuring the performance of individual employees, machines, processes, products and services. Screening measures look at whether the functional areas are supporting the strategic planning. Diagnostic measures determine whether the organisation's quality initiatives are achieving the desired outcome. Through these functions, performance measurement, if implemented and used properly, can actually change the lives of people and organizations. The implications of such performance measurement systems are [16]:

1) The role of measurement is changed from backward-looking recordkeeping to forward-looking prediction and insight;
2) Measures are used to provide feedback, build understanding and encourage intrinsic motivation, rather than as a tool for top-down management control;
3) The focus is systematic thinking, fundamental structural change and organizational learning, instead of mindless target-setting, continual fire-fighting or the rigorous allocation of blame;
4) Performance measurements become a framework for everyone to understand and align with top-level objectives of the organization, and enable them to actively and enthusiastically participate in continuous improvement.

Effectiveness is used to evaluate an applied system and it is a measure of the extent to which the system objectives are satisfied [2]. The highest degree of effectiveness is achieved when essentially all system objectives are satisfied and the lowest level of effectiveness is when priority objectives are being addressed but not satisfied. The measurement must provide adequate data to evaluate the system, data gathered must be objective, the measurement system must be credible, the system must be cost justified and well documented [2]. Only well-documented system can be objectively measured. Kutucuoglu and Hamali [16] suggest that an effective performance measurement system should include the following features: (1) Recognize different performance hierarchies; (2) Present a balanced view of the system being measured; (3) Recognize multiple dimensions of performance measures; (4) Relate the measures to the relevant goals; (5) Link performance measures to strategy; (6) Involve employees to ensure that it gets their support; (7) Include subjective measures as well as objective ones; and (8) Address cross-functional issues. Oakland [18] lists five questions which are pertinent to the development of an effective performance measurement system: 1) Why measurement is required, 2) What important factors to be measured, 3) How it should be measured, 4) When should it be measured and 5) How should the result be used. By answering these questions and keeping a score, an organisation should be able to know whether the set objective is achieved or not. Saqib and Siddiqi [19] recommend the following factors to be considered in measuring OHS performance:

1) Operational safety attributes – what is required from a plant in order to perform safely.
2) Parameters that present the level of operational safety performance – overall indicators to provide overall evaluation of relevant aspects of safety performance.
3) Convenient parameters – strategic indicators to provide a bridge from overall to specific indicators.
4) Parameters that can be directly monitored and measured – specific indicators to identify declining performance trends or problem areas so that corrective actions can be taken by management to prevent further performance degradation.

Measures Of OHS Performance

Measuring OHS performance based on conformance to established systems that identify deficiencies to reduce risk would maximize performance improvement. A system that identifies and control non-conformance to established standards is more effective than one that reacts to injury or accidents. For a safety performance measurement system to be effective, a predictive linkage must exist between the parameter being measured and the outcome produced [19]. Organizations must identify and use other measures that reflect the organizations' true initiatives and behaviors, which promote well being and safe performance. Proactive OHS metrics may include behavior-based indicators, safety culture, management involvement, employee empowerment, employee perception survey, safety audits and root cause analysis [2]. These measurements when use together with accident and injury rates statistics will indicate the overall performance of OHS and give directions for OHS management improvement. Two types of safety measures are common in industry, accountability measures and performance indicators. Accountability measures relate to specific performance expectations and specific people [5] and they are a means to motivating people. Performance indicators point out how successful systems are achieving their objectives.

OHS Performance Indicators

Targets need to be set for the health and safety system as they give the system its direction and provide a framework for on going system assessment. A performance indicator (PI) is a variable that expresses quantitatively the effectiveness or efficiency of a system, against a target [20]. Performance indicators are used to monitor performance in areas that directly affect safety and health of the workplace and corrective action to be taken to make sure the system is effective and progress is being made towards the targets. A PI is also called "performance metric". OHS performance indicators can be prospective or retrospective (measured before or after accident)[5] or process indicators or outcome indicators [21]. Process indicators or positive indicators are used to measure how well the OHS management system is operating and focus on activities at the workplace that prevent people being injured. Outcome indicators or negative indicators are usually based on measuring the failure of the OHS management system because they relate to the number of injuries that occurred at the workplace. Examples of process and outcome indicators are as shown in Table 1.

Table 1 Examples of OHS performance indicators [21]

Process or Positive Indicators	Outcome or Negative Indicators
Regular conduct of OHS committee meetings	Number of incidents and injuries
The number of staff who attend training	The lost time injury Frequency, and costs of worker compensation claims frequency rate
The number of scheduled workplace inspection that are carried out	Plant and equipment breakdown
All corrective action following inspections are carried out	Disputes over OHS issues
All identified hazards have safe work procedures written for them	Improvement and prohibition notices
Incident or injury reports are completed after every workplace incident	Workplace evacuations
The number of contractors attending induction training before starting work	Prosecutions
OHS responsibilities have been identified and assigned	First aid attendance

Performance indicators enable the plant management to use the plant resources in such an appropriate manner that the best result can be obtained. Aggregation to higher-level of these indicators identifies the areas of real concern so that the plant management can focus on those areas to improve the plant performance [19, 22]:

1) Operating performance
2] State of structures, system and components – corrective work orders issued, material condition, state of barriers
3) Events – reportable events, significant events (due to hardware/design related causes, human related causes, external causes)
4) Attitudes towards OHS – compliance with procedures, rules; attitude towards procedures, policies and rules, human performance (percentage of events due to human errors, percent of events due to training deficiencies, percent of events due to deficiencies in procedures, number of human related incident during testing, maintenance or restoration), backlog of safety related issues, safety awareness (percentage of staff trained in safety management/culture, number of seminars on safety related issues, number of external safety reviews, audits and assessment received, number of plant safety committee and executive committee meetings)

5) Striving for improvement – self-assessment (independent internal safety and quality assurance (QA) inspections and audits, findings from QA and safety reviews and audits, average time to clear
6) Deterministic approach- challenges to safety systems, safety system performance (number of failures, number of times safety system unavailable, number of hours safety system unavailable, percent of failures discovered by surveillance and testing), operator preparedness (number of hours devoted to training, errors due to deficiencies in training), emergency preparedness, risk during operation, risk during shut down
7) Probabilistic approach – risk assessment.

Inspections, assessments and audits provide the monitoring activities for positive measures of performance. An audit is only one part of OHS management system but it cannot serve as a continuous tool to maintain a prescribed level of safety [2]. The audits should result in prioritization of resource allocations on health and safety, environmental protection, process technology, training, etc. These general monitoring activities fall into three categories i.e. regular inspections and audits, periodic and in-depth inspections, assessments and audits, and overview assessments and audits. Specific monitoring activities vary from one organization to another as they may have differing scopes.

People behaviour at the workplace can have significant impact on safety performance and consequently cause accidents. Safety can be achieved through behavioural safety approach which identifies, measures and promotes safe behaviours. This is where unsafe behaviours are corrected and not penalized. People behaviours are influenced by factors such as knowledge and training, work and peer pressures, and tools and equipment to perform their job. The behaviour of peoples both individually and as an organisation is an important measurement of OHS management system as it can be used to influence the attitudes of people [2]. Measurement of behaviour can be performed through the evaluation of leadership behaviour, behaviour observations of people in operating positions and task observations of people in operating position.

Safety culture can be defined as an organisation's norms, belief, roles, attitudes and practices concerned with minimizing exposure of employees to workplace hazards and a positive safety culture is where everyone in an organization, all ranks and files are committed to working safely [2]. Indicators for safety culture among others are management commitment to safety, safety training and motivation, safety committees and safety rules, record keeping and investigation on accidents, communication, etc. [23]. Interviews and questionnaires are used to assess safety culture. The results of the assessment identify the organization strengths and weaknesses and actions can then be taken to overcome the weaknesses and build on the strengths [2].

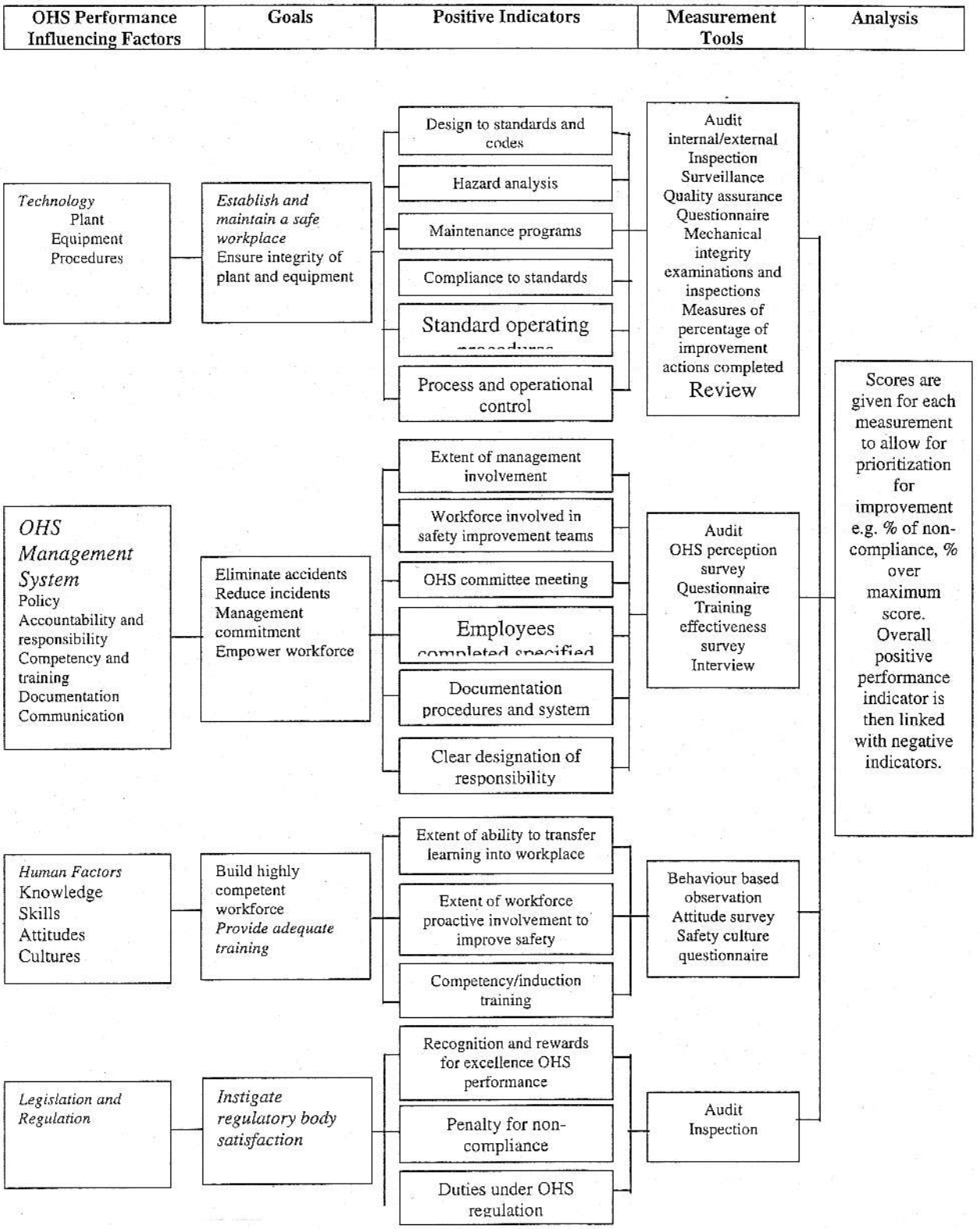
A Framework For OHS Performance Measurement

Efforts at improving OHS performance no longer concentrate on technical and people-centred measures but have began to focus more on OHS management [23]. Organizations having an effective OHS management system that improves interplay of technology, organization and human resources will have a good OHS performance. Organizational components that satisfy personal and professional needs seem to have a strong effect on cooperation, commitment, communication, and competence and ultimately drive overall OHS performance [24]. OHS management system provide a framework by means of which organizations ensure good OHS performance throughout the planning, organizing, control and supervision of OHS related activities in all aspects of operations [25,26]. Measurement of performance in these elements should form the basis of OHS improvement strategies.

A framework for effective OHS performance measurement is developed that looks at the performance influencing factors, its indicators and measurement tools, is as shown in Figure 1. Factors influencing OHS performance can be divided into two categories: internal and external factors. Technology factors (i.e. plant and equipment), human factors and OHS management system influence the OHS performance from within the organization; and undoubtedly OHS and other regulations influence the OHS performance from the outside [2]. This framework can be used by any organization but the factors to be measured must be tailored for that particular organization. Analysis of the performance measurements data will give an overall positive indicator and need to be linked with negative outcome indicators (i.e. accident rates, injury rates) to provide overall evaluation of relevant aspects of safety performance. Over time the framework can be used to identify declining performance trends or problem areas so that corrective actions can be taken by management to prevent further performance degradation.

Conclusion

A proper and proactive measure is crucial for effective occupational health and safety management. It is advantageous that OHS performance and potential risk in an organization can be predicted and action can be taken in advance to prevent accident. Continuing high performance requires employers to audit and review


OHS Performance Influencing Factors
Goals
Positive Indicators
Measurement Tools
Analysis
Technology
Plant
Equipment
Procedures
Establish and maintain a safe workplace
Ensure integrity of plant and equipment
Design to standards and codes
Hazard analysis
Maintenance programs
Compliance to standards
Standard operating procedures
Process and operational control
Audit
internal/external
Inspection
Surveillance
Quality assurance
Questionnaire
Mechanical integrity examinations and inspections
Measures of percentage of improvement actions completed
Review
OHS Management System
Policy
Accountability and responsibility
Competency and training
Documentation
Communication
Eliminate accidents
Reduce incidents
Management commitment
Empower workforce
Extent of management involvement
Workforce involved in safety improvement teams
OHS committee meeting
Employees completed specified
Documentation procedures and system
Clear designation of responsibility
Audit
OHS perception survey
Questionnaire
Training effectiveness survey
Interview
Human Factors
Knowledge
Skills
Attitudes
Cultures
Build highly competent workforce
Provide adequate training
Extent of ability to transfer learning into workplace
Extent of workforce proactive involvement to improve safety
Competency/induction training
Behaviour based observation
Attitude survey
Safety culture questionnaire
Legislation and Regulation
Instigate regulatory body satisfaction
Recognition and rewards for excellence OHS performance
Penalty for non-compliance
Duties under OHS regulation
Audit
Inspection
Scores are given for each measurement to allow for prioritization for improvement e.g. % of non-compliance, % over maximum score. Overall positive performance indicator is then linked with negative indicators.

their OHSMS and operational practices in order to identify current strengths and weaknesses. Many studies as described above agreed that accident statistics, injury rates and compensation costs reflect the past performance of OHS management and do not quantitatively describe the present state of OHS management. Therefore these negative or lagging indicators need to be complemented with other positive or leading indicators to give a more accurate measure of OHS performance. They are needed to identify declining performance trend or problem areas so that corrective actions to prevent further performance degradation can be taken by management. The proposed framework for OHS performance measurement shows the interplay of plant and equipment, systems and procedures, and people. It gives guidelines on how to effectively measure organisation activities that influence OHS performance. Analysis of these measurements and incidents and injury rates will indicate areas for improvement.

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