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Integrating Safety Performance Measures into the Safety Management System

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Introduction

Thirty-eight years ago, when the Occupational Safety and Health Act was signed into law, companies were for the first time required to keep track of their occupational injury and illness case rates. As a result of these legal requirements, many organizations began to use these case rates as the sole indication as to the performance of their safety program. These case rates, which are trailing indicators of safety performance, became the standard by which organizations and safety professionals made decisions as to how the safety program should be administered.

Over the past decade, there has been an ever-growing demand placed upon safety professionals to better quantify the safety performance of the organization in which they work beyond how many people were injured, killed, or suffered from an occupational illness. With the adoption of ANSI Z-10: Occupational Safety and Health Management System standard in 2005 and a better understanding of how safety performance programs should be developed and implemented, safety metrics have begun to expand into leading indicators and current indicators.

The problem, however, is that companies and safety professionals have developed a number of these indicators with no real understanding as to how well they measure safety performance, the types of safety program interventions that are most effective in creating change in improving the safety performance indicators, and what appropriate methods should be used to determine if the safety performance indicators are adequate.

A critical part of the safety professional's job is to show how safety performance is improving. The field for the most part has accepted the continuous improvement process as an integral component of program implementation. This continuous improvement process finds it roots in quality control in which a desired outcome is defined, activities are planned and implemented, measurements against this outcome are taken, gaps identified, changes made, and measurements taken again. In the safety arena, the development of safety performance

improvement programs has been found to at times be more of a hit and miss approach rather than a systematic process. Unintended consequences of this approach can result in poor measures, a lack of performance improvement, wasted resources, and a disconnect between measurements, safety activities, and performance.

Safety Management Systems

Safety management systems are comprehensive frameworks by which a safety program can be planned, implemented and evaluated. There are a number of safety management systems to choose from. The Occupational Safety and Health Administration (2009) defines the critical elements of an effective safety and health management systems as:

- management commitment and employee
- involvement
- worksite analysis
- hazard prevention and control
- training for employees, supervisors and managers

The Department of Energy defines a safety management system as a hierarchy of components to facilitate the orderly development and implementation of safety management throughout the DOE complex (2009). The safety management system consists of six components:

1) the objective
2) guiding principles
3) core functions
4) mechanisms
5) responsibilities
6) implementation

As part of the implementation phase of the DOE framework and the worksite analysis component of the OSHA model, and as part of all safety management systems, there is a need for the monitoring and assessment of safety performance for improvement.

Safety Performance Indicators

Safety program performance indicators are measures that focus on the differences between actual safety performance and what has been defined as acceptable. They are the observable activities and outcomes that are indicative of safety performance. Performance indicators are tools employees and management can use to continually guide and calculate their own improvement by regularly measuring individual, team, and site-wide performance. The performance indicators can be used to identify problem areas, provide some measure of accountability for employees, and corroborate the fact that the organization's goals are (or are not) being met (Janicak, 2003).

A Study which Examines Safety Performance Indicators Integrated into the Safety Management System

With this framework in mind, a study was conducted to determine how the safety profession is integrating safety performance indicators into the management system. To collect the data, a

survey administered to a sample of 700 safety professionals across the major North American Industrial Classification System (NAICS) was generated to ensure a representative sample of respondents. The subjects were randomly selected from the membership of the American Society of Safety Engineers.

An online survey research study aimed at identifying current practices in industry to quantify and analyze safety performance data was conducted. The online survey was developed and administered through Student Voice. The survey instrument collected information about the types of safety performance indicators used in industry, data collection methods employed, and the procedures used to analyze the data and make decisions based upon the performance indicator results.

The purpose of the study was to answer the following questions facing the safety profession:

- How do safety professionals determine if a safety program performing adequately?
- What are the common leading and trailing performance indicators used in industry to measure safety performance?
- What program areas do safety professionals monitor to determine overall safety performance?
- How are performance indicators analyzed by safety professionals?
- How are activity decisions made with regards to safety performance measure?

Results

Response Rate

There were 121 completed surveys used to compile the results of this study for a response rate of approximately 17% which can be considered acceptable for an online survey study. The respondents represented a variety of industries with the majority coming from the manufacturing industry (21%) and construction (18%). Approximately 48% of the respondents were from employers that had over 1,000 employees and approximately 33% of the respondents were from employers with 101 to 500 employees.

Who Collects and Analyzes Safety Performance Data?

With regards to collecting and analyzing safety performance data, approximately 84% of the respondents indicated that their organization was engaged in this type of activity. A cross tabulation of the data indicated that the size of the employer was related to whether the organization collected and analyzed safety performance data. Approximately 72 % of the employers that did not collect and analyze safety performance data were from organizations that had 100 or fewer employees.

The person(s) responsible for collecting and analyzing the safety performance data most often was the safety director or manager. In approximately 29% of the responses, the collection and analysis was completed by a team of people including corporate safety, plant/local level safety, and line supervisors.

The frequency of the data analysis ranged from daily to annually. Approximately 62% of the respondents indicated they analyzed their safety performance data on a monthly basis; approximately 14% on a quarterly basis, 8% on a yearly or weekly basis, and 7% on a daily basis.

Safety Metrics used by Type of Performance Indicator

Respondents were asked to identify the metrics they use to measure their various performance indicators. Results were broken down by leading, current, and trailing indicators. Definitions for

each category were provided in the survey to ensure some consistency in responses. Of the 42 respondents who indicated they collect and analyze data on at least one leading indicator, the most frequently identified indicators were measuring safety audits conducted and safety training programs. Audits were most frequently measured in terms of the number or percentage of audits conducted in a given period. Training was measured in terms of the number of training programs conducted in a given period, the number of workers trained, or the percentage of the workforce that participated in training. Some organizations measured training in terms of specific training topics, while others measured safety more broadly.

Of the respondents that indicated they used one or more leading indicators, results show that the use of audits and training measures were most often identified leading indicators (See Table1). Training indicators included measuring the number or percentage of employees trained, the number of training programs held over a period of time, and the number of training program attendees. Audit measures included the number of audits conducted and the scores obtained on the audit instrument.

Table 1: Most Commonly Reported Leading Indicators

Indicator	N	%
Audits	25	60
Training	25	60
Corrective Action Taken	10	24
Inspections	9	21
New Employee Orientation	8	19
Near Misses	5	12
Unsafe Behaviors Observed	5	12
JSA's	3	7
Toolbox Talks	3	7
Goals Reached	3	7
Safety Committee Meetings	3	7
Other*	12	29

*Examples of other measures include employee coaching, confined space permit and hot work permits issued, disciplinary actions taken, accident investigations conducted, and drug testing conducted.

Of those respondents that indicated they use one or more trailing indicators, incident rates of some form were the most common trailing indicators identified (See Table 2). Workers compensation EMR's, accident costs and losses were the second major group of trailing indicators identified by the group.

Table 2: Most Commonly Reported Trailing Indicators

Indicator	N	%
Incidence Rates (Not specified)	11	25
Lost Workday Case Rates	11	25
Total Recordable Incident	9	20

Rates		
DART Rates	9	20
EMR's	7	16
Costs/Damages	6	14
OSHA Recordable Case Rates	5	11
Number of First Aid Cases	3	7
Number of Near Misses	3	7
Severity of Injuries	2	5
Number of Medical Injuries	2	5
Number of Fatalities	1	2
Days Away From Work	1	2
Other*	4	9

*Motor vehicle accident rates, modified duty case rate, and Injuries YTD.

Difficulties in Implementing a Safety Performance Program

The final portion of the study identified the perceived roadblocks and difficulties in implementing a safety performance program. Respondents were presented with seven different possible roadblocks and asked to rank them in terms of their significance in preventing their organization in implementing the safety performance program. Table 3 summarizes these results. The ranking scale ranged from 1 as Most Significant to 7 as Least Significant.

Table 3: Average Rankings for Perceived Difficulties

Perceived Difficulty	Mean Ranking
Difficulty in implementing improvement activities	3.27
Lack of a relationship between program activities and measures	3.53
Difficulty in matching performance measures to program needs	3.77
Lack of available resources	3.82
Difficulty in obtaining data	4.09
Difficulty in analyzing data	4.75
Difficulty in defining benchmarks	4.76

Kendall's Coefficient of Concordance W = .071, N = 44, Chi Square =18.695, D.F. = 6,P = .005

The null hypothesis tested in the Kendall's Coefficient of Concordance W is that the rankings disagree. Because the Chi Square test was significant, the null hypothesis is rejected and we can conclude there is significant agreement among the respondents in terms of their difficulty rankings.

The results indicate that the greatest difficulties identified by the respondents in implementing the performance indicators is in the implementation of improvement activities followed by finding a relationship between their program activities being implemented and an improvement in the program measures.

There was agreement among the respondents as to the major roadblocks to implementing a safety performance program. The greatest difficulty identified was the implementation of safety program activities to improve performance. One reason for this most frequently identified difficulty is the fact that most organizations are relying solely upon accident and injury incidence rates. Use of such a broad measure of safety performance creates this difficulty for the safety professional to determine the underlying problems which should be addressed. While one may be able to use incidence rates to determine trends, it is virtually impossible to determine, from a program standpoint, what safety program interventions are required to influence the rates.

Discussion

Results from the study indicate many organizations are collecting and analyzing data as a means for monitoring and improving safety performance. One potential limiting factor as to which companies do or do not use safety performance indictors is the size of the organization. As can be expected, smaller organizations with limited resources are less likely to have a formalized safety performance program in place. The size of the organization is related to who is responsible for the data collection, analysis and performance indicator development. For almost all organizations, the safety manager at the facility level of the organization had input into the selection of the safety performance indicators. For larger organizations, corporate level safety directors tended to have a larger role in the identification and selection of the safety performance indicators.

If safety performance indicators are most effective if they are tied to the root causes of the accidents, it would seem more effective for the accidents to be investigated and performance indicators identified at the facility level. While all performance indicators for an organization need to be directly tied to accidents, a combination of global performance indicators and incident specific indicators would appear to be most effective in meeting the organization's goals and objectives.

When examining the types of performance indicators used by the organizations, training metrics, audits, and incidence rates were the most predominantly used performance indicators. In many cases, only one performance indicator was being used. For a safety performance program to be effective, the organization should utilize a variety of indicators (leading and trailing) and some of the performance indicators should be tied to the incidents that are adversely affecting safety performance.

The second highest rated reason for difficulty in implementing the safety performance program is being able to link safety activities to the measures. It is extremely difficult from a statistical standpoint to determine a true cause and effect relationship between the safety activities and safety performance. The best which can be accomplished at the program level is to determine if a relationship exists between safety activities and performance.

Integrating Safety Performance Indicators into the Safety Management System

As previously discussed in this paper, safety performance indicators are measurable activities and outcomes that are indicative of safety performance. A goal for the safety professional is incorporate these performance indicators into the ongoing activities of the safety program. The selection of the performance indicators is based upon the root causes of the incidents which are impacting the desired safety program performance. While a variety of performance indicators

may be available to the safety manager, some decisions should be made as to which indicators would be most advantageous. Some selection criteria may include:

- Availability of data to measure the performance indicator
- Degree of the association between the performance indicators and the program goals and objectives
- Availability of the data to measure the performance indicators
- Data analysis techniques required to ascertain whether the performance is acceptable or not
- Expertise of the safety staff to utilize the safety performance data

Safety Performance Framework

An example of a framework that lends itself well to safety performance improvement is one that was suggested by Organization for Economic Co-operation and Development (OECD, 2003). This framework sets forth the processes needed to establish performance goals and the means by which the safety professional can determine if they are being met. A program framework, at a minimum, consists of defining acceptable levels of performance, collecting data, comparing performance against the acceptable levels, and finally, taking corrective action to improve performance levels. Development of this safety performance measurement system requires input from a variety of sources—both internal and external. Examples of internal input include management, engineering, production, and human resources. External sources of input can include other companies and professional organizations.

Figure 1: Safety Performance Framework

To implement this framework, a safety program performance goal is first established. The performance goal defines the overall goal of the safety program. Keep in mind, the goal is a broadly written achievement for the program.

With the goal established, one or more objectives necessary to achieve the program goal are developed. The objectives are measureable activities and outcomes for the safety program.

The objectives must be tied to achieving the overall program goal. Safety objectives are well defined and measureable expectations of the safety performance program. The safety objectives must be directly tied to the safety goal(s) with the assumption that meeting the safety objectives will result in meeting the overall organizational safety goal(s).

In the next level in this framework, the Safety Performance Indicators are developed. As previously defined, safety performance indicators are observable activities and outcomes which demonstrate that the safety objectives are being met. The absence of the safety performance indicators demonstrates that the things required to meet the safety objectives are not being performed.

A best practice for identifying safety performance indicators is through the use of root cause analysis or similar process. In order to expect a change at the goal level of the framework, the root causes which explain the gaps between the desired goals and actual performance must be identified. Results from the root cause analysis can then be used to define the performance indicators and at the same time ensure the indicators are directly tied to the performance goals and objectives.

Finally, the safety metrics are the data and measures which indicate the status of safety performance indicators. The safety metrics are the means by which the safety performance indicators can be measured and quantified. For example, a performance measure may be the effectiveness of the safety training program used at an organization. The safety metrics used to quantify this effectiveness may include pre and post training test scores and the results from job observations.

Conclusions

Safety performance indicators should be integrated into the safety program activities. Safety performance indicators can be identified through a root cause analysis process. Directing safety performance indicators toward the root causes can have the most effective impact upon meeting the organizations safety goals and objectives. A framework for establishing the organizational safety goals and objectives can be utilized to define the safety performance indicators and corresponding safety metrics. The framework can also serve as a means for ensuring the performance indicators are directly tied to organizational goals and objectives.

Results from the study discussed in the paper indicate that more work is required in the development on safety performance programs. Relying upon a limited number of performance indicators and performance indicators which may not be directly related to the causes for current safety performance measures results in many of the difficulties identified by the safety professionals in this study.

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