

Environmental, Health and Safety Metric Formation— Developing Systems on Basic Principles

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Introduction

Why should Environmental, Health and Safety (EHS) professionals be concerned with metrics? The answer to this is both simple and complex. The simple answer is summed up in the quote “what gets measured gets done.”ⁱ How does the EHS professional know if their efforts are bearing fruit? This can be seen from one of the most widely used metricsⁱⁱ in the United States, the OSHA Recordable. OSHA itself statesⁱⁱⁱ, “The information in OSHA records makes employers more aware of the kinds of injuries and illnesses occurring in the workplace and the hazards that cause or contribute to them. When employers analyze and review the information in their records, they can identify and correct hazardous workplace conditions on their own. Injury and illness records are also an essential tool to help employers manage their company safety and health programs effectively.”

To paraphrase the previous paragraph, OSHA created a mandatory injury and illness record-keeping system to^{iv}:

- 1) Increase employers awareness of the injuries and illnesses occurring in their place of employment,
- 2) Aid in the identifying and correcting of hazards (by the analysis and review of the records being kept), and
- 3) To provide a tool for the effective management of company health and safety programs.

It is evident from OSHA’s statements that the intent was to create a method for companies to aid in their safety efforts in multiple methods. It is obvious how it increased awareness of injuries and identification and corrections. Are these concepts the tool for the “effective management of company health and safety program” OSHA refers to, or did they have another tool(s) in mind? Further clarity can be obtained from OSHA itself. OSHA also states^v (in reference to the Record-keeping system) “Employers and employees use them to compare their own injury and illness experience with the performance of other establishments within their industry and in other industries.” One of the management tools the record-keeping system provides is a way to measure and compare one company's injury performance to another. This comparison is fostered by concept, the Total Case Incident Rate^{vi} (TCIR). The TCIR is formula that incorporates the

number of recordable case (cases which meet the record-keeping criteria) and normalize these case to a facility of 100 employees. It allows facilities/departments/companies of different sizes to have a point of comparison. What is not stated in the OSHA documents, but which can be inferred, is if TCIR can be used to compare different facilities, why can't it be used to compare a facility to itself? Hopefully as EHS program are improved, there will be a decrease in injuries. Why not compare a facility to itself annually as a means to show improvement? TCIR is, in fact, a "metric" many corporations use to judge themselves^{vii}. Safety is a management function^{viii}, as such resources have to be directed and applied as appropriate to company goals and priorities. This is the lynchpin to why metrics are needed. While the previous discussion referred to a safety example, the principles apply also to environmental and health issues. If EHS performance is to be managed, there must be some way to indicate that efforts and resources are being placed in an efficient manner. Metrics are formed and used to assure resource efficiency. The remainder of this paper will discuss how this can be achieved.

Body

Now that it is understood why metrics are needed, the question of how to form them arises. As outlined earlier, there is a common example of a metric in the OSHA TCIR. Before the discussion commences, the definition of metric should be clarified. Webster's dictionary defines "metric"^{ix} as "a standard of measurement". So metrics are the means to standardize the comparison or measurement of some activity. From the definition provided, it can be seen that the TCIR meets the criteria provided. It is standardized (normalizing to a 100 person facility) so that various facilities can be compared against each other (or a facility can compare against itself over time). The activity being measured is injuries (or illnesses). Are injuries a worthwhile measurement? In some cases, yes. The end result of any EHS program is to reduce (or maintain the lack of) injuries. By tracking injuries the EHS professional can gauge if their end result is being met. The reduction in TCIR (injuries) is the end indicator that an EHS program is working. So does that make TCIR a good metric for EHS? From the perspective of a longer term prospective yes, but the TCIR provides little information on the effectiveness of current activities. This is due to the probability nature of safety. If TCIR is looked at for an annual period, for a safety effort put forth in January, at least a year will go by to see if it had any effect on the TCIR. For efforts put forth in November or December the question is if they had enough time to have an effect on the TCIR. That is before the probability nature of safety is taken into account.

Safety can be thought of as efforts to drive an employee's risk to as small as possible. The EHS Professional cannot assure an employee that they will be uninjured at work, but they can make it improbable that they will get injured. The EHS Professional is trying to change probability. As such, actions taken now, while beginning to effect probability, may take various amounts of time to affect final TCIR. As such, TCIR does not meet the requirement of effective resource management. Efforts (resources) can be put into a system that, due to the time implemented (as outlined above) or due to the time required to effect probability, may not show a change in TCIR in the annual period it is reported. Conversely the same resources may be applied to programs that will have not had an effect on TCIR, but this will not be learned until the annual tabulation. The program may not be changed, and further resources wasted, due to the possibilities outlined previously concerning the time factor needed to affect TCIR. The conclusion drawn from the discussion of TCIR is that it alone will not meet the requirements that metrics aid in resource management. Some other type of metric is needed.

TCIR is only an example of a metric. Other examples include;

Number of Lost Work Days

Worker's Compensation Costs

Experience Modifiers

All of the above have some commonality. They are all (including TCIR) observable and directly measurable. It should be noted that these "observable" types of metrics will center around some "unwanted" event. TCIR is measuring the number of injuries/illnesses on an OSHA 300 log. "Number of Lost Work Days" is measuring the number of days lost due to an occupational injury or illness. Worker's Compensations costs are calculated by determining the cost for each individual occupational injury/illness which generated a direct charge and adding these together. In all of the above cases, the metric is somehow based on the observable event of an injury/illness. For EHS, these directly observable metrics will be based on an unwanted event (the injury/illness). This is summed up by the question "How do you measure the injury/illnesses that did not happen"? Proving that injuries did not happen (called proving a null case^x) is difficult and not directly observable. Even what could be considered a "positive" metric of "Days without a Lost Time Accident" is truly based on the unwanted event of a lost-workday case incident.

The implication of the previous discussion is that another "type" of metric is needed. The previous discussion outlined that the direct observable event (the injury) will take various amounts of time for the changing probability to effect. This "time" is an opportunity for wasted resources. This different type of metric will also aid in highlighting how injuries/illness did not happen, it is supporting a null case hypothesis. A "type" of metric is needed which will indicate that probability is changing (as intended). This "type" of metric will not be directly observed in the end result; it will involve observations that indicate probability is changing and therefore *predict* that an injury will not occur.

An example of this is mandatory seatbelt use on forklifts. Studies and scientific observations have shown that use of a seatbelt while operating a forklift will increase the likelihood of the driver staying inside the cage area of a forklift and, therefore, decrease the likelihood of them suffering a severe/fatal injury from the cage in a tip-over situation. The driver can still be severely injured or killed in a forklift accident, but the chances of this occurring decrease with seatbelt use. Measuring and finding a high level of seatbelt use for forklift drivers indicates that the probability of a forklift driver being severely injured or dying in a forklift accident is reduced, but there is still some probability that they can be. The seatbelt use is *predicting* the injury will not occur, but until an individual driver is finished using a forklift, there is still a chance it will occur.

Following the logic outlined thus far, establishing an effective and efficient metric program will involve developing two types of metrics. One type is metrics which are directly observable events and which can be measured and observed. These metrics, while having the advantage of direct measurability will take time to be effected and may be influenced by events other than direct activities of EHS professionals. Since they are tabulated after an unwanted event occurs, these metrics will be referred to here after as Lagging Metrics. The second type of metrics is based on actions/indicators that the unwanted event will not occur, that the probability is changing so that the unwanted event is unlikely. These predicative metrics will from here forward

be referred to as Leading metrics. They are happening before an event is recorded and in some instances can be used to support the null case.

Before moving on to recommendations on forming metrics, a discussion should be had on an assumption inherent in metric formation. As stated earlier, metrics are used to measure a process and to aid in efficient resource use. Both of these objectives can be met, with ease, in an unsafe, environmentally unfriendly and injury prone workplace. The metrics can show that many injuries occur and that what resources are being used, are used in a manner that maximizes their benefit. While the previous statement meets the definition as laid out, many EHS professionals would take umbrage with them. They would argue that metrics should be used as a gauge to improvement. This is often how metrics are used^{xi}, but this use is not implicit in the definition and therefore, must be stated. Often metrics are used to help the EHS professional drive improvement. Improvement occurs in a set amount of time. If improvement is on-going the metrics can be used to drive continuous improvement.

For metrics to aid in driving improvement (and also continuous improvement), metrics must change over time. A company decides they want to set a metrics for a 25% percent decrease in TCIR every year. While this may have a benefit for a number of years, what happens when they drive the TCIR to zero? A 25% reduction no longer has meaning, so the metric itself has to change. What if the company has reached such a low number for years with no change? Due to the probability nature of safety, an organization may always have some TCIR^{xii}. If the attempt is made to reduce a TCIR below some very low point, which may be unavoidable, how is it assured that resources are being utilized efficiently?

This case highlights the fact that to continue to drive improvement, metrics must change over time. To truly improve programs, organizations must realize the need for shifting metrics. Metrics that were used to improve a program may not be appropriate to maintain a program at its current level. This is a logical extension of an EHS process. In an EHS process, the activities that are conducted will change as the process matures. As an example, a facility may go from developing machine specific Lockout/Tagout procedures to reviewing/updating (maintaining) the procedures. Just as the activities are changing, the metrics, which are measures of activities, (this will be expanded upon late in the paper) will have to shift accordingly.

Now that the different types of metrics have been highlighted, the discussion can move onto utilizing these metrics. For this to occur, a moment must be taken to discuss two other terms relevant to metrics, goals and objectives. Since the goal is the overall aim of a program, it will be based on Lagging metrics. The end result of a safety program is to reduce injuries. That is measured directly in the amount of injuries. Objectives are specific actions taken that will lead to the goal and a time frame is usually specified with objectives. While goals are general, objectives are more specific. The objectives will provide additional details on how the goal will be met. This is specifically relevant because while the ultimate goal may not change, objectives should be changing as the situations move closer to the goals. Once a step towards the goal is completed, a new step is needed. This objective should recognize the step that was completed and the new step to be accomplished.

A non-safety example would be:

The goal may be “To write a book”

The objectives would be:

Write an outline (in 6 weeks)

Write a chapter (every month)
Have the book proofed/edited (within 8 weeks of completion)

The metrics would be how the would-be author compares to the stated objectives. One item to keep in mind with this example, it is for a concrete, definable task. Once the book is written, there are no additional objectives. In a situation such as achieving a safer work place, there would be continuous objectives geared towards assuring that the processes that lead to the level of safety are continued.

With this information, the reader is in a position to begin applying metrics effectively to their process. The process can start with a question, "What is the goal of the program?" While this answer can be expressed in a number of ways, it will come down to reducing incidents. The exact wording of the goal is up to the individual organization and will be dictated by the organization's logistics. For an example, the goal of zero injuries will be used. By its nature, this is a continuous improvement goal. The lack of a specific timeframe implies it is a goal to be achieved and maintained. While the goal, which is an overall desire, is somewhat simple to state, the objectives will involve additional effort.

For objectives to have meaning, an analysis must have been conducted in the EHS program, gaps realized and strategies developed to correct these gaps. This should sound similar to managing an EHS program. As stated earlier, metric formation is partly to aid in efficient resource management. Metric formation is an extension of EHS Management and should be a complement to the normal EHS Management activities. All metrics are doing is aiding in determining if various EHS management functions are performing as desired. If they are, resources can continue being used by them, if not new strategies have to be introduced. This can be best illustrated by an example.

An EHS Manager has analyzed the company's injuries and has started a number of emphasis programs:

- Ergonomics
- Supervisor as safety coaches
- LO/TO emphasis

The manager and the company leadership have decided, based on the analysis, upon a goal of a 50% reduction in injuries over 5 years. This will be achieved based on improvement driven by the Manager in the three emphasis program. To measure the attainment of the goals, Objectives for the next three years are laid out, so that at the three year mark the attainment of the goal can be assessed and adjustments made, as appropriate. A general objective of injury reduction is set for the three years. Objectives are set for the three emphasis area. The objectives are:

Ergonomics:

- First year all of the company's facilities will have completed ergonomic training for all employees

- Second Year all of the company's facilities will have functioning ergonomic teams

- Third year all of the company's facilities will have submitted at least three ergonomic improvements

Supervisors as safety coaches

First year all of the company's facilities will have conducted Supervisor as a Safety Leader training for all supervisors and managers

Second Year all of the company's facilities will have Supervisors performing weekly Safety Training Toolboxes 100% of the time

Third year all of the company's facilities will have Supervisors submitting weekly safety inspection sheets

LO/TO emphasis

First year all of the company's facilities will have audited and identified all machinery for which a Machine Specific LO/TO procedure does not exist

Second Year all of the company's facilities will have developed Machine Specific LO/TO procedures for >50% of their inventory

Third year all of the company's facilities will have developed Machine Specific LO/TO procedures for 100% of their inventory

After three years the company can compare how the various programs, and the number of injuries, compare. They can then make appropriate adjustments for the remainder of the two years to meet the five year goal.

Conclusion

As outlined above, metrics can be used to aid in effectively utilizing resources. By analyzing the current activities of the EHS professional and building metrics to determine how well EHS activities are being applied, it can be determined which activities are driving performance (and should be given resources) and which activities are questionable (and should have the resources used applied elsewhere).

ⁱ Quote unknown

ⁱⁱ By the fact that a majority of US industry is mandated (by regulation) to track injuries in this way

ⁱⁱⁱ Occupational Safety and Health Administration (OSHA). CFR 29 1904, Recordkeeping Preamble. Section II. The Occupational Safety and Health Act and the Functions of the Recordkeeping System, Functions of the Recordkeeping System (retrieved March 5th, 2009)

(http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=FEDERAL_REGIST)

^{iv}This list is not exhaustive. The original document should be referenced for a list of all of OSHA's rationale for implementing the Record-keeping standard.

^v See iii

^{vi} OSHA "Forms for Recording Work Related Injury and illness", Page 5, 2004(retrieved March 5th, 2009) <http://www.osha.gov/recordkeeping/new-osh300form1-1-04.pdf>

^{vii} Author's personal experience

^{viii} Dan Peterson, http://ehstoday.com/news/ehs_imp_32659/

^{ix} 3/2/09 <http://www.merriam-webster.com/dictionary/metric>

^x Streiner, David L. 2003 "Unicorns Do Exist: A Tutorial on "Proving" the Null Hypothesis" *Canadian Journal of Psychiatry* (December), pp. 756-761.

^{xi} EHS Today. *Safety Metrics the Big Picture*, Mathis, Terry (retrieved March 5th, 2009)
(http://ehstoday.com/safety/SafetyMetrics_ProAct.pdf)