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Title: EFCOG Industrial Hygiene Performance Indicator Guide

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EFCOG
Industrial Hygiene
Performance Indicator Guide

Background

The accepted definition of industrial hygiene is*:* "The s*cience and art devoted to the anticipation, recognition, evaluation, prevention, and control of those environmental factors or stresses arising in or from the workplace which may cause sickness, impaired health and well being, or significant discomfort among workers or among citizens of the community."*[i] The implementation of industrial hygiene principles is generally described in an organization's Industrial Hygiene Program, with specific industrial hygiene program elements. The ability of an industrial hygiene staff to demonstrate value of an overall industrial hygiene program and of particular program elements is crucial. This allows for programs to receive adequate resources, so that true prevention and control of health hazards can be achieved. Value can be demonstrated by applying metrics, or performance indicators, to determine the "health" or effectiveness, of an industrial hygiene program.

The goal of any industrial hygiene program is to prevent disease or injury. However, it is extremely difficult to measure whether a program has prevented disease or injury for several reasons. First, the latency period of occupational disease can be years, or even decades. Examples of these include; hearing loss and chronic beryllium disease. Second, diseases related to non-occupational exposure to contaminants cannot always be discerned from occupational exposure, e.g., a smoker who with elevated blood lead levels. Third, chronic effects (vs. acute effects), are not so easily observed, and can take years to appear. Because we cannot easily or truly measure if we have achieved our goal of prevention of disease or injury, we must measure the effectiveness of our industrial hygiene programs.

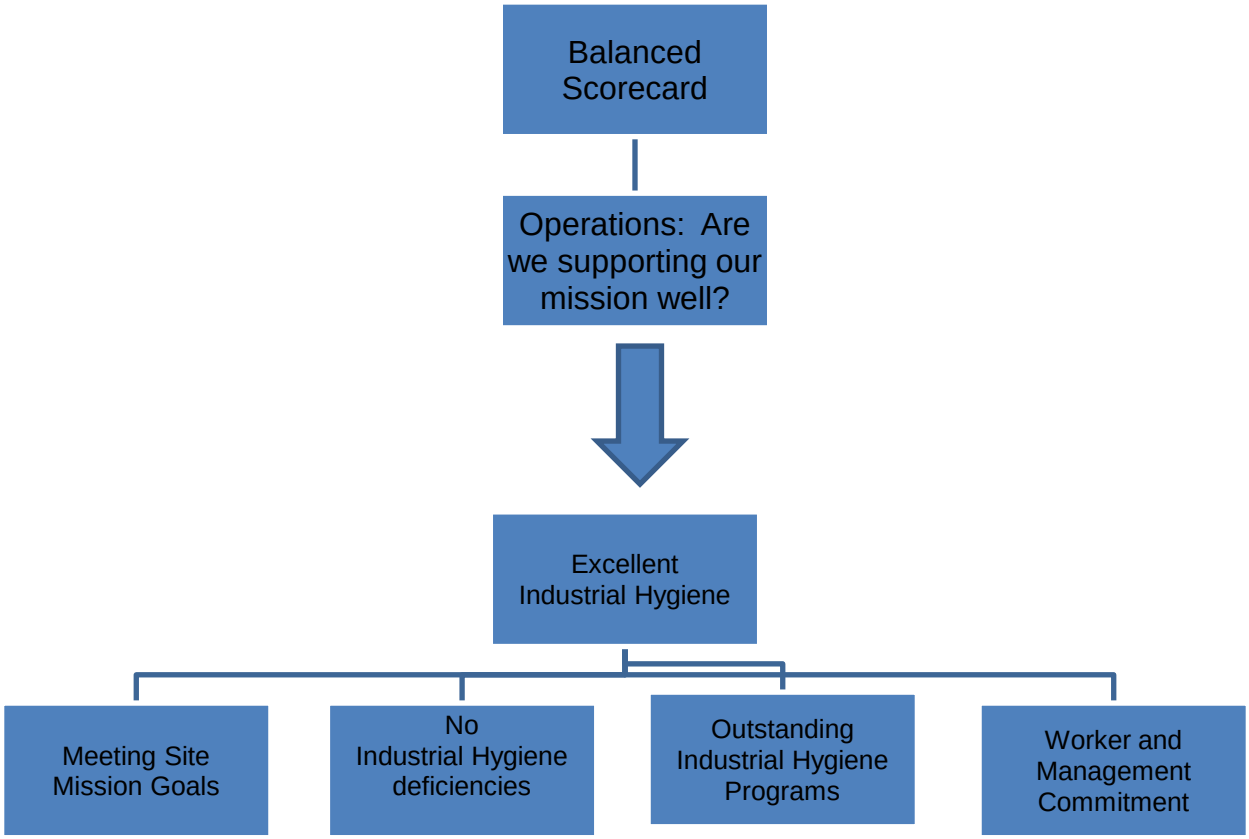
If you are an industrial hygiene program manager or are an industrial hygienist in charge of a particular program element:

- How do you know your program is being managed adequately?
- How do you show progress towards goals or completion of action plans?

- How do you integrate anticipation, recognition, evaluation, and control with business and management?
- Do you use leading indicators, lagging indicators, or both?
- How do you show continuous improvement?

Performance indicators can help answer these questions.

You may also hear senior management discussing a balanced scorecard. Industrial Hygiene programs fit directly into a balanced scorecard approach.



Performance Indicators

Effective industrial hygiene programs ensure prevention and control of health hazards in the workplace. Healthy industrial hygiene programs have a clear, risk based approach, operate efficiently, have sufficient resources, employ a feedback and improvement process, and demonstrate sustainability (i.e., long range planning, and succession planning). Healthy industrial hygiene programs have a written program that addresses regulatory requirements (drivers), consensus standards, good practices, and local requirements. Most importantly, healthy industrial hygiene programs allow for reporting performance, making decisions, implementing strategies, and improving performance. This is done by using performance indicators, based on metrics, as key indicators of the health of an industrial hygiene program, and routine collection of performance indicator information. Used properly, performance indicators show how well an organization is performing, if the organization is meeting its goals, if the organizations processes are in control, if and where improvements can be made, and if implemented improvement strategies yield the desired results.

A performance indicator is a measure of a specific observation, characterizing performance of an activity, program, or process. Review of performance indicator information results in identification of actions that need to be taken to influence trends in positive directions, along with tracking of corrective actions and regular program assessment. There are three types of performance indicators: output, process, and outcome metrics.

Output metrics are tabulations, calculations, or records of activity. They measure the direct products and services delivered by a program. Examples include; the number of employees enrolled in the hearing conservation program, the number of requests for ergonomic evaluations, or the number of indoor air quality complaints received by industrial hygiene staff. Process metrics assess the extent to which a program is operating as it was intended. Examples include results of customer satisfaction surveys, the average time between exposure assessments, number of ergonomic evaluations performed, or number of air quality complaints resolved. Outcome metrics answer the question: “Was the program effective?” by assessing the results of a program compared with the program’s intended purpose[ii]. Examples include injury and illness rates or lost workday rates. Output and process metrics are leading performance indicators; outcome metrics are lagging performance indicators.

Both lagging and leading performance indicators serve a useful purpose for evaluation of industrial hygiene programs. Outcome metrics are lagging indicators, i.e., those that measure things that have already happened. They are generally retrospective in nature. A leading performance indicator is a metric that provides assurance that the process is operating as expected. A leading indicator is prospective, and:

- is a predictor of future performance based on selected criteria, allowing for modifications or changes in performance,
- used to drive and measure activities carried out to prevent and control negative outcomes, e.g., injury, damage or loss,
- allows for prediction of the likelihood of a negative outcome before it occurs,
- allows for effective intervention to address or reverse a negative trend, or continuance a positive trend
- is proactive, predictive, and objectively and reliably measurable,
- has direct connection with desired goal, outcome, or result, and
- is built on a reliable system of data management that includes reporting, tracking and correction

In addition, leading performance indicators are also an excellent diagnostic tool. Leading performance indicators should be quantitative information, but on occasion may include qualitative information. Leading indicators are also used to assess quality and rate of improvement. Examples of leading indicators are: the number of safety inspections and audits, safety meeting attendance by affected employees, percent of employees current with required training, behavior sampling, employee safety perception surveys, risk-mapping, percent of audit deficiencies corrected on time, near-miss reporting and analysis, quality and quantity of employee safety suggestions, scope of the training plan, and compliance with standards and guidelines.

Moving Averages

While outcome metrics are by definition lagging indicators, through proper analysis, the information can still be useful in establishing trends and determining if any changes are significant.

In addition, a shorter period moving average can be compared to a longer term moving average to determine the trend. For example a 12 month moving average of the TRC

can by compared to a 60 month moving average to determine if the trend is moving up or down relative to the longer term trend.

Developing Metrics

While it is easy to measure what's "under the lamp post," a "good" metric must take into account several characteristics. It must be relevant, crucial to success, and actionable to users (i.e., in their "line of sight"). It should have proper comparatives, encourage right behaviors, be technically correct, result in clear, graphic reporting, be cost effective, and be complete and balanced (i.e., not rob Peter to pay Paul). Well-designed metrics are concrete, auditable, demonstrate assumption of risk, and yield useful information.

A simple way to develop your industrial hygiene metrics is to use a three-step process: define your performance topics, your critical success factors, and then your performance indicators[iii]. The performance topics in this case are your industrial hygiene program elements, e.g., asbestos and other fibers, beryllium, biosafety/food safety, chemical safety, confined space, ergonomics, exposure assessment, ventilation, indoor air quality, lead and other toxic metals, nanomaterial safety, noise, reproductive health hazards, respiratory protection/personal protective equipment, silica, temperature stresses, welding/cutting, IH equipment, and toxic gases.

Your critical success factors depend on your business strategies and stakeholders. For strategies, consider your mission, and your short and long-term goals. A mission statement associated with your industrial hygiene organization may be an ambitious high level goal. Success might be better reached if you brainstorm and develop your real, practical mission, based on industrial hygiene ethics, and good industrial hygiene practices. For stakeholders, consider that the worker is your most important stakeholder. Other critical stakeholders are internal and external customers, regulatory agencies, and senior management. Think about each stakeholder, and what may be of value to that stakeholder. Finally, when defining your critical success factors, include not only the "squeaky wheel" but the "sleeping alligators."

In drafting your actual performance indicators, judge the potential success of your performance indicator by answering the following questions [iv](see the example in Figure 1):

1. What type of performance indicator is it (output, process, outcome)?
2. What are the details of the performance indicator?
3. How the performance indicator will be used?
4. Who is the target audience/stakeholder?
5. What is the driver(s)?
6. What are the benefits/values?
7. How useful is it?
8. What are the weakness/limitations?
9. What are issues that could impact your performance indicator?
10. What is your data source? Is it readily available? Do you have the resources to extract the needed data? Do you have a numerator and a denominator?
11. How will you use/interpret the data?

Figure 1. Example of Performance indicator review

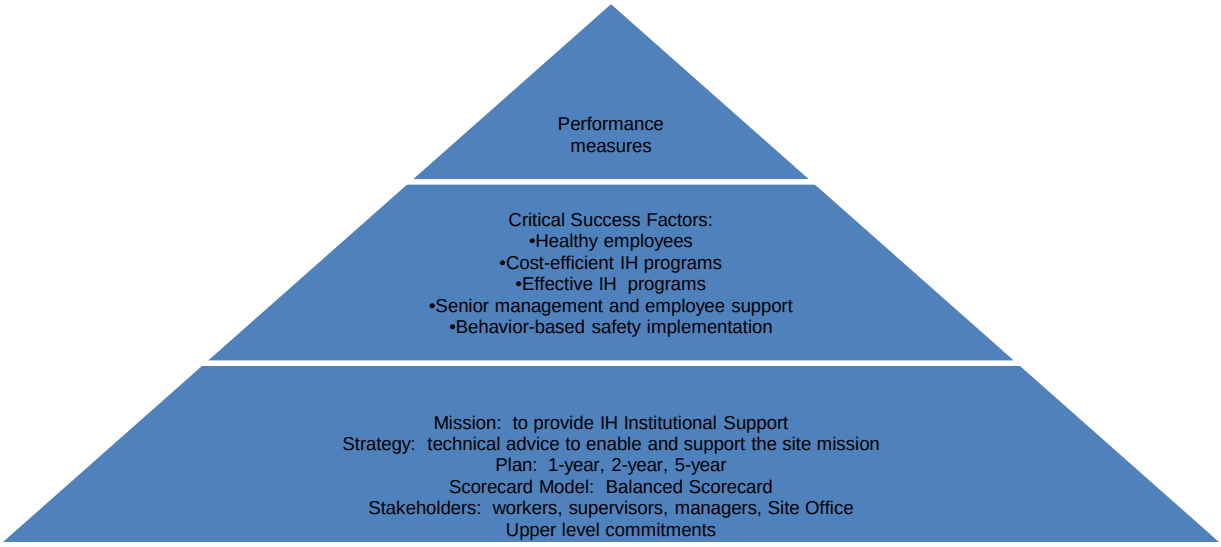
Type of metric	Description	Objective	Definitions	Target audience/ Stakeholder	Current requirements	Benefits/ value	Weakness /limitations	Data sources	Interpreting data
Output	Percentage of personnel on respiratory protection program who have exposure assessments	Assess the degree to which the requirement for employees to wear respirators has been validated.	Exposure assessment: the determination of the level of a hazard to which an employee is exposed.	Workers, Respiratory Protection Program Administrator, Occupational Medicine, Site Office	2 9 CFR 1910.132 (d)(2)	Assures proper respiratory protection has been selected for employees.	Does not include employees wearing respirators where IH has not been notified.	Number of employees notified by RPP/ number of employees using respiratory protection	A 100% rate is desirable. Rates below 100% indicate employees may be wearing improperly selected respiratory

Type of metric	Description	Objective	Definitions	Target audience/ Stakeholder	Current requirements	Benefits/ value	Weakness /limitations	Data sources	Interpreting data
	validating the need for respirators.							IH surveys	protection or employee is not formally notified of respiratory protection requirements.

Once you have completed your metrics, re-evaluate which ones will be the focus of your efforts. Ask the following:

1. How many performance indicators should I begin to measure?
2. How often should I measure?

To ensure success, it is important to focus on a "critical few" performance indicators. However, when you do so, keep in mind "sleeping alligators," realize that comprehensive pictures of performance provided by multiple performance indicators can help achieve overall understanding, and provide for important decision making. Remember, that anything not measured is subject to being sacrificed for the things that are measured[iii]. In addition, obtaining stakeholder buy-in will help ensure that results are seen as meaningful.



Reporting

When reporting on your performance indicators, consider how they are presented, how consistently they are reported, and what benchmarks are being used. Presenting the

data in graph form, rather than narrative form, allows for a quick, effective visual depiction of where you were, where you are, and where you are headed. To achieve consistency in reporting, ensure that your measurement definitions (e.g., numerator and denominator) remain constant from period to period, to allow for a true determination of whether improvements have been achieved. Benchmarks can be your own past performance, comparisons to other sites or industries, or even stakeholder expectations.

Continuous Improvement and Feedback

Once you have created your initial set of performance indicators, and have begun to measure, ask yourself the following questions[v]:

1. Could my performance measure be contaminated by factors that render conclusions uncertain or invalid?
2. Is "denominator management" a risk? When a ratio is used, denominator management occurs when focus is directed at the denominator, rather than the numerator, a wasted effort that only improves the metric itself rather than reducing the "defect." Denominator management may also mean you have hit a ceiling, and it is time to develop a new metric.
3. How can a good performance indicator be made better? Use continuous improvement, annual review, and a roadmap.

Program Performance Evaluations

Program performance evaluations include proactive identification of issues/concerns; development of controls; effective use of feedback and improvement; demonstrated recognition of hazards; correction of hazardous situations; documented results; effective institutional management of related ESH systems; achievement/results in line with chosen benchmarks; demonstration of improved operations through use of performance-based assessments; and effective implementation of a corrective action managements program.

Conclusions

A challenge for today's industrial hygienist is to be able to clearly demonstrate the value of an industrial hygiene program. This can be done using performance indicators, using reliable data gathering methods, specific to your audience and site. These, coupled with

a strong program performance evaluation system, can identify immediate status of a program or additional needs, including resources or improvements in processes or systems.

Additional Resources/References

American Industrial Hygiene Association
http://www.aiha.org/aboutaiha/Pages/WhatIsanIH.aspx
Neufeld, K., "Developing Industrial Hygiene Metrics," The Synergist, December 2006
Frost, B., "Measuring Performance", Measurement International, ISBN 0-9702471-1-7"
American Industrial Hygiene Association, "Industrial Hygiene Performance Metrics

http://www.skybrary.aero/index.php/ICAO_Methodology_for_Accident_Rate_Calculation_and_Trending

http://www.efcog.org/wg/esh_es/Statistical_Process_Control/index.htm

Attachments

Attachment A: Six Sigma Data Gathering Tools for Performance Indicators
Attachment B: Statistical Process Control

Attachment A: Six Sigma Data Gathering Tools for Performance Indicators

Six sigma is a philosophy of doing business or providing a product or service that reduces variation in the outcome of a process, focuses on continuous improvement, results in customer-focused data driven decisions, and creates a common language across a site. Six Sigma uses a methodology that using structured problem solving with roadmaps and tools. The basic tools are described below. Contact your site's Six Sigma organization for more information.

Value Stream Map

A value stream is a series of processes that represent everything required to generate an output. A value stream map is a technique used to analyze and design the flow of materials and information required to product a product. The technique allows you to ensure you don't improve one process at the expense of another. Changes made in an upstream process trickle downstream, e.g. for hazard control, and medical surveillance. The higher up in the stream you make process changes, the better Return on Investment.

Process Map (current and future state).

A process map allows reference to activities and defines what an entity does, who is responsible, to what standard a process should be completed and how the success of the process is determined.

Creating a Business Case

Define a problem statement and objective, and using cost of poor quality (COPQ). COPQ are costs that would be eliminated if systems and processes were "perfect."

Primary and Secondary Metrics

If you define a process as Y = f(x) where X's are the critical inputs, and Y is the output, the primary metric of a process is the Y of that process, meaning an output of the process under consideration. Primary metrics should be tied to the problem statement and objective, measureable, aligned to business objectives, tracked at an appropriate frequency, and expressed graphically over time with a run chart, time series or control chart. Secondary metrics track what should not be sacrificed on behalf of the primary improvement.

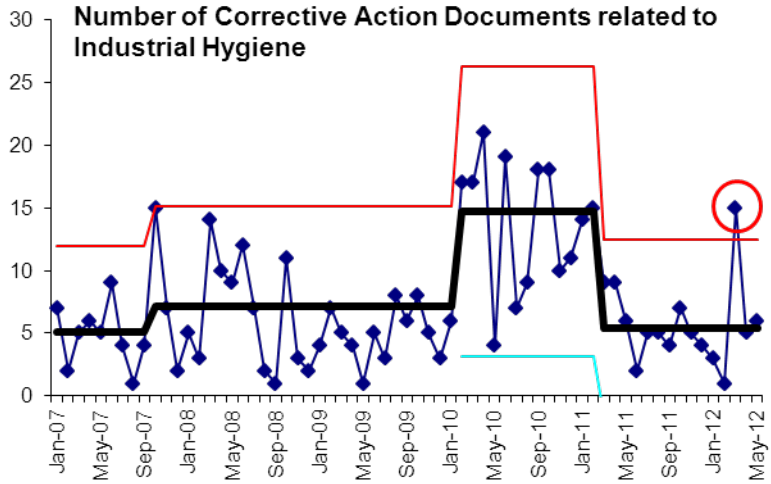
Data Analysis

Measurement system analysis, histograms, pareto and other graphs, statistical process control, R software, cause and effect diagrams (to determine improvement options), XY matrix, FMEA, Chi-square test.

Attachment B: Statistical Process Control

Energy Facilities Contractors Group ESH Working Group
Industrial Hygiene/Industrial Safety Subgroup

Statistical Process Control



The Statistical Process Control chart (or control chart) allows the safety professional to determine if a trend is occurring in the data. The control chart displays the data (diamonds above), a baseline average (black), an upper control limit (red) and a lower control limit (blue). In the chart above, the data increase from 2007 to 2010 with successively increasing baseline averages, then the rate decreases in 2011, but there is a single month spike above the upper control limit in March 2012 (circled in red).

Attachment 3 to DOE Order 231.1B *Environment, Safety, and Health Reporting* contains the following requirement:

Occupational injury and illness information must be analyzed to identify adverse trends and lessons learned and develop corrective actions that prevent recurrence.

Statistical Process Control (SPC) does provide a technical basis for identification of trends. A list of SPC criteria for declaration of a trend found in INPO Best Practice 07-

007 and the EFCOG website follows.

- Individual points above the Upper Control Limit.
- Individual points below the Lower Control Limit.
- Seven points in a row all above average or all below the baseline average.
- Seven points in a row increasing.
- Seven points in a row decreasing.
- Ten out of eleven points in a row all above the baseline average or all below the baseline average.
- Two out of three points in a row outside of two standard deviations above
- the average, or two out of three points in a row outside of two standard deviations below the baseline average.
- Four out of five points in a row outside of one standard deviation above
- the average, or four out of five points in a row outside of one standard deviation below the baseline average.

Early and effective detection of trends using SPC allows the safety professional to take action early to turn around adverse trends. Use of moving averages and targets may mask trends and prevent their detection, or trigger false alarms. Use of SPC helps to meet the following requirement in DOE Order 226.1B.

Communicate issues and performance trends or analysis results up the contractor management chain to senior management using a graded approach that considers hazards and risks, and provides sufficient technical basis to allow managers to make informed decisions and correct negative performance/compliance trends before they become significant issues.

These references are redundant to the other ones on a previous page.

[i] American Industrial Hygiene Association http://www.aiha.org/aboutaiha/Pages/WhatIsanIH.aspx
[ii] "Neufeld, K, "Developing Industrial Hygiene Metrics", The Synergist, December 2006
[iii] B. Frost, "Measuring Performance", Measurement International, ISBN 0-9702471-1-7
[iv] American Industrial Hygiene Association, "Industrial Hygiene Performance Metrics
[v] B. Frost, "Measuring Performance", Measurement International, ISBN 0-9702471-1-7