Session No. 602

SH&E Metrics: From Compliance to System Improvement

Holly C. Elke, CSP, CRSP, CMQ/OE
President & Senior QHSE Advisor
SH&E System Solutions Inc.
Calgary, Alberta, Canada

Introduction

The primary purpose of the SH&E management system is to protect the assets of an organization. To determine if the system is accomplishing this purpose, a performance measurement program must be established. The use of performance standards, commonly known as *Metrics*, has become an integral requirement of the SH&E Management system. Metrics are used to verify if the products, processes and systems that have been implemented to prevent or control losses that can impact the customers of the organization are effective and functioning as designed. As each organization has a variety of internal and external customers, such as employees, visitors, contractors, shareholders, regulators, the public and other relevant stakeholders, the use of company specific performance standards and measurements will need to be developed and implemented.

Performance goals and metrics are commonly grouped into the following categories:

- **Financial:** The perspective of your shareholders and the investment in resources
- **Customer:** What your customers experience and perceive
- **Business Process:** The key processes you use to meet and exceed customer and shareholder requirements
- **Learning and Growth:** How you foster ongoing change and continuous improvement

As the SH&E management system is a fundamental business process, there is growing pressure to verify the effectiveness of this system in preventing losses (financial, customer) and identifying improvement opportunities (learning and growth). The use of traditional *Lagging Indicators* to measure this effectiveness has often been challenged by regulators, industry and other organizational stakeholders. The evolution of the metrics program from collecting generic "after the event" measurements to presenting customized *Key Performance Indicators* is vital to the survival of the SH&E Management program and securing its role in the strategic business plan.

The Science of Metrology

The development of an effective *Metrics* program requires a basic understanding of the principles of measurement and data collection. *Metrology* is the science of logical measurement which is vital to

controlling the processes and products (training, air monitoring, software for data management, etc.) that can impact the total SH&E system and effort. The collection of data is an integral part of the metrology system and the manner in which this data is obtained and managed will have a significant impact on the SH&E metrics that are selected to be evaluated.

Data Collection

There are three types of data that can be collected and analyzed; these are attribute, variable and locational data. **Attribute** data is also known as counted data. This type of data answers questions of "how many" or "how often" and is the primary type of data that comprises the traditional lagging indicators collected by most organizations. Examples of this data may include; How many accidents? How many near misses? How often was a particular root cause identified.

Variable Data is measured data and answers questions like "how long", "what volume, "how much time" and "how far? This type of data is generally measured with an instrument or device, which needs to be considered when selecting metrics that use this type of data. The costs of training, equipment calibration and use, interpretation, equipment failure and loss of data, etc. should be factored into the decision to collect this type of measurement. Identification and quantification of air, soil and water contaminants are prime examples of variable data, along with cycle times for incident/accident reporting & investigations to be completed.

Variable data is higher in quality as it is more precise and contains more information against which to make judgments. It is better to know the quantity of a regulated substance that may injure people, rather than the number of people who have been injured by the regulated substance. If variable data cannot be collected, it is sometimes possible to use counted data to infer the performance of a product or process. For example, identifying the number of slip events within a defined area of the workplace, both before and after a new floor coating is applied to reduce injuries, can be an indicator of action effectiveness.

Locational data simply answers the question "where". Based on the example above, if the location of the loss event is not specified, then the actions taken may be greater (applying the coating to the floor of the whole worksite) or less (not applying it to the correct or complete area where slips have occurred) than is required to correct the problem. This can lead to increased costs through the application of unnecessary resources (time, people, money) or additional losses due to ineffective actions. The use of "measle" charts can help visually depict the location of recurring results or events.

Information Management

Data in the raw form is meaningless and requires manipulation in order to be transformed into something useful for the organization. These manipulations may include sorting, categorizing, analyzing, calculating, summarizing, testing, etc. in order to transform the data into information. Information has meaning within the organization, and this is based upon the interpretation of the user of the information. The user may choose to store, share or ignore the information that has been provided. Information is usually correlated or integrated with previously known information, such as rules, policies, procedures, regulations, etc. to build knowledge.

Knowledge has two forms, *tacit* and *explicit.* Tacit knowledge consists of difficult to articulate "know how" or expertise that is part of the individual or organizations expertise. This type of knowledge is generally not recorded, and while it is part of the corporate intellectual asset pool, there is no guarantee that it will be passed on to the next generation of employees. *Explicit knowledge* is the recorded or codified information that comprises our procedures, processes, standards and other documents. The majority of the organizational *knowledge management* (KM) effort focuses on trying to convert tacit knowledge to explicit knowledge without losing value or meaning.

Wisdom is developed from the collective database of knowledge and the experience, values and expert insights of the individual and the organization. Wisdom can provide the organization with the capability to use and apply the knowledge gained for informed decision making. This is assuming, of course, that both types of knowledge and skill level reside in the provider of the "wisdom".

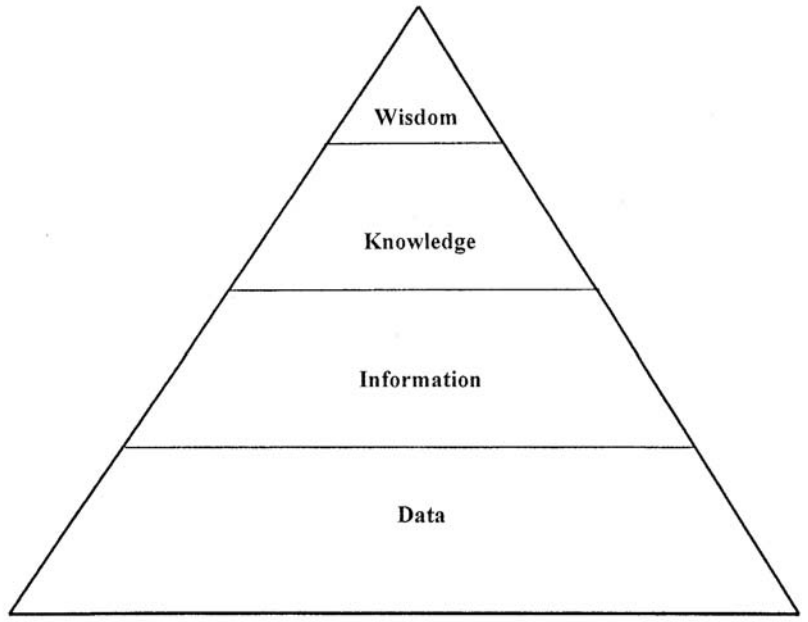

Figure 13.3 Transformation of data.

Exhibit 1. Knowledge Management.[1]

To create an effective SH&E metrics program, careful consideration must be given to the knowledge management model and processes. The creation of knowledge from information is dependent on human capability and the application of wisdom is a human function. Therefore, there are several issues that should be considered when determining the collection, communication and accessibility of data required to support the SH&E metrics that are chosen. These include:

- Identifying the types of data to be collected, and the media on which it will be captured (manual vs. electronic records);
- Determining how the data can be used to create information and whether the data needs to be upgraded to "information";
- Identifying the "customers", both internal and external, who will need or use this data, and the standards for protection;
- Methods required to search and access the data once it has been collected;
- Protocols or standards for managing (use, maintenance, handling, preservation, access, retention and disposal) data.

Why Measure?

The most common metrics or performance standards used are the traditional loss or accident statistics, also known as Lagging Indicators. These include Fatalities, Loss Time Accidents/ Incidents (LTA/LTI), Medical and First Aid Treatment Cases (MTC/FTC), Return to Work Cases (RWC),

Away from Work Days, Modified Duty days, Fatalities, Total injury frequency (TIF) and severity rates. The focus from regulators, company shareholders and those who are responsible for securing external service providers on non-compliance events or legislative orders has also increased. These are the traditional loss statistics that are required by law (OSHA, WCB), industry or formal requests for proposal. The reality is that these "after the event" or "end of the pipe" measurements provide a limited picture of the overall performance of the company and focus primarily on historical failure. For small employers, this can have a significant impact on meeting compliance requirements, securing reasonable market rates for business operations and winning new clients or contracts.

A significant shift away from using *Lagging Indicators* has gained momentum both within the regulatory framework and the corporate structure. The use of international standards, such as ISO 9001, ISO 14001, and national standards such as OHSAS 18001, ANSI Z10 and CSA Z1000, to establish and guide the corporate quality and SH&E systems are gaining in popularity and acceptance. These standards provide the framework for establishing a structured and consistent process for:

- Developing company specific strategic and tactical goals (PLAN);
- Establishing performance measurement standards (DO);
- Identifying Key Performance Indicators (CHECK), and;
- Analyzing or evaluating the results of this process to determine successes and opportunities for improvement (ACT).

This process allows each company to create a customized picture, or scorecard, of organizational performance that includes company **achievements** as well as **opportunities to improve** based upon recorded failures (Lagging Indicators) or deficiencies. This new "picture" allows the organization to demonstrate its ability to identify problems, to apply processes to correct or prevent these problems and to measure the success of the actions that have been taken. The customized collection and presentation of performance information can also significantly increase the confidence level of the organizations customers who rely on the SH&E system to prevent loss and protect them. The company specific scorecard can be used to verify that the established SH&E processes are functioning as designed, and where deficiencies have occurred, the ability to correct, improve and prevent recurrence of loss is effectively implemented.

What to Measure

The establishment of strategic and tactical goals, performance measurement standards and *Key Performance Indicators* are driven by several factors. These include, regulatory, market and customer demands, resource availability and financial impact or profitability. The initial focus for SH&E professionals should be on the financial drivers of the organization as these will help to provide a support framework for the activities and metrics that can support improvement opportunities and not just meet regulatory requirements.

The Cost of Poor Safety

Like the quality management system, **the cost of not doing safety** as well as **the cost of doing safety** needs to be tracked, analyzed and presented. These cost centers should be assigned activities that are considered to contribute or detract from the overall profitability of the company. The categorization of these cost activities should be determined with management and finance in order to establish buy-in to the final results and interpretation of the data collected. This is the first step to demonstrating the value of the SH&E activities that are currently conducted and those that are proposed for improvement.

The most famous example of "the Cost of Poor Safety" is the Accident Ratio Pyramid that was first presented by H.W. Heinrich in his book Industrial Accident Prevention in 1931. Subsequent studies by Frank E. Bird, Jr. in 1969 and the HSE group of the British government in 1993, The Costs of Accidents at Work, verified that the indicators of significant loss to life, health and property are numerous and buried within the daily operations of our organizations.

Exhibit 2. Accident Ratio Pyramid.[2]

Subsequent investigations by the International Loss Control Institute, with the help of Frank Bird, Jr. provided safety professionals with the first model for estimating the costs associated with poor safety performance. The range of losses to be considered goes beyond personal injury and is inclusive of equipment, tools, property, public impact time and corporate reputation.

Types of Costs	Cost Range	Cost Activities
Injury & Illness Costs	**$1**	Medical and Compensation (Insured)
Property/Ledger Costs (uninsured)	**$5 to $50**	Building, Tool, Equipment, Product, Material damage; Expenditures for emergency situations – supplies and equipment; Repair and replacement costs
Uninsured Miscellaneous Costs	**$1 to $3**	Time to investigate; wages paid for lost time (non-injured); hiring/training replacements; Overtime; Additional supervisory time; Admin time, Decreased output from injured or replacement or affected workers; Loss of corporate reputation; Public perception.

Exhibit 3. Costs of Accidents at Work. Based upon the ILCI Cost Studies and Iceberg Model.

The Iceberg model focuses primarily on determining the costs associated with losses that have occurred, while the quality management model focuses on determining the total costs associated with designing, implementing, practicing and improving quality within an organization. This model can also be applied to the SH&E Management system using the well established definitions and categories used by quality professionals. While the breakdown of quality costs is extensive, a similar pattern can be established for categorizing "Safety Costs" and their implication on the bottom line of the

organization. In either case, the process is designed to represent the difference between the actual cost of a loss and what the reduced cost would be if there was no possibility of that loss occurring.

The general cost activity categories that should be considered when in a SH&E metrics program are:

- Prevention
- Appraisal
- Failure – Internal
- Failure - External

Prevention Costs should include activities that specifically prevent poor or sub-standard safety design, practices or standards. These may include planning costs, design or purchasing reviews, training, contractor evaluation and pre-qualification, and SWOT analysis for new safety system designs or initiatives.

Appraisal Costs include activities that measure, evaluate or audit products or services required to assure conformance with corporate, industry or regulatory safety standards. This may include the cost of air or personal monitoring equipment, calibration of this equipment, associated supplies and materials, and audit or inspection activities.

Failure Costs are divided into two categories and are a result of losses that can impact the organization. The Iceberg model can be used as a framework to establish the activities that will be included in this category. **Internal Failure** costs are those related to internal activities that are initiated to correct or resolve a loss situation. These may include wage replacement/overtime, equipment/product replacement, training costs, re-processing lost information, downtime and lost time on repeat activities, etc. **External Failure** costs are those related to external activities that are initiated to correct or resolve a loss situation. This may include public relations, emergency situation costs, corporate reputation, compensation for life, health, or property impact, insurance costs (insured), etc.

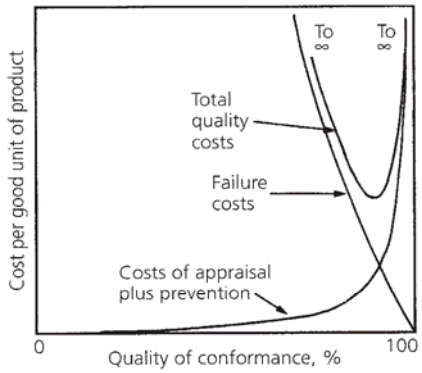

Figure 1.4. Classic model of optimum quality costs.

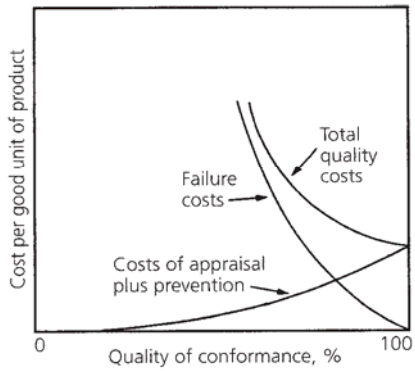

Figure 1.5. New model of optimum quality costs.

Both figures are reproduced from Juran's Quality Control Handbook, 4th ed. by J. M. Juran and Frank M. Gryna. New York: McGraw-Hill Book Co., 1988.

Exhibit 4. Cost Optimization Models[3]

Current "end of the pipe" measurements tend to focus on failure costs. A review of the cost optimization models (Exhibit 4) used in quality management programs, however, supports that a significant decrease in costs can be achieved when an organization focuses on preventive, not reactive, activities. This would suggest that the SH&E management system and metrics program should shift focus from traditional failure cost indicators and move towards investing in, and measuring, prevention and appraisal cost activities.

Resources

In addition to determining the "Cost of Safety" , and the metrics needed to demonstrate profitability, the financial impact of dedicating resources to the safety effort should also be considered. These resources may include:

- People
- Time
- Money
- Equipment/Tools

- Facility/location
- Training

The availability of resources to collect, sort and analyze data is often a limiting factor in aggressive metrics programs. Selecting measurements that require significant time, human or financial resources can paralyze the process and lead to a loss of confidence in the SH&E activity or program that is being measured.

Business Processes

One of the primary methods used to determine process metrics is Benchmarking. This method compares the current projects, methods or processes of an organization with the best practices of the industry or market leaders. The collection of this information is used to drive overall improvement of company, or system, performance through new initiatives and performance standards. The advantage of using this method is the opportunity to involve other areas of the organization in for the SH&E effort and to utilize external resources that can validate the need for improvement opportunities.

Customers

The *Voice of the Customer* is one of the most underutilized sources of information on product, process and system performance available to every organization. The use of perception surveys, management system audits and open methods of communication (360 feedback) to obtain internal customer feedback on the SH&E culture has grown in popularity. The ability to analyze and quantify these responses into measures of success or improvement has proven to be a significant challenge when managed internally. To gain organizational acceptance and credibility, the use of an independent and structured tool with clear objectives and measurement criteria is needed.

The measurement of perceptions held by regulators, the public and suppliers is generally nonexistent in the SH&E program. Supplier (contractor) evaluations are fractured or a simplistic collection of data to prevent liability issues. The development of performance metrics for suppliers and external customer feedback surveys are quality management tools that should find their way into the safety toolbox.

When to Measure

SH&E metrics need to be integrated into all levels of the organization if safety is to become an integral part of the business plan and operations. This requires SH&E professionals to integrate themselves at the highest levels of the company to ensure that the SH&E initiative is recognized and valued. The basic quality improvement process of PDCA can provide the foundation of when to collect and evaluate data that will support the metrics that have been chosen.

Plan to establish strategic and tactical goals prior to the new business strategic plan that is established each year. Strategic goals should focus on initiatives that align themselves with current organizational drivers, such as efforts to increase efficiency (reporting processes) or reduce costs (WCB premiums). These goals must be achievable within the time frame used by each company, this may vary from 6 months to 50 years, or the credibility of the SHE group will be questioned. Tactical goals should be set and managed at the department level and should establish who will do what by when.

Do establish performance standards prior to developing metrics for any SH&E activity, process or product. Without a clear understanding of the standards accepted by the organization, and the expectations that are to be met, the collection of data may be biased, inadequate or without value.

Check at periodic intervals to confirm that the goals that have been set are achievable, that the standards that have been developed are realistic, and the chosen methods of measurement are practical. The loss of support and confidence in a business process is often related to lofty goals that appear impressive on paper, standards of perfection that are achievable in theory and a resource drain that does not demonstrate "What's In It For Me? (WIFM)".

Act on the data collected. Without frequent evaluations for trends, special occurrences and confirmation that set goals are being achieved, the SH&E program will lose momentum and acceptance within the organizational culture. The statistical trap is to continue collecting as much data as possible, for as long as possible to provide a true and unbiased scientific analysis. The reality is that statistics are usually collected and analyzed by human beings and the bias factor will exist. The consistency with which the data is reviewed, shared and challenged for accuracy & applicability will help to reduce the opportunity for filtered or biased information to influence high level decision making that can impede or promote the SH&E program.

How to Measure

To establish a standardized measurement program that can provide consistent data from which information and knowledge can be derived, the principles of *Metrology* should be followed. The key elements of *Metrology* include:

- Establishing clear measurement standards that are based on national, international or industry approved requirements;
- Using measuring equipment and/or standard terms to collect and confirm that data collected conforms to internal and external specifications.
- Conducting regular calibration of measuring equipment that is traceable to an approved international or national standard;
- Establishing data integrity evaluations to confirm the quality (usefulness, value, etc.) of the data being collected.

While metrology is the foundation of an effective measurement program, the exhaustive collection of data alone is not sufficient to demonstrate either compliance or system improvement. The manipulation of data to extract information, knowledge and decision making capability based on the wisdom we develop is crucial to demonstrating that the implemented SH&E program and support system is effective.

System Variation

Interpretation of the data that is collected is a crucial crossroads between bringing value to the performance of the organization and wasting valuable resources. Careful categorization and sorting of data can lead to a summary of results that can be analyzed for trends and unusual results, commonly known as outliers. These results are often a representation of the 2 types of variation that can affect

any process or system, and the reaction to each can fundamentally affect the outcome of the process and the actions taken.

Common causes occur in most processes and may produce a system that is stable and predictable in outcome. Approximately 85% of all process problems are due to common cause variation. To decrease common cause variation, corrective action at the basic or root cause level will be required. Changes at the system level will be necessary to reduce or remove the common causes that are affecting process results and may be the contributors of a loss event. This may require changing the system, process or facility design, equipment, tools, materials, standards , or task requirements in order to effect permanent change. The use of band aid solutions is common, such as cautioning the worker to be more careful, and this surface reaction often results in tampering or avoidance instead of long term resolutions.

Special causes affect the process in unpredictable ways and result in unstable outcomes. Approximately 15% of all problems are special causes. The use of multiple suppliers (contractors) instead of a dedicated supplier can create special cause situations. Surface reactions to these outlier or unusual situations, without thorough investigation, can result in process changes being applied before it is recognized that the variation in work practices, standards or products (hazardous materials, PPE) is the actual cause in outcome variation or deviation.

The use of visual aids, such as control charts, histograms, check sheets and Pareto analysis can help eliminate tampering before a thorough analysis of the data can be completed. Refer to Exhibit 5 which represents a collection of common deficiencies noted during inspection tours conducted over a 12 month period. These deficiencies were coded to allow for easy comparison and accumulating items that had not been resolved or had ineffective actions taken. This visual representation allows the SH&E professional to determine the types of hazardous situations that have been occurring, are continuing to occur, the location the most significant conditions or practices that need to be addressed in the coming year.

CODE #	DESCRIPTION
GENERAL EHS INSPECTIONS: Facility 1 – Manufacturing Areas	
G1	Access
G2	Electrical
G3	Chemical/Environmental
G4	Hazardous Product Waste
G5	Emergency Equipment
G6	Ergonomic
G7	Safety Devices
G8	Working at Heights
G9	Practices and Procedures
G10	Documentation

Exhibit 5. Codes Assigned to Inspection Deficiency Categories

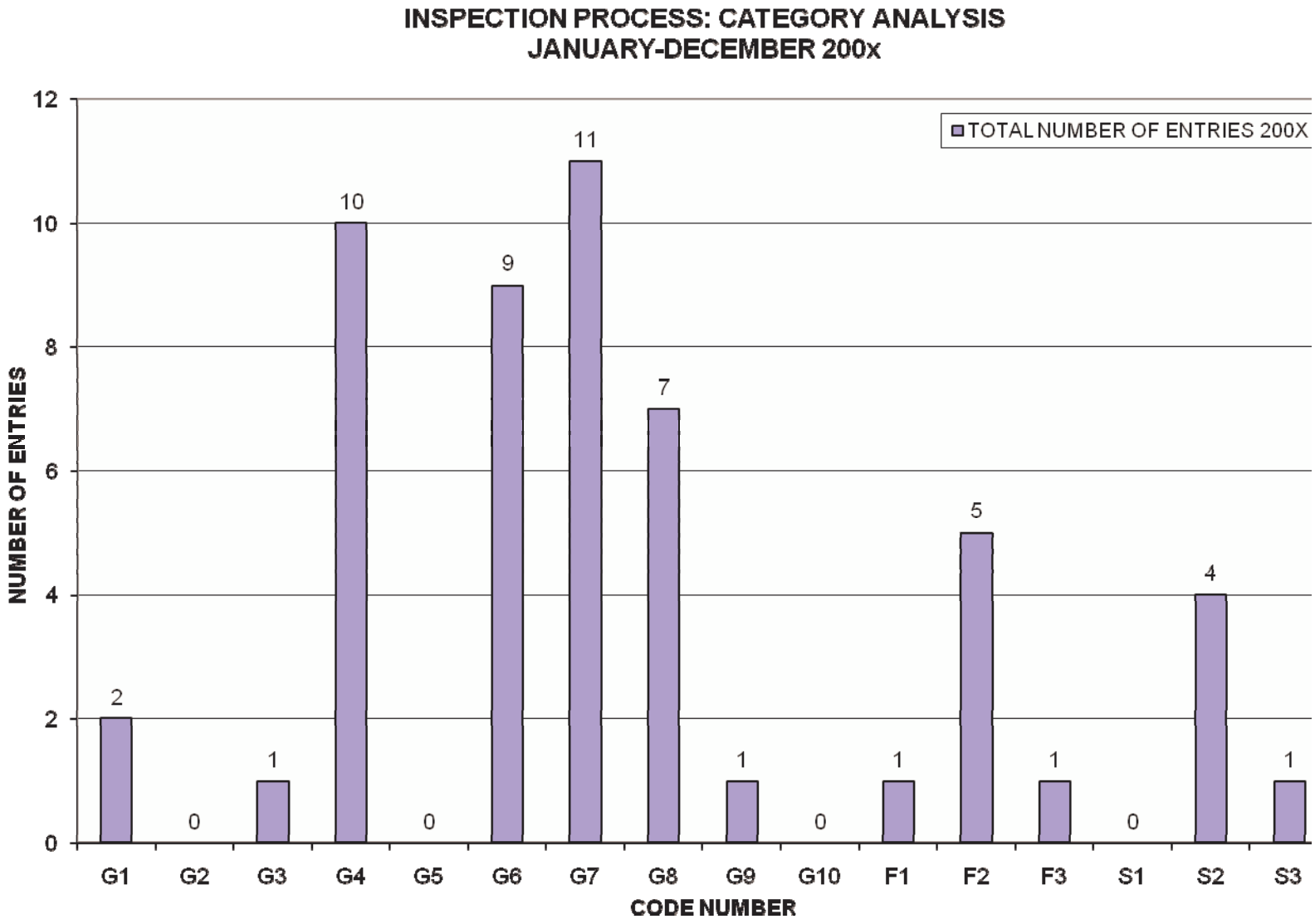

Exhibit 6. Histogram of Codes Assigned to Inspection Deficiency Categories

Company specific metrics should clearly define the performance standards for the organization, use numerical measurements where possible, and consistently evaluate the results of designated SH&E programs, projects or activities. For example, the company may establish a strategic goal to increase productivity by 10% in 12 months. A tactical goal may then be established by the operations group to decrease the number of days away from work due to injury by 20% through the implementation of a modified work program. To determine if the goal has been accomplished will require a performance standard, such as "what is the best performance or practice for the industry", and a series of measurements to determine if the goal is being met throughout the year. A quarterly assessment of how many days away from work per injury case is occurring after the program is implemented will be needed as well as a comparison measurement to determine if there has been a decrease in *away days* since program implementation. These metrics may also be a primary indicator of program effectiveness, but additional measurements, such as repeat absences after return to work, may be needed to substantiate these inferences.

Presenting Your Metrics

In the early 1990s, a management system now known as the balanced scorecard was developed by Robert Kaplan and David Norton. This system elevated the metrics program to new levels of use within an organization and provided a visual representation of company performance that could be understood by the customers of the organization. In their book *The Balanced Scorecard: Translating Strategy into Action,* Kaplan and Norton describe the balanced scorecard as a necessary move away from overreliance on financial measures. According to Kaplan and Norton, because financial measures report on the past, they offer "an adequate story for industrial age companies" but not "information age companies." In the information age, organizations must "create future value through investment in customers, suppliers, employees, processes, technology, and innovation."[4]

This philosophy holds true for SH&E metric programs which rely heavily on lagging indicators more appropriate for the industrial revolution era. The expansion of the company's attention to the four perspectives of,

- How should we appear to our stakeholders (Financial)?
- What business processes must we excel at (Business Processes)?
- How will we sustain our ability to change and improve (Learning and Growth)?
- How should we appear to our customers (Customers)?

requires that SH&E professionals also broaden their scope of focus and activities to contribute at a strategic level of the organization in order to support the overall success of the company. This requires changing not only what we measure, but how we present this information to the customers who use and support the SH&E management system. If the information that is collected is not refined into a format that is easily grasped and understood by the "customers" or stakeholders in the company, then the significance of the SH&E activities that are required or undertaken will not be recognized and elimination is inevitable.

INSPECTION PROCESS

BALANCED SCORECARD

200X

November Results

METRIC	CLOSURE RATE	QUALITY OF CLOSURE	MANAGEMENT COMMITMENT	ON-TIME/ COMPLETE	DEFICIENCIES: NON COMPLIANCE	DEFICIENCIES: NON CONFORMANCE		
DEFINITION	% of Corrective Actions Closed (rolling 3 month average)	Total # of deficiencies- all inspections	% of inspections completed as scheduled	% of inspections completed as scheduled; no document deficiencies	# of non-compliance deficiencies (rolling 3 month)	# of non conformance deficiencies (rolling 3 month)	SCORE	
SCORING AREA	100%	<3	100%	100%	0	< 2	10	LEADING
	90 - 95%	<5	90 - 95%	90 - 95%	1	<4	9	
	85 - 89%	<7	85 - 89%	85 - 89%	2	<6	8	
	80 - 84%	<9	80 - 84%	80 - 84%	3	<8	7	COMPETITIVE
	75 - 79 %	<11	75 - 79 %	75 - 79 %	4	<10	6	
	70 - 74%	<13	70 - 74%	70 - 74%	5	<12	5	
	65 - 69%	<15	65 - 69%	65 - 69%	6	<14	4	
	60 - 64%	<17	60 - 64%	60 - 64%	7	<16	3	LAGGING
	55 - 59%	<19	55 - 59%	55 - 59%	8	<18	2	
	50 - 54%	<21	50 - 54%	50 - 54%	9	<20	1	
SCORE	1	3	9	1	1	4		
WEIGHTING	0.2	0.1	0.1	0.1	0.2	0.2	0.9	
CONTRIBUTION	0.2	0.3	0.9	0.1	0.2	0.8		

INDEX	2.5	LAGGING
3 Month Rolling INDEX	2.8	LAGGING

FY 200x Areas of FOCUS

Comments: 3 Month Rolling Index. This allows us to compare the most recent month's performance with some of our history to easily see if we are making progress. A higher Index than the 3 Month Rolling Index indicates improvement.

Exhibit 7. Balanced Scorecard for Inspection Process

INSPECTION PROCESS SCORECARD

Month, 200X

Critical Measurements		Key Performance Indicators	Quarter X Performance			Detailed Information to Date, 200X			Month Score	G	Y	R	Parameters for the Measurement
INSPECTION PROCESS		Monthly Results	Month	Month	Month	Out of	Weight	Adjusted	% Score				
	CLOSURE RATE	No. of CAR's closed	10	12	5	30	0.2	0.18	18	X			G > 17; Y>14; R<13.9
	QUALITY OF CLOSURE	Total no. of deficiencies logged	12	10	8	30	0.05	0.05	5	X			G > 17; Y>14; R<13.9
		Total no. of repeat deficiencies logged	3	2	2	30	-0.2	-0.05	-4.67		X		No.of items not repeated G > 17; Y>14; R<13.12
	ACCURACY	Total no. of deficiencies noted by audit team/ missed by inspection team	4	3	4	30	-0.2	-0.07	-7.33			X	No.of items not missed G > 17; Y>14; R<13.11
Performance Drivers													
	General EHS	Performance Drivers	Month	Month	Month	Out of	Compl.	Incompl.	% COMPLETE				
		G1 Access	2	1	1	30	3	2	75%		X		
		G2 Electrical	0	1	2	30	3	0	100%	X			
		G3 Chemical/ Environmental	5	1	1	30	3	4	43%			X	
		G4 Waste	0	0	3	30	1	2	33%			X	
	Facilities	Performance Drivers	Month	Month	Month	Out of		Month	% Growth				
	Special	Performance Drivers	Month	Month	Month	Month Projects	Compl.	Incompl.	% Complete				

X MONTH SCORE:	11.00

RED < 60%
YELLOW 61 - 80%
GREEN 81 - 100%

- % Score is greater than 85% of weighted score
- % Score is greater than 70% of weighted score
- % Score is less than 69% of weighted score

Exhibit 8. Process Scorecard for the Inspection Process

Conclusion

The need to develop and implement a comprehensive SH&E metrics program that efficiently demonstrates that the SH&E Management system "does the job" is a critical part of creating confidence in our customers and soliciting support for the programs that comprise this system. Using a standardized measurement system allows for effective and consistent communication as all stakeholders speak the shared language of metrics.

The use of Key Performance Indicators, as opposed to lagging or "after the event" measurements, helps the organization to:

- Focus on activities and resources that affect profitability but may be hidden;
- Encourage participation and timely corrective actions through a regular review process; and,
- Provide and evaluate the consistency of organizational alignment between business processes.

The evolution of the SH&E Metrics program from simple counting activities to comprehensive evaluations of process efficiency and effectiveness is the next frontier for SH&E professionals to explore.

Footnotes

1. ASQ Quality Management Division, Duke Oakes & Russell T. Westcott, eds. *The Certified Quality Manager Handbook,* 2nd ed. Milwaukee, Wisconsin: ASQ Quality Press, 2001: 313.

2. Bird, Frank E., Jr. and Germain, George L. *Practical Loss Control Leadership*, revised ed. Loganville, Georgia: DNV, 1996: 5.

3. ASQ Quality Costs Committee, Jack Campanella, ed. *Principles of Quality Costs: Principles, Implementation and Use,* 3rd ed. Milwaukee, Wisconsin: ASQ Quality Press, 1999: 7.

4. Kaplan, Robert S. and Norton, David P. *The Balanced Scorecard: Translating Strategy into Action.* President and Fellows of Harvard College :USA, 1996.

Bibliography

a.) ASQ Quality Costs Committee, Jack Campanella, ed. *Principles of Quality Costs: Principles, Implementation and Use,* 3rd ed. Milwaukee, Wisconsin: ASQ Quality Press, 1999.

b.) (ASQ Quality Costs Committee 5)

a.) ASQ Quality Management Division, Duke Oakes & Russell T. Westcott, eds. *The Certified Quality Manager Handbook,* 2nd ed. Milwaukee, Wisconsin: ASQ Quality Press, 2001.

b.) (ASQ QMD 312-314)

a.) Bird, Frank E., Jr. and Germain, George L. *Practical Loss Control Leadership*, revised ed. Loganville, Georgia: DNV, 1996.

b.) (Bird 5, 8)

Kaplan, Robert S. and Norton, David P. *The Balanced Scorecard: Translating Strategy into Action.* President and Fellows of Harvard College :USA, 1996.

Quality Council of Indiana. *Certified Quality Manager Primer*. Indiana: QCI, 1996.