

How the thinking of Statistical Process Control applies to Safety Management

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The problem

Studies about how we work have shown only 35% of what we do on-the-job is considered value added or necessary.¹ The other 65% is activities that are either wasted or spent on fixing things that were done wrong. Every day you can see the results of poor management at your own company or when you participate in the economy as a supplier or a consumer. This consistent daily loss of productivity adds additional loss to our economy in the billions of dollars.

Inflicting more financial and physical damage to our lives at work is the fact there were over 4,000,000 recordable injuries to U.S. workers in 2007 and over 1,158,000 of those were lost time injuries. 5,657 people, an average of 15 every day, were killed while working on their jobs in 2007. From 2003 to 2007 over 5,000 people were killed on the job in each year!² This is in spite of the fact during this same time frame the U.S. has lost millions of manufacturing jobs. The loss to our economy from employee injuries is estimated to be an additional \$132 billion a year!³

The fact is a lot of what we do at work is just plain waste. The problem isn't the work ethic of employees or the capability of management. Employees work hard and managers are doing their best. The problem at this point in time is we are now using the wrong management theory. If we don't change our fundamental way of managing with its billions of dollars lost due to poor quality, productivity and safety, we will continue to reduce our ability to compete. We must face the fact that our management system, with its roots based on command and control, can never get the most out of any system and is responsible for most of the waste produced in it.

Focus on the system, not the person

One glaring example of how command and control, or Taylorism as it is commonly called, prevents us from gaining a deeper more complete understanding of how we should manage is revealed in how we handle safety in business. Command and control theory has taught us accidents are caused primarily by the unsafe actions of the workers. The theory being if workers would only do what they are told and follow safety instructions accidents would be all but eliminated. The assumption is everything in the system is working properly and employee's unsafe acts or at risk behavior, over which they have total control, is why most accidents happen. This is a perfect example of the hope that a complex problem can be solved by a simple, easy solution – that is wrong.

Years ago this same approach was used to explain why most defects were created in manufacturing systems. Management schemes were developed where workers were reminded their job required them to run the machinery and equipment and produce "Zero-defects." Again, it was assumed everything else in the system was just fine and the major reason for defects was workers were just not paying enough attention. Management had to learn new things about quality to change this mindset. In the 1970's and 80's one of those new things was the re-introduction of the thinking of statistical process control (SPC).

Using SPC starts with understanding systems. A system is a series of components (processes) working together to achieve an aim. All work involves a system of inputs, processes and outputs. Each component or process in the system has variation that affects the final outcome. Accidents are to safety what defects are to quality – undesired or unwanted outcomes of the system. Like quality safety outcomes are produced by how well the parts of the overall organizational system work together. The components of the safety system include people, managers, materials, methods, machinery, equipment, and environment. Each component has variation which is responsible for why most things go wrong in the system, i.e. accidents. Therefore it is important for safety management to learn what kind of

¹ Conway, William E., *The Quality Secret: The Right Way to Manage*, Conway Quality, 1992, p.24

² U.S. Bureau of Labor Statistics

³ BLS Statistics

variation you are dealing with so you can react appropriately to the outcomes of your system. Management learned the best way to do this is to apply SPC.

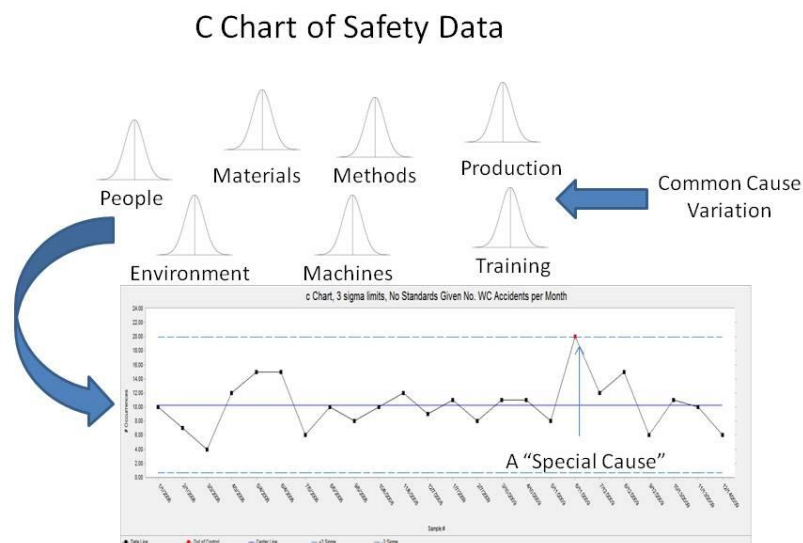
SPC for safety

Traditional management believes the best way to handle an accident is to investigate each one to find out what was happening just before the accident occurred. The purpose is to determine who did what wrong and take corrective action. Usually a superficial analysis is completed with preventive action focused on changing the worker. This approach often results in a lot of negative feelings between management and hourly employees. There is a much better option for managing safety.

Most companies keep track of the number of accidents over time and use it to react to each and every data point. For example the total number of accidents will be examined each month. If the number of accidents increases from the previous month management demands to know, why did this happen? If it decreased they may praise supervision for doing a good job. They are unaware of the mistake they are making, which is reacting to every data point as though it was a “special cause.” The difference between the two data points may only be *noise*. The only way to overcome this improper response is to learn the language of SPC and apply it to safety.

A simple control chart will rectify the problem. In this case a “C” chart which is an attribute chart is used to analyze the count of defects (accidents) to help everyone better understand the variation. Control charts are the best known tool to determine if a process is statistically stable and on target. A process is stable when there are no unusual runs or the control limits are not exceeded. Control limits are calculated from pre-established formulas applied to the data. They are set at 3 standard deviations from the mean. In layman’s term this means something very unusual (a “special cause”) is occurring when the number of accidents exceeds a control limit.

If you construct a control chart and your data has no unusual runs (For example, seven consecutively ascending or descending points in a row.) and does not exceed any the upper or lower control limits the number of accidents in your operation is “stable.” Which means the variation in the number of accidents is being driven by the common causes in your system. Common causes are beyond the control of the hourly workers. It takes action by management to affect them. They come from the variation in the system as shown in the chart below.



The diagram above depicts how the variation in common causes impacts the number of accidents per month. This hypothetical C Chart shows a special cause where one month the number of accidents exceeded the Upper Control Limit. The control chart is telling you the way safety is managed in this operation you can expect an average of just

over 10 accidents per month with as few as 1 or as many as 19. Statistically there is no difference between the two. The same system produced both numbers.

The problem is, this is an “attribute” chart so all of the numbers are defects (accidents). The target of the process would be at or very close to zero so you can see the safety system is well off-target. If management wants to improve safety it will have to work on reducing the impact of the variation between the common causes built into the system. These are systemic in nature. To work on these management and hourly workers will have to study the impact of common cause variation in the system that leads to accidents. In a command and control system hourly workers have no control over the common causes. For example on their own they cannot change the speed of production or the guidelines of purchasing that impact safety.

A simple control chart will help prevent management from making the mistake of blaming individual workers for all of the accidents in the system. As a matter of fact as you become familiar with control charts you will soon realize most accidents really do come from the system. Control charts provide a common language between management and hourly employees so each side can communicate intelligently about safety problems. If the charts show a special cause then management and hourly people will be able to examine what was happening and give a logical explanation about it. If the safety system is stable but off target management and hourly people will understand the safety problems are built into the system and solving them will require a new and different approach.⁴

Conclusion

Quality management has taught us it takes a concerted team effort to address common cause variation in the system. As is done for quality, fixing common causes in the safety system will involve application of the seven basic tools of problem solving: Flow Charts; Run Charts; Scatter diagrams; Cause and Effect; Pareto Charts; Histograms and SPC Charts. Consequently managers and hourly employees must learn how to apply these tools to safety management. They must also learn how to brainstorm to come up with creative solutions to system problems. Combined with the ability of people to work together as a team this approach will replace the traditional techniques of safety inspections, accident investigations, incentive programs, competition and focusing on employee behaviors to prevent accidents.

The thinking of SPC and control charts are important and invaluable tools to improve your company’s safety performance. Are your managers and hourly employees ready for it?

To learn more about how your company can make SPC an integral tool of your safety program you can contact *Thomas A. Smith* at Mocal, Inc. Mr. Smith works with management and hourly employees to help them learn about new theory of management to obtain team skills and work on culture change. His book; *System Accidents: Why Americans Are Injured At Work And What Can Be Done About It* has received high praise and can be obtained at Amazon.com. He can be reached at tsmith@mocalinc.com or his company website at www.mocalinc.com or (248) 391-1818.



⁴ Changing safety attitudes through a quality process, Industrial Safety and Hygiene News, Thomas A. Smith, May 1995