

# Why Statistical Methods Should Be Applied To Safety

By Thomas A. Smith

Recently I made a presentation on how to achieve continual improvement of safety to the management team whose safety performance could only be described as a deplorable. Their response was "It is too complicated." The President of the company actually said he believes "Safety is mostly common sense. The problem is, employees don't have much of it."

Is the ultimate goal of safety management to comply with safety rules and regulations or to prevent accidents/injuries? If you examine safety policy statements of companies it is quite apparent compliance is the overwhelming choice. You will also find top management delegates its responsibility for safety to the lower managers and workers then holds them responsible for safety performance. Basically these top managers (And consequently the managers who work below them.) believe the essence of safety is simply a matter of complying with safety rules and regulations; applying common sense; then holding people responsible for their actions. This approach fits perfectly with the command and control or Neo-Taylorism management model. It's not complicated.

In this world managers do not truly understand how work is a system. How could they? Deep down inside they see a business as an organization chart where people are supposed to do what they are told; carry out orders; deliver orders and hold "subordinates" accountable to follow orders. When anything goes wrong whether in the supply chain, production, quality, sales, R&D, human resources or safety corrective action is merely a matter of finding out who didn't follow orders.

This is management driven by single-event not systems thinking. Like all the other management disciplines who abide by this approach, safety management ultimately focuses on fixing behaviors of workers. Management believes its commitment to safety is proven by the fact it requires every single employee accident be investigated to find the "root cause" and take corrective action. The assumption being something special happened at the moment of the accident to cause it. Almost everyone's reaction to an accident is to attribute it to someone's carelessness or something unusual about the equipment involved. This provides a quick resolution to accidents.

The advancement of quality management has proven it is futile to try to reduce defects by investigating every single one of them. For one thing these investigations apply Ocam's Razor with a vengeance by allowing the simplest explanation of a problem to be the one that is accepted. This allows people to ignore all of the variation and problems in the processes of the system that actually produce the defects.

Managers have difficulty understanding the concept that employee accidents are the equivalent of defects. Both are a product of the work system. Even more challenging is the idea that most employee accidents are caused by interactions of factors inherent in all work systems. Not the behavior of the employee. In general human beings have the built-in psychological trait of self-preservation. Simply stated, people do not like nor do they seek to get hurt in any way shape or form. This protective reflex starts in infancy and grows stronger as we grow older.

Behaviors are variables that have only been demonstrated to be associated with accidents. There are many other system variables that combine to cause employee accidents. This knowledge is what the manager was talking about when he said continual improvement is too complicated.

So all work systems have a built-in safety mechanism of self-preservation on the part of people. You can't pay workers enough for them to want to come to work and be injured. This fact is regularly ignored in the world of command and control management.

To see the strength of management's belief that people control the system all you have to do is read the current articles about management telling businesses the only way a company can succeed is to hire the best people. There is a plethora of research and real life examples that refutes this theory.

The fact is a company's culture and the variables in work systems are responsible for most employee accidents, not the behavior of workers at the moment the accident happens. To truly understand why this is so requires a higher level of thinking about safety. Managers need to look at work differently to gain knowledge and a better understanding about why things happen and what can be done to fix the system that causes employee accidents. Fortunately there is a proven management theory to help everyone learn a new way to manage safety. It was created by Dr. W. Edwards Deming an American educator who examined companies with the aim of helping managers learn how to keep learning how to improve business and customer satisfaction.

Here is what Dr. Deming has to say about accidents:

*"Figures on accidents do nothing to reduce the frequency of accidents. The first step in a reduction of the frequency of accidents is to determine whether the cause of an accident belongs to the system or to some special person or set of conditions. Statistical methods provide the only method of analysis to serve as a guide to the understanding of accidents and to their reduction.*

*Accidents that arise from common causes will continue to happen with their expected frequency and variations until the system is corrected. The split is possibly 99% from the system, 1% from carelessness. I have no figures on the split, and the will not be any figures tell people understand accidents with the aid of statistical thinking" Dr. W. Edwards Deming <sup>1</sup>*

Unfortunately Dr. Deming has been mostly forgotten, ignored or misunderstood in the safety discipline and top management. Very few managers are familiar with the theory and methods of statistical analysis he advocated to study and improve the system. With the absence of statistical thinking, which is only a small but important part of Deming's management theory, managers cannot possibly understand what Deming's statements above mean.

Dr. Deming encouraged the use of SPC charts because they are the process talking to us. They are the most reliable tool for determining if accidents stem from *common causes* or *special causes*. Common causes are factors present in any work whose impact varies hour after hour, day after day, month after month. Factors that disrupt or are not normally found in the work system are special causes.

If you plot your safety data over time you can determine if the variation in the number of employee injuries comes from the system itself or there is something unusual about the number of injuries. But if you show an SPC chart to someone who doesn't understand SPC, in the words of Dr. Gary Fellers, *"It's like showing a wristwatch to a pig."* <sup>2</sup> Lacking knowledge about SPC, managers, won't know what the charts mean. They will not understand that you can improve productivity, produce less defects and employee injuries much easier with the aid of statistical methods.

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<sup>1</sup> Out of the CRISIS, p. 478-9

<sup>2</sup> To get a better understanding of Deming I highly suggest reading Dr. Feller's book, The Deming Vision, SPC/TQM for Administrators

The great disservice management does in safety is to treat systemic problems, i.e. common causes, as though they are local faults. Basically that means workers are looked at as though they are always the factor that causes accidents. Employees become worn down, demoralized and de-motivated and management wonders why they are not engaged in their jobs.

With knowledge about common and special causes and how they cause accidents you will look at safety differently. You will be able to identify common causes in your operations.

The following is a partial list of common causes of variation that lead to people being injured. (The reader can add to the list based on their own situation or circumstances.)

- Poor ergonomic design of a work station.
- Little, none, or ineffective safety training pertaining to job duties. i.e. Hazard Communication, Energy Control Power Lockout, Machine Guarding.
- Purchasing of safety equipment at a cheaper price but is less than adequate to protect workers.
- Lack of continual maintenance of safety equipment. i.e. eyewash safety station that has rusty water in the system, no safety glasses available because they were not ordered.
- Materials processed from one work station to the next with sharp edges that cut through safety gloves provided to workers.
- Process that requires employees to lift heavy parts in an awkward position.
- Pressure by supervisors on workers to take a chance and do their job in spite of obvious safety hazards. (Hourly workers call this the 'persecution of production.')
- Supervisors looking the other way when they need a job to be done urgently so workers can violate common sense safety precautions. (If the workers are injured they are reprimanded for not using their common sense.)
- Uncomfortable working condition such as excessive heat; noise; poor ventilation.

There is a method for supervisors and hourly employees to examine the safety of operations and determine the common causes and if any special causes exist. A simple cause and effect diagram is used to list the factors in work which include but are not limited to: people; materials; methods; machinery and equipment and environment. The people who work in the system list what things are involved in the process and then use the following criteria to label them as a common or special cause.

Common cause: A factor in a work system/process not designed by nor can it be changed by hourly workers. It is always present. Always acting on the process. It takes action by management.

Special cause: Something unusual about a work system/process that can be handled or changed by the hourly workers. It is not part of the process.

Example of a common cause: Employees are required to work in an area where the lighting is so poor they have difficulty seeing. They could be involved in an accident with the equipment or vehicles as a result. The lights are not something hourly workers can do something about. They do not have authority to request more lights be installed or existing lights be cleaned. This rests with management. Therefore lighting is a common cause.

Example of a special cause: A worker drops a glass bottle of soda in the aisle as they return to work after a break. The worker can take action to prevent this in the future and correct the problem by sweeping up the broken glass. This is a special cause.

The cause and effect diagram in Figure 1 was done by a team of hourly workers after they learned Deming's theory which includes systems thinking, common and special causes. They listed the factors of the job and then classified them as either a common cause (Designated by the letter 'c'.) or a special cause (Designated by the letter 's.'). You can readily see the safety factors of this job, which was causing minor injuries to the workers, were dominated by common causes.<sup>3</sup>

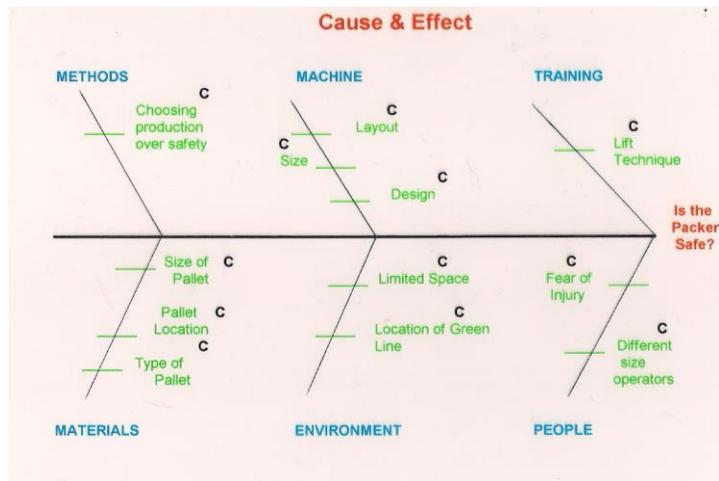


Figure 1 - A team's list of common and special causes

Prior to the team getting involved everything that had to be changed to improve safety could only be done by management. The local supervisor was aware of the minor injuries to workers but he kept ignoring their plight, telling them to be careful. In his mind controlling workers' behavior was an adequate solution to the problem. Fixing all the problems the team pointed out was just too complicated.

The team came up with a plan to redesign the entire work area and took its case to the plant manager. He possessed what Deming calls "profound knowledge"<sup>4</sup> and paved the way to get the plan implemented. All injuries ceased after the improvements. I can't help but think all hourly workers should experience the pride and joy (The injuries stopped.) this team experienced on a daily basis. It wasn't too complicated for them.

Thomas A. Smith "Smitty" has worked with management and hourly workers for the last 25 years to help them apply continual improvement theory and methods to safety management. You can read more of his articles or purchase his book: Systems Accidents at [www.mocalinc.com](http://www.mocalinc.com) He can be reached at [tsmith@mocalinc.com](mailto:tsmith@mocalinc.com) or 248-391-1818.

<sup>3</sup> Over the years I've had many teams conduct this exercise. It is interesting to note that common causes almost always account for 90% or more of the accidents. This contradicts the theory of H.W. Heinrich who is considered to be the father of modern safety management, that 88% of employee accidents are caused by the unsafe behaviors of employees.

<sup>4</sup> Dr. Deming developed what he called the System of Profound Knowledge (SoPK). It has been described as a lens to look at the complexity of systems to create better performance. SoPK synthesizes four things: Systems, Knowledge, Variation and Psychology. To learn more about it the reader should read Deming's book, The New Economics.