

Safety Management: What Causes “Accidents”

By Thomas A. Smith

Traditional safety management models its theory about accident prevention after the work of H.W. Heinrich. In his axioms of industrial safety number two (2) states, “the unsafe acts of persons are responsible for majority of accidents.” He wrote that “88% of all industrial accidents are caused by the unsafe acts of persons.”ⁱ

Heinrich was one of the first safety professionals to apply science to accident prevention. He also developed theorems for *why* accidents happen. They were;

1. A personal injury occurs only as the result of an accident.
2. An accident occurs only as the result of a personal or mechanical hazard.
3. Personal and mechanical hazards exist only because of the faults of persons.
4. Faults of persons are inherited or acquired by environment.ⁱⁱ

He also said an accident prevention engineer should focus primarily upon the factors immediately preceding the accident itself. These were the unsafe act or mechanical hazard and the proximate reasons why they exist.

Heinrich recognized the management parallel between quality and safety. His axiom number seven (7) states “Methods of value in accident prevention are analogous with the methods required for the control of quality, cost, and quantity of production.” Much has changed in quality management theory since the 1950’s. But we have been applying Heinrich’s safety management theory uncritically since then. To this day professional safety management maintains a focus on changing *the behavior* of workers as its primary basis for action.

We need to update safety and connect it with quality theory that has made major advancements since the 1950’s while safety has remained stagnant. When Dr. W. Edward Deming’s management theory and his system of profound knowledge are applied to safety management better safety performance will happen. This approach will help management understand why the majority of employee accidents are caused by the system itself, not the action(s) of individuals. Management will also stop working on the outcomes of the system because it is not as effective as working on the causes of the outcomes. What is most important for safety leadership is to determine whether an accident comes from the system or something unusual has occurred so the situation can be handled properly.

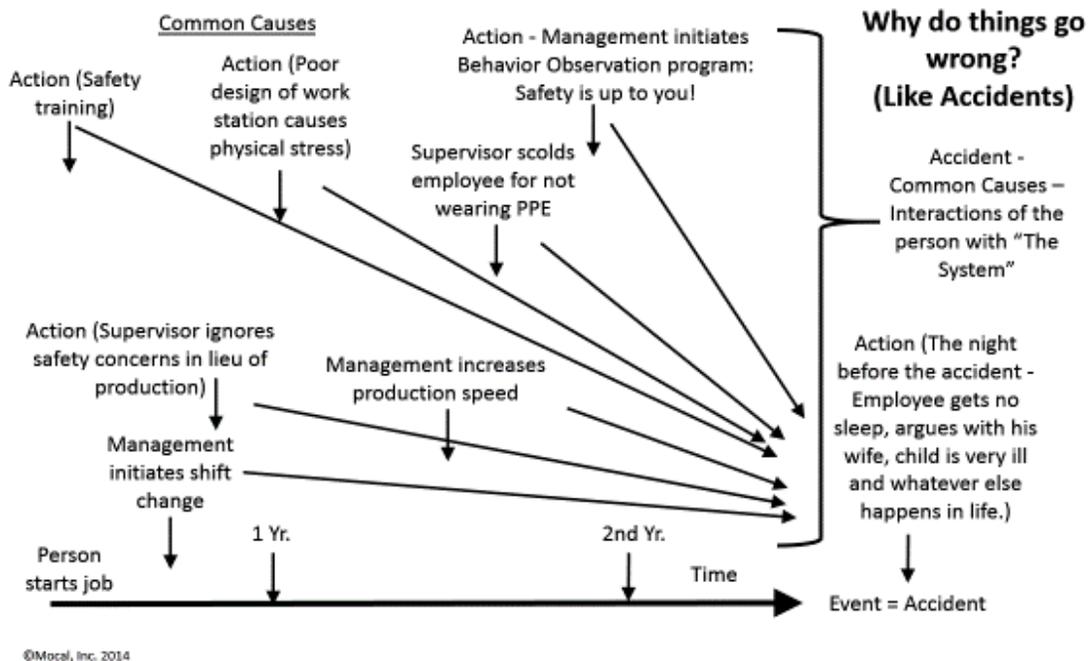
Dr. Deming flatly states most troubles and possibilities for improvement of a system add up proportionately to 96% belonging to the system (the responsibility of management) and 4% to special causes. When it comes to accidents he said the proportion could be higher. As much as 99% from the system and 1% from special causes. This contradicts Heinrich’s theory.

Dr. Deming used the equation, $x + (yx) = 8$ to expose the fallacy of ranking the performance of people where x is the contribution of the individual; (yx) is the effect of the system on the person’s performance and 8 is a hypothetical number for an apparent result. He points out to solve the equation we need x . But we cannot determine x , the effect an individual has on the entire system, nor (yx) the effect the system has on the individual. The equation has two unknowns and only one equation. It is not solvable. Managers who use the merit system to rank people think they are solving it for x . They ignore the other term (yx) which is predominant. Using Heinrich’s theory safety management commits the same mistake.

Deming's equation is useful to show the futility of trying to explain the cause of an accident when the apparent performance is actually attributable mostly to the interaction between workers and the system. Prior to his theory, management blaming individuals for quality defects was the norm. This change in thinking created a new quality paradigm enabling companies to achieve quality levels previously unattainable. It will do the same for safety.

Applying the equation to safety, x is the contribution of the individual to safety on the work system and y is the effect of the interaction between the system and the individual. Both x and (yx) are different from person-to-person.

Again we cannot determine x , the contribution of an individual for safety to their job. At best it can only be minimal and mostly undiscoverable. Individual workers do not determine the speed of production, the quality and amount of safety training administered, the daily attitude of their supervisor toward safety, the maintenance of machinery and equipment, the layout of the job process, the work environment (heat, cold, comfort), the use of fear to manage safety, and the culture of the operations toward safety. Deming called these continual factors in the work system *common causes*. We do know common causes are responsible for the majority of the outcomes of any work system. This includes safety.



There are other problems when using the unsafe action theory about accidents. The biggest reason for failure in problem solving comes from assuming a causal connection between variables when they have only been demonstrated to be associated. The fact is unsafe actions are just one of many variables associated with accidents. The mistake in the unsafe action theory is the mislabeling of a symptom (unsafe act), which is an indicator of a threat to the health of an organism, as a cause. Then it assumes cause and effect must be closely connected in time and space. It does not account for separation of time and space between cause and effect so it ignores all other factors of the system.

In reality cause and effect are often hidden and difficult to discern, precisely because they are not always closely connected in time and space. The intended and unintended effects of actions are often delayed. It's been said common causes show up later as special causes. There are many different variables involved directly and indirectly related in time and space that contribute greatly to the causes of an accident. Consequently, even though people have a built-in defense mechanism when it comes to experiencing pain and they do their best to avoid them, they are involved in accidents. Lucky for most of us accidents are rare events. But best efforts cannot overcome fundamental faults in a system.

For instance management assumes once people have attended a safety training class everyone has the knowledge presented imbedded in their brain and will use it from that point on. Human beings just don't function this way. We forget things over time and safety training is no exception. Some will remember and apply it for a long period of time. Others not so much. This is a common cause in the system.

But probably the most important common cause of accidents is the subtle and at times not so subtle use of fear in work systems. When applied in safety fear causes workers to retreat from participating in communications with management. They shy away from telling management about things that are wrong. It's not unusual for hourly workers to learn it is dangerous to bring safety problems to the attention of management. Their suggestions are either ignored, pushed up the organization and disappear or overridden. Eventually workers put themselves in even greater danger by trying to do their best using riskier alternatives rather than talk to their bosses. When they are involved in an accident they have set themselves up as being **the cause** of it and cannot defend their actions. A common cause becomes a special cause.

All of these things and more are common causes of accidents. No one thing is the root cause. It is the non-sequential interactions of common causes that ultimately produce accidents. Luckily most of the time the interactions cancel each other and nothing goes wrong. As a result employee accidents are not a normal or frequent event. Which should remind us of the fact that absence of a negative does not always mean you have a strong positive. In reality common causes are hidden in plain sight. You can observe a factory setting for hours and not be able to see everything that is happening behind and around the scene.

Every manager I've worked with agrees with me when I say that hourly workers know more about safety issues and problems than anyone else in the organization. But when you ask them what that means and what are they doing about it they can't answer. It's easy to agree with something you don't truly understand. But how could they know? Safety management would be better served by spending more time and effort heeding Dr. Deming's advice. We need to go far beyond common sense and seek to understand common causes and fix the system instead of the worker.

ⁱ Heinrich, H.W., Industrial Accident Prevention, 1950, p. 10-18.

ⁱⁱ Heinrich, p. 14

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