MANAGEMENT PRACTICE SPECIALTY NEWSLETTER

The Compass

AMERICAN SOCIETY OF SAFETY ENGINEERS www.asse.org

Low-Probability Risks Can't Be Ignored

By Terry L. Mathis

Despite the great successes at reducing accidents in the workplace, how is it that seemingly "random" accidents still occur, with no apparent cause? When such incidents are investigated, the worker(s) involved in the accident advise that they were just doing their job the way they have always done it. How can a good, long-term employee with good common sense and experience work accident-free for several years, then get hurt?

The answer lies in the laws of probability. Certain behaviors in the workplace may appear to be "safe" when, in fact, they actually have a low-probability of being "at-risk." What if a worker is doing the job the way s/he always does it and that job involves a behavior or condition which has a one-in-a-thousand risk factor? If the worker takes this risk once per day and works 200 days per year, s/he takes this risk about 1,000 times in a five-year period. A large population taking such risks will experience an accident rate proportional to this once-every-five-year ratio.

Low-Probability Risks Are Difficult to Identify

The term "low-probability" actually covers a set of risks that could produce accidents one time in 100 or one time in several thousand occurrences. Although probability remains the same with each occurrence, the volume of risk taking actually determines the number of accidents that will result from such risks. Companies with large populations have been especially helpful in understanding the real risk factors of certain behaviors and conditions. Some experts in the safety field have argued that probability ratios are very complicated and almost impossible to calculate. This becomes less true in large populations with good reporting and recordkeeping.

Most individuals and organizations have not yet realized that low-probability risks are really a major factor in their safety experiences. Many factors contribute to this going unrealized.

Experience & Common Sense

Workers depend on their experience and common sense to protect them from many hazards. These are very good tools when the probability of accidents is high enough. As the probability grows lower, so does the effectiveness of experience and common sense to help workers identify hazards and to practice effective preventive measures.

Experience is simply the memory of past consequences. If the consequence (an accident) has not occurred over many repeated occasions, then common sense tells the

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Hospitality Branch Expands

By Fay Feeney, CSP, ARM

Our Hospitality Branch members have been out enjoying the world of hotels, resorts, restaurants and cruises. We missed co-chair, Tim Jones, at the Denver PDC, but appreciate he was doing fieldwork on a family cruise to Alaska.

Many thanks and sincere appreciation to the Hospitality Advisory Team: Bill Barbarow, Bob Button and Bob Howarth. Our special thanks to Prof. Ray Ellis, Loss Prevention Management Institute, Conrad N. Hilton College, University of Houston. He gave us much encouragement sitting in the front row at our PDC presentation, "Hospitality Safety: Results Beyond Compliance."

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worker that the chances of an accident are small or nonexistent. The irony is that this assessment is largely, but not entirely, correct.

If a worker's total experience with a decision or condition is that s/he has made the decision or worked in the condition the same way 100 times and never been injured, then the worker's experience cannot differentiate between probabilities of one in 100 vs. one in 10 million. Often, the worker does not detect the danger until after the accident, if at all.

Variables & Probability

Often, an act or condition alone does not present a danger unless other factors enter into the equation. These other factors are called variables. They are called variables because they are not constant. They may be so inconstant that they are difficult or impossible to predict.

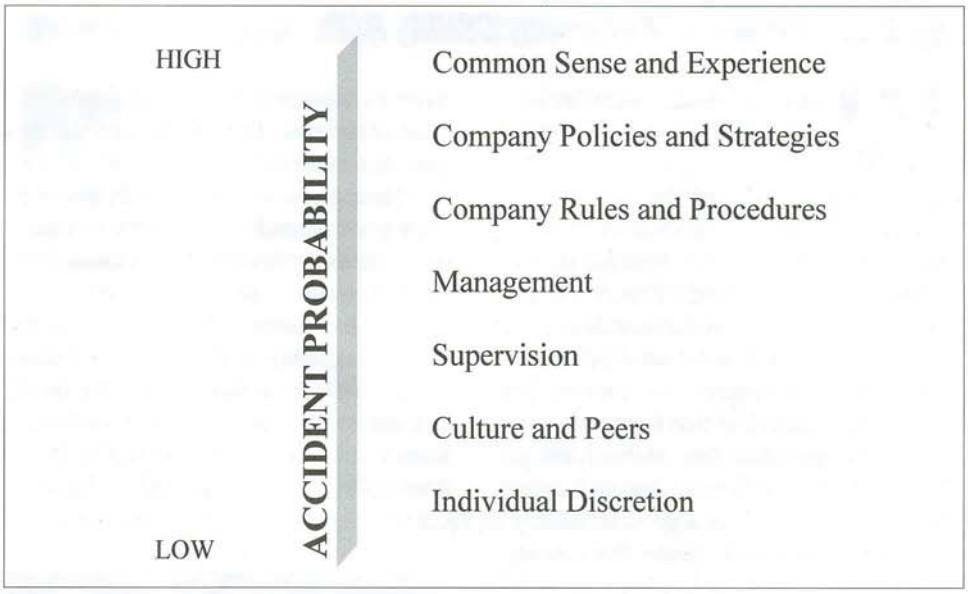
For example, if a worker is working at height, there might be a danger of falling. The behavior of the worker might impact the probability of a fall dependent on how close to the edge of the platform the work is performed. Variables might include gusts of wind, moving equipment, other workers' movements, stability of the platform, rain or ice, and other factors that might compromise a worker's balance and reaction time. The probability that a worker would move to the edge of the platform without fall protection at exactly the same time that a gust of wind blows in the right direction to push the worker off, might be hundreds- or thousands-to-one. This means that if enough workers are close to the edge enough times, probability may provide one of its unusual sets of circumstances and cause an injury.

Cause vs. Prevention

When this happens, workers and SH&E professionals alike tend to focus on what they call "root causes." Variables are often labeled root causes because they are the last answer in a chain of "why" questions.

Dean Gano, author of the book *Root Cause Analysis*, which is used by NASA in the space program, argues that root causes are almost never really discovered. He says that something is called a root cause simply because the next "why" question could not be answered. Gano also contends that every accident has a conditional and a behavioral chain of events leading up to it that contains many items that could be labeled root causes.

FIGURE 1
Accident Probability Variables



Accident investigations often focus on what was different this time that might have caused a worker to get injured. Variables are always one of the things that were different. If a worker has been on the edge of a platform hundreds of times without falling and this time a gust of wind pushed him over the edge, he is not likely to say that he fell because he was too close to the edge. He has been there hundreds of times without falling in the past. It has to be the wind, not the failure to use fall protection, that caused the accident. Experience and common sense have probably reinforced the idea that a worker can work near the edge without fall protection for years by the time that the variable entered the formula and upset the chain of seemingly predictable events.

Even though variables may be legitimate root causes of accidents, controlling variables is almost never a workable solution to accident prevention. It is often difficult for workers or SH&E professionals to focus on the best strategy for prevention rather than looking for root causes. Individuals with technical and engineering backgrounds have even greater problems abandoning the search for root causes. They have often been trained that problems cannot be solved except at the root-cause level. This is often true in mechanical problems and almost never true in human accident prevention.

For those who are still skeptical, consider the program called "defensive driving." The very premise of the program is that the average driver will not be the root cause of an accident, but can be effective at preventing accidents.

The Risk Perception Hierarchy

Tom Stoppard said, "Man stands alone from all the animals of the world in his ability to know that which is not so." What he was talking about is perception. The way we perceive risks affects the way we try to prevent accidents. We all take calculated risks, but some calculate a lot better than others.

In general, the higher the probability and potential severity of an accident, the more precautions are taken to prevent it. This is often true with both individuals and organizations. When workers are polled about their perceptions of risks, they invariably start with the most likely and/or the most severe. When organizational rules and procedures are reviewed, they also tend to address the most probable and severe accident potential. This is as it should be. Efforts should be placed where they produce the most results.

The problem is that when high-probability risks have been successfully reduced, the low-probability risks are the largest remaining category. Another problem is that the strategies for preventing high-probability risks do not always work on the low-probability risks.

As companies are more successful with traditional management and safety practices, they find the remaining accidents confusing and resistant to their traditional safety efforts. Deming said that if a process is in statistical control (predictable results), the causes of defects (or accidents) is not special, but common to the process. As companies eliminate special causes of accidents, they find the remaining causes are built into their processes. The way they do business is a contributing factor to accidents. The practices that are not considered critical to safety are left to individual discretion. Individuals make decisions based on common sense and experience and this contributes to low-probability accidents. The process is self-perpetuating.

Discovering Low-Probability Risks

How does an organization or an individual accurately assess low-probability risks and develop effective strategies to prevent them? The answers lie in the nature of probability itself.

Probability is a science based on the mathematics of occurrences with great ranges of variation. Low-probability occurrences are by definition difficult to predict and, therefore, difficult to define, understand or prevent. The average worker cannot see the probability accurately within his limited scope of personal performance and experience. A real understanding of probability requires large numbers of occurrences; in other words, seeing the "big picture."

If you roll two dice and add the number of spots on the top of the dice after each roll, the lowest number you can roll is two and the highest number is 12. The most likely number you will roll (the highest probability) is seven. This has nothing to do with luck. Of the 36 combinations in which the two dice can land, more combinations can add up to seven than any other number (six of 36). The two numbers closest to seven, six and eight, each have five combinations that add up to their numbers. Each adjacent set of numbers has one less combination that equals its number until you reach two and 12, each of which has only one combination of the 36 possible ways the dice can land that equals their number. That means rolling a seven has a one-in-six (six in 36) probability, whereas rolling a two has a one-in-36 probability.

If you roll the dice less than 10 times, the results can vary greatly. Some sets of six rolls seem to completely defy the probabilities. But, if you roll the dice a thousand times or more, the results always match the probabilities with only slight variations.

The same principle is true of accidents. There has to be enough data to see the big picture. This might mean sitewide-data vs. one department; companywide-data vs. site data; or even industrywide-data vs. one company's data. Low-probability accidents require big numbers for detection.

Strategies for Preventing Low-Probability Accidents

Seeing the big picture is the beginning, not the end. After you have discovered that people who work at heights fall every five to eight years, you have to determine a strategy for preventing these falls. These strategies often involve preventive measures that must be taken hundreds or thousands of times with no apparent result to be effective. Many workers call them "overkill" or "nonsense" (or worse) and don't support them.

Workers reason that the risk is low and their experience reinforces the idea that they can get away with taking such risks. Experience says the accidents always happen to the "other person," not to me. This perception is accurate but meaningless. There are six billion people on this planet. The six billion are always going to have more accidents than any one individual.

If a person works close to the edge of a platform and doesn't fall except when one of those variables gets in the way, that person is relatively safe. But if the situation continues, such a person will get injured every five to 10 years on average. Preventing such accidents can only follow one of three generic approaches:

1) Fix the environment. Build the worker away from the risks through design, redesign, engineering, etc.

2) Control the variables. Build windbreaks, control other workers movements, control equipment movements, etc.

3) Determine preventive strategies for the worker. Stay a safe distance from the edge of the platform, always wear fall protection while at heights, etc.

The first category should be the first to be explored. If risks can be eliminated through environmental and engineering controls, this can be an effective solution. Such solutions don't always work nor are they always financially or physically possible. Sometimes the problem is not a condition and can't be fixed by changing conditions. Murphy said you couldn't make anything idiot-proof because idiots are too smart and will find another way around your solution.

The second category is a literal way of chasing your own tail. Controlling multiple variables in many situations is virtually impossible, frustrating and ineffective. Since variables are unpredictable, they should be avoided, not controlled. If a worker doesn't know when the wind is going to gust and push him off the platform, it would be more effective to make sure he is never at the edge of the platform, at least not without fall protection.

Make sure to realize that fall protection and all other PPE are not accident-preventing devices. PPE simply reduces the severity of the injury; it does not prevent the occurrence. Putting on a hard hat does not keep something from falling on a person; it simply reduces the resulting injury. Reducing injury is definitely worth doing and is the next-best strategy. But it is not prevention.

The third category of prevention has the greatest potential for preventing low-probability risks from turning into accidents. It involves individual action and, therefore, can be taken by the individual into virtually every environment and used multiple times. Category one strategies are just for the place in which you use them. Category two strategies usually don't work anywhere.

Since category three strategies are personal, the people involved in the risks should be involved in the solutions. Deming said, "People support what they help create." If the workers who need to

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support the strategies are the ones who formulate them, the support is more natural and likely to happen.

It is also important that the strategies for preventing low-probability risks become habitual. The strategies will need to be used often and systematically to be effective. Like wearing seatbelts, low-probability strategies should be automatic and consistent to be effective. Changing habits in a work environment is not an easy task, but a lot of technology has been developed lately in the organizational and behavioral sciences that can provide effective tools.

Conclusion

Several industries have also experimented with these strategies and the research is beginning to point in some definite directions. SH&E professionals are determining which low-probability risks are common to certain industries and which strategies prove most effective in preventing low-probability risks. This is enabling the development of a new level of organizational competence in addressing a category of accidents that has been elusive and costly to many companies who are serious about pioneering the path to zero accidents. ■

Terry Mathis is the president of Integrated Performance Technologies Inc. (IPTi), New Caney, TX. He is a former director of training for Coca-Cola. This article is based on Mathis's presentation at the ASSE Professional Development Symposium, "Human Error in Occupational Safety", Atlanta, March 13-14, 2003. Mathis can be reached at tmathis@ipti.com.

ASSE Launches New Members Only Website

The new Members Only section of the ASSE website is now available. The site features a variety of networking, career development and informational tools and resources, such as an online membership directory; bulletin boards; the new A-List listserve; and the Career Center, which offers job search/posting tools, resume assistance and mentoring resources.

Members can also access PS Online, view best practices articles from ASSE's conference proceedings and download the Society's white papers on various topics. In addition, the site features an online dues payment option. Visit the site at www.asse.org; select the "Members Only" tab, then provide your member number and last name when prompted.

ASSE MPS Events & Happenings

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and networking opportunities in the year ahead.

Interested in MPS Opportunities?

Planning to go to the PDC in Las Vegas next year? If so, please plan to attend our annual Advisory Board meeting on June 5, 2004. Get involved—join an MPS committee. Committee involvement doesn't take much time and the benefits are great.

Awards & Honors for MPS

On Monday, June 23, CoPS hosted an award luncheon for all the practice specialties. Edwin L. "Brownie" Petersen, current MPS Assistant Administrator, received the CoPS Safety Professional of the Year (SPY) award. Brownie was recognized for his sustained contributions to the profession, to the Society and to the practice specialty. David Crowley received the MPS SPY award in recognition of his continuing contributions to the profession and his innovative contributions as the chair of the MPS Membership Development Committee.

Congratulations to the award winners and to the Management Practice Specialty for another successful PDC. ■

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