The Myths of Safety
The Management of Behavioral Risk:
Risk Competency Safety

Corrie Pitzer,
BA Hons Psych, B Hons Business, Grad Dip Ed, MBA
Chief Executive Officer, SAFEmap International
Vancouver, British Columbia

Introduction

The management of safety has undergone a number of radical changes in the past 100 years. The most important paradigm shifts occurred in through the work of Heinrich, then the advent of the safety systems era, and of late, the behavioral safety approaches that became popular around the world. All of these 'approaches' to safety each left an indelible mark on the way we targeted safety improvements, what interventions were deployed and how those were measured. It also resulted in a number of strongly held "myths" of safety management, each discussed, analyzed and challenged in this paper.

The paper also analyzes the effects of some of these approaches and points to a complex problem of the increased levels regulation and of perceived protection that workers enjoy in the work place – leading to what is commonly known as 'complacency'.

A second problem of modern safety management is a consequence of the superficial treatment of accidents through procedures and rules changes, leading to a phenomenon called accident migration.

The most recent approach to safety is generally known as behavior-based safety and flowed from the human sciences and quality management era. This approach had a dramatic impact on the way safety was managed around the world, but is still falling short on a number of key aspects, most notably the area of risk cognition and risk compensation. Many workplace accidents occur simply because the risk was <u>unidentified</u>, <u>underestimated</u>, not <u>understood</u> or <u>ignored</u>.

The paper proposes a new direction for safety, called risk competency safety, which is based on cognitive psychology, to combat this consequence of modern protection.

Managing safety today…

Managing safety is a young science, but an old practice. Legend has it that in 1870 BC King Hammurabi used a simple but extremely effective safety system - *if a worker lost a limb due to the overseer's negligence, the overseer's limb would be removed to match the worker's loss.*

If only it was that simple… The phenomenon of an 'accident' was treated almost with disdain by the management practitioners of the industrial age. We slapped simplistic definitions on them, such as 'unplanned, unexpected events'. We controlled them as a 'loss' through management models developed in the 1960's that are barely credible today. The central drive in safety has remained much the same for the last 90 years, traditionally known as the three E's of safety: Engineering (the hazard out), Education (of workers in the skills, rules and procedures) and Enforcement (policing for compliance and applying discipline when not). These approaches still permeate every aspect of safety: road safety, occupational safety, fleet safety, etc and the so-called 'modern' behavioral safety approach still functions well within the compliance models of safety.

However, safety improvements continue to elude us. We have achieved major improvements in the *reporting* and *management* of injuries, but less so at preventing them. International trends in the mining industry's accident statistics suggest that we have reached plateaus in performance on some indices (fatality rates) since the 1980s or showed no significant improvements on others (e.g. lost time injury rates).

We continue with an obsession with numbers – to drive down the accident rates in whatever shape or form we measured them. We have largely stayed 'static' in our safety technology, namely the application of controls (managerial, procedural, supervisory or disciplinary) and corrections. While safety has become an important issue in modern organizations, it remains an outcome-based, operational issue that escapes the attention of strategists in a "fad-driven" industry.

This paper will attempt to show that 'safety' is a strategic parameter – a multi-dimensional measurement of the organization's effectiveness and that an accident is a symptom of complex failures 'upstream' in the organization.

And then we have entered a new era:

Ulrich Beck's book, Risikogesellschaft (Risk Society) described a society that has become very, very 'risk averse'. It is a society that is now preoccupied with the production (and avoidance) of risk and less so with the production of wealth. The Global Warming Debate has swept the world, politicians and societies like a tsunami in the past few months. The Stern Report, the IPCC reports and Al Gore's, *An Inconvenient Truth,* all combined to shut down dissenting debate or any skepticism – equating it with (holocaust) denial.

The 'question is obviously not whether global warming is occurring or not, but whether it is in fact man-made, and if it is, whether man can reverse AND without 'killing' many millions of people through contraction of economies, and even if we can, how effective will we be? A rather disturbing simulation by Wigley (1998) showed that the rise in temperature over the next century is expected to be 1.92 °C around 2094, when nothing is done. If the Kyoto Protocol is implement as designed, that high point will be reached in 2100 – only a six year postponement!

The debates of the Risk Society are not rational. It is for instance the same society, same people, who shifted their appetites to organic food and healthy living, which resulted in the massive clearing of land and forests to produce healthy food, much more ineffectively than inorganic farms, for the massive demands in North America and the EU. And then it is the same society that demands more forests!

Something will have to give!

Myths about Safety Management

All Accidents are Preventable

Safety management is fraught with myths, half truths and sometimes lies. In most cases, we accept some fundamental safety concepts as 'gospel', without subjecting them to critical analysis. The most fundamental of all is the statement that 'all accidents are preventable'. This became a 'mantra' for safety management in the modern era, and the focus of vigorous campaigns to convince workers of the 'truth' of it. Strangely, workers weren't easily convinced. If they dared to express any doubt it was countered with the question "Show me any accident that is not preventable?" But are all accidents truly preventable?

The response of 'show me an accident that is not preventable' is intuitively appealing, but following that line of argument, all games that sporting teams ever played and lost could now be shown to be winnable, even if it was the Thunder Bay Colts playing the Blue Jays. It is also armchair logic that is persuasive only because it is viewed after the event when the simple, linear flow of events of the accident can be readily exposed. But it is a completely different issue prior to the accident when there is an infinite range of possibilities for accidents, and an infinite number of events in each accident. Then it is impossible to 'prevent' the accident.

The Randomness of Events

The 'randomness' of events in any organization is an unknown quantity. It is impossible to quantify what proportion of any event can be ascribed to random occurrence or coincidence. In practice, it is clear to workers at the coal face that while they are usually working without an accident occurring, the probability for accidents is significant and they are either 'lucky' to escape or 'unlucky' when they don't. 'How often' is something only they know, but the reality is that most of these events and near misses are hidden from supervisors and management for a variety of reasons. On of the fallacies in risk management is that our risk assessment processes are often static and focusing on the risk in process and in physical conditions. Risk is however *dynamic* and *random* in nature. It is an ever changing phenomenon, which shifts and changes its nature and appearance as the organization, people and activities in it change – almost every second of the day!

Accident Prevention

One of the traditional keys to unlock the risks in the organization is through accident analysis. The accident analysis process, if conducted thoroughly, is a complex and time consuming process and therefore usually limited to serious accidents. But serious accidents are intrinsically no different to small accidents or even near misses – the difference, mostly and often a fortuitous one. It is simply impossible to investigate all incidents, even though it is obvious that we can only

make strategic decisions if we have valid information. One is therefore not sure how many accidents, of all the potential accidents out there, we are preventing.

The accident prevention process barely touches the surface, but it seems wrong to say that. Because we intuitively 'know' that we have prevented an accident if we have introduced a new procedure or system – such as a tire frame to prevent blow outs when repairing truck tyres. But now the tire frame is too cumbersome and it is not used. This is now a behavioral problem which needs another correction, so we increase the supervision. The frame is now only used when the supervisors are around and not at other times. Then we increase the penalties for not using it, which induces fear and retribution as part of the safety process and the risk-taking is driven even further underground. And so it goes on. We are reducing the probability of a particular accident reoccurring, never preventing it, but creating conditions for different types of the same accident to occur. (The tire explodes while it is still fitted to a truck, moments after the workers started to remove the tire, but before it could be put into the frame. A worker is killed…)

The Link Between Beliefs and Actions

It doesn't really matter whether employees, managers, supervisors or workers, believe all accidents are preventable or not. Would managers who don't believe all accidents are preventable be less inclined to act on safety issues? What about managers who believe some accidents are preventable and most accidents not? Or managers who believe most accidents are preventable but some are not? One can even reverse the logic and argue that non-believing employees will be *more, not less* inclined to act on safety. If a driver on a road believes that accidents are inevitable, will he not be more aware of potential risks and act more safely out of basic self-preservation – a powerful driver of behavior in the human being? Or conversely, a person who believes all accidents are preventable will be more comfortable and more confident about risks in their work environments – the classic process through which complacency develops. There is no evidence anywhere to suggest that there is a direct and predictable link between safety beliefs and risky actions. No clear research has been conducted into this topic and all our conclusions and statements about this are again armchair logic and certainly not supported by behavioral or cognitive scientists.

The 'Zero Accident' Goal

It is doubtful if anyone has ever tried to do a cost-benefit analysis of the 'zero accident' goal, simply because the analysis would be no more than an intellectual exercise. However, there were some studies conducted at Harvard University which shed some light on the issue – and raised serious questions about the commercial viability of such a goal. It can be accepted that the cost curve, as we approach the zero targets (and assuming for the moment this is possible!) will show an exponential increase to remove the remaining few accidents. But the cost of doing so would be enormous. This is illustrated by an analysis of the cost of safety improvements, showing that the **cost** of an accident prevention solution is often very different from the **emotions** about the solution.

If you calculate the cost of a life saved (by dividing the dollars to implement the solution by the number of lives saved over one year) as calculated in USA, the following results are achieved:

- Mandatory seatbelts in all American states will cost $69 per life saved
- Seatbelts in school buses will cost $2,800,000 per life saved
- Benzene emission controls at rubber tyre factories will cost $20,000,000,000 per life saved.

(Source: Tengs et al, 1995, Risk Analysis, 15(3):369-90)

It seems callous to think of safety in terms like this, because the obvious counter argument is always, "What cost a human life?" But, in safety management, it is a relevant question! Will a company pay $20 billion to remove the last deficiency to achieve the zero accident goal, given that the cost of the second last one was approximately $18 billion? Because that second last decision bankrupted the organization, not only will it not pay for it, it can't!

James Reason makes the point emphatically: *"The organization can only defend against hazards (risks), it cannot remove or avoid them – and still stay in business. Similarly, an organization can only strive to minimize unsafe acts, it cannot eliminate them altogether."* (1997)

Many safety practitioners and many companies simply fail to grasp the full implications of this statement.

Reality: the Final Hurdle

Reality is the final hurdle. The asymptotic nature of accident rates approaching, but never reaching zero is such a reality, so who are we fooling? Certainly not the worker at the coal face, because they intuitively know and have lots of evidence of sporadic defects and human failures occurring every day of their lives. The reality is that no organization will ever be a *zero accident organization*. Are those who claim they are a *zero accident organization* lying? Are those who really believe they are, fooling themselves and they only have to wait a short while before they are proved wrong?

If the goal is zero accidents, companies will <u>always</u> fail, because it is impossible to prevent all 'unexpected, sporadic events'. What <u>will</u> be achieved is a high IBNR (Incurred But Not Reported) accident rate as the demand for the zero accident goal is intensified. Employees will give exactly what is asked of them, or rewarded and/or punished for: In this case a number - zero. If the goal is 'safe work', organizations will succeed most of the time, because this is true for most of the time. If the goal is, 'toward zero errors', will organizations have a focus on safety that is incorrect, too soft or just more semantics?

The implications of this dilemma are rather far reaching and involve one of the most visible images of a corporation, namely the stated safety, health and sustainability goals. Anything other than 'zero accidents' is unacceptable. On the positive side, zero accident goals are an illustration of the organizations' commitment, it states corporate citizenship and it stretches minds to reach for the stars, and everybody else is stating it! How then is it dealt with inside the organization?

Obviously communication to employees regarding the organization's goals should be congruent with communications to the outside world. Anything less would be met with suspicion and would damage credibility.

At the top level of most companies they focus on output goals. They use virtually the same measurement for safety as the small departments within the company, namely accident rates. The only difference is that they look at the statistics corporate-wide and are more able or likely to identify trends from which to conclude whether safety is improving or deteriorating. However, this hardly makes the focus 'strategic'.

However, we cannot argue the "bottom line" of safety away: we don't want anybody killed or injured, ever! The death of an employee will never be a risk we can tolerate, let alone accept. (But death is a consequence of an accident that was often just a second or a few meters away from being an injury or only a "near miss". Which means we don't want any injuries, which means we don't want any accidents or incidents – which brings us right back to the "zero risk" dilemma!).

We then convert the zero accident/incident dilemma to the zero harm one. We now make bold statements and claims to our constituents at large, including our communities where we operate and who we supply.

The Risk Society now casts a critical and demanding eye to the mining industry, and it is clear that the Global Warming emotions will rule decisions and preposterous demands: "Your dirty coal is killing our children and their futures and you are profiting hugely from it". The line of argument is irrational but very real and one can only wonder when the first lawyer will gather support for his class action, as they did with cigarette companies!

Regulation Explosion – Performance Implosion

It would appear to be an incontestable fact that compliance should form the heart of any safety program, whether it is workplace safety or road safety. It is simply not possible to imagine a world where compliance to basic rules and regulations can lead to anything else but safety, order, and predictability. A city without road rules or without compliance to them would be utterly chaotic; similarly a mine where employees fail to follow safety rules would be inoperable. So, logically, if we are able to achieve high quality rules and strict compliance to them, our safety performance should be optimal.

However, there are some disturbing facts and trends that suggest that this 'axiom' could in fact be flawed. In the 1970s and 1980s, the United States of America promulgated a large number of safety regulations, generally gathered under the so-called OSHA of 1970. These regulations were duly transferred to the workplace to improve the level of safety but surprisingly, an increase in accident trends and severity rates occurred over the same period.

Do more procedures, regulations and compliance lead to better safety? There may be a 'saturation point' beyond which more regulation not only has no more effect, but may even be detrimental to safety performance. There is some disturbing evidence and arguments to support this, referred to as the "sigmoid curve" in reliability engineering. It is strongly suspected that the same curve limits our ability to avoid all accidents.

While mining industry statistics, internationally, show consistent improvements in injury rates over the past 30+ years and still over the past 10 years, there is little doubt that these figures are 'fudged', or at least contaminated. Light duty or modified work programs are responsible for this. The ultimate measure of any improvement is the fatality rate, which is generally expressed as deaths per 1000 people employed. These rates have shown moderate improvements over the past 30 years, and have actually 'plateaued' in most mining countries in the past ten years. Have we reached the end of the line? Maybe not, however, it should be noted that this plateau occurred during a period which included the most visible and most serious focus on safety ever in the history of mining. Obviously something isn't working?

As the number of regulations has increased, so the complexity required by workers to accomplish the production targets has increased. The targets have also become more demanding; mining methods are more technologically advanced and complex; supervision spans (worker-supervisor ratio's) further stretched and the focus on safety more visible and demanding.

Worker Complacency

Concurrent with this increase in regulation, came the strange, but very obvious consequence of worker complacency. Never before had mine workers 'enjoyed' such high levels of safety protection. Increased numbers of safety personnel were employed; highly visible safety systems (which added to the complexity) were deployed and waves of new technology were introduced. Each of these initiatives was necessary and unavoidable for safety 'improvement'. They each had to be introduced. But the combined effect, which no one could have foreseen, was that workers became increasingly confident that they were safe – a confidence which easily translated to complacency. The reality is that through good management and efforts to make work a safer endeavor, complacency has developed.

Accident Migration

Another phenomenon that occurs as a result of increased regulations is accident migration, where safety measures introduced in one location result in an increase in accidents in another location. Examples of accident migration are:

- A speed limit was imposed on a German highway to help reduce the accident rate. A dramatic 21% reduction occurred and authorities promptly declared that it had been a successful measure to curb accidents. However the accident rate on a parallel road increased by 29% over the same period because drivers preferred to use the road where no speed limit existed.
- A rule of 'no overtaking' on haul roads at an Australian coal mine led to an increase of small vehicles 'racing' large trucks at intersections to avoid being caught behind slow moving haul trucks.
- The introduction of traffic lights in small Canadian towns had no significant effect on the accident rates in those towns. The type of accident just changed from right angle accidents to more rear end accidents.

Given the vast improvements in safety management and safety technology over the last three decades, visible improvements in injury rates should have occurred but haven't. It is a result of the so-called delta fallacy:

A river flows into the sea through a three-pronged delta. Damming two of the channels will reduce the flow of water into the sea by two-thirds.

While this is obviously wrong and an argument that will be quickly dismissed, we readily fall into the delta trap when we manage safety. We do this by regulating against certain practices, we ban certain behaviors, we change the designs of work places – but what we don't do is reduce the flow of the river in the first place: the level of risk acceptance in the organization, the upstream dam.

And this is one of the central notions of this paper:

People, teams, groups and organizations, alter their behavior in response to the implementation of health and safety regulations, but the riskiness of the way they behave will not change, unless those measures are capable of motivating people to alter the amount of risk they are willing to incur.

This aspect of regulation explosion and performance implosion must be addressed strategically.

<u>The Strategic Focus</u>
As previously discussed, the current focus of the top echelons of an organization is often to obtain detailed information from a site where an accident, near miss or high potential event has occurred and disseminate them to other sites. This process reproduces the error that regulation authorities make and is based on a flawed thought process: trying to prevent accidents on the basis of events that have already occurred.

A more beneficial approach to take if an accident occurs is to focus on the strategic issues. The strategic role would be:

- Express how the organization values life and convey condolences and sympathy to the victim and family
- Express support for the site's management and reinforcement of the overall commitment to safety
- Express support for the employees at that site
- Ensure that the site management maintains a risk-based accident prevention focus
- Where the site management decides on a series of actions following the specific incident, ensure that it is not contributing to other problems or complexities

People and System Dynamics

<u>Safety Management as a Science</u>
In safety management, the role and impact of people on the bottom line of safety is often overlooked. The interaction of people with their environment, systems and other people is also not well catered for or understood.

In 1931 Heinrich published a book that effectively started the scientific approach to safety. He introduced the 'domino' safety management model which was further developed by Walter Shewhart and Frank Bird. Both introduced more sophistication into safety management and this was the point when safety management became a science. The essence of the domino approach equates to Taylor's definition of scientific management: *"Management must plan, direct, organize and control"*. However, the emphasis was generally placed on 'control' which culminated in the philosophies of 'loss control', where safety was defined as a "loss event" and as a subset of the control function of management. It was soon replaced by a newer science in the 1980's, namely risk management.

<u>The Art of Management</u>
The *<u>science</u>* of management started to become the *<u>art</u>* of management and work places underwent dramatic changes:

- Workers' issues became more complex and sophisticated and organizational behavior became a management focus
- The quality movement changed fundamental thinking about risk, people and dynamics
- Complex systems thinking underpinned advanced management theories
- Electronic age systems increased the speed of business dramatically.

Despite the rapid changes and improvements in human resources and the quality management era, safety management soldiered on in the traditional way, and continued to treat safety as a control and discipline issue.

Regulations continued to multiply and workplaces were policed for compliance. Rigid safety systems continued to be applied and where more sophisticated management tools and concepts were developed, safety management lacked the ability to transfer these into workplace. Safety practitioners continued to come from the engineering sciences or the production environments and didn't quite participate in this new era.

A People Science

Safety is fundamentally a *people science*. It is about the actions, motivations and behaviors of people. The change management practices which treat people in vastly more sophisticated ways in the production and quality environment introduced over two decades ago, have not been transferred to workers' risk-taking behavior. For example, quality circles to improve production processes were dramatically successful, yet many companies still continued to manage safety through safety committees as the main vehicle for employee involvement.

In quality management, the focus used to be on the processes that produced the deficiencies, not on the deficiencies themselves. Today, the quality management tools are fully integrated into normal production processes and are no longer considered a separate function of the business. But in safety the focus is still primarily on the deficiencies, the accidents and incidents in the organization and still largely a separate function in the organization.

The People Factor

One of the biggest advances of the modern era of management was to bring safety to the people in the organization.

In safety, this translated into a focus on the behavior of employees. At the risk of over simplifying this new focus on people, the key elements can be described as follows:

The behavior of employees is a function of the mindset they have (about safety). A positive mindset towards safety implies that employees:

- Will ***want*** to work safely (motivated)
- Will know ***how*** to work safely (skilled to do so)
- Will ***believe*** it is *possible* to work safely (risk perceptions)
- Will ***see*** and ***judge*** risks competently (risk competence)
- Will ***fit in*** with the safety culture they perceive around them

Each of these statements describes the basics of a body of knowledge about humans at work, each of which is enormous and enormously complex. Each statement must be addressed and optimized, but the interrelationship and dynamic interdependency of the issues poses the biggest challenge. What comes first and which is more important?

- A person can be very skilled at seeing risks, evaluating them accurately, etc, but does not have the motivation to do so regularly.
- A person can be extremely motivated, and not have the skills or abilities to identify risk.
- A person can be skilled and motivated, but no one else is doing it, and he/she fits in to that prevailing culture
- The person can be skilled, motivated and positively influenced by the people around them, but essentially has a belief system that doesn't support the process in the long term

The list of permutations is almost never-ending, but the mistake is to think of these essentials in individual terms and how they affect each employee. A more practical and effective approach is to focus on organizational behavior and organizational performance. And ultimately on the safety culture of the organization, which is one of the most powerful determinants of employee behaviors.

Powerful Safety Culture
Safe performance outcomes at all levels will occur if we have a powerful (safety) culture which:

- Drives hard but positively towards safety values and goals;
- Has management systems and processes that incorporate safety in every facet and phase of the production processes;
- Includes supervisory practices and supervisory systems that guide safe behaviors.

This is the domain of organizational behavior. Where the outputs of the organization is understood to occur through dynamic systems, processes and value chains and where the attention is on teams, functions and stakeholder groups. The culture of the organization is not seen as a result of our management practices, but the other way around. This then brings culture into the domain of the manager: a dynamic each manager must understand, measure, analyze and manage.

The safety culture in the organization is largely influenced by what the line managers in that organization communicate.

The risk competency safety model

The competency-based safety model is a synthesis of different "people approaches" to safety, namely the behavioral safety approaches and the risk awareness approach. Each of these approaches has their strengths and weaknesses and it is believed that the one complements the other and a more powerful synthesis model has emerged.

The *behavioral safety model* is essentially an approach that is based on behavioral psychology, and specifically the processes of applied behavioral analysis (peer observation processes) and behavior modification (feedback processes). It is very similar in design and

application to the quality improvement processes that swept the world in the 70's and 80's. The following features are common to both quality and behavioral safety approaches:

- Operational definitions
- Measurement
- Display of data
- Feedback processes
- Qualitative analysis of data trends and interactions
- Problem solving
- Process improvements

In its simplest form, behavioral process implementations go through the following steps:

- Conducting a behavioral assessment, which often includes a safety culture analysis, behavioral analyzes from accident and incident reports.
- Development of critical behavior assessment forms
- Training of leadership and employees
- Training of observers, coaches and facilitators
- Deployment of the observation process
- Measurement and display of information
- Improvement of processes

The *risk competency-based safety model* is an approach that is based on cognitive psychology, where the focus is on the 'cognition' of risk in the workplace. The human perception of risk is a complex process and how the human mind processes that information, is essential in understanding why workers often take risks that would seem strange in hindsight. There are many and varied factors that can have an impact on the behavior of people and where the abovementioned *behavioral* approach fails, is in the field of risk perception. The ABC model of Antecedent-Behavior-Consequence is too simplistic to explain the complexity of in-attentional blindness, observation errors, risk evaluation biases and risk confirmation failures.

Safe behavior of workers is dependent on their abilities to detect a risk, recognize it and recognize the threat it poses and to decide on the appropriate action to take. A risk is any object, condition or situation that tends to produce and accident when workers fail to respond successfully.

The basis for this behavior is the *processing of risk information*. A person cannot take an appropriate risk avoidance action if he/she was 'unaware' of the risk. One study of Nagayama (1978) showed that 53% of accidents involved such perception failures:

- Did not notice, or attention failed – 21.6%
- Believed enough attention was paid – 16.3%
- Obscured visibility of the risk – 8.1
- Delayed perception for other reasons – 7.8%

The risk-based approach firstly aims to improve the skills of employees to observe risk and understand risk in their work environments and secondly to introduce tools or behavioral systems that would increase the identification of risk.

It goes through the following processes:

- Identify actual risk profiles of the operation
- Conduct training of leadership groups
- Develop interventions
- Conduct training of trainers and coaches
- Deploy risk tools and behavioral systems
- Conduct risk review workshops
- Link critical risks and observation activities

A Synthesis

This paper presented views and issues, arguments and controversies, in order to develop some kind of synthesis for our safety imperatives.

The most important point of this paper is that safety is not, any more, achievable through the means, techniques and approaches of yesteryear. We are at a threshold in safety management – to adopt the principles and tools from the quality and human sciences, or fail. These new principles and tools will not take us into unchartered waters. They have been tried and tested elsewhere, except in the safety discipline.

What the *quality management era* brought to the science of management is that systems are at the heart of the organization. They drive everything: outputs through behaviors and that dynamic system thinking should also be at the heart of safety management.

What the *human sciences* brought is that we can harness the hearts and minds of people and if we succeed to do it, their contribution will be creative, powerful and sustainable.

Some organizations have embarked on that road and have been able to integrate leadership dynamics with safety dynamics. They have developed a fine balance between the traditional safety approaches of technological solutions and safety auditing, embarked on the imprecise road of applying behavioral psychology to safety and they took on the challenges of applying modern information management and metrics to the field of safety. There will be a need to settle these processes down and embed them in the organization, make them work in the longer term and ensure that they are sustainable and then sustained.

But what then? What is next?

The challenges of the next decade or more are many and complex, and the list below is an attempt to outline some of them:

- To develop a level of sophistication and rigor in safety management, along with the true passion for it at all levels. We know it is possible, but we don't quite know how. We know it is difficult, but we don't know the cost of it. We know it is the only option we have.

- To do the above within the harsh realities of the profit motive of any enterprise, more so of a mine's, where the risk levels are bound to increase in future as we dig for minerals in deeper mines, more remote mines and more complex mines.
- To cope with the foreseen increase in the criminalization of safety and the accompanying spiraling of the cost of safety, both as input and as compensation costs. The legal framework of safety will become more complex and more costly to maintain,
- To stay abreast of new developments in safety management, such as through organizational behavior, evolutionary psychology, technology and automation. Safety programs of the future will have to be flexible, modular and very dynamic.
- To find the capacity to lead the field in safety management, in stead of waiting for others to pioneer new directions. To derive this capacity from creative thinking in business, innovation and continuous improvement.
- To truly empower people at all levels to act on safety, to accept responsibility for it and be held accountable for it – in a high performance environment.
- To lift the level of safety to the level of other long term business imperatives: profit, shareholder return, sustainable business.
- At the same time, to achieve the ultimate goal: to align safety to 'care' as a central value of the organization, where safety of all employees is paramount, valued and not just merely prioritized.

Conclusion

An old adage is that the "safety we want is the safety we will get". It is no more dramatically illustrated by the story of the 4-minute mile:

In the 30 year lead up to the historic event during which Roger Bannister broke the 4 minute mile barrier, this barrier had developed a mystique of its own. It was believed to be the impossible dream. No athlete even came near and doctors warned that one could die in the attempt to break the record.

But on a (wet and windswept) day, 6 May 1954, Oxford, England, Roger Bannister broke the record: a stunning 3:59:4!

A few months later, the Australian, John Landy went even faster and in the challenge between the two another few months later, they both broke even that record!

Within a few years, 16 athletes logged a time better than 4 minutes and today the record stands at 3:44.39, held by Noureddine Morceli of Algeria. The 4-minute barrier has been broken thousands of times. The athletes suddenly believed that it was *possible* when Bannister achieved it. Before that, athletes believed that it was *impossible*. The training after the historic event was done with a very different mindset and the achievements were spectacular.

In safety, our goals of zero accidents may be rationally impossible, but with the passion and the belief, we can positively hold that as a value in our business.

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