

IMPROVING YOUR MINE'S SAFETY CULTURE – THE ULTIMATE OBJECTIVE OF THE SAFETY MANAGEMENT SYSTEM

Shane Stephan B.Bus., M.B.A. (AGSM),
M.A.I.T.D.
Queensland Department of Mines and Energy

SUMMARY

The term "safety culture" has been given prominence through the reports of inquiries into such disasters as Piper Alpha and Moura No.2. Managers, inspectors and employees frequently refer to the state of the safety culture at a particular mine and a poor accident record is often said to be linked to a poor safety culture. However, few people can define exactly what a mine's safety culture is. How can it be measured? How can it be improved? This paper answers these important questions.

The importance of considering national, industry, and organisational cultural factors when implementing safety management systems is illustrated. Using the commonly understood management improvement process of Total Quality Management, the importance of safety management plans and risk assessment processes to improving the safety performance of the mining industry is demonstrated. Seven principles of implementation for a safety management system which will ensure an improvement in a mine's safety culture are described.

Finally, it is argued that only through the adoption of a new paradigm of safety management, the socio-technical systems paradigm, which considers both the engineering and human factors responsible for accidents, will significant improvement in industry safety performance be achieved. The historical reactive engineered safety paradigm has contributed to the formation of an industry safety culture that is no longer producing results.

INTRODUCTION

The phrase "safety culture" is becoming a commonly used term in association with the management of safety in hazardous industries. The inquiry into fatalities in the Western Australian Mining Industry mentioned a culture of risk taking behaviour in their industry as an important driver of their fatal injury rate

(Torlach, 1). The review of Mines Safety in New South Wales (2) mentions that despite the efforts of many individuals mine safety is impacted by "a systemic bias against rapid and effective improvements in safety, other than those induced by changing technologies". It goes on to state that this can be attributed to "the combined impact of the traditions, incentives, awareness, financial pressures, institutional arrangements and knowledge of risk mitigation strategies which have largely determined the industry's safety culture."

The term however, has no common definition and is generally poorly understood. As Reason (3) states, to most mining personnel with a hands-on engineering background the term, "safety culture" has the definitional precision of a cloud. The objective of this paper is to provide an understanding of what is meant by the term "safety culture", how it can be measured and what actions management may take to influence their mine's safety culture. The paper will achieve this understanding through taking a top down approach explaining how national, industry, and organisational cultural factors influence safety and health management. Using the familiar methodologies of Total Quality Management (TQM), methods of implementing a mine's safety management system which positively influence safety culture will be illustrated.

This paper argues that a positive safety culture will only be developed through the utilisation of a safety management system which considers environmental, behavioural and personal factors as drivers of safety performance. It is only through such a paradigm shift in safety management that a significant improvement will occur in the mining industry's rate of fatalities and serious injuries. The present paradigm of reactive engineered safety is no longer improving results.

UNDERSTANDING CULTURE

National Culture

Almost all people are aware of difference in national cultures. This awareness results from travel, international news stories, and developing personal contacts. National

cultural differences can be grouped in four main ways, namely, symbols, heroes, rituals, and values. Cultural traits have often been attributed to heredity, as historically the impact of learning was underestimated. Hofstede (4) states that values are the core of culture and that values are among the first things children learn – not consciously, but implicitly. They drive our judgement of what is good and evil, ugly or beautiful, abnormal or normal, irrational or rational. Figure 1 below, illustrates where culture fits into the regime of human mental programming.

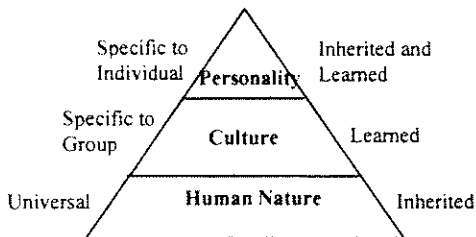


Figure 1: Levels of Human Mental Programming

Although no one culture can be said to be superior to any other some cultural factors do provide advantages to groups in particular environments. The successful implementation of a safety management system will require cognisance of the characteristics of the national culture in which the organisation is to operate. The importance of national culture to safety performance is demonstrated by Reason (3) who uses the example of the

commercial aviation industry. Airlines around the world fly the same types of aircraft in comparable conditions with flight crews, air traffic controllers and maintenance engineers trained and licensed to quite similar standards. Yet, in 1995 your risk of being killed in a commercial airliner varied by a factor of 42 across the world's air carriers, from as little as 1 in 11 million to as much as 1 in 260,000. Another example is given by Knowles (5) where in Pakistan a mines inspector states that their high fatality rate was due to, "Inshala" or the will of Allah.

Australian National Culture

Hofstede's (4) much cited work using IBM's worldwide workforce as a model determined Australia to be a country of high individualism where there is a flat power gradient between manager and subordinate. Some interesting results were obtained in a study by an English researcher, Braithwaite (6) of the reasons for the significant difference in the safety performance in the aviation industry between Australia and the UK. He determined that national cultural differences were a major reason why the Australian aviation industry was so relatively safe. When pilots were asked how they would react to the introduction of a new rule they considered to be unsafe there was a marked difference in reaction even between such seemingly similar cultures as Australia and the UK, as illustrated in Figure 2.

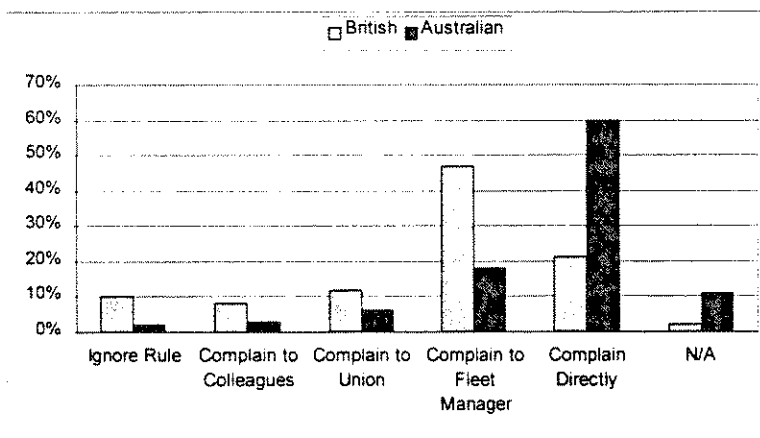


Figure 2: Response of Pilots to Implementation of an Unsafe Rule

He found that Australian's cultural tendency to communicate concern directly to their superiors was a factor that greatly improved airline safety. He states, "Senior managers in Australia appear to be more approachable even if only because they have little choice in

the matter!" This and other studies indicate that the Australian national culture demonstrates the following characteristics:

1. A desire to be left alone to do a job without direct supervision.

2. A lack of deference to authority.
3. An emphasis upon masculine friendships and team work.
4. A strong ability to innovate.

It would appear that these characteristics would make it necessary for a safety management system to involve all levels of an organisation in order to be implemented successfully. It also points to potential problems where systems are reliant upon individuals always following safe work procedures whilst working alone.

The Australian culture has been assessed as having characteristics that have enabled very high levels of safety achievement to be achieved in the aviation industry. The mining industry could therefore learn much through the experience of the Australian aviation industry in implementing safety management systems.

Industry Culture

There is a general public perception that the Australian mining industry has a poor safety culture and importantly that this must change. The review of Mines Safety in New South Wales (2) and Inquiry into Mining Fatalities in

Western Australia are two examples of this concern. There are presently many initiatives being undertaken at an industry level which have the potential to greatly influence the mining industry's safety culture. Significant changes are occurring in safety and health legislation and regulation throughout New South Wales and Queensland. The Minerals Council of Australia has committed to work towards eliminating fatalities in our industry. The MINEX awards and the Safety and Health Innovation Awards are examples of that commitment.

One tool for analysing an industry culture is through the use of a culture web. Questionnaires are answered by a cross section of the industry upon the different elements which make up the culture web and responses are tabulated to provide the inputs to the diagram. There are many such safety culture perception survey tools available or one that addresses the headings of the cultural web could be relatively easily developed. This web can then be compared with those from other industries or compared over time to determine changes in perceived industry culture. Illustrated below in Figure 3 is an example of a culture web for the underground coal mining industry.

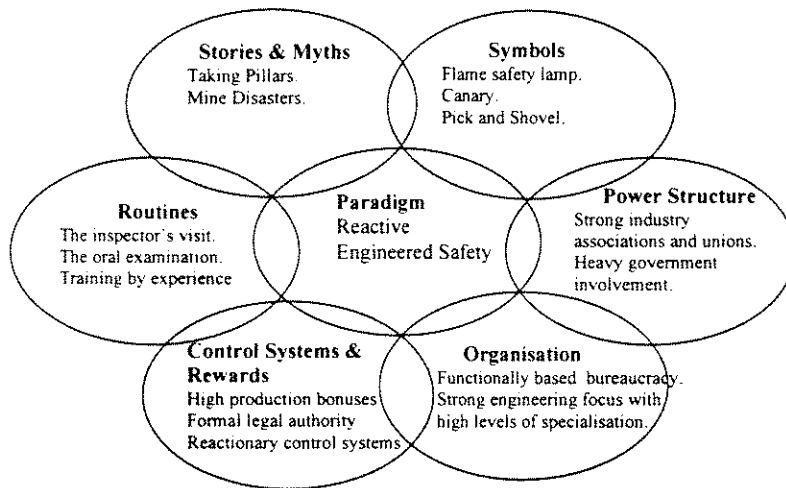


Figure 3: Historical Cultural Web of the Underground Coal Mining Industry

Any such cultural web can only provide a summary snapshot of the critical points from any survey. The paradigm of reactive engineered safety has historically served the industry well although statistical evidence would suggest that since the early 1980s this

approach has not produced results (Figure 4). A new paradigm needs to be developed, a socio-technical systems paradigm, where problems are analysed from both an engineering and human factors perspective.

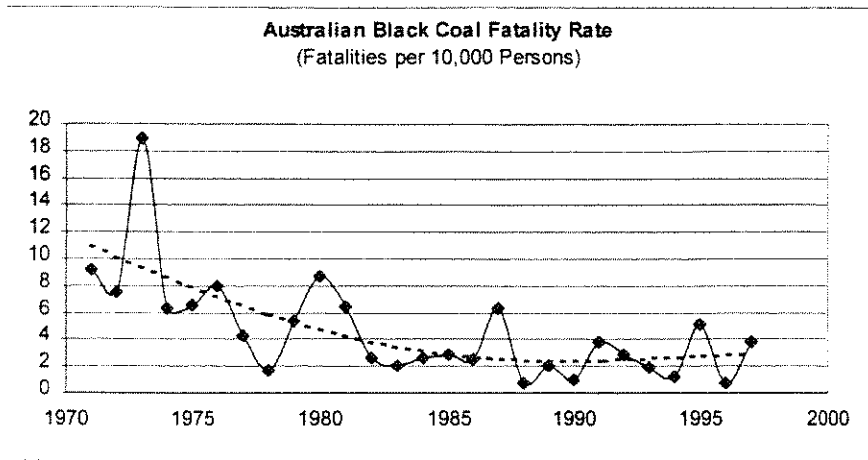


Figure 4: Australian Black Coal Industry Fatality Rate.

Organisational Culture

Safety culture is an integral part of the organisational culture. Organisational culture is best defined by Utal (7) as:

The system of shared values (what is important) and beliefs (how things

work) that interact with a company's people, organisational structures, and control systems to produce behavioural norms (the way we do things around here).

Figure 5 below illustrates the similarities of an individuals culture to that of an organisations.

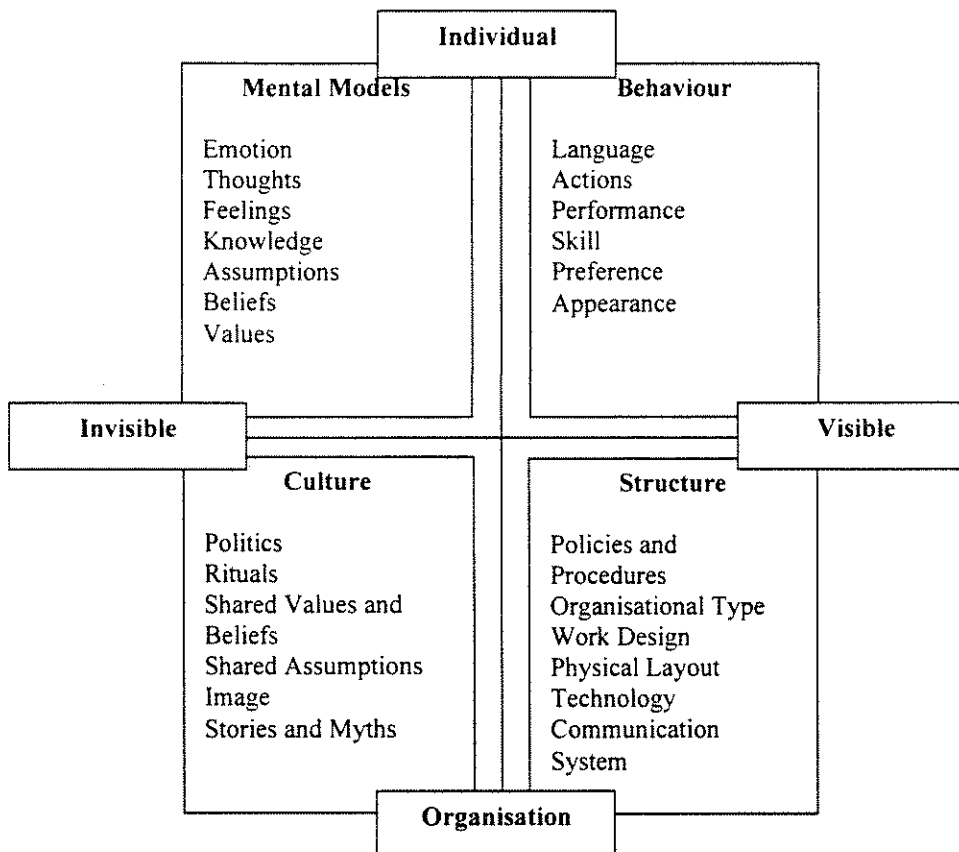


Figure 5: Organisational and Individual Human Factors

A strong organisational culture can act as a substitute for other more formalised control processes. This is best illustrated by the following account from the leader of an organisation undergoing a difficult process of cultural change.

"It was as if we had to start a new life, or bring a corpse back to life. I had my ideas which were not those of my colleagues, but I wasn't prepared to give way. I said to them: we can argue about this all we like, but the line we have decided on is going to be followed to the letter. No one openly disagreed with me or the strategy we had defined, but I discovered that they had no faith either in the strategy or themselves – perhaps even without consciously realising it -, and behaved as if they had lost before even starting.

It was as if they had to drive a golf ball over a lake on a golf course and, knowing that they could never manage it, had already chosen the worst ball they could find. I had to go around like a maniac checking that the details were right and making sure that the rules were being observed and proper methods were being used.

When things started to go better, my men couldn't believe it. They had driven the ball over the lake all right, but they didn't know and didn't want to believe that they themselves had done it. Then, things gradually began to change. They stopped throwing merit to the winds for what was happening and began to realise that they themselves and the strategy we had developed were really responsible for the way things were going. No I don't have to bother to check any more that poor quality balls are being used."(Gagliardi 8)

A fundamental question often asked is how can management influence an individual person's behaviour and ultimately the culture of their organisation especially from a safety perspective. The following model (Figure 6) adapted from Geller (9) illustrates how this process can occur. As the model demonstrates what is needed are actions by management which increase the level of personal control, self-efficacy and optimism at all levels in the organisation. This will empower people to make changes, and when such actions are taken in congruence with changes in the working environment improvements in safety culture will result.

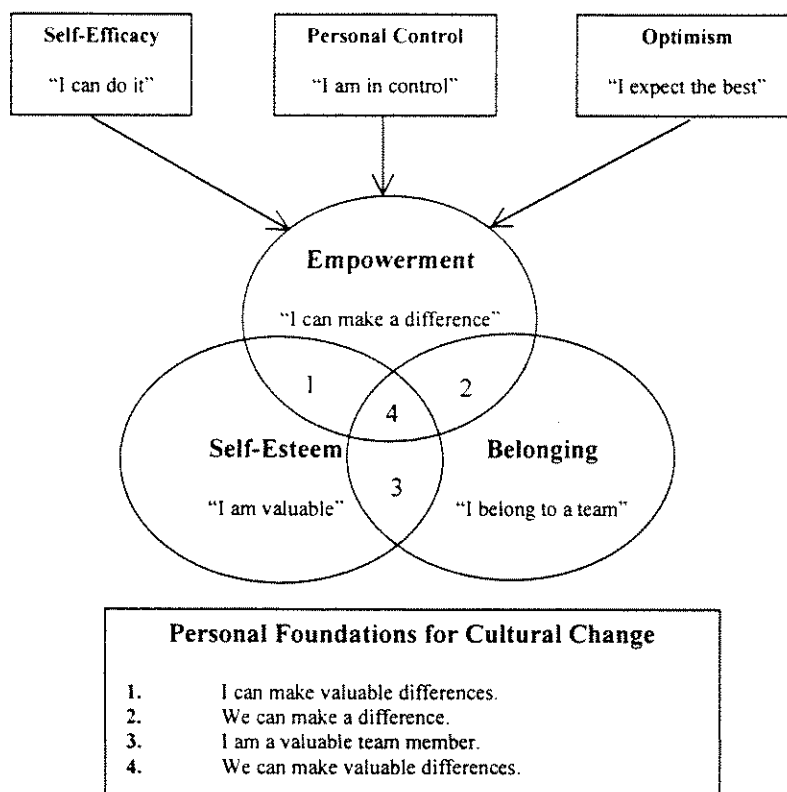


Figure 6: How Cultural Change Impacts upon the Individual.

SAFETY CULTURE

In an organisation with a healthy safety culture everyone feels responsible for safety and pursues it on a daily basis. Employees intuitively identify unsafe conditions and behaviours and intervene to correct them. In an organisation with a healthy safety culture, safety is not a priority which can be shifted dependent upon the situation but a value interlinked with other core values of the firm (Geller 9). This is easier said than done but through the application of safety management processes, which approach problems from an

engineering and human factors perspective, it can be achieved. Successful safety improvement processes require attention to three groups of factors or domains – person, behaviour, and environment, see Figure 7. These factors are dynamic and interactive – changes in one will eventually lead to changes in the other two factors. Once this is recognised, safety management plans can be developed holistically, changes with the same objective are made in all three domains. This minimises the costs of the change whilst maximising its chance of success.

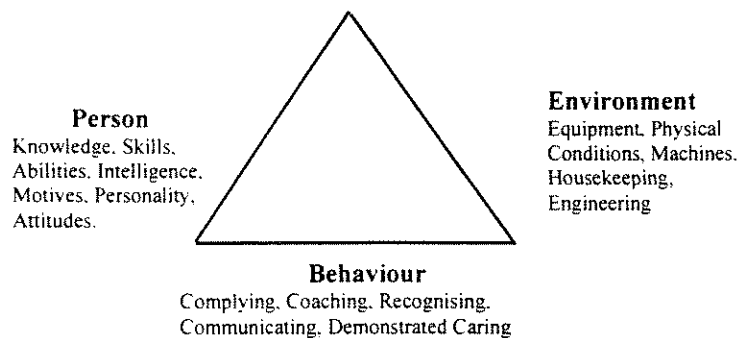


Figure 7: Three Groups of Factors Responsible for a Safety Culture.

Although safety culture change programs should be developed following a strategic review of each individual organisation's current state and vision, and therefore will be specific to each organisation, managers often find some guiding principles of assistance. The following 7 principles adapted from Geller (9) provide a set of guiding principles to establish a positive safety culture.

Principle 1: The Culture, Not the Act Should Drive The Safety Process

I often hear undermanagers, deputies, and miners refer to safety requirements as, "we have to do it it's in the Act". This creates a perception of top-down control, which motivates employees to avoid failure (avoid problems with the inspectorate) rather than achieve success (a safer workplace). Ownership, commitment and proactive behaviours are more likely to be exhibited by employees working to achieve outcomes themselves. This problem is exacerbated by the present prescriptive nature of the Coal Mining Act and General Rules. The new proposed Act is framed in a manner that is less prescriptive enabling a greater level of ownership of regulation to the people exposed to the hazards. A safety management system

is achieved by and for the people whose safety and health it protects, not simply to comply with regulations.

Principle 2: Behaviour And Person Based Factors Drive Success In Safety Management

Factors contributing to the success of safety management systems can be grouped into behaviour based, person based, or environmentally based. The impact of a behaviour-based approach can be objectively evaluated on a continuous basis by job observation. Personal factors are not directly observable but they can be influenced by changes to environmental and behavioural factors. A safety management system will not succeed without consideration of the changes in personal factors influenced through changes in behaviour or environmental factors (see Figure 7). Mine managers should therefore receive training in the management of these factors as part of their formal development.

Principle 3: Behaviour Is Directed By Activators And Motivated By Consequences

The ABC model (A = activator, B = behaviour, C = consequence) of human behaviour illustrates the nature of external influence upon behaviour. Activators are events that precede behaviours and direct certain behaviours. Consequences follow behaviours and determine whether behaviours will recur. Activators and consequences are either

naturally present in the environment, or are created by the safety management system and added to the environment in order to change or sustain desired behaviour. Signs, policies, safety culture and training are all activators of behaviour as they inform of potential consequences. Importantly though, without the application of consequences to motivate safe behaviours, unsafe behaviours should be expected, because natural consequences often motivate unsafe behaviours.

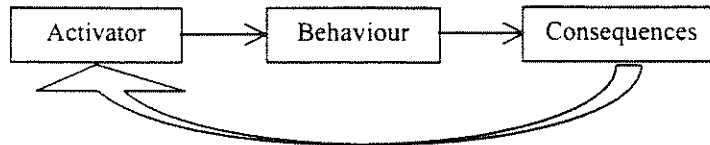


Figure 8: The ABC Model of Human Behaviour

Principle 4: Focus On Achieving Success, Not On Avoiding Failure

Given a choice, people naturally prefer a positive reinforcement situation. Importantly, people often procrastinate and take a reactive rather than a proactive stance when they feel controlled by negative reinforcement. Productivity goals are typically stated in achievement terms and documented as individual or team accomplishments. Unfortunately, safety goals are generally stated in negative reinforcement terms: "Our goal is to decrease lost time injuries by 20% this year". Measuring safety according to injury statistics limits evaluation to a reactive, outcome-oriented perspective. Safety can compete with productivity goals only if measured in achievement terms. This can be arranged when emphasis is placed on safety management processes. This measurement system should continuously track safety accomplishments and display them to the entire workforce.

the situation where the formal processes are not necessary.

All supervisors need to develop their coaching skills so that they become comfortable about giving or receiving feedback. This requires training in the five skill areas represented by the word COACH (Geller 9).

- C = Communication
- O = Observation
- A = Analysis
- C = Change
- H = Help

Principle 5: Observation And Feedback Lead To Safe Behaviours

A critical sign of a healthy safety culture is the observation of the provision of supportive corrective feedback by one worker to another and the acceptance of that feedback. Unfortunately, most work places have not yet achieved this and so more formalised job observation processes are required. Ultimately, through provision of training in behaviour observation and feedback and a system of making individuals and teams accountable for conducting regular feedback sessions the safety culture could advance to

All supervisors need to be trained in communication skills such as persuasive speaking and active listening. Feedback should be given in a one-on-one situation to avoid embarrassment and corrective feedback requires an alternative safe behaviour to be identified and potential means for eliminating the unsafe behaviour discussed. A coach needs to be able to objectively and systematically observe behaviour. Safe behaviour checklists may be of help. A good method of developing safe behaviour checklists is to involve the people actually performing the task and ask them about how injuries and near misses are caused performing the task. Analysis requires knowledge of basic human behaviour models such as the ABC model mentioned previously. A coach must understand that certain unsafe behaviours occur because they are directed by such actuators as a peer's unsafe example or management's inconsistent messages and that unsafe behaviours are often motivated by naturally occurring consequences such as

convenience, peer approval, and comfort. Finally, the change and help aspects of safety coaching recognise that many people resist change preferring what is familiar. They must help employees understand that improvement requires change and that the least disruptive change is proactive and incremental. Thus effective safety coaches look for opportunities to acknowledge safety accomplishments, even if they are small wins.

Principle 6: Involvement Increases The Activators For and Consequence of Safe Behaviours

As illustrated in Figure 6, which is a model of personal behavioural change, people need to feel positively about themselves before they will act positively towards the safety of themselves or others. This high level of self esteem can be assisted through management actions which solicit and follow-up on employee suggestions, provide opportunities for peer monitoring and personal learning, and increase recognition of personal competence and accomplishments. People need to feel part of a team to satisfy their need for belonging. This can be achieved through working at solving problems as a group, and decreasing the frequency of top-down directives and 'quick-fix' programs. The positive response to the delegation of power and responsibility is described as empowerment. A feeling of empowerment by employees is a key prerequisite of a positive safety culture. Suggestions for enhancing empowerment include, breaking down overwhelming tasks into discrete projects, set and track short-term goals, offer frequent rewarding or corrective feedback for practicing or coaching safe work behaviours rather than just for outcomes, allow employees to set their own goals, teach co-workers and chart progress (Weick, 10).

Principle 7: Focus On The Process, Not The Outcomes

Managers often focus upon outcome statistics such as LTIFR rather than the state of the safety management system processes. This is akin to trying to learn how to improve your golf game through studying your handicap. For example, consider the amount of time spent during your last corporate safety meeting discussing outcome statistics compared to process results. Safety management systems need to keep employees accountable for their behaviours which affect safety management system procedures through both incentives and penalties rather than provide incentives or

punishment for the results of outcome statistics. This will assist to provide a culture of empowerment and personal control.

Similarly, shift safety from a priority to a value in your organisation. It is common to hear managers state that "Safety is our number one priority", but priorities often change depending upon the situation; values remain constant as they are deep-seated personal beliefs that are not compromised. Making safety a value throughout a corporate culture is clearly a difficult task. It cannot be achieved overnight and it firstly requires a corporate culture which gives safety a "value" status. The principles of safety culture have to be understood and then safety processes or action plans developed to embed these principles into your safety management system. However, through using these principles when developing your safety management system you can over time develop a positive safety culture in your organisation.

SAFETY CULTURAL IMPACTS ON SAFETY MANAGEMENT EFFECTIVENESS

Why do we need documented safety management systems? How will safety management plans help my safety performance? In what ways will my safety management system impact upon the safety culture of my mine? These questions can be answered with reference to the following concepts.

As illustrated previously in Figure 4 the Australian coal mining industry has not been able to reduce its fatality incidence rate since the early 1980s. This is despite the vast amount of resources devoted to improving safety in our industry. I believe the problem has many similarities to those faced by manufacturing companies during the 1970s in attempting to improve the quality of their products and organisational performance. Vast quantities of resources were being expended without recognisable results. W. Edwards Deming (11) described the problem with the assistance of the following graph, (Figure 9). This company is investing large amounts of resources to develop planned steps in performance and these are being achieved but unplanned organisational factors are causing a decaying performance over time if further investments are not made. The decay in performance was caused through such factors as employee turnover, competition for scarce resources within the

organisation, timing and incentive problems. short term competition in the company's industry.

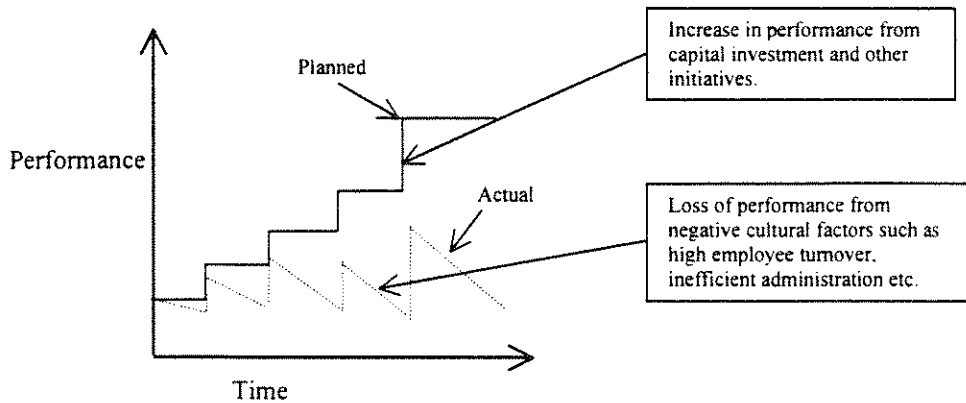


Figure 9: Results without a Management System

Deming and others devised the concept of the total quality management (TQM) system in the post war years as a method of reducing this decay in performance. The TQM system acted

as a wedge which inhibited the performance decay problem thus allowing the familiar plan, do, check, act project cycle to advance as a process of continuous process improvement.

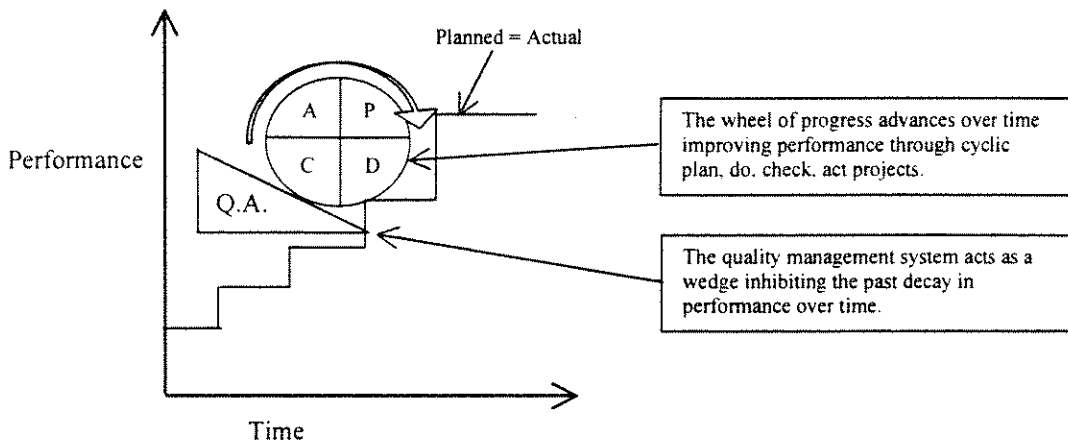


Figure 10: Improvement with Quality Management System Wedge.

This situation is very similar to the situation we now find ourselves in with mining safety in Australia. Despite significant investment in dollars and effort our fatality statistics remain unaffected, improving and then dropping back over time but remaining relatively stable around the trend line, see Figure 4. I propose that safety performance suffers a similar process of decay, and for similar reasons to the decay in organisational quality performance over time. The strength of an organisation's safety culture will determine the rate of decrease in safety performance between safety improvement initiatives. If the safety culture is poor very large investments in safety improvement projects will be required just to maintain a steady performance rating.

A properly implemented safety management system which exhibits the following characteristics (Rowan et al, 12) will act similarly to an organisation's quality management system in that it will act as a wedge to decrease the rate of performance decay over time:

1. Management commitment with visible and active leadership from senior management.
2. A supportive organisational culture which secures involvement and participation at all levels with positive reinforcement.
3. Safety is integrated into the overall management system.

4. Effective communication with all employees.
5. A planned approach to the identification, assessment and control of hazards.

For safety management system purposes, the familiar plan, do, check, act wheel of progress may be replaced with a risk management model in which the wheel of progress has the following sectors (see Figure 11):

Recognise Hazard: The fundamental starting point of any risk management process is to recognise all material potential hazards.

Assess Risk: Either quantitatively or qualitatively assess and prioritise the hazards and evaluate control measures to maintain the risk within acceptable limits.

Implement Controls: Implement controls which consider not just engineering factors but also human factor elements of control for the hazard.

Audit Effectiveness: The effectiveness of controls and degree of hazard have to be regularly monitored to ensure adequate management of the risk.

The mine's safety management plans form the wedge which inhibits the value of the improvements of the risk management process from being lost over time. The mine's safety management plans act as a wedge to safety performance decay through formalising and recording the lessons of experience regarding the environmental, behavioural and personal factors required to effectively control safety and health risk.

Through the utilisation of processes which follow the principles detailed above, the formulation of the safety management plans and the undertaking of the risk assessments will, over time, create a strong positive safety culture. This will reinforce the safety management plans by inhibiting the loss of safety system effectiveness over time.

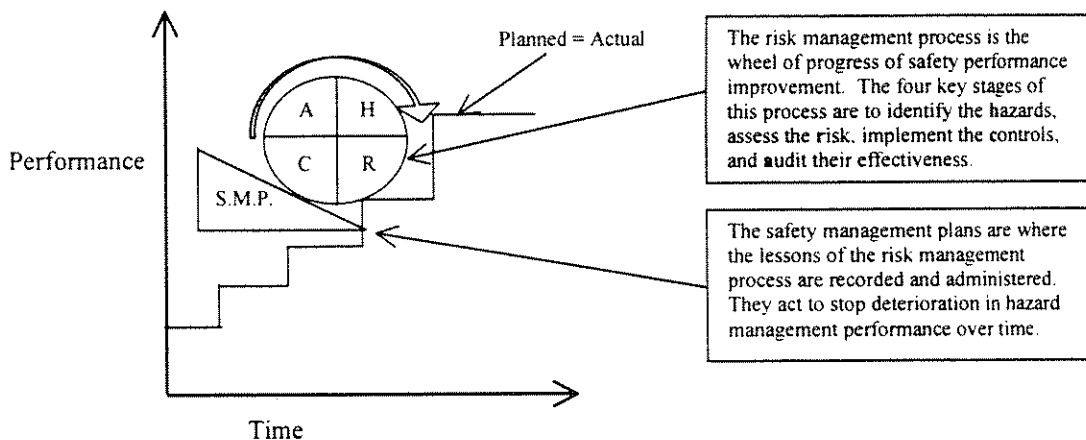


Figure 11: How a Safety Management System Effects Safety Management Effectiveness.

CONCLUSION

To gain full benefit from the implementation of safety management systems national, industry, and organisational cultural factors must be considered. The adoption of safety management plans can, if properly implemented, provide an opportunity to break the present inertia in the rate of fatalities in our industry. The actions required to properly implement a safety management system can improve our industry's safety culture.

The historical safety management paradigm of reactive safety engineering has provided such significant improvements as flame proof equipment, improved electrical protection, methane monitoring and improved strata support technologies. The mining industry can be proud of its historical record of technical improvements that have led to a safer workplace. However, since the early 1980s there have been no improvements in the trend of fatalities in our industry. Further

improvement will require acknowledgment of the importance of personal and behavioural factors to safety engineering. This new approach is the holistic socio-technical systems paradigm.

12. Rowan, G., Ward, S., Sargaison, J., Info Paper – Safety & Health Management for Queensland Mines & Quarries, DME and QMC, 1999.

REFERENCES

1. Torlach, J., Mining Fatalities Inquiry – Western Australia – Opportunities and Initiatives, Queensland Mining Industry Health and Safety Conference Proceedings, 1998.
2. NSW Department of Mineral Resources, Review of Mine Safety in New South Wales, 1997,
<http://www.minerals.nsw.gov.au/safetv/essafrev.htm>
3. Reason, J., Managing the Risks of Organizational Accidents, Chapter 9, 1998.
4. Hofstede, G., Cultures and Organisations. Software of the Mind, McGraw Hill, London, 1991, Chp.1. Hofstede, G., The Cultural Relativity of the Quality of Life Concept, Academy of Management Review, 1984, Vol.9, No.3, pp 389 – 398.
5. Knowles, J., Safety Management Systems. Friends or Foes?, Queensland Mining Industry Health and Safety Conference Proceedings, 1998.
6. Braithwaite, G.R., With Reasonable Doubt, Australia as a Case Study of a Safe System, International Society of Air Safety Investigators, 1996 Seminar Proceedings.
7. Uttal, B., The corporate culture vultures, Fortune, 17 Oct. 1983.
8. Gagliardi, P., The Creation and Change of Organizational Cultures: A Conceptual Framework, Organisation Studies, Vol 7, No. 2, 1986, pp. 117-134.
9. Geller, E.S., Ten Principles for Achieving a Total Safety Culture, Professional Safety, American Society of Safety Engineers, September 1994.
10. Weick, K.E., Small Wins: Redefining the Scale of Social Problems., American Psychologist., 39, (1984), pp40-44.
11. Deming, W.E., Improvement of Quality and Productivity through Action by Management, National Productivity Review, Winter 1981-82, pp 12-22