Risk in Safety: Some Contemporary Management Issues

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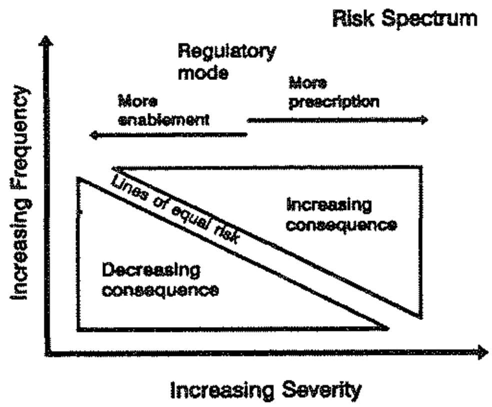
Introduction

Human failures either to recognise warning signs or to act appropriately in the face of danger, once again looms into the mining community's conscious awareness as the findings and conclusions of the recent sad succession of industry inquiries are disseminated. Disbelief accompanied by incredulity and anger overwhelms those who bear the consequences of disasters and find themselves in a tragic union with their mining antecedents wondering how to improve things.

This legacy of an historical perspective reinforces the view that disasters and their associated social upheavals are routinely followed by community interventions through government regulation. Seemingly cyclical in nature, these interventions, though understandable, may obscure the opportunities which exist to interrupt the familiar cycle of disaster followed by more stringent prescription followed by disaster.



A regulatory strategy of rigid prescription may itself be a part of the problem if it is viewed as "the" sole solution to hazard control. It may be counter productive if legislation is considered as polarised between the two extremes of either rigorous prescription or flexible enablement where one operates to the exclusion of the other.

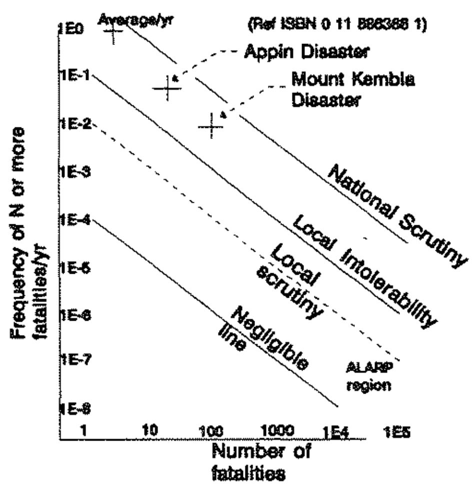
Rather, legislation should be matched to the nature of the risk. Rigorous prescription of performance for high consequence low frequency risk, in combination with enablement and concurrence for high frequency low consequence risk.

In addition, from the regulatory perspective, where a prescriptive model is applied to the maintenance of controls for high consequence risks, it must be supported by a rigorous system of surveillance of the prescribed controls. This system must operate with a high probability of detecting non compliance. If this feature is absent then the prescriptive approach will not itself be effective.

Performance measurement

Safety performance for an entire industry needs to be judged against community expectations. Such measures as lost time injury rates serious bodily injury rates and fatality rates whilst useful at the enterprise level for management to benchmark against they do not provide independent comparisons from a community perspective.

There may be a general consensus that the mining industry needs to improve its safety performance and indeed the calls abound for "cultural change," to be made, but from which culture to where, and how much change is needed. If The UK Health and Safety Executive's published risk criteria for major hazards (ISBN 0 11 886368 1), is examined in the Australian context and if it is accepted that the Australian community in general has a conservative expectation for safety then some insight into this problem can be gleaned in the following charts.



The crosses marked on the adjacent chart are some of the NSW fatality figures taken from the time of the Mount Kembla disaster up until the present time. These are located on the chart so as to gauge the NSW coal industry's safety performance relative to the wider community's expectations of risk tolerability.

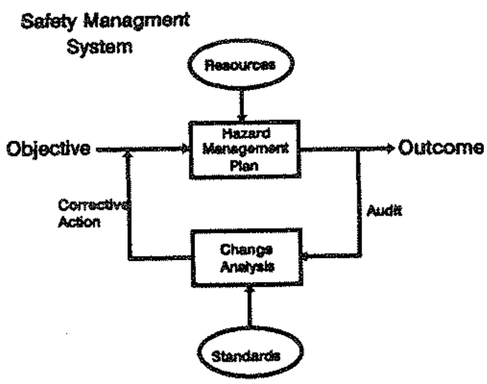
A line drawn through the crosses is clearly parallel to the other lines and locates itself just below the line of National Scrutiny meaning that the risk level is intolerable at the national level. A second point worth noting is that a performance improvement vertically downward of two orders of magnitude (100 times) is required for this line to get below the Local Scrutiny line.

In this context it would not be sufficient for the industry to improve performance by ten twenty or even thirty percent; according to these figures, the industry needs to improve its performance by at least two thousand percent (20% times 100) if progress into an acceptable **ALARP** risk region below the Local scrutiny line, is to be achieved. (ALARP - risk is As Low As Reasonably Practical). The implication is that an improvement of this sort is unlikely to be attained by merely tinkering with existing regulatory systems; a paradigm shift for a new approach in the way safety is managed is indicated.

It is also an important matter that improvements where they are achieved be sustainable in the future. If the index of lost time injury rates is used an an example improvements in recent years are being steadily eroded

Systemic management

One form of expression of a management system is the idealised elementary control system with feedback depicted in the adjacent figure, with some licence of my own. The model is useful to describe a collection of elements which when assembled together comprise a system. There is often confusion in discussions of management if the terms used are not shared. The diagram shown here is often helpful in this regard.



Management needs be systemic such that key outcomes are routinely monitored and deviations are corrected as a normal and continuous part of the system. Quality, in such a system is not a measure of excellence but rather a performance indicator which is intended to match some nominal value.

The essential element in such a management system is the notion of continuous management feedback, and at a rate which matches the rate of change of the outcome. In this model the actual outcome of a procedure or process which here is described as the "plan," is continuously monitored. The results of the monitoring process are compared with the "expectation" or standard and any difference is "fed back" to management for corrective action. It is important to recognise that this is the key element of any management system and that it is not merely an externally provided "inspection" function.

It is into this generalised management framework that the additional complexity of "risk management" can be incorporated. This brings further diversity of terms and concepts but the real challenges are associated with expressions like "uncertainty" and "reliability". These terms require some form of quantification as "quality" variables in order that they can be integrated into the type of management systems described here.

Risk Management

Risk management is essentially the management of uncertainty in circumstances where undesired events can occur randomly. The underlying strategy of risk management is to reduce exposure to undesirable random events through the use of reliable controls and barriers. As the consequences associated with exposure to any particular hazard increases then so must the reliability of associated controls and barriers increase.

Recognition of exposure is an important feature of risk management and it is a common human behavioural attribute to ignore, or even worse, deny that exposure exists. It is a common feature of high consequence incident investigation that the relatively low frequency that such incidents occur leads to a relaxation of standards over time. This is particularly the case where procedures rather than hardware is the instrument of hazard control.

Safety is a management issue

Health and safety are in general, management rather than technical issues. Health and safety problems arise directly as a result of failure to manage existing controls and barriers for known hazards. These observations are consistent with the findings of investigations into major incidents throughout the world.

This point has been made during enquiries into the Three Mile Island nuclear incident in the US. The report pointed out that popular discussion of nuclear power plants tended to concentrate on technical questions arising out of equipment safety engineering but added that as evidence accumulated, it became clear that problems were "people related" and not equipment.

Similar issues were brought out by the Norwegian Royal Commission into the Ekofisk Bravo oil platform blow out. The Commission found the accident to a large degree was due to human error. Certain technical weaknesses were present but were only of peripheral significance. The underlying cause was that the organisational and administrative systems were inadequate to ensure safe operations. Similar findings followed the Piper Alpha disaster and of course Chernobyl.

All of the hazards associated with these events, together with their associated controls, were known prior to the event's occurrence; there were no unknown or new hazards! These incidents occurred as accumulations of failures to manage existing controls and barriers to known hazards became critical. The controls and barriers, many of which were already in place, were either not working properly or were not adequately applied.

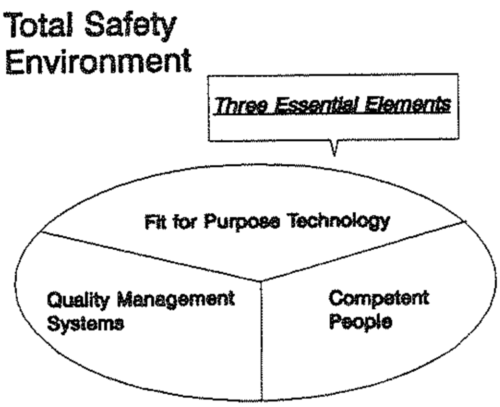
Research shows that between 70% and 80% of all accidents have human causes in one form or another. In New South Wales for example, recent research into the causes of roof fall fatalities in underground coal mines shows non compliance with support rules as a causal factor in some 83% of the cases over a 35 year period.

System Safety principles

System Safety is a derivative of the Management Oversight and Risk Tree (MORT) and has been identified as an appropriate management vehicle on which to base strategies aimed at improving safety performance. This methodology provides for the necessary management infrastructure identified in Roben's style legislation, that hazards must be managed by those who create and work with them.

The methodology also provides for a regulatory role which is either enabling (concurrence) or prescriptive as appropriate. Such an approach tends however to a "concurrence" with the intent of regulation rather than "deterrence" from non compliance, as a regulatory objective.

This regulatory model recognises the primacy of management accountability for health and safety. It also provides for an external (independent) audit function on the risk management and maintenance of controls and barriers, and on the quality control of systems within which controls and barriers are imbedded.



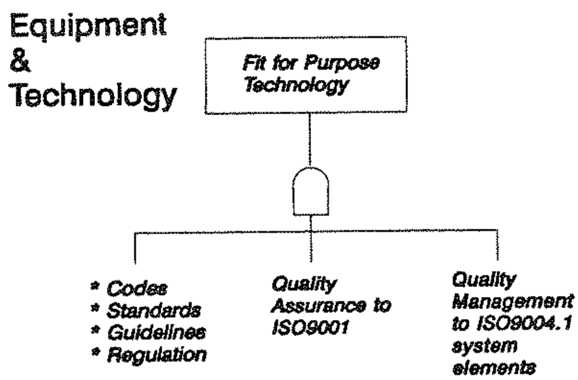
An important feature of system safety is its holistic approach to management which includes three essential elements -

* **technology fit** for use as was intended ,
* **people competent** to use, service and maintain technology,
* **management systems** which are self correcting within acceptable limits.

This model takes into account the inherent variability of human performance but it does not seek to exclude humans from systems of control; rather it provides for redundancy in systems of control to accommodate behavioural variability from people, but also from technology which can be unreliable or unpredictable for purely technical reasons.

Fit for purpose technology

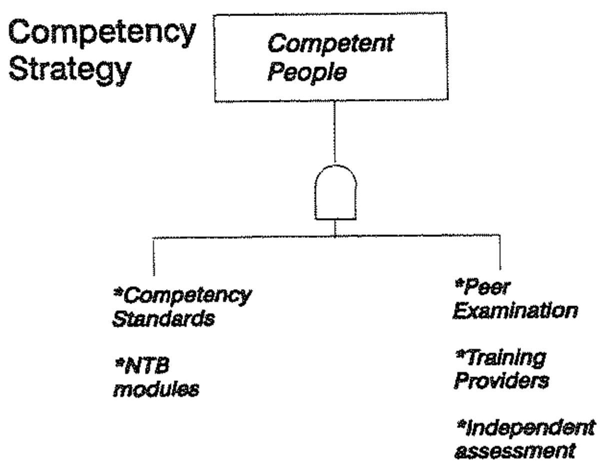
In this context all technology from equipment and hardware through computer software and human resource management systems is included. The underlying assumption is that technology is to be used for the designer's or manufacturer's intended purpose and in the manner it was intended.



In the diagram fitness for purpose will be assured only if all three of the elements are in place (the logic connector is an "and" in all of these graphics). Also these conditions are at the bottom in the system safety hierarchy; in other words where technology is in use these conditions are a prerequisite for the next two.

Competent people

Once fitness for purpose has been assured competency to use and maintain technology becomes the next issue. This is the second building block in the safety management hierarchy.

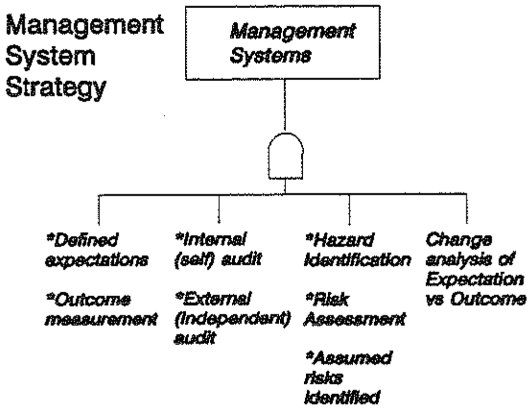


In Australia models for competency based programs including standards development have been developed by the National Training Board as a part of the national training agenda and mutual recognition principles. The objective is to ensure that relevant knowledge combined with practical experience has been attained by operators prior to their deployment on specific duties.

In this context it could be expected that a range of duties would be regarded as nominal industry wide and relevant industry standards would be available; these would be supplemented by enterprise standards to cover particular hazards or technology which appear in individual workplaces.

Once competency standards are available then delivery of training and assessment may be considered. This does not mean that enterprises would of necessity become training providers but rather alternative means for the independent delivery of these services can be considered.

__Management systems__



The safety management systems described here are objective and therefore require measurement of outcomes. It is the difference between objective and outcome that drives the corrective processes depicted in the management system picture illustrated previously, and in the diagram described here as change analysis.

The process of change analysis where it is properly implemented also enables the function of external audit. This feature completes all of the basic elements necessary before it can be asserted that a management system has been implemented.

External audit here is not concerned with the objective of a system nor it's outcome, but rather that the corrective processes exist and they are working. External audit tests this by returning an answer to the question of ***how does the system __self-correct__ deviations from expected norms and standards?***

__Conclusion__

Where systems of the type described here are implemented to manage safety then measurable, consistent and sustainable improvements over time may be expected. In one sense everything that transpires in industry results from some management action (or inaction). What has been described here only examines rigorously those elements of management which deal with measurement and control, for as Demmings observed that which can not be measured can neither be managed.

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