INTERNATIONAL PERSPECTIVE ON MINE SAFETY MANAGEMENT PLANS (MSMP)

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Summary

The paper begins by examining what is meant by the concept of a Mine Safety Management Plan (MSMP) which, while often used, is rather ill-defined. A brief review of some examples of mining disasters is used to show that, traditionally, there has been little evidence of systematic safety management planning in the mining industry. Having examined some of the recent trends toward less prescriptive regulation in the mining industry, the paper concludes by identifying some of the fundamental requirements necessary to ensure the effective use of the concept of MSMPs

Mine Safety Management Plan - What does it mean?

The phrase "Mine Safety Management Plan" is one of those which seems to suddenly appear "out-of-the-ether". If it had been mentioned a year or two ago most mining engineers would have probably thought of a mine plan marked-up with the location of fire-fighting and first aid equipment etc. Now, as if by magic, MSMPs have become *the* fashionable topic of conversation and, whatever it means, it is certainly nothing as simple as a mine layout plan!

Such "instantly fashionable" phrases and concepts tend to gain their credibility largely because they seem simple, transparent, answers to a widely perceived need, especially when the need is obvious but intangible. On the back of such apparent simplicity and relevance they tend to gain their own momentum, becoming "accepted" almost before they are understood.

This is, in many senses, the position with MSMPs - the concept appears simple, rational and highly likely to create a new approach to mine safety improvement but if you asked a group of mining engineers what they thought it meant you would probably get a wide range of differing interpretations.

The most official use of the phrase so far appeared in the Warden's Report on the inquiry into the Moura No.2 mine disaster (1) where it states:

> *MSMPs should be .... "formulated and implemented as the primary means of controlling risks at a mine and which compliment statutory requirements to aid in ensuring the safety of mine personnel."*
>
> and later ...
>
> *"The plans should include:*
>
> - *standards to be adopted at the mine for the prevention, management, and control of risks which have been identified by the risk analysis;*
> - *action plans in the event of an identified risk occurring;*
> - *appropriate training programmes for the identification and prevention of risks: and*
> - *procedures which are consistent with the intent of Quality Assurance Standards.*

Although this appears initially to be very informative, in reality it says very little which is actually definitive. For example, it is likely that if these requirements had been put to the Moura management before the incident they would almost certainly have felt that they had most of them covered. As MSMP is a very ill-defined concept it is important to state how it is interpreted in this paper and perhaps the best way to do this is to take each word in turn:

Mine: self explanatory but must incorporate both surface and underground.

Safety: viewed in its widest context i.e. effective control over all hazards with the potential to cause injury/harm.

Management: the deliberate and active control of the necessary resources to achieve a defined set of objectives (in this case improved safety).

Plan: a pro-active, systematic, programme designed to harness and co-ordinate the available resources to achieve the designed objectives.

Combining the above MSMP becomes:

> *Deliberate, pro-active and co-ordinated Management action to create a systematic and comprehensive organisation of resources in order to control all mining hazards with the potential to cause injury/harm.*

Unfortunately there is still the temptation to ask ..... "what's new?" and to add ..... "that's what we've being doing for years!"

No matter how superficially valid such a response may seem, the reality is that MSMPs *are* a new concept and we certainly haven't been following such principles, as any historical analysis of mining accidents would show.

Brief Historical Perspective

The historical safety failures of mining have probably been written about in more detail than those of any other industry. As a result there are many examples which could be considered, however as the purpose of this paper is not an historical one, three will suffice.

Example 1

The investigation into the Haswell Colliery explosion in the UK in 1844 was the first official report to recognise the importance of coal dust in mine explosions. It was almost exactly 70 years later before the first positive, pro-active recommendation on controlling the coal dust hazard appeared in any official document. In 1914 the 6th Report of the UK Explosions in Mines Committee recommended:

> *".... the treatment of the roads with stone dust in conjunction with the systematic removal of the coal dust so as to maintain, at all times, at least 50% of incombustible matter in the road dust."*

Almost 80 years after this recommendation, in 1992, an explosion occurred at Westray Mine in Nova Scotia killing 26 men. Evidence to the inquiry showed that, despite the fact that the mine was known to be gassy and that stone dusting and stone dust barriers had been discussed, no action had been taken to control the coal dust hazard.

Example 2

The first recommendation on the need to maintain accurate plans of abandoned workings in relation to the threat of water in-rush was in a paper by Thomas which was published in 1797 following an in-rush of water at the Slatyford Mine in the UK. It was almost 80 years before this recommendation was enacted in the Coal Mines Regulations of 1872. In 1973, just over 100 years later, a massive in-rush of water from old workings occurred on a face at Lofthouse Colliery in the UK resulting in multiple fatalities.

Example 3

In 1967 nine men died in a fire at Michael Colliery in Scotland. This fire was notable for it involved the ignition of polyurethane foam used to line the roadway. The fact that polyurethane has the additional hazard of releasing highly toxic gases when burnt, rapidly led to it being banned in underground workings in the UK. Very soon thereafter almost every other major mining country followed suit in banning its use underground. There was one notable exception - South Africa. Two decades or so later a fire occurred as a result of the ignition of polyurethane roadway lining at Kinross Gold Mine resulting in over 170 deaths.

What these and many other disasters in the history of mining show is that despite the considerable improvements in safety which have occurred over the years, the traditional approach to safety has been largely re-active, passive and ad hoc. The stimulus for action was, almost always, disaster-driven and the stimulus for compliance was, almost always, regulation-driven. Moreover, as the first two examples show, there were often decades between the recognition of a problem and regulations covering the same problem. Even when the painfully slow process of regulation was in place, the application of known and proven safety requirements was far from reliable or systematic.

More generally there is no doubt that the principle hazards in coal mining have been known for many generations. For example, following an explosion at Hertoz Colliery and a massive in-rush of water at Beaujoinc Colliery (both in Belgium which was, at the time, part of the French Empire) the French Government issued, in 1813, an Imperial Decree (quoted in 2), the preamble to which stated:

> *"On the report of our Minister of the Interior: Events recently occurring in the mine workings in some of the Departments of our Empire, having particularly aroused the concern of our subjects daily employed in mine workings, we recognise that these accidents may have derived from: The non-observance of the requirements relating to the stability of mine workings imposed on licensed mine owners; lack of precautions against underground flooding and the ignition of mephitic gases, insubordination on the part of the miners; failure of the mine owners to provide the necessary safeguards ...."*

Allowing for the rather "flowery" language, this definition of the mine safety problem is just as valid to-day as it was 183 years ago.

None of the comments above are meant to suggest that our predecessors did nothing about safety for even in the dark days of the Victorian Coal Owners in the UK or during the worst excesses of the South African Migrant Labour System, significant safety improvements did occur. Such improvements were however, quite clearly, not managed or planned in the way alluded to above in terms of MSMP.

The historical problem in mining safety is, in many ways, analogous to a quotation taken from the inquiry into the Piper Alpha oil rig fire off the coast of Scotland in the late 1980s:

> *"I am convinced from the evidence that the quality of safety management is fundamental .... No amount of detailed regulations for safety improvements could make up for deficiencies in the way that safety is managed." (3)*

A remarkably similar point was made, in a mining context, by Kejriwal (4) when reviewing the roof-fall at Kessuragh Colliery in India in 1975:

> *"The management had shown no sign of being anxious to promote safety on its own but was keen to keep up appearances merely of being law abiding.*
>
> *The attitude of the management was primarily one of defence against the criticism of possible violation of the safety regulations."*

There can be no doubt that in those countries with a significant coal mining history, mining is now safer than it was even a few decades ago. Equally however it is impossible to escape the conclusion that few, if any, of the past successes had anything to do with planned, systematic and pro-active safety management.

In other words, no matter how tempting it is to write-off MSMP as "fancy words for old ideas" there can be no doubt that the principles of MSMP as described earlier are new in the mining industry.

The Changing Nature of Mining Regulations.

The obviously high hazard nature of underground coal mining and the frequency of major mining disasters fostered the development of mining regulations which were focused on major hazards/risks and which, over the last 150 years or so, became increasingly prescriptive, increasingly technical and ever more detailed. While this process started in Europe and, particularly in the UK, the trend was to be echoed across the mining world. Indeed Kejriwal (4) has stated:

> *"Probably no other Indian citizen to-day enjoys greater protection by law than does the Indian miner".*

Over recent years and over a wide range of mining countries a significant change is occurring in the nature of mining regulations. The genesis for change came from outside the mining industry in the report of the Robens Committee in the UK during the early 1970s which had been charged with reviewing .... "the provision made for the safety and health of persons in the course of their employment" and which found expression within the UK as the "Health and Safety at Work etc. Act" (1974). Although concerned with industry in general, the findings of the Robens Committee have had a profound effect on shaping new mining regulations and lead, implicitly at least, to the concept of MSMPs.

Probably the two must fundamental (and inter-linked) concepts in the Robens report were the need to move away from prescriptive regulations and an increasing emphasis on the importance of self-regulation. The relevance of these to concepts such as MSMPs is indicated in the following quotations (5):

> *"Our present system [i.e. the UK H&S Regulations then in force] encourages too much reliance on State Regulation and rather too little on responsibility and voluntary self-generating effort.*
>
> *We need a more self-regulating system. This calls for the acceptance and exercise of appropriate responsibilities at all levels ... it calls for better systems of safety organisation, for more management initiatives and for more involvement of the work people themselves."*

The change in the role of regulation which the Robens Committee foresaw was a move away from a prescriptive, technical and detailed approach to one where the Regulations set the general requirements, responsibilities and objectives but leave the method of achieving compliance open. In simplistic terms they define the need for a system but not the system.

This approach is being reflected widely across mining countries. It is used within the European Union in the form of the "Framework Directive on Health and Safety at Work" and, as such, now forms the basis of H&S regulations across all 15 Member States. Within Australia, the New South Wales regulations were adapted to a Robens' based approach in 1983 and a recent major restructuring of the Western Australian regulatory system has been undertaken based on the Robens' "model" (6). It also forms the corner-stone of the approach adopted in the draft Mine Safety and Health Bill currently before the Parliament of the Republic of South Africa.

The increasing tendency to adopt such an approach in very different countries suggests that there must be benefi in it and indeed if you consider it in terms of both safety theory and the psychology of motivation there can be no doubt that it should be more effective than the highly detailed and prescriptive approach which preceded it.

However, in mining in particular, where the management remains largely based on professional engineers, these changes are likely to be "uncomfortable".

Engineers like technical issues, they also love detail - both are their "stock-in-trade". Engineers also like measuring things - they like regulations which you can put a micrometer on and know whether it is within the acceptable band or, by how much it is outside it. Finally, engineers are, first and foremost, practical people - they like to know what they have to do and get on with it. The "old", prescriptive approach fitted the engineer like a glove.

By contrast, the post-Robens approach is much less tangible, almost impossible to measure, with ill-defined boundaries and (as yet) no defined methodology. It is, in a single word, about *Management* in its "purest and simplest" sense.

What is needed in a good MSMP?

One commonality across the countries which have been discussing this issue in recent years (albeit using a variety of descriptors) is that MSMP is, in essence, the Risk Management Strategy which is derived from a systematic Risk Assessment. Unfortunately from this point on, common ground becomes increasingly rare. For example within the European Framework Directive no constraints are placed on the self-regulation approach (and therefore on the dependence on good quality MSMPs). By way of contrast, the Warden's Inquiry into the Moura No.2 Mine (1) states:

> *"The Inquiry sees no inherent objection to introducing self-regulation at mines. Indeed it is allowed for in existing legislation where managers are required, for example, to make support rules and transport rules. Any self-regulation must, however, be established within a framework of a legislation that prescribes minimum requirements in respect to safety. It seems that high probability, low consequence matters might be suitably addressed by self-regulation but that low probability, high consequence matters should remain subject to prescriptive legislation."*

This is similar in sentiment to Reczek's comparison of US and NSW approaches (7):

> *" ... management and inspection strategy in the US has a strong emphasis on loss control at the high frequency low severity end of the incident spectrum which is reflected in the non-fatal days lost figure.*
>
> *In NSW management and inspection resources have largely, because of the nature of prescriptive regulation, been directed into preventing high loss incidents. Certainly in the US close attention is provided to the investigation and reporting of what here [i.e. NSW] could be considered as relatively trivial matters."*

While Reczek cites prescriptive regulation as a "cause" of the NSW "bias" to high loss incidents he does not suggest a "reason" for the US "bias" to high frequency, low severity. One possibility could be the highly litigious nature of the US where compensation claims appear, to the outsider, to be almost obligatory even, as Reczek suggests, for what could be considered relatively trivial matters.

A further national variation is suggested in the Report of the Leon Commission into Mine Safety & Health in South Africa (8) where, despite a high fatality rate (by international comparison) the report suggests that safety improvements may be being limited by too great a concentration of thinking on fatalities to the detriment of the much more extensive data base which would be available from a wider focus.

In the context of the title of this paper therefore there are two difficulties; firstly the concept of MSMP is not very well defined and, secondly, there is, already, differing interpretations of the boundaries of potential role of MSMPs. Despite this few would doubt the need or potential benefit of a more structured and systematic management of safety.

Despite the uncertainty around the concept, two primary requirements in the future development of the concept of MSMPs have emerged as crucial in recent IMCL investigations of mine safety management practices in the UK and RSA:

- The need to raise the profile of safety as a necessary and legitimate management activity.
- The need to concentrate more effort on the behavioural aspects of safety.

Raising the safety profile in Management

The need for serious management commitment if safety is to be improved is now widely accepted, at least in principle. In reality however, turning such a commitment into the commensurate action necessary to support the effort required is often much more difficult to achieve.

Developing a reasonable MSMP should be relatively straight forward, especially where there is available a collection of risk assessments on which to define both required action and relative priorities. Putting such a plan into effect however will often require not only commitment in time and finance but also, quite commonly, a re-think of organisational issues such as the clarity of roles, responsibilities and accountabilities for safety.

All of these actions need significant and maintained effort by staff who are, almost certainly, already very busy. Successful busy people quickly develop an ability to concentrate effort on the priorities of those above them. Unless managers (at all levels) are actively held accountable for delivering their role within a MSMP it will, inevitably become a second order priority.

Safety commitment, no matter how genuine, is of no value unless it generates action and such action will only arise if it is required within the managerial and organisational framework. The problem of failing to institutionalise such commitment was nicely summarised in the inquiry into the Clapham Junction Railway crash (9) which occurred in South London and resulted in over 30 deaths:

> *"A concern for safety which is sincerely held and repeatedly expressed but, nonetheless, not carried through into action is as much protection from danger as no concern at all."*

To be successful in developing effective MSMPs it is essential therefore that the importance of the management of safety is raised not only in the minds of individual managers but also incorporated within the corporate management organisation, structure and philosophy.

Increasing the attention on behavioural Safety.

As described above the traditional concerns for safety in mining have been based on the implicit assumption that safety problems have engineering solutions. While this is in part true it is not and cannot be the definitive approach for any examination of mining accident records will show, quite convincingly, that effective safety assurance is much more concerned with the behaviour of people than with the behaviour of engineering components and/or systems.

Moreover it needs to be accepted that an apparent error by a miner which leads to an accident cannot be simply written-off as human error if safety standards are to improve. Both accident investigation and accident prevention needs to break out of the blame-culture and seek the factors within the operations (machine design, adverse environments, inadequate training, poor/ill-conceived rules and procedures, supervisory and management pressure etc.) which are likely to predispose such errors. Unless such pre-disposing factors are identified and rectified then repeat, or similar, accidents are inevitable.

Modern approaches to safety can deal effectively with such requirements. For example, the IMCL BeSafe system of Safety Management Review has been devised specifically to identify the potential for human error (and thereby accidents) and the design, training and organisational circumstances likely to predispose error. Such approaches have already been used effectively in both UK and RSA mining operations For further information see, for example, Simpson (10), Simpson et al (11), Simpson et al (12).

Conclusion

If at least as much safety effort can be directed to understanding safe behaviour as is currently devoted to engineering safety within the framework of effective safety management systems based on rational Mine Safety Management Plans, then considerable improvements in mining safety can be reasonably expected. Whether such an objective can be achieved will in reality depend on the extent to which the management of the mining industries accept the fact that safety can and should be positively and actively managed in exactly the same way as we manage all other aspects of the business.

References

1. Windridge FW (1995) *Report on an accident at Moura No2 Underground Mine.* Queensland: Dept. Mineral & Energy Affairs

2. Byran A (1975) *The evolution of health and safety in mines.* Letchworth: Ashire Publishing

3. Lord Cullen (1990) *The Public Inquiry into the Piper Alpha Disaster.* London: HMSO.

4. Kejriwal BK (1994) *Safety in Mines.* Dhanbad: Gyan-Khan

5. Robens Committee (1972) *The report of the Committee on safety and health at work.* London: HMSO

6. Torlach JM (1996) *Safety in mining - future role of the regulator - perspective from Western Australia.* In Proceedings of the Institution of Mining & Metallurgy conference "Health and Safety in Mining and Metallurgy" London: Institution of Mining & Metallurgy

7. Reczek AA (1974) *Risk based regulatory systems in New South Wales underground coal mines.* In Proceedings of the Institution of Mining & Metallurgy conference "Risk Assessment in the Extractive Industries" London: Institution of Mining & Metallurgy

8. Leon Commission (1995) *Commission of Inquiry into Safety and Health in the Mining Industry.* Pretoria: Department of Mineral & Energy Affairs.

9. Hidden A (1989) *Investigation into the Clapham Junction Railway Accident.* London: HMSO

10. Simpson GC (1994) *Promoting safety via potential human error audits.* The Mining Engineer vol. 154 pp 38 - 42.

11. Simpson GC Mason S Rushworth AM Talbot CF (1992) *Risk perception and hazard awareness as factors in safe and efficient working.* Eastwood: British Coal Corporation (Final Report on CEC Contract no. 7249-12/067).

12. Simpson GC Rushworth AM von Glehn FH Lomas RM (1996) *Investigation of the causes of transport and tramming accident on mines other than coal, gold and platinum.* Huthwaite: IMCL (Final Report on SIMRAC Contract no. OTH 202)