Where are we now?

Some 11 years after

Moura No. 2 Disaster

John P. Brady October 2005

www.joncris.com.au

Table of Contents

Executive Summary

The Moura No 2 Disaster occurred on the 7th August 1994, just over 11 years ago and it is apparent that there is a need to revisit this incident, the findings and recommendations of the extensive Mining Wardens Inquiry, the impact that this incident and the implementation of the recommendations has had on the mining industry, the lessons learned and the effectiveness of the changes made.

There is no doubt that the fallout from the Inquiry has bought about extensive changes in the way our business is regulated and managed, however it is apparent to the author that to a large degree, the passing of time, the turnover in management and other coalmine workers has resulted in the loss of 'corporate memory'

Our industry like any other business or organisations that deal with hazardous and challenging work places has significant intellectual capital resources but have we created an environment that facilitates better decision-making processes or have we, by the loss of corporate memory, continued to foster the 'culture of denial' or the firm entrenched belief that it will not happen again.

The ultimate cause of the Incident was 'management neglect' as stated in:
(Windridge F, 1996, Report on an Accident at Moura No.2 Underground Mine. p.41)

> 'It is the opinion of the Inquiry that events at Moura surrounding assumptions as to the state of knowledge of the night shift on 7 August, and the safety of those at the mine, represent a passage of management neglect and non-decision which must never be repeated in the coal mining industry. Mineworkers place their trust in management and have the right to expect management to take responsible decisions in respect to their safety. They also have the right to expect management to keep them informed on any matter likely to affect their safety and welfare.
>
> It is regrettable that the air of caution, arising out of uncertainty, which was exhibited at the mine in order to bring forward the sealing of 512 Panel did not extend to the general safety and welfare of the workforce and, in particular, to informing and keeping persons out of the mine for a time subsequent to that sealing.'

Management neglect suggests an organisational type failure where the Mining Inquiry Reviewer Panel found that the management team paid no attention to; disregarded or were remiss in the care for, or treatment of, a particular event or series of events.

The Mining Inquiry made 25 firm recommendations covering 16 key subjects or elements that were aimed at preventing the occurrence of a similar accident. The Inquiry also identified a number of areas where there is a need for investigation and improvement to assist in securing the safety of those employed in the coal mining industry.

In framing its recommendations, the Inquiry took careful note of and received encouragement from various reported undertakings of the Minister for Minerals and Energy to fully implement, as soon as practicable, the recommendations of the Inquiry.

Subsequent to the Mining Inquiry and the Coroners Inquest a Moura Implementation Committee was formed to oversee the development and implementation of the Mining Inquiry Recommendations and the role and responsibility of the 5 Task Groups that were set up by the Chief Inspector of Coal Mines to develop guidelines and protocols for key elements of the recommendations.

One would assume that the Task Groups completed their work; however it is a concern that the location of the final reports which detail the working parties findings and recommendations is unknown.

The Special Project examined the Moura No. 2 Incident including the findings, recommendations and the outcome of the Task Groups as far as is known and through detailed research attempted to ascertain where the industry presently stands with respect to the implementation of the Mining Inquiry Recommendations.

The Special Project details the perceived shortcomings identified by the review.

1.0 Introduction

The Moura No 2 Disaster occurred on the 7th August 1994, just over 11 years ago and it is apparent that there is a need to revisit the incident, the findings and recommendations of the extensive Mining Wardens Inquiry, the impact that this incident and the implementation of the recommendations has had on the mining industry, the lessons learned, the effectiveness of the changes made and we are we now.

There is no doubt that the fallout from the Inquiry has bought about extensive changes in the way the coal industry is regulated and managed, however it is apparent to the author that to a large degree, the passing of time, the turnover in management and other coalmine workers has resulted in a loss of 'corporate memory'

Our industry like any other businesses that has to cope with a hazardous and often challenging environment has significant capital and intellectual resources invested but have we created an environment that facilitates better decision-making processes or have we, by the loss of corporate memory, continued to foster a 'culture of denial' with a firm entrenched belief that it will not happen again?

1.1 Background and Context

Over the past twenty years there have been three mining disasters in the Moura district that cost 36 lives and severely impacted the lives of the next of kin, families and loved ones.

The first occurred at Kianga Mine on 20 September 1975, when thirteen miners died from an explosion which was found to have been initiated by spontaneous combustion.

The mine was sealed and the bodies of the men were never recovered.

The second occurred on 16 July 1986 at Moura No 4 Mine when twelve miners died from an explosion thought to have been initiated by one of two possible sources, namely frictional ignition or a flame safety lamp. The bodies of the miners, in this case, were recovered.

The third of the disasters, which is the subject of this review, occurred at about 2335 hours on Sunday 7 August 1994. There were twenty-one persons working underground at the time. Ten men from the Northern area of the mine escaped within thirty minutes of the explosion but eleven from the Southern area failed to return to the surface.

Those who failed to return comprised a crew of eight who were working in the 5 South section of the mine undertaking first workings for pillar development, and three others, a beltman and a sealing contractor with an assisting miner who were also deployed in the Southern side of the mine.

We should never forget the persons who were lost this day:

Name	Position
Robert Allan Newton	Deputy
Darrell William Hogarth	Miner
David Brian King	Miner
Mark Reginald Nelson	Miner
Christopher Robert Ritchie	Miner
Michael Edward Ryan	Miner
Michael Edward Shaw	Miner
Geoffrey Mazzer	Electrician
John Robert Dullahide	Beltman
Robert Parker	Contractor
Terry Gordon Vivian	Miner

A second and more violent explosion occurred at 1220 hours on Tuesday 9 August 1994 and as a result of this, rescue and recovery attempts were abandoned and the mine sealed at the surface and the bodies of the victims were never recovered.

It is this fact that continues to cause pain and suffering for those left behind. There is no closure, no graves for loved ones to sit and ponder on what may have been; just a couple of monuments out in a paddock where visitors meet, place flowers and ask why this was allowed to happen and just as importantly, when will it happen again.

Given this tragic history, it was inevitable that a subsequent Mining Inquiry into this third disaster would be the focus of considerable public attention and concern.

Mining Inquiries such as this were required by the Coal Mining Act of 1925. The purpose of the Inquiry was to determine the Nature and Cause of the incident and to make Recommendations on how similar incidents could be avoided in the future.

Pursuant to Section 74 of the Coal Mining Act 1925, an Inquiry into the nature and cause of the accident was convened at Gladstone before the Mining Warden and four persons having practical knowledge and skills in the mining industry who were not connected with the coal mine where the accident occurred.

In conjunction with the Mining Inquiry, a Coronial Inquiry was conducted by the Mining Warden in his capacity as Coroner.

In all sixty-six (66) witnesses were examined and a total of three hundred (300) exhibits were tendered. The transcript of evidence heard at the Inquiry comprises some 5200 pages.

1.2 Objectives and Scope

The purpose of this Report is to revisit the Moura No 2 Disaster and the events that followed. This will include a critical review of the incident, the findings and recommendations, the outcome of the recommendation implementation process and the impact that the changes have had on the industry.

In particular, we will attempt to ascertain:

- What lessons have been learned?
- What do we do differently?
- How do we measure success or otherwise?
- Where are we now?

The report will contain suggestions on the opportunities for improvement that are still available and the cultural change that is considered necessary for our industry to achieve safe production without the constant fear that 'another disaster is not too far away'

1.3 Methodology

An extensive literature review and painstaking research was necessary before a clear understanding of the Incident, the Mining Inquiry Report, the Coroners Report, the outcome of the Task Groups set up following the Inquiry was possible.

In addition to the background knowledge gleaned from the content of the formal and draft Reports, considerable research, which included, talking to ex-employees of Moura #2, questions, observations, library searches, detailed examination of numerous risk assessments and four mine site's Safety Management Systems, review of monitoring data, Training Schemes, Legislation and Recognised Standards was necessary before a project of this magnitude could be attempted.

Where possible the Project Report summarises the Incident, the Findings and Recommendations, the outcome of the Task Groups set up following the Inquiry and where considered necessary includes a hypothesis on what may or could have been.

The compilation of the Special Project would not have been possible without the benefit of my Minerals Industry Risk Management studies that have proved invaluable.

2.0 Moura No 2 and the 512 Panel

Moura No 2 mined the D seam, which is typically 4.5- 5 metres thick. Depth below the surface varies throughout the mine to something over 265 metres.

The D seam comprises fairly soft, well-cleated coal. It is a gassy seam containing up to 15 cubic metres per tonne of 98 percent methane gas. There is no history of gas outbursts, with the seam being sufficiently permeable to enable effective methane drainage without the application of vacuum. The coal is known to be liable to spontaneous combustion.

The seam has some minor faulting within the mine area but nothing of a major nature and is free from intrusion by dykes or sills. It is not considered to be a particularly wet seam and in some areas was deemed to be quite dusty, especially where the seam had been pre-drained of methane gas. The immediate seam roof and strata through to C seam consists mainly of competent beds of massive sandstones. The floor strata comprise sandstones and competent shales.

In general, panels were developed by forming solid coal pillars on the advance, which was the first phase of the coal extraction process ('first workings'). Once fully developed, the second phase of the operation designs was to partially extract the pillars while retreating from the panel ('second workings'), including that of 512 Panel, were for the goaf to remain open and be supported by leaving selected pillars either totally or partially in place. It was believed that an open and ventilated goaf would mitigate the risk of spontaneous combustion. On completing the extraction, the panel was abandoned and isolated from the rest of the mine by the erection of brick and cement rendered seals across all entries to the panel. These seals were erected at pre-determined locations and the foundations for them ('prep-seals') were constructed while the panel was being worked, to facilitate the speed of final sealing when necessary.

The design of 512 Panel was subject to several constraints. Its width was governed by the distance from 511 Panel to the 5 South development headings, and its length was determined by the extent of the methane drainage boreholes.
It was expected that extraction would be completed in three to four months after development, and so well within the presumed six month minimum incubation period of the D seam coal. The panel was designed to achieve, and did achieve, the highest rate of production of any previous panel at Moura No 2 mine.

The significant geometrical features of the panel are seen in Figure 1. Its overall dimensions were approximately 440m long from the entries to the back rib and 170m wide rib to rib.

It was driven, using 5 headings, parallel to and on the south side of the previously extracted 511 Panel and was separated from it by a mandatory 45m wide barrier pillar. A 37m wide pillar on the opposite side separated 512 Panel from 5 south.

The No 1 heading of 512 Panel, adjacent to 5 South was at the highest elevation in the panel and was the main return airway. Headings 2, 3 and 4 were intake airways and No 5 heading was used as an alternate main return with No 1 heading during panel development and as an occasional bleeder return during pillar extraction.

The preceding paragraphs have been extracted virtually verbatim from the paper by Cliff; Beamish; and Cuddihy; AusIMM Chapter 31, p 4; and the information contained therein provides adequate detail from which we can gain an understanding of the design and coal recovery concepts.

3.0 The Nature and Cause of the Incident

The Inquiry (Windridge F, 1996, Report on an Accident at Moura No.2 Underground Mine. p.22 - 23) found that based on the evidence, there was an overwhelming likelihood that the first explosion originated in the 512 Panel of the mine and resulted from a failure to recognise, and effectively treat, a heating of coal in that panel. This, in turn, ignited methane gas which had accumulated within the panel after it was sealed. The Inquiry did not reach a finding regarding the cause of the second explosion. While the Inquiry found that the eleven persons who failed to return to the surface died in the mine as a direct or indirect result of the first explosion no definite finding could be made regarding the precise cause of death of any of the victims.

'Contributing causes to the first explosion were identified as a number of failures in responses, approaches or systems at the mine. These were:

- Failure to prevent the development of a heating within the 512 Panel;
- Failure to acknowledge the presence of that heating;
- Failure to effectively communicate and capture and evaluate numerous tell-tale signs over an extended period; and
- Failure to treat the heating or to identify the potential impact of sealing with the panel consequently passing into an explosive range due to the methane gas accumulating in the panel.

Ultimately, there was failure to withdraw persons from the mine while the potential existed for an explosion'

In addition the Inquiry, (Windridge F, 1996, Report on an Accident at Moura No.2 Underground Mine. p.41) made comment on a number of other issues with the most damming of these detailed below:

> 'It is the opinion of the Inquiry that events at Moura surrounding assumptions as to the state of knowledge of the night shift on 7 August, and the safety of those at the mine, represent a passage of management neglect and non-decision which must never be repeated in the coal mining industry. Mineworkers place their trust in management and have the right to expect management to take responsible decisions in respect to their safety. They also have the right to expect management to keep them informed on any matter likely to affect their safety and welfare.
>
> It is regrettable that the air of caution, arising out of uncertainty, which was exhibited at the mine in order to bring forward the sealing of 512 Panel did not extend to the general safety and welfare of the workforce and, in particular, to informing and keeping persons out of the mine for a time subsequent to that sealing.'

4.0 Discussion and Hypothesis

4.1 Decision Making Process

We know now that the mine had virtually no effective safety management system and from the evidence presented to the inquiry that the primary focus for the management team and the employees was cost effective production. People were working hard and trying to maintain job security and the future of the mine. It is apparent that this focus had an impact on many of the decisions made prior to the incident.

4.2 Spontaneous Combustion Hazard

Spontaneous Combustion; we all know what it is; the subject has been studied extensively for over 200 years. Hundreds of papers have been written and there are many experts and pseudo-experts in this phenomenon, but spontaneous combustion events still occur, usually with catastrophic consequences.

We have little control over the oxidation of carbonaceous material, which in reality is a natural process. We do know that once coal is exposed to air, oxidation commences almost immediately, heat is generated and if the heat is not dissipated readily the oxidation process will accelerate to an incipient heating and if corrective action is not taken, spontaneous combustion is usually inevitable.

The mine had experienced a spontaneous combustion event in the 5 North Pillar Extraction Panel in 1986 and it may be more than coincidence that the 5 North Panel is almost directly opposite the 512 Panel and on the northern side of the Main Dip Headings.

Little evidence about this event was presented to the Inquiry and from the evidence presented it is apparent that the seriousness of the 5 North Pillar Extraction Panel heating was not fully disclosed.

This would be re-enforced by the fact that a briefing given to the new mine manager indicated that the 5 North Panel was sealed as a precautionary measure when the CO Make reached 12 Ltrs/Min.

The facts are that this heating was discovered at about 0640 hrs on Saturday 19th April 1986 and shortly after this time the CO Make was recorded at 12 Ltrs/min. Continuous monitoring throughout the day indicated that the CO Make increased to 34Ltrs/min by 0930 hrs; to 76 Ltrs/min by 1145 hrs and 1415 hrs when actual sealing operations commenced, the CO Make had risen alarmingly to 126 Ltrs/min with black smoke present in the return airway.

The heating had in fact reached a critical temperature before ‘taking off’ and this is where this saying originated.

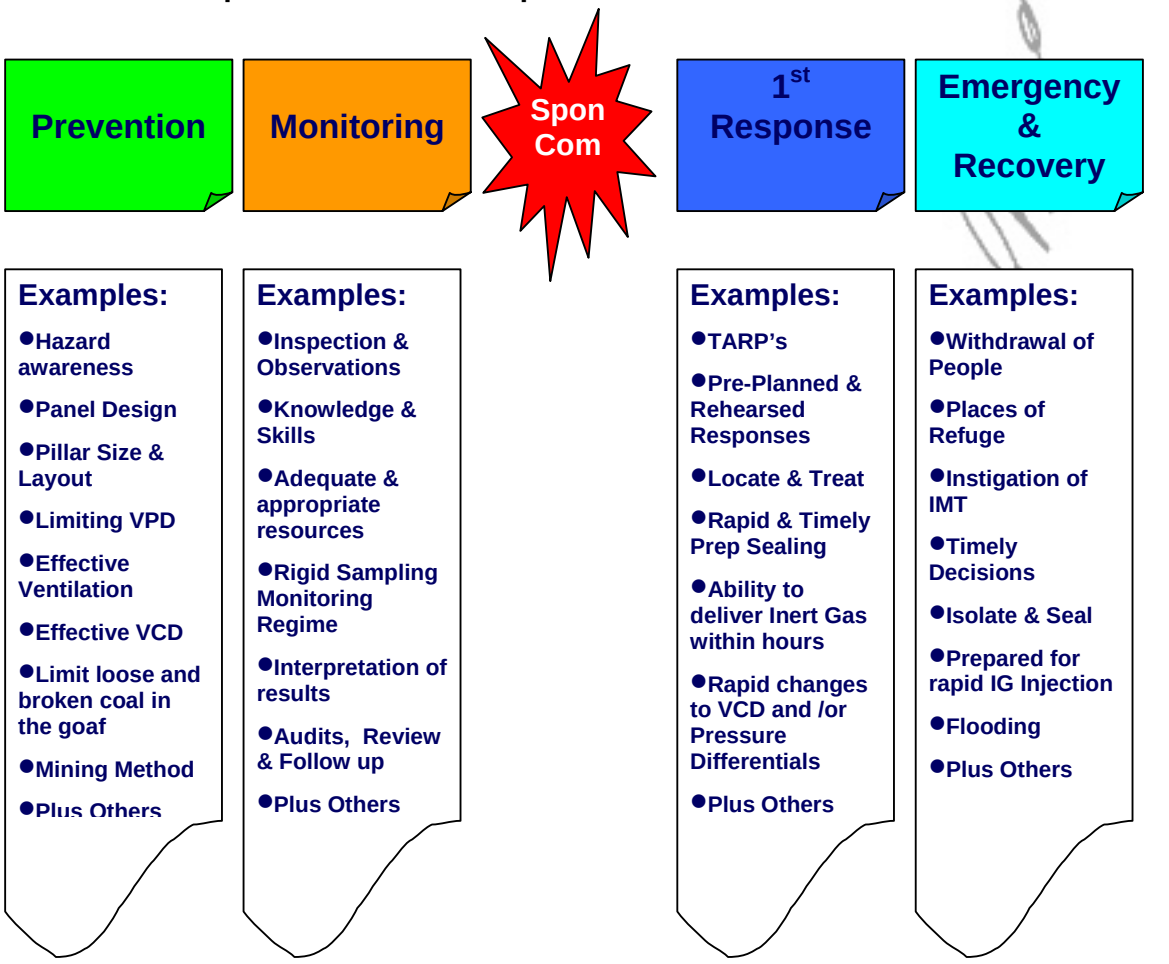
A number of the persons who were present during the 5 North event also assisted the author to collect, collate and graph the raw data and gas makes for the life of the panel and to compare the 5 North data with adjacent panels. It is also relevant that a number of these people were also present at the mine prior to and during the 512 incident.

It is remarkable that a risk assessment into the development and extraction of the 512 Panel was conducted and the risk of spontaneous combustion was not considered as a high risk. The reasons for this oversight are unknown however, it is likely that the incident was not mentioned because one would assume that if this was known by the facilitator, then it would be highly unlikely that the risk of a spontaneous combustion event would have been omitted or downgraded.

A Paper, titled Recent Mine Emergencies in Central Queensland by John Brady and Ron McKenna containing details of the 5 North event and other serious incidents was submitted for inclusion in the Training of Mine Officials Course that was conducted at SIMTARS during 1999, however the Moura # 2, 5 North Incident was not included in the official Manuals.

We can gain a better understanding of the challenges associated with spontaneous combustion by applying the MIRM Model and in particular the elements of the Work Process Factors that deal with Hazard specific Barriers; for example:

4.3 Hazard Specific Barriers for Spontaneous Combustion



4.4 Failed or Absent Prevention Barriers

Evidence before the Inquiry strongly indicated that a heating arising from spontaneous combustion of coal was present in the panel for some time prior to sealing. The failure to prevent the development of a heating in the 512 Panel is attributed to a number of aspects of the design and operation of the panel together with certain beliefs concerning panel life in relation to an assumed incubation period.

Fallen rock may well have covered some loose coal and so screened it from goaf ventilation.

In addition, there was evidence of ventilation problems with gas backing up the number two heading. This was generally associated with the erection of a line of brattice to channel air to the continuous miner when working near the bottom side of the panel. If this brattice line was made too tight then insufficient leakage ventilation was available to effectively remove gas from the top rear corner of the panel.

There can be little doubt that remedial measures taken to clear these gas accumulations caused variation in the distribution of goaf ventilation. A number of instances where the goaf was deliberately 'flushed' were identified in evidence.

On other occasions when mining up dip near the bottom of the panel, while stripping the bottom return rib, the bottom return regulator was opened to facilitate ventilation across the miner. This appliance was meant to be shut at the completion of the up dip sequence, but on some occasions it was not.

This was recognised by the registered mine manager to be compromising positive goaf ventilation and the practice stopped.

The likely compound effect of all these ventilation alterations was considered undesirable by the Inquiry.

Overall, it seems that day to day ventilation problem solving and operational or accidental alterations to panel ventilation may have defeated the overall design intent regarding positive, controlled goaf ventilation and so increased the likelihood for spontaneous combustion in the panel. It seems likely that parts of the goaf may have been alternately starved of, and then supplied with, ventilating air; a most undesirable situation. This situation was probably not helped by the absence at the mine of a dedicated and regularly updated plan showing the state of mine ventilation together with the status of regulators and other appliances.

The alteration of regulators at the mine appears to have been, to some extent, uncontrolled and unrecorded with no single point of reference, or for that matter responsibility, for the status of ventilation.

Coal in the panel had been drained of gas for about 25 months prior to mining. As well as removal of gas this also resulted in the removal of water from the coal. Expert opinion, in general, agreed with the proposition that this may well have increased proneness to spontaneous combustion through two mechanisms.

The first was through the removal of barriers to the ingress of oxygen to the coal and the second was the possibility of the generation of heat through hydration of the coal if subsequently wetted.

There appears to have been heavy reliance at the mine on the concept of an incubation period for the seam being mined. This was revealed in evidence to have some roots in the report of the Inquiry into the Kianga explosion which occurred in 1975.

In general it was considered that the rapid extraction of panels within the presumed incubation period provided an effective defence to spontaneous combustion since panels would be extracted and sealed before a heating was likely to develop.

Incubation period is a commonly used term in coal mining and is generally acknowledged as the time between initial exposure of coal to the atmosphere and the subsequent onset of self heating. Although in common use at the time, its actual value in any particular case is difficult to determine and then it may be influenced by many factors.

The 512 Panel was to be extracted well within the presumed incubation period of six months and spontaneous combustion, although routinely monitored for the oxidation process was not considered a significant risk. In a risk assessment conducted after extraction in the panel had commenced, spontaneous combustion appears to have had no particular prominence.

There were sixteen roof and sixteen rib related risks, seven concerned ventilation and gas, six concerned persons injuring themselves, and there was one for spontaneous combustion. The current controls identified for spontaneous combustion were a short panel life and continuous gas monitoring.

Reliance on incubation period as a primary, if not sole, determinant of the likelihood of spontaneous combustion led to some false sense of security and likely to a failure to take precautions and be sufficiently alert to other indicators of spontaneous combustion.

4.5 Failed or Absent Monitoring Barriers

Most of the persons associated with the incident stated that they could associate the importance of sensory indicators, such as smell, with the likelihood of a spontaneous combustion.

There appeared to be a singular lack of concern from those in positions of authority at the time of the explosion that is from undermanager up, to maintain and update knowledge. Training related to spontaneous combustion and provided by the mine itself, in response to statute, could best be described as minimal.

In total there were a significant number of reports of 'smells' from the 512 Panel during its life and, indeed, these proved to be fleeting. In this respect they did not reward subsequent observation and left the scope for those making, or hearing of, those examinations to reason away not only the occurrence but, unfortunately, the potential importance of those signs.

As early as 17 June the then undermanager examined the 512 goaf in response to a ventilation layering and recirculation problem and at that time noticed what he, in evidence, described as 'a slight tar smell'.

Regrettably, no mention of a smell made its way to Undermanager's shift report and claims of verbal reporting of the occurrence of that smell, to the Undermanager in Charge and the Mine Manager were uncorroborated. On 24 June during the afternoon shift the deputy stated that he noticed a smell at 7 cross cut 1-2 heading. This observation found its way to the deputy's shift report which stated that the Under Manager was informed that there was a strong ‘benzene’ type smell and to keep an eye on it.

Descriptions of the smell varied in the evidence of others and, in particular, the ventilation officer described it as a 'chemical' smell. Despite numerous references to the reporting of smells no satisfactory explanation of the fate of the actual reports was forthcoming.

This was despite the fact that, if taken on its face value, the report must have been alarming to anybody reading it. The undermanager on shift did not deny that he may have read it, but did not recall doing so. Similarly, he did not deny being informed, but could not recall being so.

The report was not counter-signed by the shift undermanager, nor for that matter any other under manager. The end result was that the content of the report simply 'slipped through the cracks'.

There appears to have been no follow-up action and every official of the mine examined by the Inquiry, bar one, denied knowledge of the report or its content. It should also be noted that the deputy who reported the smell appears to have made no follow-up, even by way of casual enquiry, of the fate of his observation of 24 June.

On Friday 22 July the substitute Ventilation Officer , in the company of another deputy, got a higher than expected gas detector tube reading in the 512 top return when taking readings associated with the normal weekly ‘CO make’ monitoring.

The result of 8 ppm was higher than the approximately 6 ppm being indicated at the time by the mine's tube bundle system for the Top Return of 512 Panel. When combined with the bottom return make, a figure of 18.98 l/min was obtained for the CO make of the panel.

In response to concerns raised by this result the mining engineer, the Mines Rescue Superintendent and the Shift Undermanager conducted an inspection of 512. The group obtained several readings of the order of 5 ppm CO in the top return and noticed nothing else that gave rise to concern.

The 'high' CO reading was, on the basis of these further examinations, discounted as an anomaly. Apparently none of those making this assessment knew of the ventilation difficulties and 'smell' observations in June.

The acting registered manager did, however, cause some ongoing observation of 512 to be undertaken. This appears to have resulted from discussion and some form of agreement with the acting ventilation officer.

Although the acting manager indicated that the purpose of further monitoring was simply to maintain a comparison between hand held detector tube readings and those of the tube bundle system, that purpose became confused in the observance.

The acting manager produced a blank of the normal worksheet for ‘CO make’ monitoring and this contained the formula for ‘CO make’ calculation on the sheet and the Undermanager in Charge posted a written instruction requiring deputies to take daily readings for CO and air velocity readings, methane, oxygen and wet and dry bulb temperature.
In practice, the deputies began to take the required readings not just on a daily basis but every shift and the readings from then on appear on deputies reports right through until Saturday 6 August.

During the afternoon shift of 5 August a deputy in the company of miner noticed a smell at 10 cross cut while inspecting the top return in 512 Panel and reported that a strong tar smell was evident at 10 cross-cut. The following day a deputy noticed what was variously described as a haze or ‘heat shimmy' around a fall area in the vicinity of 2 cross-cut, 2-3 heading.

The reversal of air in 2 heading was seen as undesirable, at least from the point of view of the potential for recirculation, and from the evidence provided this was a justification for sealing the panel earlier than planned.

There was no attempt to utilise the Gas Chromatograph that was available or to collect and send bag samples away for full analysis. This would have provided a detailed analysis of the atmosphere in the goaf and in particular in the panel returns.

No satisfactory explanation was given for the failure to use the GC Analyser even though the technology was well proven and used effectively at other mines.

Mine personnel relied completely on the Tube Bundle Monitoring System but the unauthorised acknowledgement and resetting of Alarm Levels negated its value as an effective gas monitoring tool.

There was no process in place for audit and review of the mine monitoring system or the corrective action that should have been taken.

4.6 Failed or Absent First Response Barriers

The presence of smells and higher than normal CO levels and gas makes should have caused those present, to question the status of the panel and the need for urgent action.

Some of these people were heavily involved in the sealing of the 5 North Incident and the subsequent reopening and recovery of the production equipment from a sealed area that contained a known heating, so they were very familiar with the smells and the gases produced by spontaneous combustion.

A number of the senior people including some of the deputies were involved in the evaluation of the monitoring results and assisted the author in the preparation of the CO Make Trends and the subsequent Paper and CO Make Graph. The manually plotted Graph clearly demonstrated that once a critical point was reached there was an exponential increase and that caused the heating to 'take off' (Brady J. Paper on Recent Mine Emergencies in Central Queensland 1989)

Remarkably, since the discovery of a smell at 10 cross-cut during the Friday afternoon shift, it appears that no one had returned to that particular location to follow matters up. A deputy of the day shift reported in evidence that during his time in the panel he noticed a tarry smell near the seal in the top return and the same type of smell, but of less strength, at the goaf edge in 2 and 3 headings, and that he informed the Undermanager in Charge of this observation.

The Undermanager in Charge denied being told of anything about a stink in the panel that evening and since the deputy was only relieving in the panel for a time he did not complete a report with respect to the panel. The 'smell' observations went unrecorded and subsequently uncorroborated.

The sealing of the 512 Panel was originally proposed for early in the week beginning 8 August and only preparatory work for sealing had been scheduled by the Undermanager in Charge at the regular weekend-work planning meeting of Thursday 4 August.

The first mention of sealing appears to have been around the day to afternoon shift change on 5 August when the shift Undermanager asked if the panel could be sealed over the weekend.

The Undermanager in Charge initially did not assent to a change to the work schedule but subsequently relented to the point of supporting sealing on the following Sunday (7 August) subject to resource availability. The final decision to seal was taken at about noon on Saturday 6 August as a result of another approach to the Undermanager in Charge by the shift Undermanager.

This decision was put into effect immediately and the sealing of the panel was no doubt brought forward from the time originally planned. To that end extra weekend labour was organised which necessitated consultation with a site union official since overtime limits were to be exceeded. In addition, the duties of the Sealing Contractor were altered and he was sent to the 512 Panel, with the other contractor being called to the mine at short notice.

The spectre of a heating in the 512 Panel is reinforced by the evidence available from the Seal Contractors one of whom recounted a smell 'that I have never smelt underground before'. However, the evidence of those involved in and supervising the sealing was variable and largely uncorroborated with respect to noticing and reporting smells and hazes.

The Inquiry concluded that these reports may well have been coloured by differing individual perceptions, the passage of time and the merging of pre and post event knowledge.

Certainly more weight must be given to reports of smells, and for that matter other observations, of which there was some record made prior to the explosion.

(Windridge F, 1996. Report on an Accident at Moura No.2 Underground Mine. p.30)
'In Parker's case it is mute, posthumous evidence in the form of a diary entry, discovered after the event:

"George Mason requested 1pm that I go in because of concerns over heating."

This entry was evidently made some time between 1300 hours Saturday 6 August and the time of the first explosion'.

The Inquiry considered there to have been enough of such evidence to firmly indicate a problem in the 512 Panel, had that evidence been effectively gathered and evaluated prior to the explosion and despite some subjective difficulty with sensory indicators such as smell and haze in the underground environment they are, nonetheless, widely recognised and often vital indicators of a spontaneous combustion event.

Information commonly covered in attaining statutory qualifications, and mines rescue training materials both, clearly, make this association and it was considered highly likely that the vast majority of management, and many of the workforce at the mine were at some time exposed to this association.

Such an association not being made in practice was a stark failure in the application of knowledge which must have been widely available at the mine. This, in turn, must bring into serious question the efficacy of training arrangements at the mine in relation to spontaneous combustion recognition.

4.7 Failed or Absent Emergency & Recovery Barriers

At about 2330 the Shift Undermanager noted that production from the 5 South Panel was well below expectation and in response he telephoned the section to determine the status. He spoke to the electrician who informed him that there had been some concern over a noise in the vicinity of the hydraulic pump motor of the continuous miner.

The electrician indicated that mining was proceeding but that a fitter may like to look at the motor later. As the Shift Undermanager was responding that he would organise it, the phone cut out.

This was the time of the first explosion.

All of the nine men who were working in the 1 North West panel survived the explosion. Some of them felt their ears "popping" and others were knocked over by a pressure wave. The ingress of dust and acrid smoke into the intake airways caused the men to use their self rescuers and leave the mine.

The evidence given by the survivors about the heat experienced from the self rescuers suggests they were exposed to carbon monoxide gas. Statements from the survivors indicated that visibility was severely restricted on their way out of the mine. The men also reported difficulty in finding their way out of the face area of the panel where no consistent guide was available. There was no evidence of significant damage to the transport and conveyor roads from the surface and into the mine as far as 1 North West panel. Several timber props were reported as having been dislodged and across the transport road near the entrance to the mine.

The belt deputy, who at the time was at 15 cut-through on the Main Dips belt, experienced "popping" of the ears and about 20 seconds later was knocked over by a strong blast of air contaminated with dust. He left the mine by his own means and met the 1 North West crew at the mine portal entry, then travelled in one of the underground diesel vehicles to the mine office.

At the same time as the explosion occurred power to the mine was interrupted. Power to the mine's twin ventilation fans was interrupted due to an apparent fault in the underground electrical circuit assumed to have been caused by the explosion.

The stand-by diesel alternator automatically started to provide emergency ventilation. This was sufficient to power only one of the two fans and it is estimated that about 60 to 70% of the normal ventilating quantity was restored.

The mine's emergency procedure was implemented and company officials and the inspectorate notified of the situation.

Power was restored to both fans approximately 3 hours after the explosion and the fans appeared to operate normally. No damage was done to either fan although an explosion relief door was blown about four metres away from the fan housing.

This was replaced at approx 0040 hours Monday 8 August.

The total mine ventilation pressure was reduced by an estimated 15 mm water gauge from that existing before the explosion.

Based on this evidence, past experience during the Moura # 4 explosion and extensive research of mine explosions it is probable that a valuable window of opportunity to re-enter the mine and re-establish the ventilation network may have been lost.

When the first explosion occurred, which was apparently fairly weak and confined to predominately methane, most if not all of the fuel would have been consumed. If this was not the case a second explosion would have occurred very shortly after the first event.

The purpose of Emergency and Recovery Barriers is to prevent the situation from escalating or getting worse. In this case the immediate use of personal self rescuers and the availability of a diesel vehicle and excellent Leadership saved the lives of ten (10) coalmine workers. This left eleven (11) persons unaccounted for.

There is little doubt that by not taking timely proactive action, the methane escaping from damaged seals and or gas drainage lines, coupled with the products of combustion produced by residual fires will build up and accumulate and as a result a second explosion was inevitable.

The fact that a second explosion occurred some 36 hour or so later demonstrates that the Hazard Specific Emergency Response Barriers failed.
The current Mines Rescue Guidelines and the Risk Management approach to mine re-entry now demand exhaustive analysis of data and time consuming data collection and re-analysis of countless 'What if ' scenarios that it is highly unlikely that the mines rescue service will ever be used to re-enter a mine after a similar event.

The practice of drilling holes to collect samples introduces further delays and of more importance these holes permit the ingress of oxygen into areas where it could do more harm than good. This hazard was recognised during the Moura #4 recovery and controlled by drilling the last six metres of critical holes using Nitrogen Gas as the flushing agent. I understand that this was not the case at Moura # 2 and it may be coincidental that the second explosion occurred shortly after the holing of a Borehole into the mine workings.

There is no evidence on the public record which details the events that transpired during the period from the first to the second explosion and therefore it is difficult to make a valued judgement on the actions that were taken by the Incident Management Team.

This is in stark contrast to the extensive Critical Review that was conducted following the Moura # 4 explosion and it was clearly evident to those of us who were involved in the 1986 explosion, that a number of the same mistakes, errors of judgement and omissions were being made.

Once again history records that fact that we fail to learn from the mistakes of others.

4.7 Human Factors

The human factor is one of the most difficult to control in the risk management process. Firstly we have to deal with the three basic elements of human behaviour, namely:

- Perception
- Cognition
- Action

Perception is the stimulus that initially triggers the mind of the individual. This is caused by one or more of our built in senses like, smell, touch, sight, taste, hearing or that feeling that one gets when things are just not right. This should lead to the next basic stage of human behaviour, cognition.

Cognition governs the way we process or deal with the information provided by the first stage, our perception that something is not right. The way individuals process the information may be influenced by many factors for example; knowledge and skill, training, position in the hierarchy, experience, respect for and of others but the fact remains our cognitive behaviour controls the way we process the information and the decisions that we make which lead to the action that we or others will take.

Action taken is regarded as the output of the previous processes. In very simple terms, ones perception or feelings lead to the processing of the information which in turn governs the decisions that we make and subsequently the action that is taken. It is important to note that these processes overlap to a degree and in complex or changing situations we will sub-consciously set up a constant loop where we perceive change, process the information and react accordingly.

When we examine the Moura # 2 Incident we see numerous instances where theses basic human factors failed.

In addition to this basic human behaviour we have to accept that humans are fallible and we do and will continue to make errors in our perception of a problem, processing the information, making decisions and taking what should be appropriate action,
Reason (1990, 1997) argues that human error can never be eradicated and that it is the responsibility of the organisation, senior managers and supervisors to put effective safety management systems, barriers and defences in place to buffer our basic and somewhat defective, cognitive behaviour.

Reason, J. (1997) the worlds leading organisational safety psychologist argues that it is the responsibility of organisations to manage the risk of what he terms organisational accidents.

To understand this logic we have to accept that there are two types of accidents;

- Accidents that happen to individuals that results in serious injury or death
- Accidents that happen to organisations which have a devastating effect on the organisation and individuals both within and outside the organisation.

By this definition the Moura # 2 Disaster was an organisational accident or as I prefer, an Organisation Incident because it was preventable. The term accident is and should be reserved for those events that occur purely by chance or those events that after an exhaustive investigation reveal no apparent cause.

According to Reason (1997) Organisational Accidents have two basic components:

- Latent Conditions;
  - These are things like poor system design, gaps in supervision, undetected manufacturing defects or maintenance failures, unworkable procedures, clumsy automation, shortfalls in training, inadequate tools and equipment. They typically arise from decisions made by government, regulators, manufacturers, designers and organisational managers. These decisions spread throughout the organisation creating a distinctive safety climate and culture, and may create error producing factors at individual workplaces. As the name implies, latent conditions may be present for some time in the organisation. When they combine with adverse local circumstances and active failures they penetrate the system's many layers of defences.
- Active Failures:
  - These are errors and violations committed at the 'sharp end' of the system, that is, by the human operators of the systems. These are likely to have a direct impact on the safety of the system.

5.0 Mining Inquiry Recommendations

The Inquiry made 25 firm recommendations covering 16 key subjects or elements that were aimed at preventing the occurrence of a similar accident. The Inquiry also identified a number of areas where there is a need for investigation and improvement to assist in securing the safety of those employed in the coal mining industry.

From the extensive media coverage of the Moura 2 Disaster Inquiry, the numerous Papers, Reports which have been written since, reference is mainly confined to the Warden's Findings and Recommendations and it is apparent that there is a perception that the Mining Warden, Mr. Frank Windridge was responsible and to a degree held accountable by some, for the outcome of the Inquiry and the subsequent impact that the Findings and Recommendations has had on the industry as a whole.

The facts are that the findings into the Nature and Cause of the incident and the subsequent Recommendations and delivered in the main by the Reviewers or the four persons with the practical knowledge, experience and skills in the mining industry.

The Mining Warden's role in this phase of the Inquiry is to ensure that the legal process is adhered and that all stakeholders are provided with an equal opportunity to present evidence for consideration by the Panel.

The role and function of the Reviewers is to hear the evidence, question witnesses, gather, collate and analyse the evidence on which their findings and recommendations are based.

The Mining Warden assists and directs the Mining Inquiry under the provisions of Section 74 of the Coal Mining Act 1925 by ensuring that the proper legal processes are maintained and that deliberations are fair and equitable.

In this particular Inquiry, the Mining Warden also acted as the Coroner and as such, he sat alone under the provisions of Section 24 of the Coroners Act 1958, and conducted an inquest into the death of the 11 persons who were trapped by the explosion.

The four Reviewers for the Moura No 2 Mining Inquiry were:

MR R J PARKIN	General Manager,
	Capricorn Coal Management Pty Ltd
MR P J NEILSON	District Secretary,
	Construction, Forestry, Mining & Energy Union United Mine Workers Division
PROF F ROXBOROUGH	Professor of Mining Engineering,
	School of Mines,
	The University of New South Wales
MR C W ELLICOTT	Training and Development Officer,
	Department of Mineral Resources,
	New South Wales

It should be recognised that the Findings and Recommendations made following the Mining Inquiry were made in the main, by the above persons. Mr Windridge, acting as the Mining Warden concurred with their findings as to the nature and cause of the incident and endorsed the recommendations of the reviewers.

In all sixty-six (66) witnesses were examined and a total of three hundred (300) exhibits were tendered. The transcript of evidence heard at the Inquiry comprises some 5200 pages.

Mr Windridge acting in the role of the Coroner delivered a separate Report.

Section 24 (1) of the Coroners Act 1958 sets out the scope of an Inquest into the death of a person or persons and the most relevant clauses of this section may be summarised as establishing so far as is practicable:

- The fact that a person or persons had died,
- The identify of the deceased person or persons,
- When, where and how death occurred,
- The person or persons (if any) who are to be charged with murder or manslaughter or any other offence contained within section 311 of the Criminal Code.

5.1 Summary of the Mining Inquiry Recommendations

The previous three Inquiries into major explosions in Queensland coal mines have consistently made recommendations aimed at addressing perceived deficiencies in the coal industry's arrangements for training, or the state of knowledge of industry personnel.
There has been the conduct of seminars and symposia as a response to those disasters, accompanied by the production of publications about the hazards of underground coal mining revisited in the course of those Inquiries.

These measures have not been effective in the longer term with the industry displaying a capacity to lose sight of the lessons of the past and to not maintain an adequate knowledge base among key personnel.

Coroner Windridge (Coroners Report – Moura No. 2 Fatal Inquiry 1995) made the following observation:
'No doubt there will now be a plethora of steering committees, advisory panels and consulting groups. I concede that such things are necessary, given the impact of the recommendations'

The immediate past track record is that these measures will be effective for somewhere around a decade with fundamental problems beginning to re-emerge somewhat earlier.

There seems a clear need to put measures in place to ensure that vital lessons are effectively revisited and that the past is not repeated.

To not do so is to invite further disasters.

Many of the recommendations and comments contain a suggestion that industry working parties be convened by the Chief Inspector of Coal Mines for certain purposes.

This approach has been taken because, although the Inquiry considers itself to be in an excellent position to identify issues which should be addressed, it recognises that it may well not be in the best possible position to work through those issues to an optimal conclusion.

It is the express intent of the Inquiry that where such groups are convened that all reasonable steps are taken on the part of Government to ensure that they are adequately resourced and supported for the tasks with which they are charged.

It is also expected that employers and unions provide adequate support for these processes.

The work of the groups cannot be considered complete until the results of their work are in place and effectively operating in the coal industry.

In framing its recommendations the Inquiry took careful note of and received encouragement from various reported undertakings of the Minister for Minerals and Energy to fully implement, as soon as practicable, the recommendations of the Inquiry.

5.1.1 Spontaneous Combustion Management

The recommendation for Spontaneous Combustion Management Plans is intended to ensure that spontaneous combustion never again becomes the subject of assumption as a means of management and that capable, reliable and durable arrangement are put in place to effectively manage that hazard.

There must surely be a sense of deja vu with the recommendation relating to industry training as it applies to spontaneous combustion - how many times does it have to be said?

The absence of a specific and durable system for the management of the spontaneous combustion risk was identified as highly pertinent to the ultimate outcome at Moura No 2.

The management system is to take the form of a Spontaneous Combustion Management Plan that should be based on an assessment of the spontaneous combustion risk present at a mine and there should be reassessment of that risk from time to time and modification of the system, if required.

The system should also contain provision for review of adequacy both on a regular basis and as a result of defined events or significant change in operating conditions.

Responsibilities and authorities of all persons with a role in the operation of the system should be defined and the system should be in a form which allows up to date information to be effectively communicated to those concerned.

The system should contain means to ensure that appropriate training is delivered to persons operating within the system.

There must be means of attaining assurance that the system is being followed at the mine and this should involve a schedule of timely internal and external audits of system integrity and operation.

There must be measures defined by the system to, as far as practicable, prevent the occurrence of spontaneous combustion. Such measures may include, but may not be limited to, mine and panel design together with ventilation and working methods. There must be effective means for the gathering of information related to spontaneous combustion with an emphasis on early detection and evaluation.

These should include, but may not be limited to, appropriate gas monitoring, personal observation and reporting processes.

Responsibilities and authorities within those decision processes must be made clear.

Such a system should take the form of a spontaneous combustion management plan which should, in turn, form part of a broader mine safety management plan.

5.1.2 Mine Safety Management Plans

It is recommended that mines be required to put in place Mine Safety Management Plans to cater for key risk areas. It is further recommended that Mine Safety Management Plans be based on detailed risk/hazard analyses.
Mine Safety Management Plans should be regularly audited both internally and externally and meet any requirements of the Chief Inspector of Coal Mines.

As a minimum key risk areas which should be addressed by Mine Safety Management Plans should include but may not be limited to:

- Ventilation
- Spontaneous Combustion
- Gas Management
- Methane Drainage
- Emergency Evacuation
- Strata Control

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.

5.1.3 Training and Communication

There is a basic need for all members of the coal mining industry in Queensland to improve their knowledge with regard to the fundamentals of spontaneous combustion and other underground mining problems.

With this in mind the reviewers recommended that all coalmine workers receive appropriate training in the specific hazards associated with mining and in particular, spontaneous combustion and mine gases and that the training requirements be formalised in a compulsory Mine Training Scheme.
It was further recommended that all persons holding statutory appointments receive specialised, site specific training in communication, mine gases, spontaneous combustion, mine fires and emergency procedures and that emergency procedure exercises be conducted at each mine on an annual basis. This mine-site specific training was to be over and above that required to maintain statutory appointments.

5.1.4 Statutory Certificates

The recommendation relating to statutory qualifications is intended to ensure that those holding such qualifications revisit the lessons and update their knowledge.

It should not be taken for granted that a statutory certificate of competency to practise as a Mine Manager, Undermanager or Deputy carries an assurance that the person possessing the qualification is maintaining and where necessary developing, the knowledge base required for the appointment.

It is recommended that the procedures for granting statutory certificates for underground coal mining and the conditions under which they are awarded, be reviewed.

In particular, the panel recommended that certificates not be granted for life and that a system be developed and put into effect as soon as practicable that requires certificate holders to demonstrate their fitness to retain the certificate of competency on a regular basis, at intervals of not less than three and not more than five years.
The process should aim to ensure that certificate holders maintain a sound knowledge of technical developments in coal mining and most particularly those relevant to coal mine safety.

5.1.5 Ventilation Officer

The role of ventilation officer appeared to have been one of taking statutory measurements, keeping records and little else. The panel recommended that a position of ventilation officer be established as a statutory position at all underground coal mines. The ventilation officer appointed must have demonstrated competencies appropriate to the duties and responsibilities of the position and would be directly responsible to the mine manager.
The primary function of the Ventilation Officer should be the planning, design and implementation of the mine ventilation system and for the establishment of effective standards of ventilation for the mine, methods for its control and protection, monitoring of performance, reporting procedures, maintenance of ventilation records and plans, and emergency action plans.

5.1.6 Self Rescue Breathing Apparatus

The Inquiry recommended that a representative industry working party, containing appropriate expertise, be convened by the Chief Inspector of Coal Mines and that group be charged with the development of guidelines for the industry covering life support for escape.

These guidelines must:

- effectively address the use of alternatives or supplements to the use of filter self rescuers such as oxygen self rescuer technology;
- adopt best available technology and practice as assessed world-wide;
- not consider the issue of self rescuers in isolation but rather as part of an overall escape strategy; segregated airways; designated escapeways and refuge chambers;
- Lead to the development and introduction of oxygen based escape systems from underground coal mines.

When developed, the guidelines must be expediently and effectively implemented by legislative or other means. The Inquiry considers that suitable guidelines should be prepared as soon as practicable and that effective implementation should take no longer than two years from the date of this report.

5.1.7 Emergency Escape Facilities

In respect of facilitating the emergency escape of persons from a mine, there are lessons to be learned from the experiences of the men who escaped from Moura No 2 following the first explosion.

Accordingly, it is recommended that the Chief Inspector of Coal Mines set up a working party, comprising persons with appropriate knowledge and experience to examine and report on a range of issues relating to emergency escape facilities.

Consideration should also be given by the group to the potential role for motorised transport in emergency escape arrangements.

Several counsel made submissions to the Inquiry urging that consideration be given to the introduction of refuge chambers in underground mines. The intention is that strategically placed self contained life support chambers could provide vital refuge for mineworkers who are trapped below ground. Although there is no evidence that refuge chambers would have assisted those who perished at Moura No 2, the proposal is worthy of careful evaluation.

Two further specific issues, proposed in submissions to the Inquiry should also be considered by the group.

One is the introduction of a requirement for all underground mines to have one intake airway that is completely segregated from other parallel intake airways so as to provide two separate means of egress from the mine via an intake airway.

The other is the development and provision of portable equipment capable of rapid deployment to mine sites to bore a large diameter hole from the surface to reach miners trapped below ground.

This would be a means of quickly establishing communication, providing life support and a possible route for emergency recovery of personnel.

The working party should be established immediately and work expeditiously to produce a report to the Chief Inspector of Coal Mines.

The report should make specific recommendations regarding emergency escape facilities for the Chief Inspector of Coal Mines to consider and forward to the Minister for implementation.

5.1.8 Gas Monitoring System Protocols

It is recommended that mines be required to develop and implement protocols for the setting, re-setting, and the noting and acceptance of alarm conditions raised by any gas monitoring system in use at the mine.

There also appears a need for mines to schedule gas monitoring system testing to occur before critical times when the system may be required, such as after sealing an area, and for consideration to be given to making gas alarms readily distinguishable from other alarms.

5.1.9 Sealing Design and Procedures

The Inquiry established that seals were destroyed as a result of one or other of the explosions at Moura No 2 which gives rise to important questions on the adequacy of current designs of seals and sealing practices.

Existing legislation requires that permanent seals be able to withstand a pressure of 345 kPa and, in the case of mines with seams liable to spontaneous combustion, be capable of being erected in three hours.

These requirements of the legislation in force at the time were not satisfied at Moura No 2 and it is almost certain that two of the 512 Panel seals were still soft at the time of the first explosion.

The Inquiry believes further that it is necessary to set minimum standards and requirements for the design, installation and maintenance of seals and for the maintenance, control and management of sealed areas and as a results recommended that:

- The Chief Inspector of Coal Mines should determine and then apply requirements appropriate for the design and installation of seals and for their long term stability.
- Regular inspection and periodic auditing on the long term performance of seals and sealed areas.

The Inquiry panel recommends that it be a requirement that no part of a mine be sealed without the prior written approval of the District Inspector of Mines.

5.1.10 Withdrawal of Persons

The Inquiry recommended that mines be required to develop and implement protocols for the withdrawal of persons when conditions warrant such action.

It also recommended that the Chief Inspector of Coal Mines convene an appropriate industry working party to develop guidelines for the development of protocols for the withdrawal of persons.

5.1.11 Inertisation

It is recommended that the research which has been previously undertaken by the committee which was instigated as a result of the Moura 1986 Inquiry be evaluated as soon as possible by representatives from the Inspectorate, Miner's Union, and Coal Operators, in order to determine the most appropriate method of inertisation for Queensland coal mines.

It also recommended that funds to be made available through the Queensland Government in order to obtain such a system and equipment for the inertisation of a coal mine or parts of a mine with appropriately trained people and operating systems. This equipment should be maintained and operated by the Queensland Mines Rescue Service in a central location such that it can service all the mines in Queensland on a fee for service basis.

5.1.12 Research into Spontaneous Combustion

The Inquiry Panel recommended that funds be made immediately available to undertake an exhaustive international literature and data search to critically review the literature and data and to prepare a comprehensive state-of-the-art report on the subject of spontaneous combustion in coal mines.

The investigation should include the collection and analysis of the available international information on field experiences with notable spontaneous combustion events in mines on the circumstances of the occurrences and of the actions taken.

5.1.13 Panel Design

As we now know, the factors considered and taken account of in the design of 512 Panel and its extraction were lamentably inadequate.

It is recommended, therefore, that it be made a requirement of Part 60 (Second Working Extraction) submissions that spontaneous combustion be specifically included as a factor to be considered and evaluated.

5.1.14 Mine Surface Facilities

The layout of mine entries relative to surface installations could impede or prevent emergency procedures in the aftermath of a disaster. Layouts for new mines should take this potential into account and be subject to the approval of the Chief Inspector of Coal Mines. Copies of the plan should be provided to the Chief Inspector of Coal Mines and lodged with the mines rescue brigade and local police station.

It is also recommended that both new and existing mines make provision for the rapid sealing of the mine from the surface through the installation of an air lock facility in at least one of the mine intakes for ready access to re-enter the mine.

The plan should also indicate the location of any surface boreholes that may facilitate the monitoring of the underground atmosphere.

5.1.16 Literature and Other Training Support

The Inquiry has formed the view that the present status of the literature and other learning aids on spontaneous combustion and access to them by mining officials, mineworkers, trainees and mining students needs to be addressed.

The Panel recommended that as part of their safety training facilities, coal mines establish a reserved area accommodating a basic library of safety literature and other learning materials available for mine officials and mineworkers to consult at any time.

The Inquiry believed that a thorough academic grounding on the subject of spontaneous combustion is an essential educational pre-requisite for statutory qualifications as manager, undermanager and deputy in coal mining.

The Panel recommended that to be accredited as satisfying the academic pre-requisites for the granting of Managers, Undermanagers, and Deputy's Certificates of competency in coal mining, all courses of instruction be required to include adequate instruction on spontaneous combustion, using appropriate supporting literature, case study material and other learning aids.

The Panel recommended that the industry should support and be supported by a well established and developing body of technical literature and technology transfer capability.

It is in this context that the panel urges the Australian coal industry to consider reintroducing the financial support needed for the production and national distribution of a high quality journal devoted to the regular publication of technical and scientific papers and notes on coal mining matters including safety.

It should, furthermore, look favourably on supporting the wider distribution of important learning materials generated from selected safety workshops or specialised safety courses.

5.1.16 Future Inquiries

The Mining Inquiry was conducted over a considerably long period and this has both cost and social impacts and as a result the panel recommends that the Act be amended to enable either proxy or alternative members to fill temporary or permanent positions on the panel or for an Inquiry to continue with a reduced number of panel members.

6.0 Additional Comments

The Reviewers made a number of general comments which were based on the evidence gleaned from the Mining Inquiry and from submissions made to the Panel by the stakeholders. The comments that were made covered a wide range of subjects but because the subject matter was to a large degree beyond the Scope of the Inquiry's Terms of Reference which is primarily, to determine the Nature and Cause of the Incident and to make Recommendations that if implemented would reduce the likelihood of a similar incident occurring.
The additional comments and observations included:

- Legislation: Duty of Care concept; Statutory Positions; Retention of Statutory Hierarchy; Introduction of Self Regulation; Standardisation of Legislation between States.
- Remote sensing and Exploration: Development of a Remote Controlled Vehicle.
- Mines Rescue: Role of Training; Adequate Resources and Training Aids; Rescue service to be included in relevant Risk Assessments; Maintenance of Mine Plans including Borehole Locations; External Review of Disaster Control arrangements.
- Mine Re-Entry: Non recovery of victims is not acceptable; Risks verses Benefits of Re-entry to be evaluated; Obligation of mine operators to take all possible steps to recover victims and to gain whatever evidence that may be available to prevent a recurrence.
- Methane Drainage Installations: Design and Installation of Gas Drainage Systems to minimise damage and to prevent airway contamination in the event of an explosion.
- Gas Detection Equipment: Improvement in the Design, Function and Accuracy of Instruments.
- The Inspectorate: Role and Resourcing of the Inspectorate.
- Role of SIMTARS: Gas Chromatography; Detection and diagnosis of spontaneous combustion; Gas Interpretation; Trigger Level Identification; CO Make and Grahams Ratio.
- Maintenance of up to date Knowledge: Regular exchange of information and research with overseas experts.

7.0 Coroners Findings

In this particular Inquiry, the Mining Warden also acted as the Coroner and as such, he sat alone under the provisions of Section 24 of the Coroners Act 1958, and conducted an inquest into the death of the 11 persons who were trapped by the explosion.

Mr Windridge acting in the role of the Coroner delivered a separate Report.

Section 24 (1) of the Coroners Act 1958 sets out the scope of an Inquest into the death of a person or persons and the most relevant clauses of this section may be summarised as establishing so far as is practicable:

- The fact that a person or persons had died,
- The identify of the deceased person or persons,
- When, where and how death occurred,
- The person or persons (if any) who are to be charged with murder or manslaughter or any other offence contained within section 311 of the Criminal Code.

The Coroner was fairly critical of the Department of Minerals and Energy and the perceived lack of support and resources provided to the Inspectorate over a period of years.

Concern was expressed over the quality of the Investigation process and the taking of Statements from witnesses which were not electronically recorded and collected in such a manner that it would not be possible to rely on such Statements for prosecution purposes if it was considered that there was evidence of a serious criminal offence.

It was recommended that the entire system of accident investigation be overhauled and that if the Inspectorate was to continue its investigative role then further training was urgently required. It was further recommended that the Police take a more active role in the investigation of fatal accidents at least to a stage where they are satisfied that there is no evidence or insufficient evidence to support a criminal charge.

Based on the available evidence no person was committed for trial.

8.0 Discussion on Negligence vs. Neglect

The ultimate cause of the Incident was ‘management neglect’ as stated in:
(Windridge F, 1996, Report on an Accident at Moura No.2 Underground Mine. p.41)

> ‘It is the opinion of the Inquiry that events at Moura surrounding assumptions as to the state of knowledge of the night shift on 7 August, and the safety of those at the mine, represent a passage of management neglect and non-decision which must never be repeated in the coal mining industry. Mineworkers place their trust in management and have the right to expect management to take responsible decisions in respect to their safety. They also have the right to expect management to keep them informed on any matter likely to affect their safety and welfare.

> It is regrettable that the air of caution, arising out of uncertainty, which was exhibited at the mine in order to bring forward the sealing of 512 Panel did not extend to the general safety and welfare of the workforce and, in particular, to informing and keeping persons out of the mine for a time subsequent to that sealing.'

Management neglect suggests an organisational type failure where the Mining Inquiry Reviewers Panel found that the management team paid no attention to; disregarded or were remiss in the care for or treatment of a particular event or series of events.

On the other hand negligence infers that an individual is guilty of being negligent and it needs to be clearly understood that the purpose and scope of a Mining Inquiry is to ascertain the Nature and Cause of the Incident and to make Recommendations that will prevent or reduce the likelihood of a recurrence and not a apportion Blame.

It is up to the Coroner or the Police after considering all of the available and duly collected evidence to be satisfied that the evidence disclosed wilful reckless negligence and that an individual or individuals or an organisation is culpable.

Based on the available evidence, the Coroner was not satisfied that this was the case and it is this finding that has left many Moura residents and some of the next of kin with the perception that justice had not been done.

9.0 Mining Inquiry Outcome

Following the release of the Moura No2 Findings and Recommendations, the Minister for Mines supported by the Government of the day made a commitment to implement all of the Recommendations in their totality. This was a very brave step but one which was made nevertheless.

As a direct result of the Mining Inquiry the Department of Minerals and Energy established an Implementation Committee to oversee the development and implementation of the Moura Recommendations and the Chief Inspector of Coal Mines established a number of Task Groups to review the Recommendations and to report back with the action to be taken.

This phase of the Report has been constrained by the fact that despite the author's best endeavours, Final Copies of the Task Group Reports have not been located and to the best of my knowledge the completed Reports are not available. We did manage to locate and compile over 600 pages of Notes, Minutes of Meetings and a number of partially completed Draft Reports but the whereabouts of the final completed Reports is not known.

This is a matter of grave concern considering the impact that the Task Group Findings has had on the Industry, the time and effort expended by the Task Group members and the overall costs involved. There can be no doubt that the victims and their families deserve better.

9.1 Task Group 1

This Task Group was charged with the responsibility for developing guidelines for a Spontaneous Combustion Management Plan and the development of a guideline for Mine Safety Management Pans for the key risks of:

- Ventilation
- Spontaneous Combustion
- Gas Management
- Methane Drainage
- Emergency Evacuation
- Strata Control

Hazard Management Plans and the Mine Safety Management Plans were to be based on effective risk and hazard analysis systems.

9.2 Task Group 2

The Terms of Reference for this working party included the responsibility for the development of guidelines for Protocols governing the Withdrawal of Person; Protocols governing the Re-entry of a Mine or part of a mine and the Conduct of Emergency Procedures and Exercises. Included in this groups deliberations Protocols for the notification of and approval prior to sealing a mine or part of the mine.

9.3 Task Group 3

Task Group 3 was charged with the responsibility for the development of protocols governing the Training of coalmine workers in hazard awareness, spontaneous combustion, risk management, communication and emergency procedures.

This working party selected the competency requirements for the statutory functions of Manager, Undermanager, Deputy and Ventilation Officer and the rules governing the refresher training that would ensure that the holders of statutory positions demonstrated their fitness to retain their certificates of competency on a regular basis. Refresher training was to be conducted at least once every 5 years.

9.4 Task Group 4

This specialist working party focused on the identification and selection of Self Rescue Breathing Apparatus and guidelines for the industry covering life support for escape and Emergency Escape Facilities. As a minimum the Terms of Reference included responsibility for the development of guidelines that;

- Effectively address the use of alternatives to the Filter Type self rescuer
- Adopt the best available technology and practices
- Not to consider self rescuers in isolation but rather as part of an overall escape strategy including segregated airways, designated escapeways and refuge chambers
- Design criteria and protocols for emergency escape Facilities including, Transport, Large Diameter Boreholes and Communication options.
- Training for persons working in Inert atmospheres

9.5 Task Group 5

Task Group 5 focused on the Design, Installation and Maintenance of Seals and Ventilation Control Devices including the provision for the rapid sealing of a mine when conditions warrant such action.

This working part was also charged with the responsibility for continuing the work commenced after the Moura No 4 Explosions regarding the identification and selection of effective inertisation systems and protocols for use in Queensland mines.

10.0 Conclusions and where are we now?

There is no doubt that there have been enormous changes in the way the industry conducts coal mining operations.

The legislation has changed from the predominately prescriptive rules of the past to a much more flexible self regulatory, risk based system which has a number of advantages but like all relatively new systems a number of shortcomings have been recognised.

The present status of our industry may be best explained in the following table:

Key Issue	Strengths	Improvement Opportunities
Principal Hazard Management Plans	▪ Site specific ▪ Hazard specific ▪ Based on Risk assessment ▪ Formalised Controls ▪ Contain essential elements that persons must know	▪ Remove irrelevant information ▪ Train coalmine workers in the worth and use of PHMP's ▪ Conduct Systems rather than Compliance Audit to determine the effectiveness of the Plan rather than establishing that a Plan is in place ▪ Standardise Risk Management practices in accordance with the Minerals Industry Risk Management Guidelines ▪ If a hazard exists at a mine then documented ways of working should be developed and implemented in accordance with Regulation 10 ▪ If this is the case then this should be made very clear to the industry because at the present time there is a belief that RA's are only required for SOP's and PHMP's ▪ Standardise the conduct of formal Risk Assessments in accordance with Recognised Standard 02 ▪ Clarify the definition of SOP's and remove the confusion surrounding Prescribed or Mandatory SOP's vs. SWI's; SWP's; SWG's; and many other work standards that have not been developed in accordance with best practice
Safety Management Systems or Plans	▪ Contain the Essential Elements for achieving Safe Production	▪ Too many different standards ▪ Very difficult to manage ▪ Non Standardisation leads to confusion, especially for Contractors and Service Providers ▪ Conduct Systems Audit rather than Compliance Audits ▪ Training for mineworkers as they do not know or understand their obligations under the site's SHMS.

Key Issue	Strengths	Improvement Opportunities
Withdrawal of Persons and Emergency Exercises	▪ Protocols for the establishment of Trigger Levels are robust ▪ Most mines have effective Emergency Preparedness and Response Plans ▪ Level 1 Emergency Exercises are conducted on an annually for one mine on a rotational basis	▪ More focus should be given to Desk Top Exercises ▪ Individual crews could be Challenge Tested more frequently ▪ Contractors are fully aware of or conversant with the site's Emergency Procedures ▪ The outcome of the Level 1 exercises has been generally fairly poor and it has been stated that it is likely that less than 20 percent of underground workers would survive a real Incident similar to a Moura # 2 event. This is unacceptable
Training and Communication	▪ Availability of Competency Based Training Standards for all Qualifications ▪ Communication processes reasonably robust at most mines	▪ Develop and Implement a Recognised Standard for Mine Training Schemes because at the present time it has been left to individual SSE to determine what training is needed or necessary for each site. ▪ As the SSE changes, so does the site Rules because being individuals we all have our different perspective on what is required verses what is necessary to meet the needs. ▪ Clearly define the term Competence and communicate this effectively. ▪ Define and Standardise Competency Based Training and Assessment ▪ Conduct Refresher Training for Mine Managers, Undermanagers and Deputies in accordance with the Regulations and the Moura Recommendations ▪ Re-Instate the position of Undermanager ▪ Remove the position of Coordinator and persons who are not qualified or competent to the standard required to Implement Hazard Management Plans ▪ Outlaw the Position of Coordinator and Production Supervisors or Superintendents who believe or who have been told that they have no statutory duties and that their primary duties are Production orientated ▪ We now have numerous persons classified as Supervisors who it is claimed do not give instructions under the mines Safety Management System and therefore have No Statutory Duties.

Key Issue	Strengths	Improvement Opportunities
		This is much worse than the days of the Overman because at least this person held a deputies Certificate (a step back of almost 30 years) ▪ Train the Inspectorate in effective Accident Investigation Techniques with formal qualifications or hand over this role to professional Investigators ▪ Retrain Mine Managers to the Advanced Diploma Level which is the minimum Competency required to Establish site specific Hazard Management Plans ▪ Complete most of this before March 2006 because this is when the 5 year Refresher Training window for Mine Officials officially expires. ▪ Clarify sections 82 and 84 of the Coal Mining Safety and Heath Regulations 2001 with respect to RPL and RCC. ▪ The question that needs to be answered is does the RPL process satisfy the requirement for Refresher Training?
Self Escape of Persons and Emergency Escape Facilities	▪ The Filter Type Self Rescuers have been replace with oxygen based self rescuers ▪ Self Rescuer Caches are strategically located through most mines ▪ Some mines employ CABA First Response Back-up Systems and Quick fill Stations ▪ Mines have generally segregated airways, with designated Places of Safety, Primary and Secondary Escapeways suitably signposted and effective communication to a central Control Room ▪ Mines Rescue Strategy Development Report is comprehensive and it contains 21 Recommendations	▪ Refuge Chambers have not been generally adopted. ▪ Some 20 years after the need was recognised we still do not demonstrated an effective Emergency Vehicle for remote Sensing and Exploration ▪ Provision for respirable air in mine transports has not been made ▪ The principle of 1st Response and Assisted Escape has not been generally adopted ▪ Self and Assisted Escape Systems should be subjected to Systems audits rather than Compliance audits ▪ This process should apply to the Rescue Service Providers ▪ Not all of the recommendations made by Task Group 4 have been adopted

Key Issue	Strengths	Improvement Opportunities
Inertisation; Seal Design and the Installation of Ventilation Controls Devices	▪ High and Low Flow Inertisation is available for emergency use when or if required. ▪ The standard of Seals and VCD's has improved dramatically ▪ Prescriptive legislation governing the Design Criteria and Testing for Seals and other VCD's are in place ▪ Provision for the injection of Inert Gas using the Gag is available at most mines	▪ A formal Report from Task Group 5 could not be sourced and only the Terms of Reference document was found.

There is little doubt in my mind that there is a very strong 'Culture of Denial' Hopkins, A. (2000) and that some industry leaders, government officials and possibly the odd politician will claim that this is a slanted view of a very important subject.

The facts are that this subject is very close to my heart and it is the waste of human life that is the driving force and my motivation to strive for a proactive approach to risk management.

Unfortunately, it is my belief and the perception of many others associated with our industry that most of what has been achieved and much of what is planned is reactive management. For example; when we direct the industry to erect explosion resistant VCD's and to spend hundreds of thousands of dollars to maintain a mobile Inertisation Unit and Surface Airlocks are we saying that we expect mines to explode but don't be alarmed because never again will we leave bodies entombed in a mine.

This is reactive risk management and the money should be spent on prevention.

When we reduce the height of the bar by removing one complete layer of the old but proven management structure, that is the Undermanager and replace this with production focused supervisors who have been told and in some cases instructed that they have no statutory duties, this is reactive management.

Our industry will shortly face another major challenge and that is the Refresher Training of Managers; Undermanagers (if there are any left) and Deputies as the 5 year window of opportunity will expire in March 2006. To the best of my knowledge very little of the Refresher Training has been completed.

This raises a number of questions with respect to sections 82 and 84 of the Coal Mining Safety and Heath Regulations. Will the bar be lowered again to allow the use the RPL or RCC process in the mine's Training Scheme to deem a person competent to the standard required? How does the RPL or RCC process, which is an assessment tool, satisfy the requirement for Refresher Training? How will a lowering of the bar satisfy the commitment made by the Minister and endorsed by the Industry to fully implement all of the Moura # 2 Recommendations?

11.0 Recommendations

It is clear from the above that there is a need for further work to finalise this Special Project and more importantly to address the shortcomings identified by this Review.

References

Windridge F, (1996). *Report on an Accident at Moura No.2 Underground Mine on Sunday, 7 August, 1994.* Warden's Inquiry, The State of Queensland, Brisbane.

Windridge F. (1996). Coroners Report – Moura No. 2 Fatal Inquiry.

Hopkins. A., (1999). Managing Major Hazards; The lessons of the Moura Mine Disaster

Hopkins, A., (2000) "A culture of denial: sociological similarities between the Moura and Gretley mine disasters", Journal of Occupational Health and Safety, Vol 16, Issue 1.

NSWMRS, (2001). *Emergency Preparedness and Mines Rescue,* Mines Rescue Board of New South Wales.

Brady J. Paper on Recent Mine Emergencies in Central Queensland 1989

D. Cliff; B. Beamish; and P. Cuddihy; AusIMM Chapter 31 Explosions, Fires and Spontaneous Combustion.

Task Group Draft Reports and personal Notes supplied by a wide range of interested parties in the absence or unavailability of the Formal Task Group Reports