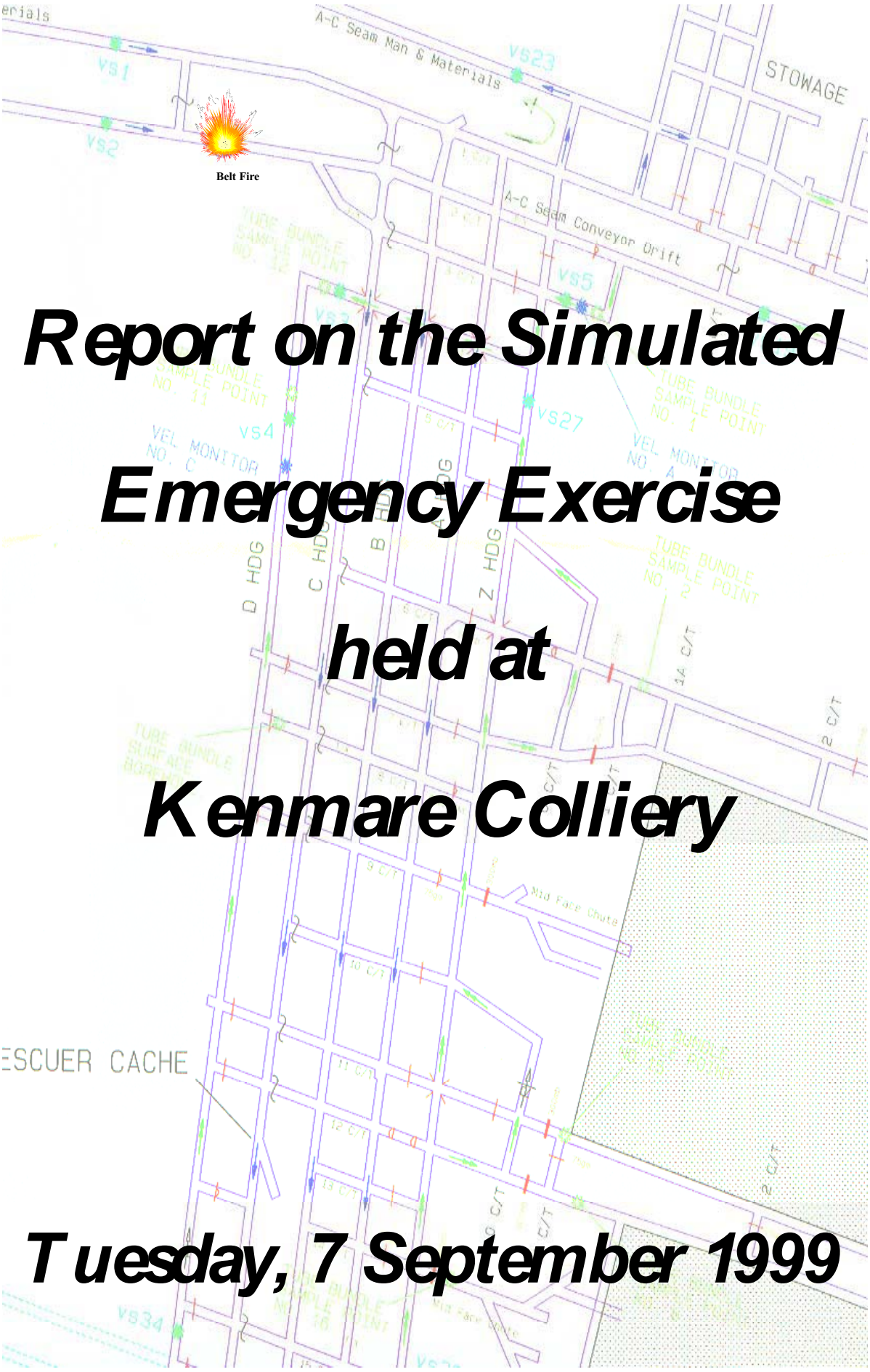

Report on the Simulated Emergency Exercise held at Kenmare Colliery

Tuesday, 7 September 1999

EXECUTIVE SUMMARY

As the second chapter in an ongoing program, the 1999 Level 1 Emergency Exercise at Kenmare focused on some aspects of emergency response not covered in the 1998 exercise. The timing of the exercise was planned so as to engage several different contracting firms planned to be underground at the time, a mid-afternoon initiation facilitated full manning of the Emergency Response Management Team and Duty Card system. A cascading scenario involving a rapidly developing fire allowed for full and extended deployment of mines rescue teams. No ventilation devices were disrupted and the mine's surface and underground communication system remained fully operational. As in the previous exercise, lethal concentrations of carbon monoxide and thick smoke entered the intake airways, requiring the evacuation to be conducted in limited visibility. The correct use of self-rescuers and changeover practices were critical to survival.

One key finding from this year's exercise was again to validate the 'self-escape' philosophy as the best and most viable formula for enhancing the chances of survival of underground personnel. It is apparent that event the best prepared and fully operational Incident Management System can have only limited impact on the survival of persons underground during the first few critical hours following a major event. Survival depends on the training and competence of the persons underground, the maintenance of a well rehearsed emergency evacuation plan, provision of adequate oxygen supplies and escape routes that are easily located and free from hazard.

Although there were a limited number of persons underground at the time of the exercise, the attitude of the crews underground was commendable with all persons treating the exercise as a real event and gaining much valuable experience. The donning, use and changeovers of the oxygen self-rescuers were handled well. It is the view of the Exercise Committee that the use of the same type of units worn by personnel as are stored in the caches greatly assisted.

First response actions to an evacuation order tended toward walking secondary escape ways rather than driving the primary escape way. Perhaps this can be explained by an incorrect perception of an increase in the possibility of an explosion by driving through smoke, or of persons not being sure how to navigate a diesel vehicle in poor visibility. Operators are encouraged to explore this issue at their own mines.

The critical issues of accurate recording and reporting, communication flows, formal de-briefing and the quarantining of vital evidence are issues that operations are again encouraged to address. These issues are dealt with in more detail in the body of this report.

One other important issue arising from this scenario was the disappointing lack of technical expertise and understanding of mine ventilation demonstrated by a number of key players. Smoke issuing from the belt road portal was incorrectly diagnosed as evidence of the reversal of the entire airflow in the belt drift. Decisions subsequent to this false assessment removed most of the viable options available to control the fire, and may, in this event, have resulted in the loss of the mine. Obviously, the saving and preservation of life is paramount for any emergency response, however, a co-ordinated two pronged response of rescue and fire fighting would have considerably reduced the hazards and threats to survival – the primary objective.

Another issue requiring consideration is that of having nose-clips suitable for persons of different ethnic origin. There was no possibility of the nose-clips supplied with the self-rescuers used during this exercise providing an effective seal for some users. Manufacturers, suppliers and operators are urged to address this issue.

The Queensland Mines Rescue Service and its rescue team personnel are to be commended for their efforts and professionalism. An emergency response is not the time to be reviewing operating procedures and protocols, however, in light of the lessons learned during this exercise, a review of some procedures appears justified to ensure their continued compatibility with the self-escape philosophy.

This report contains detailed analysis of these and other significant issues. Included as Appendices are some worthwhile readings, and you are requested to view this report with a critical analysis of its application to your own enterprise.

Finally, I would like to commend the valuable assistance provided by representatives from other mines. Their careful and energetic support ensured all sections of the exercise were comprehensively evaluated. Whilst there is little doubt that the emergency response systems at the mines they represent will benefit from their participation, the planning and conduct of these exercises involves considerable expenditure in resources, not the least of which is time, and I thank those concerned for their efforts. Special mention is made of the efforts of SIMTARS for the work done in developing the computer software program used to generate real time gas monitoring data and to Dr David Cliff for his assistance in the design of the scenario used during this exercise.

GREG ROWAN
Senior Inspector of Mines
Chairman - Emergency Exercise Management Committee

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PLANNING AND CONDUCT OF EXERCISE

Several planning meetings were conducted and a detailed risk assessment process was undertaken during the development of this exercise scenario. The scenario and subsequent events were based on the hazards and risk profile specific to Kenmare mine.

The scenario itself was based on the 1976 Appin Colliery belt road fire. A report of this event is included as Appendix 1. Whilst the scenario at Kenmare was somewhat accelerated to allow the exercise to be completed within a single shift, it is always pertinent to review the experiences of the past.

The mine atmospheric monitoring data was planned to be provided through the mine control room, in real time and in a format to allow for computer assisted analysis and system interrogation. SIMTARS developed a powerful software program capable of providing atmospheric monitoring data in real time and in formats identical to those used at Kenmare. This program has the capability to provide accurate data across a number of PC's on the local network, allows for variations to be made and the generation of monitoring data dependant on any fire fighting controls attempted during the exercise. This software provides another tool for industry in its ongoing program of conducting emergency exercises.

It was anticipated that the exercise would be attached on two simultaneous fronts:

1. Rescue and recovery of missing personnel
2. Fire fighting and control

It was cause of considerable deliberation by the Exercise Committee on how to progress events should the mine's immediate response be to dispatch a fire fighting team to the suspected location of the fire (identified as early as 4:20 pm – 30 minutes after its break out).

It was planned that there would be no constraints placed to prohibit full and extended deployment of the Queensland Mines Rescue Service teams other than those imposed by its internal policies and procedures.

The practice adopted by the Emergency Exercise Management Committee of providing advance notice of the "window" during which an exercise will be conducted is designed to minimise the economic impact on the operation, ensure unnecessary risks are not introduced to the mine and prevent unwarranted distress to the community at large who otherwise may not be fully aware of the simulated nature of the exercise.

In providing this advanced notice, it is expected, and encouraged, that operations focus on preparation and rehearsal for the exercise. This can only enhance the emergency preparedness of a mine. However, the draw-back of inherently placing "expectations" on mine personnel can result in much valuable information being lost if these expectations result in barriers being placed that prevent the exercise from unfolding as a "real" event. Circumstances existed at the time of this exercise that did not allow an assessment of the ability of contractor employees to utilise their training in emergency escape, or evaluate the interaction of contractor management personnel with the mine's Incident Control Team.

Perhaps prior knowledge by the stakeholders that inertisation capability is to be assessed as part of all Level 1 exercises led the Incident Management Team to a specific fire fighting strategy they otherwise would not have employed.

These issues must be considered in the planning stages of future exercises.

In developing the final scenario, research was conducted in several actual event scenarios. One source of research data was a group of Case Studies compiled by Mr Malcolm Smith, currently State Manager of the QMRS. These case studies are reproduced, with permission and grateful acknowledgement, as Appendix II.

In the planning of this exercise, it was necessary to provide an opportunity to demonstrate the ability for an effective inertisation capability. To this end, the GAG inertisation equipment was deployed from the Dysart Mines Rescue Station prior to the exercise being initiated as a provision against transport times.

The deployment times were well within acceptable limits. There were no docking facilities at the portals and the available water supply was found to be inadequate.

GENERAL COMMENTS AND POINTS FOR DISCUSSION

People underground at time of exercise

11 – "C" Seam Longwall Installation (9 permanent, 2 contractors)
7 – "C" Seam Main Gate 2
4 – "A" Seam (3 permanent, 1 contractors)

In total there were 22 people underground at time of exercise (excluding 6 persons sitting in a PJB at the bottom of the supply road drift).

Overall, the evacuation of underground personnel was handled well. There are still some significant trip hazards along the conveyor belt roads. In poor visibility, the smallest obstacle can become a major hazard. One individual could not step down off a 4" pallet – understandable given that it would be akin to stepping off into space and hoping the ground wasn't too far away.

The attitude of the people evacuating underground was commendable with all persons treating it as real.

People continued the practice of ignoring available transport and chose to walk out – normally along belt roads. Does the conveyor structure provide better guidance than the Primary Escape Route – it should not. Perhaps emergency escape routes needs to be re-evaluated to ensure adequacy under circumstances of reduced visibility.

The Incident Management Team, including senior management, treated the exercise as a learning experience and are to be commended.

There needs to be a clearly defined decision making and validation process in place for all decisions – particularly those of the Incident Management Team.

One of the key elements in the scenario was the reporting to the Control Room of smoke issuing from the belt road portal. This information was greeted with a range of responses, few of which captured the true nature of events responsible for this circumstance occurring.

It must be clearly understood that for smoke to issue from the belt road portal, it is only required for the buoyancy effect of the heated air to overcome the increment of the ventilation pressure acting between the portal and the fire site – a fraction of the total mine ventilation pressure. Given the close proximity of the fire site to the portal, the size of the fire and the inclined aspect of the drift, air temperatures need only rise by a few degrees to result in a layer of smoke laden hot air backing up the drift against the lower air flow velocity near the roof. These small changes in temperature would not significantly impact on either the total quantity of intake air moving down the drift, nor the overall mine fan ventilation pressure. Data consistent with these parameters was provided by the assessment team to the Control Room, the Incident Management Team and mines rescue personnel when questioned or measured.

The mistaken belief that smoke issuing from the belt road portal could only occur through the reversal of the entire air flow down the belt road drift had significant impact on possible fire fighting strategies. As a result, no effective fire fighting strategy was employed. Little attempt was made to locate the source of the fire and as a result no hazard control or mitigation could be deployed.

Knowledge and change-overs of self-rescuers was of a high standard. This was aided by having the same type of rescuer in the caches as was normally worn by the workers. The issue of having nose-clips suitable for persons of different ethic origins is one that needs careful consideration. There was no possibility of the nose-clips in the units at Kenmare providing an effective seal for some employees.

The DAC system was severely under-utilised. It was not used to determine the location of persons underground, nor were the attempts by persons underground to signal control without talking recognised as such. One of the few things surface personnel can do to improve the survival rates of those underground is to provide information. The DACs provided an ideal vehicle for the transfer of information and support. It is a most distressing circumstance to be blind, disorientated, surrounded by lethal atmosphere and possibly hours from safety.

Inaccurate communication flows again highlighted the need for a better way of doing things. Runners, verbal exchanges and use of third or forth hand information is fraught with danger and errors were evidenced a number of times during this exercise.

Despite the heroic efforts of persons assigned to record information, hand written notes provide at least four significant opportunities for error:

1. Interpretation of what has been said – often not directed at the note taker and often in unfamiliar technical terms
2. Abbreviation of the interpretation to write it quickly
3. Reinterpretation of the written abbreviation into words without the technical context
4. Time lapse between when it is written and when it is read

At least one of the assigned record keepers was required to maintain three separate logs for more than 6 hours without a single break.

The gas monitoring system was such that it could not provide early warning to the Control Room of a fire outbreak. Smoke entered the working faces before the tube bundles could sample it. Eleven out of twenty sample points are located in goaf.

The full capabilities of the gas monitoring software and computer generated information was not used.

No quarantining of evidence occurred. Vital information was overlooked and evidence destroyed.

Caches need to be clearly marked and easily found. One crew located their cache only when a crewmember tripped over it.

By 4.20pm the Control Room believed the fire to be at the bottom of the main ramp conveyor. By 6.00 pm the Ventilation Officer knew the fire could be nowhere else. This information was not acted upon and may have resulted in the loss of the mine.

SCOPE

To conduct an Emergency Exercise in accordance with the "Guidelines for the Conduct of Emergency Procedures Exercises" as established by the Moura Recommendations Implementation Task Group 2.

These guidelines proposed that exercises:

- Be systematic;
- Be consistent with the concept of mutual assistance from other mines;
- Require direct reference to the risks at the mine;
- Recognised that exercises should not necessarily be held on day shift;
- Be inclusive of external agencies such as QMRS, police, media and senior company officials;
- Have an audit and evaluation process;
- Be subject to risk assessment principles to ensure the exercises do not introduce new safety risks to persons at a mine;
- Require inertisation equipment to be put in place, as well as confirming airlocks and emergency stoppings on the surface are found to be safely accessible and operative.

In recognition of these guidelines:

1. A strategy document was produced establishing the systematic initiation, control and assessment of the exercise;
2. Mines signed to provide mutual assistance were required to supply mines rescue trainees and GAG operators sufficient to meet the exercise minimum needs ie. 14 trainees and 3 GAG operators;
3. A scenario was developed strictly in accordance with the hazards present at Kenmare Colliery;
4. The exercise was conducted on change over from day shift to afternoon shift commencing 7 September 1999;
5. QMRS, police, media, senior company officials, SIMTARS, Department of Mines and Energy, District Union Inspectors, hospitals, ambulances and doctors were involved;
6. Formal audit tools were developed and validated by all members of the Emergency Exercise Management Committee. Formal de-briefings of assessors and Kenmare Colliery personnel were conducted to evaluate the results. This report is the result of the comprehensive audit and evaluation process;
7. Formal risk assessment was conducted at the inaugural meeting of the Emergency Exercise Management Committee held in Emerald on 12 May 1999. This risk assessment covered risks at the mine and risks to the general community;
8. Inertisation equipment was called to site and operated.

All audit and assessment tools were developed against the internal procedures of the agencies involved and in line with accepted practise for systems audits.

OBJECTIVES

The objectives of the exercise were to:

- Ensure no personnel injury, equipment damage or introduction of additional risks. Please note that the design of the emergency exercises must be done using risk assessment methods.
- Test the ability of the current Mine Emergency Procedures Plan, known at Kenmare as SEMS, to meet the desired outcomes of an emergency response.
- Relate to the principle hazards identified as being integral to the mine itself.
- Demonstrate a co-ordinated response, involving Kenmare permanent employees, external contractors and a number of different contracting companies
- Assess any additional training needs.
- Avoid any community alarm / apprehension.
- Enhance the confidence and ability to respond in an emergency.
- Allow for a performance analysis and debrief to occur following the emergency with outcomes recorded and relevant information disseminated to the industry.
- To test the ability of external agencies to respond to an emergency.

To meet this objective, and additional to the steps outlined in the previous section, audit and assessment tools were developed to cover the following functions:

- Emergency Initiation
- Duty Card System
- Incident Management and Emergency Control
- Emergency Evacuation and Debrief
- QMRS – Ability to Respond, Mutual Assistance, GAG, Mandatory Performance Criteria
- External Agencies – ability to respond.

N.B. Some external agencies were involved in the risk assessment process ie. SIMTARS and Police District Disaster Co-ordination Officers.

Media outlets were informed in advance through police and ministerial media advisers. This information was held under embargo by the media until the exercise window opened.

There was wide community awareness of the 'window' for the exercise.

SCENARIO

During a routine belt inspection at approximately 8.00 am on day shift, Friday, 3 September, it was noticed that an accumulated pile of coal under a conveyor return roller had reached open combustion temperature with red hot, glowing material evident. There were wisps of smoke and a slight smell apparent.

The roller was located in the main ramp conveyor drift, approximately 90 metres outbye the ramp conveyor's transfer point with the 'A' seam trunk conveyor in 'C' heading.

The burning material was hosed out and shovelled onto the conveyor. The area was cooled down, the incident reported to the control room and noted in the deputy's statutory report.

A further inspection carried out at approximately 12.30 pm showed no sign of hot or burning material and was reported as such in the deputy's statutory report.

The belts were shut down on Saturday, 4 September 1999 due to a scheduled longwall move, and have not been run since. Regular four hourly inspections have been conducted with no reported problems.

At 4.04 pm on Tuesday, 7 September 1999, the control room is contacted by underground face personnel reporting smoke in both intakes.

By 4.21 pm, the fire site is ablaze with thick smoke entering the intakes to both 'A' and 'C' seams and backing up the conveyor drift itself.

3 September 1999, 8.00 am First inspection	Ventilation: More than adequate Gas: Nil Roof and Sides: Appears secure Other danger: Hot coal under main ramp conveyor – hosed out and cleaned up
The loose coal had been heated for some time (perhaps a few days) by the roller prior to reaching open combustion. The extended duration of this heat source triggered a heating / spontaneous combustion event in the coal in the floor of the drift.	The volume of heated floor coal was quite extensive by the time the loose burning coal was noticed – approximately 1.5 m^3.

3 September 1999, 8.30 am The loose coal was hosed down and loaded out.	The surface of the floor coal was cooled by the cleaning up operation and water entered surface cracks in the floor. The hot coal in the floor is still drawing oxygen through cracks in the surrounding strata, particularly up dip, and is now self-sustaining.
Continued Inspections	▪ No external evidence of combustion. ▪ High ventilation quantities making liberated CO concentration undetectable. ▪ Hot coal mass in the floor now continues to slowly combust. The water has been driven out of the strata and oxygen has free ingress.
6 September 1999, 3.42 pm The combusting coal mass, triggered by the earlier hot roller event, finally breaks through to the surface.	The heated coal mass now has an unlimited oxygen supply and, fanned by the air velocity in the drift, rapidly accelerates into open combustion. Smoke enters the 'A' seam via A, B and C headings. Smoke enters the 'C' seam via the A-C seam conveyor drift and into the man and materials drift through the cut-through opposite Z heading.
4.04 pm Smoke arrives at working faces	Control room contacted and advised by face personnel of smoke entering production panels.
4.11 pm Floor and rib coal now fully ablaze. Conveyor belt begins smouldering.	Buoyancy effect of heated air and smoke generated by the fire temperature, overcomes the incremental mine ventilation pressure and smoke starts backing up the drift.
4.21 pm Conveyor belting now fully burning.	Thick smoke billowing into 'A' and 'C' seam intakes.
5.21 pm Smoke issuing from belt road portal.	

EXERCISE LOG

In the course of the exercise, numerous Event Logs were compiled by the assessment team as well as Kenmare personnel. The following Table is a simplified compilation of the major events provided to assist in understanding the interaction of the various activities and processes unfolding simultaneously.

	EVENT
3 : 43 pm	Exercise Initiation Fire breaks out in main drift conveyor roadway – 90 meters outbye "A" Seam transfer point
3 : 55 pm	Longwall Take-Off Crew (CREW 1) at bottom of Main Ramp Conveyor Drift advised by assessor of smoke entering their workplace
3 : 57 pm	CREW 1 attempt to contact Control by two-way radio – unsuccessful
3 : 58 pm	CREW 1 don self-rescuers - time taken 1minute. Commenced walking out via supply drift
4 : 04 pm	Main Gate 2 Crew (CREW 2) advised by Assessor of smoke entering both intakes – 30ppm CO Deputy contacted control advising of circumstances and his intention to evacuate via belt road
4 : 05 pm	Longwall Installation Crew (CREW 3) advised by Control of smoke in intakes and to investigate
4 : 06 pm	CREW 1 & SBD Contractors (CREW 4) at bottom of supply drift in man carrier. Advised of smoke entering roadway. CREW 4 donned self rescuers (simulated only) abandoned vehicle and walked up supply drift
4 : 07 pm	Gas Monitoring Alarms begin to report to Control Room
4 : 08 pm	CREW 2 commenced evacuation
4 : 09 pm	General Evacuation order given by Control
4 : 10 pm	CREW 3 deputy gathers crew and commences donning self rescuers Advised by control to evacuate via Primary Escapeway
4 : 10 pm	CREW 1 & CREW 4 reach surface. Encountered three persons in 2 man-carriers at Portal entrance (Group 5)
4 : 11 pm	Group 5 advised of smoke issuing from belt road portal who then drive off – leaving CREW 1 & CREW 4 behind at the portal CREW 1 leader advised Control (from portal phone) of smoke issuing from belt road portal
4 : 16 pm	CREW 2 visibility restricted. Deputy attached life-line to crew – 500 ppm CO

	EVENT
4 : 17 pm	CREW 2 encounter 2 outbye employees. Self rescuers donned and joined Crew 2 Attempted contact to Control via DAC without talking – No acknowledgement by control
4 : 18 pm	CREW 3 commence evacuation in PJB via Main Gate Eimco driver travels out via Tail Gate
4 : 19 pm	Shift Controller has opinion fire site is somewhere along Main Ramp Conveyor Drift
4 : 22 pm	Emergency Alarm sounded SEMS log initiated. Call outs commenced
4 : 23 pm	QMRS advised of evacuation and that there was "*a fire at the top of the in-seam conveyor drift"* MAIN FAN STOPPED alarm reporting to control room
4 : 25 pm	Portal Security posted in stone dust shed adjacent to Supply Drift
4 : 27 pm	CREW 1 and CREW 4 reach Control Debrief conducted under blare of Emergency Alarm
4 : 27 pm	CREW 2 reach oxygen cache – units taken but not donned. Second attempt to use DAC to indicate position to Control – No acknowledgement. CO off scale on MiniGas
4 : 28 pm	Control provided briefing to Incident Management Team - unable to account for all persons No mention of probable location of fire site or smoke issuing from belt road portal
4 : 35 pm	CREW 2 arrive at top of "A" – "C" conveyor drift. Don second oxygen self rescuer – time taken 2 minutes Crew member (Lamp No 113) collapsed due to CO poisoning
4 : 36 pm	Ventilation Officer arrives INCIDENT MANAGEMENT TEAM Duty Cards still being handed out
4 : 40 pm	Eimco driver from CREW 3 arrives at portal wearing self-rescuer and carrying spare. Had walked up from "C" seam supply drift where road was blocked by abandoned machinery.
4 : 41 pm	INCIDENT MANAGEMENT TEAM advised that fire was "*probably the diesel fuel bay"* [totally contrary to available information]
4 : 42 pm	CREW 3 drive to 6C/T M/G 1 where road is blocked by abandoned machinery. Continue evacuation on foot via belt road
4 : 43 pm	CREW 2 arrive at fire site. Cannot continue via belt road due to radiant heat. Retreated to 1C/T and continued evacuation via supply road
4 : 46 pm	GAG mobilised by INCIDENT MANAGEMENT TEAM
4 : 51 pm	Incident Recorder takes up station in Control Room to write up record of events – 3 different logs required

	EVENT
4 : 57 pm	CREW 2 arrive on surface. Contacted Control from portal advising of name and location of missing crew member (Lamp No 113)
4 : 58 pm	INCIDENT MANAGEMENT TEAM Notified of missing man (Lamp No 113)
4 : 59 pm	Ventilation officer raises possibility of fire site being in the Main Ramp Conveyor Drift
5 : 01 pm	CREW 3 crew member (Lamp No 58) incapacitated at 7C/T "C" hdg
5 : 04 pm	CREW 2 arrive at Control for de-brief. Deputy is sent for minor first aid treatment and for first 10 minutes, his crew is de-briefed without him.
5 : 08 pm	INCIDENT MANAGEMENT TEAM was advised by Control that no information was available on possible location of fire site
5 : 10 pm	CREW 3 arrive at oxygen cache at bottom of "A" – "C" seam conveyor drift. Fresh units donned. CREW 3 crew member (Lamp No 66) incapacitated at cache
5 : 10 pm	DME Inspectorate arrive on site
5 : 11 pm	QMRS Superintendent arrives on site
5 : 18 pm	Still no confirmation of whether MAIN MINE FANS are running
5 : 19 pm	Full briefing – INCIDENT MANAGEMENT TEAM
5 : 28 pm	Blackwater hospital rang – claimed they where Not informed of the simulated nature of the exercise
5 : 32 pm	District Union Inspector arrives on site
5 : 34 pm	CREW 3 arrive at portal and advise control
5 : 37 pm	CREW 3 arrive at control for debrief – much confusion over exactly where the two people were lost
5 : 40 pm	QMRS Team 1 ready – wont be deployed until there is a CONFIRMED backup team
5 : 49 pm	GAG arrived on site. GAG superintendent in INCIDENT MANAGEMENT TEAM
5 : 52 pm	Final compilation of MISSING PERSONS list and last known location
5 : 56 pm	Confirmation that MAIN MINE FANS are running normally
6 : 00 pm	Missing persons list and last positions reported to INCIDENT MANAGEMENT TEAM
6 : 02 pm	QMRS requested to rescue 2 survivors – assumption made that one (Lamp No 113) was already dead
6 : 16 pm	QMRS Team 1 suiting up
6 : 27 pm	Gas monitoring tube cycling changed to speed up sampling from affected points
6 : 37 pm	INCIDENT MANAGEMENT TEAM briefing on fire fighting options Fire site assumed to be in tail end of ramp conveyor

	EVENT
	Possibility of putting GAG into Man and Materials drift discussed
7 : 00 pm	Incident Management Team advised that QMRS Team 1 had located Lamp No 66 deceased
7 : 14 pm	Incident Management Team advised previous message was confused - Lamp No 66 **NOT** deceased Lamp No's 66 and 58 were unconscious but breathing Lamp No 113 was in fact deceased
7 : 18 pm	QMRS Team 1 bringing out unconscious patient Lamp No 58
7 : 28 pm	Decision made to leave deceased and send 1 team down to recover remaining survivor
7 : 30 pm	Company senior officials to urgently halt notification process to next-of-kin of Lamp No 66
7 : 45 pm	Decision made to deploy QMRS Team 2 deployed
8 : 00 pm	QMRS Team 2 Stopped – No-one to go underground until analysis of smoke issuing from belt road confirmed
8 : 05 pm	QMRS Team 1 reports to first aid room with survivor Lamp No 58
8 : 34 pm	First results of belt road smoke returned
9 : 00 pm	QMRS Team 2 leaves the surface to recover survivor Lamp No 66
10 : 06 pm	Request from QMRS Team 2 – NEED ASSISTANCE TO RECOVER SURVIVOR
10 : 15 pm	QMRS Team 3 went underground in PJB to assist QMRS Team 2 with recovery
10 : 28 pm	Decision to put GAG down Man and Materials drift
10 : 50 pm	QMRS Teams 2 & 3 arrive on surface with survivor Lamp No 66 Deceased still underground
11 : 00 pm	ALL RESCUE TEAMS REPORTED TO CONTROL **EXERCISE TERMINATED** GAG deployment to be continued until engine start up and run
12 : 05 am	GAG ready to run NO DOCKING FACILITIES NO ABILITY TO DUCT EXHAUST INTO EITHER PORTAL
12 : 11am	INSUFFICIENT WATER QUANTITY – Flames issuing from ducting – Shut down

EMERGENCY INITIATION

Assessment Summary

Gas monitoring sample points should enable alarms to be raised in the surface control rooms prior to smoke entering any working face.

In the initiation stages of this exercise, once notified of smoke by phone, it was expected that actions would be initiated to determine the fire site. Information available to the control room gave adequate indications of where the fire could be and the shift controller had made an accurate determination on its location as early as 4.20pm. No-one investigated the matter further and no attempts were made to fight the fire.

Process analysis techniques applied to this circumstance suggests how this could eventuate. Briefly, once the Emergency Management System was initiated, every available person was tied up with the responsibilities allocated to a Duty Card – none of which required, or even allowed for, an investigation to be conducted into the original cause of the emergency.

The ergonomics of the control room were satisfactory, although some of the wall plans attached to the side walls were difficult to access and hence not used.

The control room functioned well throughout the exercise. It is recommended that consideration be given to the installation of automatic recording systems. Hand written notes may, if kept in enough detail, provide data on **what** was done, but rarely can it provide insight into **why** something was done.

The information flows appeared almost exclusively one-way – outwards. The Incident Management Team channelled very little information back into the control room, nor availed themselves of the interpretations put on the information by the Control Room operators.

Assessors Comments – David Cliff

Prior to developing the scenario, all reasonable efforts were made by the team to characterise the monitoring systems in place in the mine, and the ventilation network at the mine. A number of pieces of information supplied were incorrect, inadequate or simply absent. In addition, some of the information supplied was internally inconsistent.

Emergency exercise gas monitoring data was provided through the control room's continuous gas monitoring system. The Control Room Operator was advised of gas readings, sensor readouts and alarms as they would have occurred in line with the incident scenario. The data was presented in real time and in the same format as it would appear on the computer screens. No trending or other interpretative data was provided unless the operator performed the correct keystrokes to obtain that data.

A number of points of focus emerged through this initiation strategy:

1. Initial enquiries to determine the lag times of the tubes installed at Kenmare revealed that only one tube had been tested and the procedure used for establishing that tube's delay was inaccurate.

   Following a request from the incident development team, the delay time for only one tube was provided.

   The incident gas evolution data was thus estimated using the USBM formulae for lag times calibrated against this tube.

   The Australian Standard recommends that tube integrity be checked monthly and this should be done for all tubes and repeated regularly in order to validate the operation of the tube bundle system and identify any problems with the system such as blockages or leaks.

2. The VentSim mine ventilation models supplied were at variance with the mine plans supplied. In some cases, ventilation was shown through solid coal and into stub ends.

3. The incident development team were unable to acquire calibration details of the gas monitoring system or reliable details of the ranges of the sensors.

4. It was difficult to evaluate the effectiveness of the control room's initial response as it was obvious that as soon as we triggered an alarm the whole emergency response plan would be enacted – everybody was "in the blocks". Instigating a series of false alarms may have overcome this, but the emergency response management team decided against this strategy as being counterproductive.

5. The attached observations, comments and recommendations are provided to expand on the detail of these focus points. Please take time to consider them carefully.

Recommendations

1. It is recommended that in future the scenario be created with false alarms and staged introduction to allow for more realistic response from site personnel.

2. To overcome the problems with providing paper based gas monitoring data, an on-line incident simulation was used that emulated the mine monitoring system. This worked exceptionally well. Its full capabilities were not tested by the site response as no attempt was made to fight the fire or control the situation in any way.

This system, developed at SIMTARS and known as the Mine Emergency Monitoring systems (MEMS), allows for modification of the scenario in real time as the incident changes and site personnel attempt to control the situation. These changes can be fed to the Incident Management Team via secure communications. An improvement would be to connect to printers to allow hard copy output.

3. The underground gas concentration data for the incident were displayed graphically in a series of isopleths. This allowed for quick access of concentrations versus location. Again this worked.

4. The gas chromatograph was used for supplementary analysis. The check samples analysed were reported accurately except for the absence of any methane in the analysis despite it being present in percentage levels. This inaccuracy was due to calibration error coupled with inability to recognise the correct peak.

   Where analysis is carried out by more than one method, it should be cross-checked to ensure accuracy and consistency. If high reliance is to be placed on analyses, then all reasonable steps should be taken to ensure accuracy, including calibration and check sample analyses over the range of gas concentrations expected.

5. The use of hands free walkie-talkies to communicate between key surface incident assessment team members worked well.

6. The Kenmare tube bundle system monitors both goaf and ventilated airways. It was not till well into this incident. 6.30 pm, that the sampling regime of the tube bundle was modified to focus on the areas of interest in order to improve the sampling frequency. However, when the order to do this was given it was given to personnel who did not have the computer security clearance to undertake the task.

7. A better understanding of the operation of the tube bundle sampling regime, the capabilities of the software and the computer control system is necessary to optimise the collection of relevant information.

8. Site personnel had to be prompted to use the Gas Chromatograph is order to overcome the “over scale” problems of the tube bundle system.

9. There was initially much confusion over who was missing and when bodies were found and who they were. Ten minutes after a confirmed message that Lamp No. 66 was deceased, it was changed to Lamp No. 113. By this stage, the process to inform next of kin had already commenced.

10. Samples of gas were taken from the portal of the belt drift. These samples were not labelled with the time taken or the location of the sample ie. in the smoke or in the fresh air.

11. Translation of gas concentration data over the phone led to a number of incorrect calls – 30 000 ppm became 3 000 ppm.

12. On a number of occasions during the incident, the actual mine environment monitoring system reported high CO alarms, when in fact that sensor had been disconnected.

13. On several occasions the DAC activated and all that was heard was static. It turns out that personnel wearing SCSR’s had activated the DAC to indicate where they were. Control room personnel were not aware of this informal procedure.

General Comments

- Mine focus seemed to be on evacuation – no attempt was made to control the incident.
- The initial identification of the source of the fire was lost – observation of smoke – this lead to a delay of over an hour in identifying the fire source. The fire type was not identified from the gas concentrations such as Jones–Trickett ratio or Kim ratio.
- Key personnel were not aware of key factors of their system such as response times and analyser ranges.
- The SAFEGAS system is capable of full network availability, up until the day before the incident it was only available in the control room and on the Ventilation Officers computer. It was then installed on the incident management room computer.
- Secretarial assistance in the control room was vital in keeping track of all the incoming and outgoing communications and actions. This person appeared within minutes of the SEMS being triggered – how would this work on night shift?
- It seemed that a number of persons were required to take on differing roles during the incident eg. surface controller – rescue team member – GAG operator; this suggests that more personnel should be trained in these functions, bearing in mind that the incident occurred on day shift on change over to afternoon shift so there was maximum personnel availability.
- The supply of two-way batteries for radios for surface use was insufficient to allow long term use of the sets available. As the incident progressed, a number of radios were returned and could not be reused as the batteries were flat with no charged spares.

Observations from the Exercise

- First phone call from underground at 4:04 pm.
- First gas alarm activated at 4:05 pm
- SEMS initiated at 4:10 pm
- Artificial. As soon as abnormal readings appeared, a full evacuation was ordered – staged with no evaluation.
- Environmental Data Analysis Identification and quantification of incident - use of MEMS to locate and quantify incident. Smoke was reported from the belt drift at 4:11 pm with source of the fire identified in the control room at 4:19 pm, however this information was not actioned on and lost.
- At 17:30, some very basic trending was being carried out including explosibility diagrams. However, most use was made by hand written data collections for trending. The personnel in the control room in analysing tube bundle data did not allow for the lag times in the tubes nor the delay in a gas travelling along roadways to report to a sample location.
- Analysis of the incident log indicates that alarms were typically acknowledged within one minutes of being triggered. No other actions were then initiated. Environmental data communication and related hazards and interaction with Incident Management Team was a one way supply of information to Incident Management Team. IMT did not regularly update the control room on the status of the incident, decisions made or proposed action.

Audit Tools

Incident Initiation / Data Supply: Greg Rowan and David Cliff

					COMMENT
Emergency Control Room Operator	Assess Incident as Presented	Commence Incident Sheet	Time Exercise Commenced Time Incident Sheet Commenced		3.43pm 4.22pm
		Contact with Senior Surface Official Senior U/Ground Official Section LW "A" seam Section LW "C" seam Section MG devel "C"seam Mains devel "C" seam Belt Installation area Outbye Areas	Time Called See Log	Actions Recorded See Log	Too much information to be recorded manually 1 persons heroic efforts could not match need to fill out three separate logs and listen and interpret for 7hours without a single break
	Initiate Underground Evacuation		Advise of Routes of Travel Question Transport Available Question Conditions Encountered		1 crew only Not done Not done
		Initiate Emergency Alarms	Sirens Broadcast Dac's		Yes Only at start – NO ATTEMPT TO BROADCAST INFO OVER DAC's TO PERSONS WHO MAY BE EVACUATING
	Activate Call Out Procedure	Contact with Mine Manager	Record of Actions		Yes

				COMMENT
Duty Cards 1 and 1A	**Establish contact with Senior Official on Site Duty Card 1**		Record of Actions	Yes
	Appoint Lamp Room attendant to establish how many are missing			Yes
	Follow Duty Card 1A			Yes
	Contact and communicate clearly as required of Duty Card 1A			Communication was only one-way
Emergency Control Room Operator (cont.)	Gather and Record Information		Record of Actions	No record of decision making processes
	Report on Results of Communications with Underground Sections		Inform Site Senior Official of results of communication	Communication breakdowns evident as incident progressed. No information leads to guesswork which leads to independent actions
	Gather Relevant Data	Distribute Data		Average
	Continue Collection and Dissemination of Gas Readings			Average

DUTY CARDS

Assessment Summary

Duty Cards were used as the primary control mechanism supporting the emergency response management system.

The Duty Cards provided invaluable support to the incident management, although their inherent shortcomings were again evident. Duty Cards do not and can not:

1. prioritise
2. set objectives
3. nor reflect the decision-making processes and dynamic changes to circumstance involved in any emergency scenario

With full management personnel available, a comprehensive evaluation of the completed duty card logs following the exercise indicated that a number of duty cards were not issued.

The following assessors comments provide compelling reading, together with the analysis of completed duty cards. In addition to the assessor's comments, the complete audit tools evaluating the SEMS Support Team and Duty Card 2, the Incident Controller, are included.

As mentioned previously, it would appear that personnel engaged in complying with the responsibilities of their issued duty cards were prevented from initiating actions which may have mitigated and prevented on-going deterioration of circumstances. Duty cards and emergency management systems must provide for the thought processes and decisions making capabilities of competent and experienced personnel. They must be flexible enough to allow for contingencies not forecast and for rapid control actions to be formulated and implemented. This fire may have been brought under control well before lethal concentrations of carbon monoxide were generated had the shift controller's initial desire to dispatch a fire fighting team been acted on.

Assessor Comments - Gavin Taylor

The Duty Cards assigned for this observation consisted of:

- Duty Card 3 – Technical Officer
- Duty Card 19 – Support Team Controller
- Duty Card 20 – Technical Support
- Duty Card 21 – Administration Support
- Duty Card 22 – Environmental Support

Immediately following the emergency, which was declared at 4.04 pm, I observed the activation of DC1A at 4.13 pm. I decided to observe this Duty Card until such time as the first of my assigned Duty Cards were activated.

DC1A, on collection of this Duty Card, retired to a quiet office with a phone and commenced contacting personnel and organisations in strict rotation as decreed by the Duty Card. Those persons and organisations were as follows:

		Time Contacted
Gary Evans	Incident Controller	4.14 pm
Bruce Muir	Dayshift Co-ordintor	4.14 pm
Keith Falconer	Technical Officer (DC3)	4.15 pm
Norm Marshall	Relief Technical Officer	No response
Lester Anderson	QMRS	4.17 pm

At this point I notified John Rowe, Assessor, that DC1A was commencing to contact rescue members and he may wish to observe, as I wanted to ensure I picked up DC3 as soon as he activated his Duty Card.

Garry Bailey, during my observation, completely enacted the duties required of Duty Card 1A.

Duty Card No. 3

Mine Manager – Laleham Colliery, was assigned DC3 as per the SEMS. He was contacted by DC1A at 4.15 pm and arrived in the lamp cabin at Kenmare at 4.22 pm to collect his card. It is my contention that this DC, as with many others, were on standby for the emergency exercise and it would have been more beneficial to all concerned had more realistic response times been observed and analysed.

DC3 reported to the Incident Controller in the incident management room at 4.24 pm.

According to the SEMS, on which the audit was formulated, DC3 Technical Officer was to brief DC19 Support Team Controller on the current status and what support the Incident Management Team required or deemed necessary. This did not occur and never at any time did DC3 have direct contact with DC19.

This is not stated as criticism, merely as an objective observation on the SEMS. Duty Card holders did not always follow the requirements of the cards and one wonders what would occur in a real emergency if the personnel carrying out the duties were not as competent, substitutes or replacements and had not rehearsed as well or had not been involved in an exercise for a period of time.

DC3 on arriving in the incident management room, immediately reported to the Incident Controller. DC3 assisted the Incident Controller in the initial minutes of the incident to good effect, and his technical knowledge appeared to assist.

It became very obvious early in the exercise that DC3 was not going to leave the incident management room and that the SEMS identified interface with DC19, and that the support team was not going to occur. Therefore, I attempted to locate DC19, which was being fulfilled by Human Resources Manager for South Blackwater Coal Limited.

As DC3 was to remain in the incident management room, and there were two assessors assigned in this area, I decided to concentrate on other areas where there were lesser numbers of assessors.

Some observations of personnel and events within the incident management room from my initial time with DC3 and as the exercise progressed when DC19 had occasion to interface with the incident management room:

There was some confusion in the early stages as to whether the Ventilation Officer had been contacted. Much of this has to do with the fact that DC3 had not talked to DC19. As a suggestion I would seriously consider the responsibility for calling out the Ventilation Officer being placed with DC1A, DC3 or the Incident Controller. The Ventilation Officer is a key member of the Incident Management Team, and it is vital he is called and called early.

At 4.58 pm, the Ventilation Officer informed the Incident Controller, based on hard fact, the cause of the smoke and carbon monoxide readings and the location of the fire. The Ventilation Officer was virtually ignored.

It took a long time, almost an hour, before the Incident Management Team awoke to the fact that people that had safely evacuated the mine could provide objective evidence and detail of the status below ground.

When detail was forthcoming from personnel who had evacuated the mine, it was not recorded in the incident management room and sketches were not retained. Much was lost in this manner.

The changeover of Duty Cards was not achieved without confusion. At one stage the Relief Incident Controller's position was to be changed out and three different people were nominated from different quarters.

The whole situation in the incident management room was surreal. There were people in danger below ground and there was no sense of urgency and no firm and hard decisions being made.

Duty Card No. 19

Having decided to leave DC3 with the Incident Management Team, it took some time to locate DC19 – Support Team Controller. When located he was found de-briefing three persons with knowledge of the drift bottom area.

On receiving the callout procedures and the activation of Duty Cards, both his own and those cascading from his, the following was established:

Phone call received from DC1A at 4.25 pm

At 4.30 pm, contact was made with the Relief Incident Controller who provided a briefing as to the current status.

Again, either fortune was smiling or people were on standby, as it only took DC19 five minutes from receiving the call to arrival at the Kenmare Control Room for a briefing.
The following Duty Cards were activated by DC19:

- DC20 – Technical Support Team at 4.50 pm

- DC21 – Administrative Support Team at 4.47 pm
- DC22 – Environment Team at 4.50 pm.
- DC23 – Ventilation Officer was activated at 4.33 pm according to DC19. However, he appeared in the incident management room at almost the same time.

Throughout the period of the exercise, DC19 operated in a thoroughly professional and competent manner, ensuring all personnel that were responsible to him were kept fully informed and updated at regular intervals. His dissemination of information gained, to those responsible for the incident, was accurate and timely.

Apart from the fact that the SEMS, on which we were auditing was not followed, there was only one incident which marred an otherwise competent performance, that being incorrect information on casualties being released from site. Extremely comprehensive records and notes were kept by DC19, and I do not propose to reproduce these in this report, save for the one incident as mentioned above.

At 7.03 pm, DC6 – Senior Company Official (General Manager, South Blackwater Coal Limited) informed DC19 that the Incident Management Team had been informed of a fatality. DC19 then gained personnel details of the deceased person whose Christian name was given incorrectly.

At 7.07 pm, DC19 provided details of the deceased and a decision was made that as the deceased's next of kin lived in New South Wales, the deceased living in the single persons quarters, his wife in New South Wales, that information should go via Centacare and the police to the wife. The concern was that any delay may see the media gaining knowledge and the next of kin being informed through non-official sources. DC19 and DC6 went through the motions but no information left site as agreed, as this was an exercise.

At 7.20 pm, DC19 spoke with the "Casualty Controller" with respect to a morgue and handling of the deceased's body once recovered from underground.

At 7.32 pm, DC19 informed DC6 that a mistake had been made in the identification of casualties (it was later learned that someone had transposed lamp numbers). Another employee was in fact deceased and the previously identified casualty was unconscious, but alive.

Although this was only an exercise and no person was contacted external to the exercise, this incident was particularly sobering for those involved.

Throughout the exercise, DC19 was in constant contact with DC6 but at no time was the "Support Team" assembled as decreed in the SEMS.

Duty Card No. 20

DC20 was activated when he was briefed by DC19 at 4.50 pm, following a short briefing. At 5.00 pm, DC20 spoke with a person in Blackwater who was placed on standby as a relief Ventilation Officer. This is somewhat confusing as after discussions later in the exercise, the indication was that this person did not have the knowledge of the ventilation programs to act in this capability.

At 5.15 pm, DC20 dispatched a graduate engineer to the gas shed and the gas chromatograph to be on standby to run gas samples. He was to relieve a person who was required for the rescue team. This is a conundrum I could not resolve, who activated DC3. DC19 and DC20 did not, and they, under SEMS, are designated the authority to activate technical back up.
At 6.00 pm, DC19 requested DC20 to come to Kenmare from the SBCL office to relieve the Relief Incident Controller who would form part of the rescuer team. At about the same time, DC3 was requesting the Relief Technical Officer to carry out the same duty. There should be some clear definition as to who appoints relief DC's and the person to fulfil the responsibility.

From 6.00 pm until 6.45 pm, DC20 was in the incident management room when the SEMS states he should have been with the support team. At 6.45 pm, the Incident Controller requested he assist QMRS in setting up the GAG.

Duty Card No. 21

DC21 – Administrative Support Team was activated at 4.47 pm.

This Duty Card arranged secretarial support for the Incident Management Team and the control room, in addition to ensuring food was provided to those involved in the exercise. This Duty Card appeared to work well.

DC19 ensured DC22 was kept informed of the status of the exercise.

Duty Card No. 6

Although I was not assigned as an assessor for DC6, at various times throughout the exercise this Duty Card was involved in numerous ancillary decisions. At all times this role was supportive and mindful of the time people were under stress to ensure clear heads and objective decision making.

GENERAL OBSERVATIONS

- The exercise largely lost the perceived learnings and benefits to the mine and the industry as a whole, as the vast majority of anticipated contractors were not at the mine.
- It was clearly obvious the mine and personnel were more than aware of not only the exact day of the exercise but also the approximate time. Part of the learning for the mine would have been how quickly and the problems encountered in bringing together the Incident Management Team and personnel to adequately dealt with an emergency. Again, this opportunity was lost and I would contend Kenmare learned nothing with personnel hanging around in close proximity waiting for a call.
- The situation in the Incident Management Room was surreal. There were people in danger below ground, it is not a time to pontificate. Decisions need to be made and made quickly when facts are known.
- Exact and lengthy notes were taken, these were not collated or analysed.
- Word of mouth messages at times lost accuracy.
- DC19, Support Team Controller performed well throughout the exercise. His communications were accurate and regular to ensure all personnel responsible to him were well informed of the status of the exercise.
- This was also true of DC6.
- With contractors having different lamp room locations, perceived problems are possible in identifying whether people are underground or have evacuated safely.
- As the only personnel at SBCL who had knowledge and competency within the ventilation programs, David Boyd and John Grieves, were actively involved during the exercise, if the exercise had continued there was no other person available to provide technical knowledge on ventilation systems.

KEY LEARNING

Ensure that there is no doubt whatsoever about the identity of casualties prior to the release of information to outside parties.

Review and Evaluation - SEMS Duty Cards

Duty Card No. 1: First Aid Attendant / Control Room Officer

Duration of Log: 4.21 pm to 6.54 pm

Responsibility: "Notifying the Senior Mine Official on Site" – called Gary Evans at 4.48 pm

Appoints: Contact Person – DC1A – no mention of appointment in log or of who was appointed.

- Senior Mine Official – log states Gary Evans called at 4.48 pm.
- Persons to assist in communications – no mention of these appointments in log.
- Nominate someone to follow direction on Duty Card 1A: no mention in log of OCE being contacted; no mention in log of Kenmare person being contacted; no mention in log of Open-cut person being contacted.
- Ensure sufficient first aid response is mobilised: no mention in log of first aides names nor of those in attendance; no first aid facilities relocated to FAB; witnessed sufficient coverage in first aid room (next to mines rescue sub)
- With log having last entry at 6.54 pm and exercise being terminated at 10.58 pm it is difficult to state whether the following occurred: Point 7, Point 8 and Point 10 ie. Stand Down Steps.
- No signature indicating receipt of duty cards.
- No incident sheet filled out as per attachment to Duty Card 1.

Duty Card No. 1A

- No record of incumbent of this card.
- No record of who was issued with Duty Cards 10, 7, 3, 5, 19 as required.
- Phone numbers for police, ambulance were changed on Duty Cards but no dates or times recorded for when this was done.
- Time of callouts of police, Blackwater hospital and ambulance recorded, but no record of results of calls.
- List of people contacted included, but no other details.

Duty Card No. 3

- No name recorded on card to identity incumbent.
- No clues as to who card was issued to.
- No record with card Duty Card 1A as to who card was issued to.
- Last entry on log was at 6.45 pm, except note of stand down at 11.02 pm.
- No specific record of contact with Duty Card 20 and Duty Card 23 as required by Duty Card 3.
- At 4.47 pm it mentions contacting "rescue" to mobilise GAG.
- Some records of monitoring results.

Duty Card No. 4: Relief Controller

- 3 separate Duty Card Holders were assigned this card between 4.25 pm and 9.53 pm.
- One holder was fullfilling DC 4, DC 22 and DC 20 simultaneously
- The Relief Controller arrived at the Control Room at 4.15 pm and SEMS was initiated.
- At 4.18 pm the incident siren sounded
- At 4.25 pm the Relief Controller took Duty Card No. 4
- From 4.38 pm till 4.50 pm Duty Cards 19 to 23 inclusive were issued and names and time of issue was logged.
- No other log of duty cards issued was found in Relief Controllers log. This was his responsibility to perform.
- The Relief Controller's task (using old duty card) was to call out IMT members. No log of this is available, but IMT members appeared in IMT room, the Laleham mine manager acting as Technical Officer arrived two minutes after incident initiation (no notification recorded).
- Relief Controller did not look at potential for exercise to last more than 12 hours (even after GAG was called out). The purpose of the Relief Controller in the Duty Card is to be able to come back and relieve for Incident Controller.

Duty Card No. 6: General Manager

- Name of Duty Card holder not recorded
- Information recorded was vague
- No indication of where the information was coming from
- Press release was completed, however, no record of it being released or when – confirmation of action not recorded.

Duty Card No. 7: Mines Rescue Controller

Duty Card No. 8: Mines Rescue Surface Controller

Duty Card No. 9: Mines Rescue Fresh Air Base Controller

No mention of issuing authorisations for Mines Rescue persons to go underground.

***Question:* Do Mines Rescue Persons or Teams need to have authorisation to go underground, if so, who gives this authorisation?; who manages the log of persons underground?; including mines rescue personnel.**

Duty Card No. 10: Shift Controller

- This folder contained the following documents:
- SEMS call out telephone lists
- Attachment I – Authorisation to proceed underground (identified 15 authorisations, no log of authorisations found)
- Hand written listings of lamps / rescuers. This log appears to be well documented.
- Painted list of names and lamp list included in the folder – has been used as a working document.

Remarks

- Responsibility – issue authorisations for all persons (other than mines rescue team members) required to proceed underground.
- No further information in this folder
- Relied on scribe to record information called for in this Duty Card.

Duty Card No. 11: Mechanical Controller

- Gary Kunst – duty card activated at 4.20 pm.
- Mechanical controller reports to shift controller.
- Gather sufficient personnel to carry out duties
- Service vehicles
- Service compressors
- Water supplying (inefficient to run GAG)
- Other mechanical work as required
- Responsibilities as to Duty Card 11 seem to be carried out and logged.
- Quite successfully from initiation of exercise to end of exercise.
- Availability of machinery and personnel vehicles quite adequate at times of need.

Comments

- Arrangement made quite early in exercise to inform oncoming shift, communication between mechanical controller and men servicing machinery seemed quite adequate.
- Duty Card seemed to be followed and logged as series of events unfolded.

Duty Card No. 12: Electrical Controller

- Detailed log kept until 6.45 pm, then nothing for 3 ½ hours and only one further entry made at 10.16 pm.
- Given to Col Taylor.

Duty Card No. 13: Casualty Controller

- Conflicting data
- Entry "7.20 Advised that 1 deceased, 1 Casualty by first aid attendant"
- Entry "7.25 Advised by HR Manager…deceased name is "*Lamp 66*"
- Entry "7.40 Correction "*Lamp No 113"* is Deceased"
- Comment
- Information such as this will spread like a bush fire. This incorrect information is still being passed on 20 minutes after the Incident Management Team had been advised of error. Names of victims must be protected.
- No logs signed.

Duty Card No. 15: MAN AND MATERIALS Drift Guard

- Don't know if this person received full briefing or who appointed him.
- Two-way on site (not working) – phone working at stone dust shed.
- Was stopping men coming out and recording names, numbers and times.
- Stopped Mines Rescue Team in PJB and asked for written authorisation, but members not counted.
- Did not have any barricade or roped off area close to Portal.
- No sure if some persons logged on as going underground actually went underground
- Rang Control to ask if they were to record the numbers of people coming OUT of the pit – Control Room log entry 8.06pm. *Was this not specified in the Duty Card*

Duty Card No. 16: Portal Security (Conveyor)

- This card was held by Duty Card Holder No. 15 and not filled out in any way.
- We don't know if he was appointed for this position as well.

Duty Card No. 17: Road Security

- No vest issued with Duty Card
- Radios were not working
- No communication, felt they were left in the dark
- Stop sign or boom gate retrieved to restrict access
- Not enough site entrance record sheets were available
- Site map would have been good if supplied
- No record on Duty Card of when the exercise was completed or who informed them it was over
- Name of who held the Duty Card was not recorded

Duty Card No. 18: Lamp Room Attendant

- No paperwork form this folder used.
- Duty Card holder has written up their own forms.
- Unable to decipher information.
- No records kept of lamps in and out of racks, and the particular times issued.
- No detailed records of lamps and rescuers issued on an ongoing basis.
- Some gas sample bag (green tags) discovered in this folder.
- No SEMS log completed.
- There is a green copy of a current lamp list dated 30/08/99 in the notes. Does not appear to be a part of the SEMS duty card folder.

Duty Card No. 19

- Log filled out as required by SEMS – appears to be the only card that was. The description was truncated into a form of short had which is difficult for another to interpret.

Duty Card No. 20

- At 6.02 pm, he became Relief Controller – there was no indication on the duty card of who became technical support.
- There was no indication of any actions after 6.02 pm.

Duty Card No. 22

- Put on standby at 5.15 pm – no other entries recorded.

Duty Card No. 23

- Not in SEMS Version 2.00 as supplied to incident development team – Ventilation Officer.
- Not filled out.

Duty Card No. 23: Ventilation Support

- Provided records not completed at all.
- Some photocopies of record sheets filled in with gas analysis results.
- Other gas analysis results in folder

Audit Tools

Duty Cards for SEMS Supporting Team – Gavin Taylor

Duty Card 3 – Technical Officer	❖ Mobilisation of Technical Officer ❖ Briefing of incident from controller ❖ Incident Management Team Member ❖ Inform Technical Support	❖ Time of Call ❖ Report to Incident Controller ❖ Time of briefing ❖ Detail of event / summary ❖ Notes taken ❖ Minutes of meeting ❖ Action required – what, how, who, when (documented) ❖ Information to support team ❖ Time of notification ❖ Information provided (time, people, type of incident) ❖ Level of support required, current status, what if? ❖ Notify of external assistance ❖ Issues to be addressed ❖ Action required by Support Team Controller, by when etc ❖ Listen to response from Support Team	❖ 4.15 pm ❖ 4.24 pm ❖ 4.25 pm ❖ Yes ❖ Taken by mine manager's secretary ❖ Documented by DC3 until I left to follow DC19. ❖ No information given to support team. Support team gathered their own information from IMT and other sources. No formal de-briefing from DC3. ❖ This was all done through DC19 or external assistance. ❖ Contact of mines rescue was done through DC 1A. ❖ Ventilation Officer in IMT contacted SIMTARS.	❖ As DC3 remained in IMT and did not brief Support Team, DC19 left DC3 and observed DC19 as two observers were with IMT throughout the exercise.

		Controller, record actions committed to ❖ Notify SIMTARS, ACIRL, external experts.		
	❖ Clerical assistance provided.	❖ Name of assistant ❖ Put in place a system to record relevant information, records etc.	❖ Mine Manager's secretary	
	❖ Support Incident Controller ❖ Inform Technical Support of change of status of emergency ❖ Gas Monitoring Results ❖ Ventilation System ❖ Develop hypothesis on cause of incident ❖ Strata Control Management ❖ Monitor activities that require the attention of the incident controller ❖ De-brief	❖ Provide information ❖ Secretary of meetings ❖ Technical expert ❖ Deliver expectations 'on time' ❖ Results dated, graphed, authorised. ❖ Gas data interpreted / analysed ❖ Failures of system recorded and communicated to IMT ❖ Results filed ❖ Identify triggers under Hazard Management Plan ❖ Ventilation model results ❖ Update IMT of ventilation changes ❖ Possibilities ❖ Supporting data ❖ Consequences of cause ❖ Potential failure areas of roof and rib		
Duty Card No. 19 – Support Team Controller	❖ Mobilisation of Controller ❖ Briefing of incident from controller	❖ Time of call ❖ Report to Incident Controller ❖ Time of briefing ❖ Detail of event / summary	❖ 4.25 pm ❖ 4.30 pm – Relief Incident Controller ❖ Short detail from relief incident controller	❖ Very aware of what was required and enacted his

		❖ Notes taken	❖ Notes taken were comprehensive and detailed.	responsibilities competently
	❖ Establish Support Team	❖ Administration ❖ Technical Support ❖ Environment ❖ Stores	❖ DC 2 activated at 4.50 pm ❖ DC 22 activated at 4.50 pm ❖ DC 21 activated at 4.47 pm ❖ DC 23 activated by DC 20 at 4.35 pm	❖ The same person held DC2 & DC22 (C Campbell) ❖ DC 22 in town on standby ❖ DC 21 held by G Lederhose ❖ DC 23 was the Ventilation Officer.
	❖ Brief Support Team	❖ Time of notification ❖ Information provided (time, people, type of incident, level of support required, current status, what if?) ❖ Issues to be addressed ❖ Actions required by support team, by when etc. ❖ Listen to response from support team controller, record actions committed to.	❖ Short briefing given on activation of Duty Cards. ❖ Good, regular and accurate updated throughout.	
	❖ Delegate Support Team functions	❖ Administrations ❖ Human Resources ❖ Stores / Purchasing ❖ Counselling ❖ Technical Support ❖ Catering ❖ Accommodation ❖ Communication / computers	❖ Well delegated and feedback loop to ensure all these functions and support were in place.	
	❖ Update Support Team		❖ Frequent, accurate and detailed information was given to the mine.	
	❖ Monitor Support Team and its actions in progress.		❖ Yes. Carried out.	
	❖ De-brief Support Team			

Duty Card No. 20 – Technical Support Team	❖ Mobilisation	❖ Time of Call ❖ Report to Support Controller	❖ 4.50 pm ❖ By phone	
	❖ Update of situation	❖ Time of briefing ❖ Detail of event / summary ❖ Notes taken	❖ Short detail to begin with and then regular briefings ❖ Comprehensive notes were taken.	
	❖ Establish Technical Team ❖ Delegate actions required ❖ Monitor progress ❖ Update team of situation ❖ De-brief	❖ Geologist ❖ Mining Engineer ❖ Surveyor ❖ Technical Assistant	❖ Ventilation Officer informed and he confirmed on his way. ❖ Deputy Ventilation Officer on standby by 5.00 pm. ❖ At 5.15 pm J Grieves activated to go to gas shed to monitor and check. He relieved D White who was at the gas shed (I don't know who activated White). ❖ Updated by Duty Card Holder No. 19. ❖ All this team on standby, apart from Boyd, Ventilation Officer and J Grieves.	
Duty Card No. 22 – Environment Team	❖ Mobilisation ❖ Update of the situation ❖ Establish Environment Team ❖ Delegate actions required ❖ Monitor progress	❖ Time of Call ❖ Report to Support Controller ❖ Time of briefing ❖ Detail of event / summary ❖ Notes taken	❖ On standby in Blackwater after call from Duty Card Holder No. 20.	
	❖ Update on situation			

	❖ De-brief			
Duty Card No. 21 – Administrative Support Team	❖ Mobilisation	❖ Time of Call ❖ Report to Support Controller	❖ 4.47 pm ❖ Activated by Duty Card Holder No. 19	
	❖ Update of the situation ❖ Establish Administrative Team ❖ Delegate actions required. ❖ Monitor progress ❖ Update team of situation / de-brief	❖ Time of briefing ❖ Detail of event / summary ❖ Notes taken ❖ Catering ❖ Computers ❖ Communication ❖ Stores	❖ 4.47 pm ❖ Yes ❖ Team established and catering was effective. ❖ Duty Card 19 was updated at regular intervals.	

One major error encountered was when a family was notified of a death and this was found to be incorrect information. Notification of the wrong person had been given to Duty Card Holder No. 19 due to an error in the lamp numbers.

Audit Tools

Duty Cards for SEMS Supporting Team – Norm Gow

				COMMENT
1 / 2	Ability to appraise situation during initial contact by Contact Person (by Duty Card 1A person)	• Gathers necessary information • Appraises possible scenarios • Takes timely action	IC contacted by CRO @ 4.15 pm 7/09/99 IC immediately went to control room to check facts Confirms SEMS initiation and goes ICR	Controlled response both adequate and timely
2. / 2	Incident Controller keeps a comprehensive log of the incident and activities	Existence of a comprehensive Incident Controllers Incident Log	Incident Control Log kept by Secretary Robin Brown Robin had problems collecting multiple discussions IC did not establish Incident logging protocol	Extensive log notes recorded but they do not accurately record all decisions & preface
3 / 2	Successfully contacts and briefs the Relief Controller (Duty Card 4)	• Relief Controller successfully contacted and briefed • Standby status triggered • Relief Controller instructed to contact and brief : - • Shift Controller (Duty Card 10) • Technical Officer (Duty Card 3) • Relief Technical Officer (Duty Card 5) • SBCL General Manager (Duty Card 6) • Mines Rescue Controller (Duty Card 7) • Support Team Controller	• Relief Controller contacted & briefed almost immediately • No evidence that Standby status triggered • Not Known but Shift Controller mobilised • Yes • No evidence & position not observed • Secretary instructed to contact GM • Mines Rescue Controller informed by Technical Officer • No evidence & position not observed	Relief Controller in close proximity IC went straight to mobilise) Only partial compliance with) requirements of Duty Card 2) IC was using different) Incident Management) Operational Flowchart to that) contained in SEMS

				COMMENT
		(Duty Card 19)		
4 / 2	Directs that Incident Management Team proceed to mine site	All Incident Management Team arrive on site in a timely manner	All contacted IMT members quickly on site Ventilation Officer added to IMT	IMT not 100% in conformance with SEMS
5 / 2	Directs that Incident Management Team collect their Duty Cards and follow directions	Incident Management Team have their Duty Cards and are following the required directions	IMT collected their Duty Cards from muster area Duty Card directions only partially followed Neither Advisory Team nor Support Team formed	SEMS not followed
6 / 2	Successfully contacts the Mines Inspector and informs him of the situation	Inspector can describe the situation as given to him by the Incident Controller	Observed telephone briefing of Inspector	Inspector understood issues

7 / 2	Incident Controller is in control of incident management	• Incident Controller is at mine
		• Incident Controller is in charge of the Incident Management Team
		• Incident Controller informs all personnel of required response level :
		  • **Standby**
		  • **Mobilise**
		  • **Stand Down**
			• IC still at mine when SEMS triggered
			• IC observed managing IMT
			• IC did not trigger standby at any time
			• IC mobilised when contacted by ESO
			• Exercise terminated prior to Stand Down
				Participating members of IMT appeared all in close proximity to mine and were in place quite rapidly
				Auditor not aware of any Stand Down activities

8 / 2	Incident Controller consults with the Incident Management Team to commence development of an Incident Management Plan	• Incident Management Team are present • All existing available data is used by the Incident Management Team • All Incident Management Team members contribute to Incident Management Plan formulation	• Not all SEMS nominated personnel present Mines Rescue Controller often left the room • Limited available data used by IMT • Initially IC formulated a plan & sought confirmation from team. Later other members brought forward contributions and strategies	No defined IMT protocol to ensure all IMT members contributed e.g. Ventilation Officer identified possible location of fire but was ignored

				COMMENT

9 / 2	Incident Controller ensures formation of the Advisory Committee which has appropriate and useful membership	• Advisory Committee set up in time to add value to the development and maintenance of the Incident Management Plan
		• Advisory Committee has appropriate membership : -
		  • Mines Inspector
		  • State Miners Officer
		  • Mines Rescue Superintendent
		  • Other appropriate experts
		• Incident Management Team uses Advisory Committee to add value throughout the management of the incident
			• No specific Advisory Team set up
			
			  • In IMT
			  • In IMT
			  • In IMT but frequently left the room
			  • Ventilation Officer member of IMT
			• Advisory Team were included as part of the IMT
				The IMT missed an important opportunity to avoid any "Group Think" bias in their Decision-Making process
				
				An opportunity was also missed for separate analysis that may have improved the Decision-Making process
				
				The IC failed to follow a requirement of SEMS

10 / 2	Incident Management Plan remains relevant and appropriate throughout the duration of the incident	• Incident Controller ensures that the Incident Management Team reviews the Incident Management Plan in light of new and updated data • Incident Controller ensures that the Advisory Committee are appraised of new and updated information • Incident Controller ensures Incident Management Team takes account of the Advisory Committees advice when amending the Incident Management Plan	• IC required 15 minute updates, where possible, throughout the conduct of the incident • No separate Advisory Committee • IC continually advised and decisions audited by Inspectors and State Miners Officer	The IMT constantly used updated data in reviewing their decisions. However no formal validation process was in place. Validation efforts were adhoc With no Advisory Committee to advise and review strategies, there was only limited access to alternative strategies
11 / 2	Clerical support, as required, is arranged by the Relief Controller and	• The Incident Controller has spoken to the Relief Controller	Clerical support was put in place at initiation of SEMS	Good clerical support was available but could have been

				COMMENT
	provided by the Support Team	and authorised provision of the necessary clerical support	Additional clerical support was subsequently added part way through the incident	better utilised with instigation of some protocols
12 / 2	Under **mobilisation** status the Incident Controller manages the implementation of the Incident Management Plan	• Incident Management Plan is implemented • Incident Controller monitors progress of Incident Management Plan • Incident Controller ensures Incident Management Plan is revised when and as required • Incident Controller prepares regular briefings for the General Manager and site personnel	• Incident Management Plan generally implemented with some confusion • IC used 15 minute intervals or when update available to monitor progress of Incident Management Plan • IC generally ensured that Incident Management Plan was revised when and as required • IC briefed General Manager when prompted by General Manager. IC maintained little or no contact with site personnel	IC generally handled these requirements quite well IC appeared clinical in approach to decisions IMT operated with extremely controlled emotions IMT exhibited limited urgency regarding persons in jeopardy
13 / 2	Under **stand down** status the Incident Controller manages the scaling down of the emergency	• Incident Controller informs Incident Management Team and all other personnel of the stand down status of the emergency • Incident Controller prepares and distributes a brief written statement to the Incident Management Team informing them of the reduced status of the emergency situation and requiring them to pass this information to their reports • Incident Controller stands down non required personnel at the appropriate time • Incident Controller prepares a Post Incident Recovery Plan	)No observations made in relation to Stand Down	Exercise terminated before incident brought to a conclusion Auditor also absent from Incident Control Room due to observing operation of GAG inertising equipment

				COMMENT
		• Incident Controller ensures all personnel involved in the incident are debriefed • Incident Controller manages Post Incident Recovery Plan as required	))))))	

INCIDENT MANAGEMENT

Assessment Summary

Detailed and comprehensive analysis of the incident management is provided in the following sections, including the audit tools and an incident log maintained of activities in the incident management room.

An important observation being generated by research in the field of incident management indicates that incident management systems have little, if any, impact on the survival rates of underground personnel in the first two hours following a major event. Secondly, there appears a growing body of evidence that stated Extrinsic Objectives, such as:

- Saving lives
- Protecting property and
- Recovery operations

are naturally influenced by other unstated Intrinsic Objectives, such as:

- Complying with established written procedures
- Mitigate legal liabilities and
- Favourable judgement of performance by peers.

What is at question here is not the legitimate and valid existence of these objectives, but the impact they may have on attaining the stated Extrinsic Objectives.

Specifically, did the adherence to the duty card / emergency management systems / mines rescue service procedures (Intrinsic Objective 1 – follow written procedures) prevent the rapid and immediate actions needed to control the hazard i.e. fire fighting, rescue team deployment ? Did this result in a deterioration of circumstances and a greater risk to underground personnel, - a conflict with Extrinsic Objective 1 ? Does Intrinsic Objective 3 - to be judged favourably by our peers, place greater expectations on individual performance that may exaggerate potential decision-making failures common within Incident Management Teams ?.

Another aspect apparent in the incident management of this exercise was the ‘closeting’ of the Incident Management Team for the greater part of the exercise. Such confined team environments, especially when maintained for long periods of intense pressure, increases the likelihood of developing a Group Think mentality that may reduce the potential of individuals to develop independent and innovative solutions.

Audit Tools

Incident Management Team – Norm Gow and Greg Dalliston

				COMMENT
SEMS Initiation	Control Room Officer successfully initiates SEMS	▪ Control Room Officer receives emergency details and records the relevant details on the provided incident sheet and acknowledges receipt thereof. ▪ Control Room Officer initiates appropriate trigger in mine Hazard Management Plan according to the required staged response. ▪ Control Room Officer establishes contact with the most Senior Official on site. ▪ Control Room Officer has contacted the First Aid Attendant in case first aid assistance is required. ▪ Control Room Officer is following Duty Card 1A. ▪ Senior Official on site has assumed temporary role of Incident Controller.	▪ Appeared to occur but did not witness. ▪ Do not know if appropriate trigger initiated according to HMP. Check with G Rowan and D Cliff. ▪ Observed Incident Controller receive telephone message from person initiating SEMS at 1615 on 7/09/99. ▪ Not known. Check with G Rowan and D Cliff. ▪ Not known. Check with G Rowan and D Cliff. ▪ Senior Official on site was the Incident Controller and that person assumed the role.	▪ SEMS was initiated by the Control Room Operator on being informed of smoke being detected in the mine workings. ▪ The Incident Controller initiated the evacuation of the mine on being informed of situation. ▪ No apparent reference was made to trigger points in HMP's. ▪ SEMS does not specify any reference to trigger points contained in HMP's.
		▪ Senior Official on site follows the required responses as per the mine Hazard Management Plan.	▪ No evidence that the Senior Official on site followed the required responses as per the mine HMP's	▪ No opportunity was taken to have someone investigate source of smoke (fire) during evacuation of the mine and during subsequent rescue missions.

				COMMENT
SEMS Handover	Incident Controller receives briefing of incident by Senior Official on site.	▪ Incident Controller establishes the following: – Update on nature of emergency. – Update on status of staged response requirements as per Hazard Management Plans – Update of presence and expected whereabouts of missing personnel. – Descriptions of incident by survivors who have been debriefed on their arrival at the mine surface.	▪ Incident Controller was the Senior Official on site. Investigated nature of emergency personally. ▪ No evidence sighted that HMP's were consulted or that any staged response occurred. ▪ At 1634 Incident Controller requested information on whereabouts of persons underground as follows – total numbers, names and locations. ▪ Incident Controller was told that survivors had been interviewed but no definite description of the incident was received by him.	▪ The Incident Controller focussed strongly on evacuation of the mine and rescue of missing persons. ▪ An opportunity was missed to have evacuees investigate the source of the smoke during the evacuation. ▪ An opportunity was missed to have a rescue team investigate the cause of the smoke early in the incident.
Incident Control Room Facilities	The Incident Control Room is ideally positioned, has a suitable layout and has adequate suitable stationary supplies.	▪ Incident Control Room is suitably located in relation to all necessary strategic functions. ▪ Entry into the Incident Control Room is controlled. ▪ The layout of the Incident Control Room is adequate and suitable, with particular reference to:	▪ The Incident Control Room was located in the main office complex that is approx. 30 metres away from the Control Room, Shift Controllers Officer and Muster Area. ▪ No control of entry to the Incident Control Room was apparent. People entered and left this room indiscriminately.	▪ The Incident Control Room was less than 5 minutes walk from the Shift Controllers Office and Control Room allowing IMT members easy access to these facilities. ▪ Security of the Incident and Control Room was poor. Any interested persons were able to enter the Incident Control Room unchallenged.

				COMMENT
		– Size – Seating – Lighting and emergency backup lighting (auxiliary power)	▪ There was insufficient room to house all the persons entering and using this facility. ▪ There was sufficient seating to accommodate all the persons remaining in this facility. ▪ No knowledge of any provision of backup lighting and power.	▪ With no separation of the Advisory Team from the Incident Control Team, the facility was overcrowded. ▪ No interruption to lighting or power occurred throughout the conduct of the exercise.
		– Environment Monitoring Facilities	▪ Access to available environmental monitoring was via a computer terminal in the Incident Control Room and operated by the Ventilation Officer.	▪ AMR's and tube bundle sample results automatically displayed on computer monitor. ▪ Bag samples had to go to Laleham for analysis. ▪ Considerable delays were experienced due to remoteness of Laleham facility.
		– Display Boards ▪ Adequate suitable stationary is available for use by the Incident Management Team and which includes:	– Two large whiteboards were located on walls opposite ends of the Incident Control Room.	

				COMMENT
		– Incident Log Book	▪ No specific log book was provided.	▪ The major tools used in the decision making process were the environmental monitoring computer and a mine plan. ▪ This plan was marked with environmental monitoring information and updated regularly.
		– Writing pens and pencils – Erasers and correction fluid / tape implements	▪ Supply appeared adequate. ▪ No usage observed.	
		– Writing pads	▪ IMT members had their own.	▪ The ebb and flow of information, including scenario modelling, was not captured precisely.
		– Large sheets of drawing paper. – Highlighting pens.	▪ No usage observed. ▪ Supply appeared adequate.	▪ ▪
		– Stick-it pages	▪ Limited use of stick-it pages.	▪ The Ventilation Officer's computer had no printing facility. Although the Ventilation Officer attempted some trending of the environment and did not interrogate the computer for rations, none of this information was presented to the IMT in hard copy.
		– Suitable scale rules. – Marker pens and erasers – Calculators	▪ No usage observed. ▪ Supply appeared adequate. ▪ Ventilation Officer only person observed using a calculator.	

				COMMENT
Incident Management Team Resources	The Incident Management Team is provided with sufficient resources to adequately carry out its duties	The Incident Management Team is provided the following minimum information: – Incident background	The Incident Controller carried out an unstructured IMT briefing of incident background.	▪ The Incident Controller spent little time briefing the IMT.
		– Background Gas Levels – Typical gas types – Typical makes	▪ Background gas levels were not provided. ▪ Typical gas types information not provided. ▪ Typical gas makes information not provided.	▪ The change in mine environment was so dramatic that no comparison to background levels was necessary.
		– Copies of Safety Management System – Copies of Principal Hazard Management Plans – Up-to-date underground plans showing: – Ventilation including ventilation appliances – Gas monitoring points – Escape routes – Electrical installations	▪ No provision of copies of Safety Management System was observed. ▪ No provision of copies of Safety Management System was observed. ▪ An up-to-date plan of the underground workings was on the Incident Control Room wall. ▪ Ventilation circuits and appliances were shown. ▪ Gas monitoring points shown. ▪ Escape routes shown ▪ Unsure whether electrical installations shown.	▪ There was no apparent reference to Safety Management Systems or Principal Hazard Management Plans. ▪ An up-to-date plan of the workings, showing the necessary requirements for mines rescue purposes, was hung on the wall in the Incident Control Room. This plan was used extensively during the conduct of the exercise.

				COMMENT
		– Up-to-date surface plans showing – Building locations – Road systems – Location of main services isolation control equipment – Location of fire fighting equipment – Location of rescue equipment – Location of hazardous materials including explosives.	▪ No surface plan observed. – Not observed – Not observed – Not observed – Not observed – Not observed – Not observed	▪ No surface plan was used by the Incident Control Team during the course of the exercise. However, there did not seem to be much confusion in relation to knowledge of the whereabouts of any required surface infrastructure.
Incident Management Team Communication Hardware	The Incident Management Team are provided with sufficient communication equipment to enable them to effectively carry out their duties.	▪ The incident control room is provided with at least two (2) external telephones on separate lines. ▪ The incident control room is provided with at least two internal telephones on separate lines. ▪ Two-way radios or alternative means are provided as back-up between incident control room, shift controller and mine control room.	▪ Two telephones were observed as available and in use in the incident control room. ▪ Both external and internal telephonic communication appeared to be on the same handsets. ▪ No two-way radios or alternative means of communication as back-up between the incident control room, shift controller and mine control room were observed.	▪ There were no equipment failures in telephonic communication in the incident control room throughout the conduct of the exercise. ▪ No visible provision of emergency back-up communication, in the event of a normal system failure, was apparent. ▪ Communication between the incident control room and the GC room experienced problems.

				COMMENT
Incident Management Team Formation	The Incident Management Team rapidly responds to emergency incident.	▪ Incident Management Team members report to incident controller in an acceptable time frame. ▪ Incident Management Team members locate themselves in the incident control room. ▪ Incident Management Team members are ready and willing to assist the incident controller in managing the emergency incident.	▪ The Incident Management Team members responded to their call-out within minutes. ▪ The Incident Management Team members responded to their call out within minutes. ▪ The Incident Management Team members were present in the Incident Control Room within 15 minutes.	▪ Incident Management Team response was extremely rapid following the incident rigger (hair trigger?). ▪ The Incident Management Team make-up was different to that nominated in SEMS. ▪ The Incident Controller listened to input from his team members but his extreme focus often resulted in their opinions having low ranking in the ultimate decision.
Incident Management Team Procedures	The Incident Management Team is effective in the management of the complexity of the emergency incident.	▪ The Incident Management Team establishes protocols for: – Communications: internal and external	▪ No establishment of protocol observed.	▪ No formal protocols for the effective management of the complexity of the emergency incident were established.
		– Inflow of information – Outflow of information	▪ No formal protocol established. ▪ No formal protocol established.	▪ The Incident Control Team and the Advisory Team operated collectively in the Incident Control Room. This negated an important opportunity to provide a review of the decision making process.

				COMMENT
		– Use of Advisory Team	▪ No evidence of Advisory Team being established.	▪ Where additional peripheral resources were required, these were provided although no formal structure was in place.
		– Use of Assisting Team – Use of Support Team	▪ No formal protocol established. ▪ No evidence of Support Team being established but SEMS requirements of Support Team activities appear to have been met.	▪ Incident Management Team members remained totally supportive of the Incident Controller throughout the entire conduct of the exercise. This may have resulted in some opportunities being missed to explore alternative strategies.
Incident Briefing	The Incident Controller sufficiently briefs the Incident Management Team to allow them to function immediately	▪ The Incident Controller briefs the Incident Management Team. ▪ The Incident Management Team seeks clarification where necessary.	▪ The Incident Controller briefed each Incident Management Team member on their arrival at the Incident Control Room. ▪ The Incident Management Team asked questions and sought information to clarify their understanding.	▪ Briefing by the Incident Controller very limited in content due to lack of information available. ▪ Incident Management Team was disinclined to challenge assertions and strategies adopted by the Incident Controller.

				COMMENT
		▪ The Incident Management Team reviews available existing information on: – Missing and unaccounted persons – Emergency incident witness accounts.	▪ The Incident Controller despatched the Relief Incident Controller to establish the extent of missing and unaccounted persons. ▪ Emergency incident witness accounts verbally provided by messenger from Shift Controller.	▪ Very little information was being supplied to the Incident Control Team at this time. ▪ The Incident Controller's focus was centred on determining missing and unaccounted persons at this time.
		– Environmental information including: – Gas monitoring	▪ Gas monitoring information provided by the Ventilation Officer from computer workstation.	Gas monitoring and ventilation information available on line and being accessed by Ventilation Officer from approximately 4.30 pm.
		– Ventilation – Ventilation appliances – The Incident Management Team determines the preparedness of the Emergency Response Team.	▪ Ventilation information provided by Ventilation Officer from computer workstation. ▪ No information was available as to the in ▪ Blackwater Mines Rescue Superintendent briefed at 1715 by Incident Controller. Rescue Teams have been called to the mine. Insufficient resources (4 men) currently to mount any rescue attempt.	▪ Mobilisation of the GAG requested by Incident Controller at 4.46 pm. ▪ Early signs that rescue resources are a problem. Rescue efforts may be delayed by lack of rescue personnel.

				COMMENT
Data Collation	The Incident Management Team ensures that all data is collected and manipulated to become usable information.	▪ Data capture protocol is established to ensure all generated data is made available, with particular reference to: – Gas analysis – Ventilation Modelling – Reports – Observations	▪ No data capture protocol apparent. ▪ Available via Ventilation Officer's computer. ▪ Verbal reports available from shift controller via runner. Few written reports. ▪ Lack of effort to seek and collect observations.	▪ The Incident Management Team relied completely on data access via the Ventilation Officer's computer, telephonic communication and verbal reports from Shift Controller's runner and rescue services management.
		▪ Data flow protocol is established to manage distribution of information.	▪ No observed protocol in place to manage distribution of information.	▪ The Ventilation Officer had the capability of producing Explosibility Diagrams and Oxygen-Consuming Rations. However, he was unable to produce them in hard copy for use the by Incident Management Team because no suitable printer was available.
		▪ Data is processed whenever and wherever required to ensure that it becomes usable.	▪ The Ventilation Officer supplied some Explosibility Diagrams and some Oxygen Consuming Ratios, when incident management demands allowed.	▪ The Ventilation Officer also had the capability to carry out some ventilation modelling. The facility was observed to be used only once during the exercise.
		▪ Information critical for decision making is given the highest priority.	▪ The Incident Controller prioritised type and flow of information according to his needs.	

				COMMENT
		▪ Information and decisions are captured in a specific log with particular reference to: – Date	▪ Incident Control Room log kept by secretary. ▪ Date recorded in log.	▪ The prioritising of information type and flow was almost solely determined by the requirements of the Incident Controller. This resulted in the Incident Management Team maintaining a somewhat narrow focus.
		– Time – Decision and reasons – Person or person taking action – Person or persons to whom action directed	▪ Time recorded in log. ▪ Attempt to record decision and reasons in log ▪ Attempt to record person or persons taking action. ▪ Attempt to record person or persons to whom action directed.	▪ The logging of events, decisions and reasons was carried out initially by one secretary. Additional secretarial resources were added to assist this information capture. The lack of Incident Management Team protocols made if difficult for the secretarial resources to capture all necessary information in a format useful for review. The secretarial resources also had problems understanding the meaning of jargon being used by the Incident Management Team.

				COMMENT
Data Verification	The Incident Management Team verifies, as far as possible, all data collected before processing and use.	▪ The Incident Management Team ensures integrity of all gas sampling points.	▪ The Incident Management Team observed to require integrity of tube bundle sampling regime to be checked and validated only once.	▪ The Incident Management Team appeared to take incoming information at face value with little or no validation eg. decisions were made using information gained via telephone conversations.
		▪ The IMT ensure the integrity and calibration of any gas analysers used.	▪ No knowledge of whether the integrity and calibration of gas analysers used was tested. The Incident Management Team was not observed to require this.	
		▪ The IMT ensure the validity of gas readings by checking both percentage and range.	▪ The Ventilation Officer was using Segas to process gas readings. This system validates percentages during the compilation of Explosibility Diagrams. IMT checked range.	▪ Vital decisions were made using information gleaned from analysis of 'bag samples' run through a gas chromatograph. Little attention was paid to the integrity of the samples and accuracy of the gas chromatograph.
		▪ The IMT makes use of gas ratios before and in scenario modelling.	▪ The Ventilation Officer provided gas ratios on receiving updated environment analysis most of the time.	
		▪ The IMT establishes additional strategically located sample points, where possible.	▪ Some of the live tube bundle points monitoring sealed areas. Incident Management Team requested that some of these could be diverted to new locations near fire. No real outcome from this request.	▪ Despite conjecture as to the cause of the ventilation reversal in the belt drift, no instruction was given to the Ventilation Officer by the IMT to model the circumstances that would cause such a reversal.

				COMMENT
		▪ The IMT cross references observations and reports to validate hearsay information.	▪ There was little evidence to suggest that the IMT used any cross referencing processes to validate incoming information.	▪ IMT missed opportunities to strengthen their decisions.
Scenario Modelling	The IMT efficiently develop scenarios that are identical or at least closely resemble the true situation.	▪ The IMT assemble relevant data in a timely manner.	▪ The IMT quickly assembled all readily available relevant data.	▪ The Incident Controller had already developed a scenario that identified the existence of a fire prior to the formation of the IMT.
		▪ The validity of any relevant data is checked by the Advisory Team.	▪ No validity checking observed. Lack of Advisory Team inhibited validity checking of data.	▪ The IMT subsequently confirmed the Incident Controller" hypothesis. Only limited validation techniques were used by the IMT.
		▪ The IMT develops the most likely scenario.	▪ IMT quickly identifies the presence of a fire. However, they are unable to identify its exact location.	
		▪ The Advisory Team validates any scenario developed by the IMT.	▪ No validation of IMT developed scenarios occurred as no validation process was apparent and no Advisory Team in place.	▪ The IMT was unable to identify the most probable location of the seat of the fire throughout the conduct of the exercise.
		▪ Both the IMT and the Advisory Team make use of all available experts.	▪ Only local expertise used plus the Mines Rescue and Inspectorate. No ventilation or fire fighting expertise sought.	▪ This occurred despite the Ventilation Officer predicting a fire location in the interseam conveyor drift. Contaminates levels from ventilation modelling exercises replicated actual levels as sampled and analysed.

				COMMENT
		▪ The IMT and the Advisory Team update the scenario as often as is necessary.	▪ The IMT updated the scenario every 15 minutes whenever possible. No separate Advisory Team scrutiny of the scenario.	▪ Use of an Advisory Team and experts would have provided improved validation and improved scenario definitions.
Decision Making Process	The IMT is effective in decision making.	▪ The IMT makes decisions as a team.	▪ The Incident Controller led the decision making process and only appeared to use the IMT as a form of validation of his decisions.	▪ The early decision by the Incident Controller to immediately evacuate the mine turned out to be a good decision and probably saved a considerable number of lives.
		▪ The IMT follows a defined process in decision making.	▪ The IMT appeared to use the same decision making process throughout the conduct of the exercise. No decision making protocol was apparent.	▪ The Incident Controller was dominant in the IMT. Team member opinions were listened to by the Incident Controller but not always considered in any subsequent decision.
		▪ The IMT takes into account all scenarios when making decisions.	▪ Little evidence was observed to suggest that any other scenarios were considered outside the Incident Controller's original scenario.	▪ The IMT missed opportunities to determine the seat and extent of the fire during the early stages of the incident.
	The IMT uses risk management techniques in arriving at decisions.	▪ The IMT is not hijacked by event spontaneity.	▪ The IMT was mindful of unfolding events but remained focussed on its objectives.	▪ The IMT, in not attempting to extinguish or at least contain the fire, may have further jeopardised the safety of person remaining underground in the early stages of the incident.
		▪ The IMT identifies all hazards.	▪ The IMT focussed its attention primarily on the hazard of explosion.	

		▪ The IMT identifies the appropriate controls for each hazard. ▪ The IMT incorporates appropriate hazard controls and constraints in all operational decisions.	▪ The IMT primarily focussed on the risks to Mines Rescue personnel going underground. ▪ As all IMT operational decisions centred around rescue and recovery of persons underground, all hazard controls and constraints in operational decisions were focussed on minimising the risks to Mines Rescue personnel. The IMT and Mines Rescue executive made some compromises on team size and backup capability.	▪ The lack of any review committee or expert advisors inhibited the developed of other possible scenarios. This meant that the IMT 'had all its eggs in one basket'. ▪ Although focussing on the risks to Mines Rescue personnel in going underground, the IMT may have overlooked the dangers of using under-resourced Rescue Teams in such a hazardous situation.
	The IMT acts to preserve life at all times.	▪ The IMT does not invoke any action that endangers life. ▪ The IMT takes all reasonable action to rescue person remaining underground.	▪ Generally the IMT were observed not to deliberately invoke any action that endangered life. ▪ Rescue of persons remaining underground was delayed due to lack of Mines Rescue resources and uncertainty over the mine's explosion risk.	▪ The IMT may not have recognised or underestimated the risks to personnel developing in the portal area. ▪ A further deterioration of circumstances in the mine, during the course of the exercise, may have exceeded the capability of already overstretched resources.

				COMMENT
		▪ The IMT considers the safety of any persons in any decision to deploy such persons in underground rescue and / or recovery, including rescue teams.	▪ The IMT sent seemingly understrength rescue teams into the mine and with, at times, the lack of adequate back-up team capability. The IMT initially failed to recognise the toxic gas risk to persons deployed in the portals area.	▪ The IMT may have compromised its own effectiveness by allowing the Relief Incident Controller to leave his posting to become part of rescue efforts. The new Relief Incident Controller then had to climatise himself to the circumstances of the incident.
	The IMT takes into account missing persons and non-recovered deceased persons in any decision taken to seal the mine.	▪ The IMT takes into account the fate of any missing persons in any decision to seal the mine. ▪ The IMT make provisions for recovery of deceased persons after sealing.	▪ No decision to seal the mine was taken during the conduct of the exercise. At the time of abandonment of the exercise, there was one remaining person underground, who was known to be deceased. ▪ At the time of abandonment of the exercise, the IMT stated intention was to recover this deceased person, if possible, and then inertise the workings of the mine to extinguish the fire.	▪ The IMT did not make any provision for their relief in the case of an extended incident. It was obvious, prior to the abandonment of the incident, that management of the incident was going to be protracted. ▪ Although some preparations were put in place towards sealing of the mine, the IMT's stated intention was to extinguish the fire through inertisation. Whilst the GAG was on site and being tested, no definitive plan for its use was at hand.

				COMMENT
Communication Process	The IMT establish and maintain effective communication with all necessary internal emergency agencies.	▪ The IMT prohibits unauthorised personal contact or communications with its team members.	▪ No prohibition of entry to the Incident Control Room was evident. Persons entered and left the confines of this room unabated. ▪ Part way through the conduct of the exercise a second secretary was stationed in the Incident Control Room and that person then monitored incoming telephone calls.	▪ The non adherence to SEMS and the subsequent lack of division between teams caused communications to be mainly informal. ▪ Most communications was made using a face to face method.
		▪ The IMT maintains effective communications with the Control Room Officer by: – On-line computer communication if available. – Telephonic communication – Back-up communication facility (eg. two-way etc)	▪ The IMT appeared to prefer to use a runner to maintain communication with the Control Room Officer. ▪ Although an on-line computer was available in the Incident Control Room it was not used for direct communication with the Control Room Officer. ▪ Telephonic communication was available and used. ▪ There appeared to be no back-up communication facility provided.	▪ The IMT and Shift Controller made extensive use of runners to relay information and decisions. This made it extremely difficult for the Incident Log keeper to accurately record all events and information. ▪ Mines Rescue management shuttled backwards and forwards between the Incident Control Room and their own base, both for giving information and receiving instructions.
		▪ The IMT maintains effective communication with the Advisory Team by:	▪ No Advisory Team set up remote from IMT – most Advisory Team members were part of the IMT.	

				COMMENT
		– Regular face to face contact	▪ Regular face to face contact maintained.	▪ The siting and communication methods were not conductive to independence of thought and ideas.
		– Telephonic communication	▪ No telephonic communication necessary as face to face contact remained.	▪
		▪ The IMT maintains effective communication with the Shift Controller by:	▪ Only limited direct telephonic communication observed between IMT and Shift Controller. IMT preferred to use a runner for communication.	▪ The organisational structure, teams geographic location and method of communication appeared to be adequate for the size and complexity for the management of this particular incident.
		– Telephonic communication	▪ Some limited telephonic communication observed between Incident Management Team and Shift Controller	▪ However, a large and more complex incident, requiring more concurrent operational decisions and activities, may have overtaxed the incident organisational structure used by IMT.
		– Back-up communication facility (eg. two-ways)	▪ The provision of a back-up communication facility not observed.	
		▪ The IMT maintains effective communication with the Mines Rescue Team by:	▪ The IMT appeared to prefer to use a runner or personal contact to maintain contact with Mines Rescue personnel.	▪ Of particular concern was the lack of available resources throughout the conduct of the incident. The IMT was frustrated in its attempt to deploy the first rescue team both with numbers and with back-up.

				COMMENT
		– Telephonic communication	▪ Telephonic communication was available between the IMT and the Mines Rescue Control room.	▪ The second deployment was also frustrated due to lack of numbers. The difficulty of the allotted Mines Rescue tasks also appeared not to be fully appreciated by the IMT.
		– Back-up communication facility (eg. two-ways)	▪ The IMT sought direct radio communications with Rescue Teams operating underground but this was not achieved.	▪ Had the exercise continued past the time of abandonment, more serious deficiencies in mines rescue resources would have become apparent.
		▪ The IMT maintains effective communications with the assisting team by:	▪ Some communications was observed between the IMT and some members of what would have been the assisting team.	
		– Telephonic communication	▪ Telephonic communication appeared to be available.	
		– Back-up communication facility (eg. two-way)	▪ No back-up communication facility was observed.	▪ I understand that the Mines Rescue Superintendent was on his way to the IMT to inform them that the existing mines rescue capability would be unable to continue its underground commitment without further resourcing when the exercise terminated.
		▪ The IMT maintains effective communication with the support team by:	▪ No evidence that a support team existed. Function of this team appeared to be carried out by the General Manager.	

				COMMENT
		– Telephonic communication	▪ General Manager located himself in managers' office next door to Incident Control Room. Telephonic communication was available.	
		– Back-up communication facility (eg. two-way)	▪ No back-up communication facility observed.	
	The IMT ensures the identification and traceability of information.	▪ The IMT records information flow inwards and outwards by logging:	▪ An IMT log was kept by a secretary stationed in the ICT. However, without an established incident log protocol the log struggled to maintain a valuable record of the incident management.	▪ After witnessing the unfolding of the incident events and decisions and then subsequently reviewing the incident log, it is evident that the incident log provided limited value for analysing incident management performance.
		– Content	▪ The incident log recorded extensive notes of events but logging of details was unstructured.	▪ To enable incident logging to be more effective, it will be necessary for the IMT to be more structured and disciplined in their inwards and outwards communications.
		– Source	▪ Not all sources of inwards and outwards information sources were recorded.	
		– Destination	▪ Not all information, both inwards and outwards, had their destinations recorded due to respondents failing to inform the incident log keeper.	
		– Date and time	▪ The incident log keeper appeared to diligently record the date and time of events and decisions when aware of them.	

				COMMENT
Incident Scale Down	The IMT effectively wind down emergency requirements at conclusion of emergency.	– The IMT debriefs all emergency incident participants before stand down	▪ The exercise was terminated prior to the need for any stand down required. The incident controller was observed debriefing a number of persons after termination of the exercise.	The emergency exercise status at the time of termination was: ▪ Majority of workforce safely evacuated from mine.
		– The IMT stands down the mines rescue team as soon a they are no longer required.	▪ No mines rescue personnel appeared to be stood down at any stage during the incident.	▪ Miner Van derMoulen recovered alive by mines rescue team.
		– The IMT stands down all other persons as soon as they are no longer required.	▪ The IMT apparently stood down the second relief incident controller near the termination of the exercise.	▪ Miner Lane alive and under recovery by mines rescue team 2 somewhere in C seam drift.
		– The IMT prepares a statement for release to the public. – The IMT arranges security of IMT documentation before stand down. –	▪ No knowledge of any statement for release to the public prepared by the IMT. Auditor was not present in the IC room at termination of the exercise. ▪ No knowledge of what arrangements made for security of IMT documentation prior to stand down. Auditor not present in IC room at termination of exercise.	▪ Mines rescue team 3 at bottom of MAN AND MATERIALS drift on way to assist team 2. ▪ Miner Brown deceased and body remains underground. ▪ Substantial fire underground somewhere near bottom of conveyor drift – actual location unknown.

				COMMENT
		– The IMT arranges an early meeting date to commence preparation of the Emergency Incident Report.	▪ No knowledge of any arrangement for an early meeting date to commence preparation of the Emergency Incident Report. Auditor not present in IC room at termination of exercise.	▪ Reversal of airflow in conveyor drift – gas analysis of atmosphere emanating from conveyor drift at 2145 as follows: – Methane – 0.8% – CO – 30 000 ppm – Hydrogen – 0.9% – Oxygen – 6.0% ▪ Mine main ventilation fan operating normally: – Quantity - 230 cu m/s – Pressure – 700 Pa
				▪ GAG on site and undergoing commissioning trials – experiencing some problems – 2nd GAG on way. ▪ Earthmoving equipment ready to mobilise if needed. ▪ IMT still do not have a mine recovery strategy – GAG inertisation of favoured option.
		▪ The IMT stand down.	Exercise Terminated 11.00pm	

Incident Management Control Room – Log of Events

Greg Dalliston

	ACTION TAKEN
4.03 pm	❖ Shift Manager contacted by Control ❖ 30 ppm alarm sounded at Main Gate 2 ❖ Contacted Deputy underground to investigate
4.05 pm	❖ Controller informed Shift Manager of whisp of smoke at Main Gate end and to take men to cribroom
4.06 pm	❖ Main belt road called Control to report a whisp of smoke
4.11 pm	❖ DUTY CARD 1 & 1A – issued by Control Room ❖ Shift Manager and control room operator in control room ❖ Smoke billowing out of the smoke drift reported to control room by person ❖ Person left control room – no name was taken ❖ Person was called back to repeat information given
4.15 pm	❖ Relief Controller takes Duty Card 4 – Richard Mills ❖ G Evans and R Mills spoke briefly and was told to account for all persons
4.18 pm	❖ Emergency siren sounded ❖ G Evans and R Mills decided that more information was required
4.20 pm	❖ R Mills seek information from Control ❖ Told there was 30 ppm in Main Gate 2 ❖ Got information from sheets in control room and off control operator
4.23 pm	❖ QMRS Station called to inform mine of estimated arrival time ❖ Fan alarm on control screen (Col ? told to confirm) ❖ Still evacuating in Longwall and Main Gate 2 ❖ SBD contractor heading out
4.27 pm	❖ Readings taken off Segas
4.28 pm	❖ Main Gate 2 travel road 30 ppm ❖ Longwall installation face and main gate 2 crews both coming out at face – could not confirm on foot or in vehicle ❖ Fans “glitch” on computer being checked – alarming as fans stopped. ❖ 4 cut-through off scale at 999 ppm ❖ Plans up in Incident Control Room on whiteboard ❖ People – accounted for? ❖ ‘C’ Heading - longwall: all ❖ main gate 2: all ❖ contractors: all ❖ Duty Cards 19, 20, 21, 22 & 23 issued
4.41 pm	❖ Ventilation Officer – phone call ❖ Fire reported – “probably diesel fuel bay”. ❖ Called Laleham to draw samples from gas shed ❖ Points 11, 12 & 18 asked to call back on 504 phone
4.44 pm	❖ SIMTARS called for mobilisation
4.46 pm	❖ Technical Officer asked to mobilise GAG – Mines Rescue called ❖ Duty Card 6 completed – General Manager
4.48 pm	❖ ‘A’ seam plan - gas reading ❖ ‘C’ seam plan – route of travel discussed and where persons are ❖ Believe all persons accounted for at this point in time ❖ ‘C’ seam – gas readings put onto plan
4.50 pm	❖ Discuss issues of change in air circuit ❖ Short circuit possibility discussed
4.52 pm	❖ Confirm with Mines Rescue Station regarding GAG mobilisation

	ACTION TAKEN
4.54 pm	❖ G Evans – lethal CO in intakes
4.55 pm	❖ D Boyd – Duty Cards 3, 11, 12, 18, 17 & 19 ❖ CH_4 increase – reasonable amount (R Mills) ❖ Tail gate 1 – 5 ppm – 653 ppm ❖ Relief Incident – R Mills ❖ Technical Control – K Falconer ❖ Mine Manager – G Evans ❖ D Boyd – Ventilation Officer ❖ Robyn Brown – Log Recorder
4.58 pm	❖ Record of gas levels on plan ❖ Point 19 – 653 CO, traces of CH_4, 0.001% ❖ Fan off scale at >1000, O2 – 17.5%, CH_4 – 0.016% and others ❖ Main Gate 2 – 770+ ppm, O_2 – 20.6%
4.58 pm	❖ One man missing in Main Gate 2 – Lamp No. 113 reported and recorded
4.59 pm	❖ Fire in 'A' seam in ramp conveyor raised by D Boyd ❖ Asked if there were any reports from anyone
5.00 pm	❖ Need to get people who are up from underground de-briefed
5.03 pm	❖ Decision to get vehicle ready to go underground to rescue people ❖ Prep fire trailer ❖ Check rescue gear, prep rescue team, pre fire team ❖ Are the Longwall crew accounted for? ❖ Main Gate 2 minus one person accounted for
5.07 pm	❖ Still to determine if fans are running
5.08 pm	❖ Department of Mines and Energy arrive in IMT and were debriefed by G Evans ❖ No numbers of men were available from the mine on route to IMT ❖ No persons to go into the mine ❖ No persons in 'A' seam – all out of mine ❖ Status of monitoring system okay and validated? ❖ Status of communication system okay
5.11 pm	❖ QMRS arrives at IMT
5.14 pm	❖ CH_4 Main Gate – still only 0.3 % ❖ No vehicle to take samples to GC, Laleham
5.18 pm	❖ Are we prepared to send a vehicle underground to the men out? ❖ Evidence of short circuit at our 'C' seam ❖ No fan status ❖ Still have O_2 to make way out?
5.19 pm	❖ Briefing in room ❖ 'A' seam – slight smoke in main drift ❖ Thick black smoke billowing out of conveyor drift ❖ Lamp No.113 – man down 'C' seam drive head and still alive ❖ Only two QMRS people here ❖ 8 more people still underground somewhere ❖ No-one has been beyond 'B' heading 'A' seam conveyor drift ❖ 10 men unaccounted for, very little CH4, 1000 ppm + CO ❖ All points validated as reporting accurately ❖ What fire fighting equipment have we got? ❖ QMRS main concern is to rescue man still underground ❖ Minimum of 6, 7 if we can get it – can we use the PJB? ❖ What about a standby team? ❖ Fire Team vehicle in behind QMRS team ❖ Drift blocked by monorail sled at bottom of transport

	ACTION TAKEN
5.28 pm **(Real)**	❖ QMRS are to locate and retrieve Lamp No. 113. ❖ No-one is allowed into the mine except for people under O_2
5.31 pm	❖ Ran simulation of fire in 'A' seam and confirms what readings available
5.32 pm	❖ District Union Inspector arrives at IMT ❖ No contact with Main Gate 1 or 2 Joy Fitters ❖ In order of 12 people missing
5.37 pm **(Real)**	❖ Message over radios to 4HI (radio station) etc to ensure people in town know it is an exercise
5.40 pm	❖ 6 people – QMRS ready ❖ no movement until there is a confirmed back-up team ❖ report 60 min rescuers on – only 30 min left ❖ still 12 other people missing ❖ evacuating from Main Gate 1 – no contact since then
5.45 pm **No mention of bag samples**	❖ Stopping down between conveyors and mine drifts 'A' seam (reported) ❖ Phone call from Control – suggesting 4 still missing on his books ❖ Instructed to confirm numbers and names with lamproom attendant ❖ QMRS – 8 people on the way between portal and lamproom ❖ 0.146% CH_4, Point 3, Maingate 5 Return ❖ 0.066% CH_4, Point 12 ❖ CO > 1000 ppm ❖ No upper hydrocarbons
5.49 pm	❖ GAG arrived on site ❖ Point 1 in 'A' seam in Tail Gate – dog leg still has fresh air
5.55 pm	❖ Stopped SBD going into mine main gate drift, 'A' section ❖ White haze and smoke in travel road, no radio contact to control ❖ Dark brown smoke out of conveyor drift ❖ Road is blocked – Dozer, EIMCO and sled at 4 cut-through, bottom drift ❖ SBD had showers and left site ❖ Re-assign persons to Relief Controller and other positions
5.56 pm	❖ Both fans running – pressures normal ❖ QMRS team briefed – 5 men ready for transport, only pillar or two to walk
6.00 pm	❖ No closer to fighting the fire ❖ Partial reversal of conveyor drift ventilation ❖ 3 men still unaccounted for (not on surface) ❖ Lamp No. 58 – 'C' seam, Belt Drift ❖ Lamp No. 66 – 'C' seam, Main Gate 1, Longwall installation face ❖ Lamp No. 113 at 4 cut-through injured – noises coming over DAC's – may be person trying to contact control
6.02 pm	❖ Update on person missing – last known siting of all 3 persons ❖ Change QMRS assignment ❖ Asked QMRS team to split and get other 2 missing persons
6.10 pm	❖ IMT looking at fire fighting strategies
6.16 pm **Asked for trends – not done**	❖ QMRS team suiting up – 6 men ❖ 3 people still missing – names and last positions briefed to recover those 3 people ❖ Asked for further briefing? ❖ Report on trends of gasses towards potentially explosive range. This needs to be trended and time estimated

	ACTION TAKEN
6.23 pm	❖ Point 3, Main Gate 5 Return – bag sample, CO 17 000 ppm, 1.7% ❖ At Point 3, last reading, H - 0.49%, no other upper CH_4 ❖ CO – 14 600, 7 000, 7 600 ❖ 12 people in IMT room ❖ 0.05%, 0.06% in 'C' seam return ❖ Bag higher than tube bundle ❖ Asked for rising CO and H_2 – trends to be monitored while people are underground
6.27 pm	❖ Can we take out some sample points to speed up sampling times? ❖ Another rescue team on site going underground ❖ Team underground will change bottles and suits and be back-up team for Team 2 ❖ Maximum 3 to 4 teams will be on site within the next hour ❖ How can we be sure integrity of system? ❖ Validated at gas shed – person on standby ❖ S Vaccaneo – keep one goaf sampling point for reference to satisfy integrity. Keep point 4 live – agreed
6.31 pm	❖ 13 people in IMT room
6.33 pm	❖ Phone calls on disabling monitoring points
6.35 pm	❖ Velocity readings in underground readings requested ❖ What is ventilation pressure doing? Only can tell by fan collar pressure
6.37 pm	❖ Possible ways to attack fire, assumed to be a 'A' seam tail end ❖ Can we look at putting GAG to MAN AND MATERIALS road? ❖ Has any thought been given to taking GAG underground to 4 cut-through ❖ What is the normal mine volume – 230 m^3 ❖ Belt drift – 100 m^3 (71.9) ❖ MAN AND MATERIALS drift – 127 m^3 (55) ❖ GAG only gives 20 m/sec dilution – would be to great ❖ Ventilation survey figures from August used in calculations ❖ Need to reduce flow to 40m^3 / sec to use GAG ❖ Consider these figures in VentSim ❖ Only one GAG on site – 6 hours to get second GAG ❖ Truck needs to go back and get it
6.42 pm	❖ Set up GAG at portals as stand by operation ❖ Need mine operator and fork lift
6.45 pm	❖ Point 1 – 97 ppm CO ❖ O_2 – 20.6%
7.00 pm	❖ Lamp No. 66 – deceased ❖ Lamp No. 113 - not located ❖ Duty Card 4 – Relief Controller has not looked at possible length of exercise and organised relief as per duty card
7.07 pm	❖ Phone call to Relief Controller – previous report confused ❖ Report of Lamp No. 66 was in fact No. 113 – deceased ❖ Lamp No. 66 and 58 found unconscious and breathing ❖ Rescue team putting SSR 90's units on these men to bring them out of the mine
7.11 pm	❖ Quickest way to get rescue team out and two patients ❖ Vehicle to assist? ❖ Deceased body marked and left there
7.16 pm	❖ Still thick black smoke coming out of the conveyor portal and some re-entering the MAN AND MATERIALS drift

	ACTION TAKEN
7.18 pm	❖ Relief Controller (N Marshall) phoned through mines rescue report ❖ Rescue team bringing out one man – Lamp No. 58 ❖ Lamp No. 113 deceased ❖ CO – offscale ❖ CH_4 – traces ❖ O_2 – 15% ❖ Visibility at the bottom of the drift was nil ❖ Route markers were left to be able to relocate Lamp No. 66 who was unconscious with a 90 min SSR ❖ Deputy drove down to portal to get QMRS
7.22 pm	❖ MC asked to beef up portal security
7.23 pm	**Point 11** ❖ CH_4 – 0.09% ❖ CO – 14 300 ❖ H_2 – 0.14% ❖ CO_2 - 2.8% ❖ O_2 – 16.6% **Point 12** ❖ CH_4 – 0.09% ❖ CO – 10 800 ❖ H_2 – 0.14% ❖ CO_2 – 3.56% ❖ O_2 – 15.9% ❖ CH is high at 55 ppm **Point 18 – 'C' seam shaft return** ❖ CH_4 – 0.07% ❖ CO – 7 600 ❖ H_2 – 0.067% ❖ CO_2 – 2.53% ❖ O_2 – 17.39% ❖ CH is high at 47 ppm Nothing flammable / explosive in the mine.
7.28 pm	❖ Brief synopsis on where people were: ❖ 1 unconscious – 90 min SSR, markers to show route ❖ 1 vehicle bringing out 1 QMRS team ❖ 1 person on way out – Van De Moulen ❖ 1 person – inbye portal in vehicle ❖ 1 body – route marked ❖ Decisions on retrieval of body to leave there for now. ❖ 11 people in IMT room
7.30 pm	❖ General Manager – wrong notification of deceased person to company senior officials, who have already commenced notification.
7.31 pm	❖ Decision of IMT to send second team underground to help recovery of other persons.
7.32 pm	❖ QMRS need last known location of Lamp No. 66. ❖ Relief Controller said – south trunk transfer adjacent to cache with SSR 90 fitted. ❖ Third team on site ❖ First team will be de-briefed and stood down. ❖ First team coming out of the mine with a stretcher ❖ Decision on what to do with fire or get body out ❖ Which point was trending fastest?

	ACTION TAKEN
7.37 pm	❖ Point 3 discussed. ❖ No attempt was made to supply trendset gases to IMT team.
7.45 pm	❖ Relief Controller Report ❖ QMRS Team 2 – deployed ❖ Bag sample taken from conveyor drift portal ❖ Bag will be brought back by the vehicle which takes team down to portal ❖ No update on Team 1
7.50 pm	❖ Still no trending of CO on graphs ❖ No smoke at 0 cut-through
7.53 pm	❖ No bag available for mines rescue team for portal ❖ QMRS – 3 people contacted from Cook for third team but would have come if it was a real scenario, but would have to stop production ❖ Have four others on team on-site.
8.00 pm	❖ Mines Rescue Team out of mine with patient. ❖ Second team have been told to get bag samples at portal before going underground ❖ How long has person got left on his SSR 90 who is underground and unconscious? ❖ Concern at what products are going back over that fire. ❖ Should have these within five minutes ❖ Different information was given to Relief Controller
8.03 pm	❖ At 5.00 pm, CO and CO_2 ratios at Point 3 – fire 100 - 150°C ❖ Ratio thickets 0.8 → coal fire ❖ QMRS have not had person in IMT at all times ❖ Team will go underground as soon as samples are confirmed ❖ GAG has been bogged (forklift has flat tyre) ❖ Discussion on calculating volume for GAG to dilute
8.10 pm	❖ Forklift unbogged ❖ Two hours to have GAG ready for use ❖ Do not know exactly where the fire is ❖ Mine Manager does not wish to send anyone underground to fight fire ❖ Are there any boreholes in that area? ❖ All boreholes are cemented
8.20 pm	❖ D Boyd – Point 11 CO – 136 000 ppm (13.6%) ❖ O2 – 16.6% ❖ Call to clarify result to see if it is correct. ❖ Result now 13 600 ppm (1.36%) – clarified by D Cliff ❖ Starting to put priority on Portal bag sample ❖ Person still unconscious underground
8.26 pm	❖ Samples on their way to G/C ❖ Belt road seal on surface would by use of dozer if required
8.30 pm	pm Team 1 arrived at surface with patient ❖ 8.24 pm bag sample sent to G/C ❖ Coming out – minigas 1.9% CH_4 ❖ CO > 1000 ppm ❖ O_2 – 7.6% ❖ Results of bag sample available at 8.34 pm ❖ Three trainers of GAG not here yet ❖ 1 Kenmare and 2 Laleham people were in Team 1 and Team 3 ❖ Not enough GAG operations to set up

	ACTION TAKEN
8.34 pm	**Samples from Portal and Belt Road** ❖ CH_4 – 0.8% ❖ CO – 32 800 (3.2%) ❖ H_2 – 0.8% ❖ CO_2 – 10.8% ❖ O_2 – 7.6% ❖ If breathing rate normal on SSR 90, time nearly exhausted. If breathing shallow maybe up to 5 hours duration.
8.38 pm	❖ Discussion held on whether or not there was a need to get the other GAG. ❖ QMRS given readings – second team to be dispatched ❖ Decision to send truck back for second GAG ❖ Six hour round trip or arrange N Qld.
8.43 pm	❖ Relief Controller confirmed GAG persons on site. ❖ Some are part of third team ❖ General Manager would want the GAG set up 70 metres from the portal. Can we get H_2O up there?
8.45 pm	❖ Discussion to shut down one fan ❖ Partial closing off portal ❖ Point 11 – CO, CO_2 fire in excess 150°C – trickets ratio 1.0 coal fire ❖ Bag samples at conveyor portal 15 mins interval by QMRS persons may be able to put tube in place to take these
8.50 pm	❖ QMRS – report back from mines rescue team 1. ❖ Fresh Air Base – 0 cut-through ❖ Very low visibility ❖ Travel down 'B' heading to 2 cut-through ❖ Found Lamp No. 113 at top of 'C' seam drift ❖ No rescuer, no pulse, assumed deceased ❖ Marked plan ❖ Found two persons unconscious – both wearing lifesaver 60's. Put both on 90 minute SSR ❖ Left Lamp No. 66 with SSR 90 on ❖ CO > 1000 ppm, O_2 – 15% - visibility low ❖ Carried Lamp No. 58 in stretcher ❖ Came back out travel route of 'C' seam ❖ No investigation done in mine ❖ Lamp No. 58 still unconscious ❖ 0 – 1 cut-through stopping intact ❖ no visual flame, only smoke at 'C' seam
8.55 pm	❖ Estimated time to recover deceased? Last rescue took 1 ½ hours.
8.58 – 9.10 pm	❖ G Dalliston left IMT room
9.14 pm	❖ Discussion once again on how to get GAG exhaust ducted to portal. ❖ How to get the GAG into conveyor drift ❖ GAG $20m^3$/sec flow ❖ Drop one fan off to slow vent? ❖ Be ready to doze in onto conveyor road? ❖ Two other issues – (1) close travel road doors and put GAG into conveyor road or (2) turn fan off and put GAG into MAN AND MATERIALS and let it create its own ventilation circuit.
9.25 pm	❖ Dozers and low loaders are on stand by from South Blackwater Open-cut

	ACTION TAKEN
9.32 pm	❖ Tube bundle results for 9.00 pm ❖ **Point 3** ❖ CO – 15 600 ❖ CH_4 – 0.145% ❖ H_2 – 0.41% ❖ Upper CH_4 – steady ❖ **Point 11** ❖ CO – 14 200 ❖ H_2 – 0.14% ❖ Upper CH_4 – steady ❖ **Point 12** ❖ H2 0 0.16% ❖ Upper CH_4 - steady
9.40 pm	❖ Portal Readings ❖ CO 28 000 ppm ❖ CH_4 – 0.56% ❖ H_2 – 0.45% ❖ O_2 – 6.4%
9.43 pm	❖ Decision to set up GAG with tee piece to enable second GAG to be used on arrival. ❖ Shut down one fan and regulate intakes
9.45 pm	❖ Ramp 9 loader dozer has been flooded. Another dozer ready in less than one hour. ❖ Rear dumpers are required as well? ❖ General Manager – thinking about Appin belt drift fire and how this was handled with high expansion foam.
9.50 pm	❖ Lamp No. 66 located south trunk 'C' seam unconscious. ❖ Fresh SSR 90 has been fitted ❖ Asked for second QMRS team to go to help retrieve patient ❖ Has an airflow / quantity been measured into MAN AND MATERIALS (travel) road portal and what is coming out? ❖ Fan to try and determine if there is air both going in and out of conveyor portal. ❖ Contacted control for these readings ❖ Pressures and quantity is normal ❖ 230 m^3 / sec with pressure at 700 pa
9.58 pm	❖ Third QMRS five man team gone to assist retrieval of Lamp No. 66 and standby Team 1 at the FAB at portal. ❖ Discussion that is there is an intake flow (convection current) down conveyor drift. Put GAG into conveyor drift. ❖ Stop one fan to introduce and measure gases.
10.10 pm	❖ Relief Controller left (to go home) ❖ No relief for Duty Card ❖ The portal readings measured at 9.45 pm were as follows: ❖ CH_4 – 0.8% ❖ CO – 30 000 pm ❖ H_2 – 0.9% ❖ O_2 – 6.0% ❖ Plot on Ellicott each portal reading
10.15 pm	❖ Phone call to say that the GAG was ready to test in 15 minutes ❖ Pump down the mine in 30 minutes ❖ Body still to be retrieved before use of GAG
10.18 pm	❖ Started standing persons down but still available.
10.21 pm	❖ Third QMRS team taken PJB to help rescue Lamp No. 66.

	ACTION TAKEN
10.25 pm	❖ Not physically possible to keep getting samples from three points underground and surface portals with one person. ❖ Gas Shed at Kenmare, GC at Laleham ❖ Point 3, 11 and 12 readings given again from 8.45 pm ❖ Trend gases from last four or five samples
10.28 pm	❖ QMRS anticipate having Lamp No. 66 on surface by about 11.00 pm unconscious but breathing. ❖ Look at recovery of Lamp No. 113 body and put GAG down MAN AND MATERIALS drift.
10.50 pm	❖ Portal intakes (MAN AND MATERIALS) 124 m^3/sec, velocity 4 m/sec ❖ Conveyor 108 m^3/sec, velocity 3.32 m/sec ❖ ***(These were real, not scenario based figures)*** ❖ Rescue Team and Lamp No. 66 on surface.
11.00 pm	❖ Emergency Exercise terminated ❖ Simulations on GAG not done by end of exercise
12.00 am	❖ GAG Run ❖ Not sufficient H2O flow and pressure to be able to run one GAG let alone two as proposed. ❖ No plan for use of GAG at surface area including how ducting could be installed to allow flow of inert gas.

EMERGENCY EVACUATION AND DE-BRIEF

Assessment Summary

The preparation and practice generated by having prior knowledge of the exercise window is regarded by the Emergency Exercise Management Committee as pro-active and targeted towards achieving better emergency preparedness.

This section contains detailed analysis of the circumstances and difficulties encountered by the personnel evacuating from the mine. It is recommended that carefully consideration be given to the findings detailed in this section for critical analysis and application to individual enterprises.

The de-briefing of personnel and the accurate recording and passing of this information is vital to any effective incident control. Some crews were divided by the question, "Do you have any information to provide?". This practice is not supported.

The fact these people had just evacuated from an emergency circumstance must inherently mean they have information to provide. They will not be aware of what, if any, information the de-briefing officers or the Incident Management Team currently hold and should not be required to make a subjective response to such a question.

Catering for re-hydration of survivors is of paramount importance, and first aid treatment should not be limited to the tending of obvious injuries.

During the de-briefing process no objective evidence was sought or quarantined. De-briefing sessions must be structured with adequate resources, such as mine plans and question prompt sheets, to facilitate accurate and complete capture of information.

Assessor Comments "C" Seam Main Gate 2

Deputy and crew of four. It is noted that this is not the normal deputy for this section. The normal Deputy was on shift but not assigned to the panel.

Shane Shepherd

- Deputy led crew well
- Link line used well between crew
- Deputy checked and accounted for crew members through evacuation
- Route of travel was known – good knowledge of area
- Attitude of all involved in crew was very good towards the exercise and on what was required
- Frustration with not have the ability to communicate was evident, however, he made conscious effort not to side breath to avoid contamination.
- Deputy's attempt to communicate on route out of mine via calling exchange on DAC's and ringing 555 on phones. He was unable to speak, however, control did not realise what was happening and did not track communication attempts.
- Mine was very well lit. This made evacuation easier.
- De-briefing needs to be more structured with the possible use of standard question sheet. Movement in and out of this room required more control and its location needs to be reviewed.
- No water or sustenance was not offered to employees after evacuating the mine.
- Self - rescuer change over was achieved quite well. This may be due to a benefit of using the same type of rescuer and not a different unit.
- The general comments by crew members included: problems with trip hazards along belt road; waist straps on rescuers were hard to locate and tie up; the crew had not walked this egress before; crew felt confident in their ability to get out; they believed the deputy did a good job in leading the crew out
- All crew members had a good idea of what had occurred.

Col Klease

- Deputy led team well and was aware of his route of travel – good time was made and checks were made at regular intervals on crew and he used the lifeline well (very convenient having string in his pocket).
- Lifeline was not present in areas and obstacles pose a problem along conveyors (lumps of coal, pallets etc).
- Some form of indicators eg. Reflective droppers needs to be erected so personnel are aware when they reach a self-rescuer cache otherwise you would walk past them.
- It should be noted that this was not the permanent Deputy for this panel (Maingate 2) and that the usual Deputy was told to work outbye for the day.
- The use of DAC's and telephone by the Deputy could prove beneficial in knowing the team location, but this would depend / rely on the awareness of the controller and for him to note where each call is coming from and the time to plot the position and, therefore, route and rate of travel by person / persons egressing the mine.
- The position of the portal sentry in relation of the portal could be hazardous should an explosion occur. The position was within the line of blast and some consideration should be give to repositioning this to back behind portal.
- In the debrief there was some confusion as to the location of the Eimco and sled and no mention was made of the Eimco some 5 – 6 metres above it in the belt road – this information could be important to a rescue team working in low visibility.

Jan Oberholzer - Self Rescuer Problems

During the exercise there were certain problems experienced with the donning of the selfrescuer sets. Although these problems were not the cause of a non conformance in that they led to a casualty it is however a potential risk that will have to be addresses.

These problems flowed out of the bands used to tighten the selfrescuers to the wearer's body.

In the process of changing sets problems were experienced in trying to loosen these bands.
The clasp holding the neckstrap causes problems if it has to be loosened with one hand.
It was observed that the new selfrescuer was firstly activated before the old was removed. In absence of sight this meant that one hand was used to hold the new selfrescuer. In reality the wearer had only one hand free with which to execute the changeover process and to loosen and remove the spent selfrescuer
Attention should be given to this aspect during training sessions.

If the knot in the straps around then waist is not made using bows then loosening of them with one hand becomes almost impossible. All that is achieved is a tightening of these knots. The strength of these straps are such that they cannot be broken with ease.

This makes the whole changeover process very risky and it is strongly recommended that the process be closely investigated and through consultation with the manufacturer a standard procedure for the change over of these sets be formulated.

It is proposed that SIMTARS could do this and once completed such a procedure could then form part of the normal training process.

Audit Tools

Emergency Evacuation System - Main Gate 2

Shane Shepherd Jan Oberholzer Cole Klease

				COMMENT
❖ Incident received	❖ Incident received ❖ Correct message received ❖ Emergency alarm recognised	❖ Recognition of changed circumstances ❖ Attempt communication	❖ 30 ppm immediately recognised as a hazard. ❖ Established communications immediately with the Control room.	❖ Good reaction – no non-conformance.
❖ Incident Communicated	❖ All crew members accounted for ❖ All crew members notified ❖ Crew marshalled together ❖ Options considered ❖ Partial / Total evacuation	❖ Location of outbye workers considered ❖ Plan formulated and decided on	❖ No workers were outbye and under his supervision. ❖ Deputy communicated to his plan, based on readings both to his crew and Control.	❖ Conformance – good reaction.
❖ Incident Equipment	❖ Self Rescuers fitted ❖ First Aid equipment taken ❖ EBA units taken ❖ Tools required	❖ Recognition of expected duration	❖ SCSR fitted when required – used sparingly ❖ No FA taken – physically impossible. ❖ N/A ❖ Adequate	❖ Conformance
❖ Escape Route	❖ Escape route determined ❖ Escape route communicated to Control room ❖ Number of people escaping ❖ Rescuer / Light numbers ❖ Appropriate route taken	❖ Recognition of deteriorating circumstances ❖ ***(Impose smoke glasses)*** ❖ Re-evaluate escape options ❖ Re-evaluate escape times and duration of SCSR's	❖ Based on reading – deteriorating sight. ❖ Yes ❖ Yes. ❖ Deputy ensured that team was led out as well as checking regularly.	❖ Conformance

				COMMENT
❖ Travelling	❖ Appropriate means decided ❖ All crew travelled together ❖ Pace of travel appropriate ❖ Correct egress route was maintained ❖ Egress clearly marked ❖ Duration of self rescuers ❖ Duration of EBA's ❖ Use of lifelines, etc.		❖ Yes. Primary escape route was used. ❖ Yes. Joined together when sight became bad. ❖ Yes. Reached surface, pace steady and calm ❖ Route was changed when required. ❖ No. Egress in construction – structures used to best avail. ❖ No problems experienced. ❖ N/A ❖ Yes. Deputy was very well prepared.	❖ Deputy maintained a calm attitude. ❖ No major non-conformances under the circumstances.
❖ Observations	❖ Take note of circumstances and environment	❖ Duration times recorded	❖ Smoke, location, density ❖ Heat, location ❖ Gases detected, location concentration ❖ Services - Compressed air - Water - Communication - power	❖ Deputy did regular checking of the environment. ❖ No non-conformances
❖ Self Rescuers	❖ Self rescuers fitted correctly ❖ Fitted in sufficient time ❖ EBA's fitted correctly ❖ Fitted in sufficient time ❖ Adequate number of EBA's ❖ EBA's at station sufficient in number ❖ Crew takes spare EBA's ❖ Self Rescuers / EBA's correctly worn and used		❖ All self rescuers were fitted correctly and in time (see separate report on change over)	❖ One major non-conformance (one person died)

				COMMENT
❖ Communication with Control Room	❖ Control room informed of location ❖ How is communication carried out? ❖ Informed on changed conditions	❖ Where was communication attempted?	❖ Deputy did full report based on available information. ❖ Used mine communications. ❖ Unable to inform on the change of conditions due to use of SCSR, however attempted by pressing buttons.	❖ No non-conformances
❖ Arrival on surface	❖ Muster ❖ Report ❖ Medical aid ❖ De-brief	❖ Check off at Lamp Room ❖ Report to ESO and Incident Controller ❖ Arrange medical aid and re-hydrate ❖ De-brief observations	❖ Done according to requirements. ❖ Done according to requirements. ❖ Yes. All survivors were checked. ❖ No rehydration sustenance was given. ❖ No organised method employed – fragmented team in discussion. ❖ No formal checklist. ❖ Lack of sense of urgency. ❖ Deputy had concerns about crew as well as missing member. ❖ Initiative should have been from management.	

Debriefing - Main Gate 2

				COMMENT
❖ How notified of incident	❖ RadioPhone DAC not notified.	❖ Contact with control ❖ What time were you notified?	❖ At 4.04 pm they were informed that smoke was entering the panel.	❖ Deputy asked for gas readings, then contacted Control.
❖ How was incident detected?	❖ Environment damage ❖ Change in circumstances	❖ Smoke, dust increase in smoke	❖ Smoke entering panel. ❖ Increase in CO.	
❖ Did you assemble crew at place of safety?	❖ Place of safety	❖ Crib Room, ERS Station	❖ Crew has assembled in the crib room.	
❖ Account for crew or personnel including contractors in section of pit		❖ How did you account for personnel?	❖ Account for in section and asked about crew member who had returned to the surface.	❖ Deputy knew who was to be located. ❖ Two additions entered section. Deputy was not aware they were in the area.
❖ Call control to confirm that personnel are accounted for		❖ Did you make contact with control?	❖ Contact was made	❖ Deputy kept Control informed.
❖ Decide intended route		❖ What route was used?	❖ Yes. Belt Road	
❖ Location of closest ERS		❖ Easy to find?	❖ Yes. Found with no difficulty	
❖ Where all rescuers taken?		❖ What was taken?	❖ No. one person was taken	

				COMMENT
❖ When changed over, to long duration self rescuers		❖ Time of change over?	❖ Two minutes	❖ This was done quite well. ❖ One man was slow and died as a result.
❖ Problems encountered on escape route?		❖ Visibility / condition of roadway?	❖ Smoke, location, heat ❖ Gases, location, concentrations ❖ Communications	❖ Trip hazards
❖ What was seen on evacuation route?	❖ Environmental	❖ What were the changes?	❖ N/A	
❖ Time taken to reach the surface		❖ Was it recorded?	❖ Yes	❖ Deputy knew time taken to evacuate
❖ Were names checked off		❖ By whom?	❖ Checked by Portal Security and Lamproom Attendant	
❖ Who approached the crew or personnel on the surface?		❖ Senior Mines Official	❖ Mr Cannon approached crew on arrival.	❖ No vest identifying who he was and what his position was.
❖ What information was given on the surface?			❖ Lamps were checked in ❖ First aid area ❖ De-brief area	
❖ How long before de-briefing took place		❖ Too long – Time on Surface Time of De-briefing	❖ Not all informed that de-brief had commenced. ❖ De-brief went for approximately 15 minutes	
❖ Location of de-briefing room?		❖ Was the room allocated an emergency plan?	❖ No. Mine plan was put on the table	❖ Personnel not sure of briefing area or where to go

				COMMENT
❖ Personnel involved		❖ Who was involved?	❖ Two people were involved – B Pollycronk and B Muir	❖ Did not know who they were or where they were coming or going. ❖
❖ How was de-briefing recorded?		❖ Tape recorded / notes / videos	❖ Notes were made on the mine plan.	
❖ Was there a format followed for questions?			❖ No	❖ Statement from individuals - notes taken
❖ Type of questions asked?	❖ List of questions	❖ Relevant to questions	❖ Two officials	
❖ Person leading the de-briefing		❖ Senior Mines Official	❖ No. At no time when crew was on the surface were they offered any drink or food.	
❖ Was the person / persons made comfortable?	❖ Re-hydrate ❖ Medical aid		❖ 15 minutes	❖ Time was sufficient.
❖ Time of de-briefing?		❖ Length of de-briefing?	❖ Yes	
❖ Was all information gathered?			❖ Yes	❖ Answered all questions asked where relevant and covered the requirement.
❖ Were all possible questions asked?				

Assessor Comments "C" Seam Longwall Installation

Greg Hunt and Andrew Monaghan

- Well rehearsed
- Crews were split up
- Deputy assembled men well. Called after crew assembled using DAC
- Exited via Maingate side belt road, down 1 cut-through, drove down two cut-through's then went back into belt road as 2nd egress
- Were assisted to minimise injury
- No barriers blocking holes in ground to minimise injury to persons evacuating
- Housekeeping needs to be picked up. Little things become big obstacles
- Should have been contractors along belt road. B Morrall took 3 EBA's for contractors that shouldn't have been there.
- Glasses thought to be dangerous by B Morrall – didn't want his crew to use them
- Lost along transfer use from Maingate belt – last cut-through (re-routed due to smoke)
- Reflectors marked red on the way in, green on the way out, located along belt and ribs
- Confused at south belt along drift belt (turned left instead of right)
- Two crew were dropped out – talking
- Deputy and crew went past the cache – didn't see it.
- Last crew member found the cache – accidentally tripped over it.
- Crew hit EIMCO in belt structure – re-routed to normal route down belt road and back into mains
- Got into PJB and got to 'O' cut-through and were then asked to remove their goggles as the smoke had cleared.
- Escorted into de-brief room. Everybody talking – hard to gather all information.
- Rescue underground – poor communication
- Third rescue team – captain with only mouthpiece not full mask
- No reflectors along transfer belt
- Crew stopped along Maingate belt – wouldn't have made it out without assistance
- Reflectors were not reflecting under fluro lights. If cap lamp is turned off or no low beam.

Audit Tool

Emergency Evacuation System "C" Seam Longwall Installation

Greg Hunt and Andrew Monaghan

				COMMENT
❖ Incident received	❖ Incident received ❖ Correct message received ❖ Emergency alarm recognised	❖ Recognition of changed circumstances ❖ Attempt communication	❖ Recognition by means of card from assessor – calmly done. ❖ Use of communications – DAC and radio	
❖ Incident Communicated	❖ All crew members accounted for ❖ All crew members notified ❖ Crew marshalled together ❖ Options considered ❖ Partial / Total evacuation	❖ Location of outbye workers considered ❖ Plan formulated and decided on	❖ Crew assembled in maingate. ❖ All crew members were notified. ❖ Location of outbye operators were considered. ❖ Route was determined.	
❖ Incident Equipment	❖ Self Rescuers fitted ❖ First Aid equipment taken ❖ EBA units taken ❖ Tools required	❖ Recognition of expected duration	❖ Rescuers were fitted correctly. ❖ No first aid equipment was taken ❖ No emergency tools were taken.	❖ First aid equipment was in the maingate. ❖ None there.
❖ Escape Route	❖ Escape route determined ❖ Escape route communicated to Control room ❖ Number of people escaping ❖ Rescuer / Light numbers ❖ Appropriate route taken	❖ Recognition of deteriorating circumstances ❖ ***(Impose smoke glasses)*** ❖ Re-evaluate escape options ❖ Re-evaluate escape times and duration of SCSR's	❖ Route was determined. ❖ Could not make communications to Control due to rescuers being worn. ❖ No rescue and numbers were given. ❖ Were told to use primary route.	❖ Escape route was notified to Control. ❖ Number of people escaping was not given. ❖ Smoke goggles were on.

				COMMENT
❖ Travelling	❖ Appropriate means decided ❖ All crew travelled together ❖ Pace of travel appropriate ❖ Correct egress route was maintained ❖ Egress clearly marked ❖ Duration of self rescuers ❖ Duration of EBA's ❖ Use of lifelines, etc.		❖ Were told of route by Control. ❖ Crew travelled together. ❖ Pace was slow due to visibility limitations ❖ Route was marked most of the way. ❖ Units did not run out. ❖ No lifeline used, only belt structure.	❖ A hole in the walkway was not fenced off.
❖ Observations	❖ Take note of circumstances and environment	❖ Duration times recorded	❖ Smoke, location, density ❖ Heat, location ❖ Gases detected, location concentration ❖ Services - Compressed air - Water - Communication - Power	❖ No notes were taken due to low visibility. ❖ Crew had a general pit and location sense
❖ Self Rescuers	❖ Self rescuers fitted correctly ❖ Fitted in sufficient time ❖ EBA's fitted correctly ❖ Fitted in sufficient time ❖ Adequate number of EBA's ❖ EBA's at station sufficient in number ❖ Crew takes spare EBA's ❖ Self Rescuers / EBA's correctly worn and used		❖ Rescuers were fitted correctly ❖ Rescuers were fitted in sufficient time. ❖ EBA's were fitted correctly and fitted in sufficient time. ❖ For the exercise there were enough EBA's ❖ They were donned as found – both were worn and used correctly.	❖ Fitted at cache and not fitted when first exhausted.

				COMMENT
❖ Communication with Control Room	❖ Control room informed of location ❖ How is communication carried out? ❖ Informed on changed conditions	❖ Where was communication attempted?	❖ Communication was made at the exercise but not after self rescuers were donned. ❖ Communication then was made by radio or DAC. ❖ Only in de-briefing.	
❖ Arrival on surface	❖ Muster ❖ Report ❖ Medical aid ❖ De-brief	❖ Check off at Lamp Room ❖ Report to ESO and Incident Controller ❖ Arrange medical aid and re-hydrate ❖ De-brief observations	❖ Done well. ❖ Didn't notice anybody donning this. ❖ None asked or given. ❖ First aid officer asked group if they were okay. ❖ Not a good location (tea room) ❖ People walking in and out – too many people were talking. ❖ People were taken out of de-briefing for rescue duties.	

Debriefing "C" Seam Longwall Installation

				COMMENT
❖ How notified of incident	❖ RadioPhone DAC not notified.	❖ Contact with control ❖ What time were you notified?	❖ Assessor by card. ❖ Noticed smoke on roof – Deputy contacted Control	
❖ How was incident detected?	❖ Environment damage ❖ Change in circumstances	❖ Smoke, dust increase in smoke	❖ Assessor card – indicated smoke was coming into the section.	
❖ Did you assemble crew at place of safety?	❖ Place of safety	❖ Crib Room, ERS Station	❖ Crew assembled at the Maingate of the Longwall. ❖ Mustered at the Maingate and waited for Deputy. Deputy was at the Tailgate. Chock carriers told of smoke. Deputy told them to stop the machines and to go to Maingate. 936 in Tailgate kept going out to keep going out – Jason Travis	
❖ Account for crew or personnel including contractors in section of pit		❖ How did you account for personnel?	❖ Deputy counted his crew to account for them.	
❖ Call control to confirm that personnel are accounted for		❖ Did you make contact with control?	❖ Control advised primary egress to be used. Travelled to 6 cut-through in PJB then went to Belt Road.	
❖ Decide intended route		❖ What route was used?	❖ Control told them of route to take (Primary Route)	
❖ Location of closest ERS		❖ Easy to find?	❖ Had trouble finding the ERS.	❖ Location not in a good position.
❖ Where all rescuers taken?		❖ What was taken?	❖ All rescuers were taken.	

				COMMENT
❖ When changed over, to long duration self rescuers		❖ Time of change over?	❖ At 1710 - change over to another 60 min unit.	
❖ Problems encountered on escape route?		❖ Visibility / condition of roadway?	❖ Smoke, location, heat ❖ Gases, location, concentrations ❖ Communications	❖ Smoke increased as crew moved outbye. ❖ High CO as crew went. ❖ No communications due to SCSR's.
❖ What was seen on evacuation route?	❖ Environmental	❖ What were the changes?	❖ Poor visibility	
❖ Time taken to reach the surface		❖ Was it recorded?	❖ 1604 till 1837	❖ Left Maingate at 4.18 pm, arrived at the Portal at 5.34 pm, arrived at Surface at 5.37 pm.
❖ Were names checked off		❖ By whom?	▪ Yes. Two unknown persons.	
❖ Who approached the crew or personnel on the surface?		❖ Senior Mines Official	Un-marked man called "Canon" told crew to go to de-brief after sorting team. First aid attendant asked if they were okay.	
❖ What information was given on the surface?			▪ None till de-brief.	
❖ How long before de-briefing took place		❖ Too long – Time on Surface Time of De-briefing	❖ After arriving at lamp room, team sorted and put back lamps and went to the de-brief room. Fitters joined the group half way through the de-brief.	

				COMMENT
Location of de-briefing room?		Was the room allocated an emergency plan?	❖ De-brief room used beside the mechanical department – tea room. ❖ Training room should be de-brief room?	Wrong location for de-briefing
Personnel involved		Who was involved?	❖ Three SBCL employees, Bruce Muir asking questions; Bill Polychrome note taking. Unknown taking notes to ICT.	
How was de-briefing recorded?		Tape recorded / notes / videos	❖ Scribe only and plan filled out with smoke and route.	
Was there a format followed for questions?			❖ No formatted sheet followed.	
❖ Type of questions asked?	❖ List of questions	❖ Relevant to questions	❖ Relevant off cut questions.	
❖ Person leading the de-briefing		❖ Senior Mines Official	❖ Company representative.	
❖ Was the person / persons made comfortable?	❖ Re-hydrate ❖ Medical aid		❖ Question was not asked if there was a need for first aid treatment. ❖ They were made comfortable.	
❖ Time of de-briefing?		❖ Length of de-briefing?	❖ After lamps were checked off.	
❖ Was all information gathered?			❖ Not to all aspects.	
❖ Were all possible questions asked?			❖ Not all.	

Assessor Comments "A" Seam

Neil Winkleman and Adrian Best

- Access to caches quite tidy. Signage very visible, 27 caches, 12 cut-through Belt Road.
- Definite arrow direction from Travelling Road to Belt Road.
- Route markers visible along Belt Road.
- Training of contractors in use of self rescuers – competency in use of rescuers.
- Location and positioning of caches – signage.
- Purposeful walkouts during Induction Training
- Information transfer – recording / actioning decisions, information used without validation, de-briefing location, racking of lamps, recording lamp numbers and who goes where.
- Monitoring use of people
- Managing information and Incident Management Team
- No objectives set or raised
- Priority list was to get the men out of the mine, should have been to put the fire out.
- Communication between Incident Management Team and Mines Rescue Team
- Improvement of Hazard Management Team

Audit Tool

Emergency Evacuation System - "A" Seam

Neil Winkleman Adrian Best

				COMMENT
❖ Incident received	❖ Incident received ❖ Correct message received ❖ Emergency alarm recognised	❖ Recognition of changed circumstances ❖ Attempt communication	❖ Experienced first hand. ❖ Sign "wisps of smoke" shown.	❖ Recognition affected by prior knowledge of incident coming up.
❖ Incident Communicated	❖ All crew members accounted for ❖ All crew members notified ❖ Crew marshalled together ❖ Options considered ❖ Partial / Total evacuation	❖ Location of outbye workers considered ❖ Plan formulated and decided on	❖ Yes. Three workers only. ❖ Yes. Plan developed – communicate and evacuate.	❖ Communication failure. Radio didn't work and unable to access a DAC
❖ Incident Equipment	❖ Self Rescuers fitted ❖ First Aid equipment taken ❖ EBA units taken ❖ Tools required	❖ Recognition of expected duration	❖ Yes. Duration not considered as men were close to surface.	
❖ Escape Route	❖ Escape route determined ❖ Escape route communicated to Control room ❖ Number of people escaping ❖ Rescuer / Light numbers ❖ Appropriate route taken	❖ Recognition of deteriorating circumstances ❖ ***(Impose smoke glasses)*** ❖ Re-evaluate escape options ❖ Re-evaluate escape times and duration of SCSR's	❖ Yes. Changed plans ❖ N/A ❖ Yes ❖ N/A	❖ Consensus on decision to go to travel road when it was discovered that the belt road was full of smoke.

				COMMENT
❖ Travelling	❖ Appropriate means decided ❖ All crew travelled together ❖ Pace of travel appropriate ❖ Correct egress route was maintained ❖ Egress clearly marked ❖ Duration of self rescuers ❖ Duration of EBA's ❖ Use of lifelines, etc.		❖ Yes ❖ Yes ❖ Yes ❖ Yes ❖ N/A ❖ N/A ❖ N/A ❖ No	❖ 6 – 7 cut-through: SBD contractors were walked past in drift. They were sitting in a PJB in fresh air. Confusion was due to 'simulation".
❖ Observations	❖ Take note of circumstances and environment	❖ Duration times recorded	❖ Smoke, location, density ❖ Heat, location ❖ Gases detected, location concentration ❖ Services - Compressed air - Water - Communication - power	❖ Responded appropriately to smoke levels.
❖ Self Rescuers	❖ Self rescuers fitted correctly ❖ Fitted in sufficient time ❖ EBA's fitted correctly ❖ Fitted in sufficient time ❖ Adequate number of EBA's ❖ EBA's at station sufficient in number ❖ Crew takes spare EBA's ❖ Self Rescuers / EBA's correctly worn and used		❖ Yes } Not specifically tested. Employees appeared / claimed to have knowledge of caches.	❖ One employee was unable to fit the nose clip due to shape of nose.

				COMMENT
❖ Communication with Control Room	❖ Control room informed of location ❖ How is communication carried out? ❖ Informed on changed conditions	❖ Where was communication attempted?	❖ First communication from Portal.	❖ De-briefing revealed that the undermanager had answered the call.
❖ Arrival on surface	❖ Muster ❖ Report ❖ Medical aid ❖ De-brief	❖ Check off at Lamp Room ❖ Report to ESO and Incident Controller ❖ Arrange medical aid and re-hydrate ❖ De-brief observations	❖ Not observed (see de-briefing comments)	

Debrief "A" Seam

				COMMENT
❖ How notified of incident	❖ RadioPhone DAC not notified.	❖ Contact with control ❖ What time were you notified?	❖ Experienced first hand.	
❖ How was incident detected?	❖ Environment damage ❖ Change in circumstances	❖ Smoke, dust increase in smoke	❖ Smoke	
❖ Did you assemble crew at place of safety?	❖ Place of safety	❖ Crib Room, ERS Station	❖ Did not specifically retreat to place of safety. First response was to establish communications.	
❖ Account for crew or personnel including contractors in section of pit		❖ How did you account for personnel?	❖ N/A. Three only – all present. ❖ Good job on assembling crew.	
❖ Call control to confirm that personnel are accounted for		❖ Did you make contact with control?	❖ Not until on surface. ❖ Radio didn't work ❖ Couldn't access DAC in belt road due to smoke.	
❖ Decide intended route		❖ What route was used?	❖ Tried Belt Road (better chance of communications) then used the Travel Road.	
❖ Location of closest ERS		❖ Easy to find?	❖ Knew where they were but didn't pass or require.	
❖ Where all rescuers taken?		❖ What was taken?	❖ N/A	
When changed over, to long duration self rescuers		❖ Time of change over?	❖ N/A	

				COMMENT
❖ Problems encountered on escape route?		❖ Visibility / condition of roadway?	❖ Smoke, location, heat ❖ Gases, location, concentrations ❖ Communications	
❖ What was seen on evacuation route?	❖ Environmental	❖ What were the changes?	❖ Slowly – encountered smoke	
❖ Time taken to reach the surface		❖ Was it recorded?		
❖ Were names checked off		❖ By whom?	❖ Yes	
❖ Who approached the crew or personnel on the surface?		❖ Senior Mines Official	❖ Checked off only. No first aid assistance. ❖ No-one asked if they were okay.	
❖ What information was given on the surface?			❖ None given	
❖ How long before de-briefing took place		❖ Too long – Time on Surface Time of De-briefing	❖ Approximately 1 hour – was actually given duties in the meantime.	
❖ Location of de-briefing room?		❖ Was the room allocated an emergency plan?	❖ No-one used the whiteboard.	
❖ Personnel involved		❖ Who was involved?		
❖ How was de-briefing recorded?		❖ Tape recorded / notes / videos	❖ Notes were taken.	

				COMMENT
❖ Was there a format followed for questions?			❖ See SBC notes	
❖ Type of questions asked?	❖ List of questions	❖ Relevant to questions	❖ See SBC notes	
❖ Person leading the de-briefing		❖ Senior Mines Official	❖ Human Resource Manager – Greg Garrick	
❖ Was the person / persons made comfortable?	❖ Re-hydrate ❖ Medical aid		❖ No. See previous notes	
❖ Time of de-briefing?		❖ Length of de-briefing?	❖ Approximately 15 minutes	
❖ Was all information gathered?			❖ Yes	
❖ Were all possible questions asked?				

COMMENTS

Undermanager not controller answered emergency call. Unexpected and unusual. Took information but were instructed to walk up. Thought they should have provided transport as someone could have been distressed.

Assessor Comments "A" to "C" Seam Conveyor Drift

Mark Donghi

Throughout the exercise I was positioned at 'C' seam overcast with Ken Singer. At 1545 hours we positioned a drift runner diagonally across the travel road beneath the overcast. This was done to simulate an accident involving an operator that was overcome by smoke, thereby restricting access to pedestrian traffic only.

No individual approached the vicinity of the 'C' seam overcast until 1620 hours. This individual was walking and had walked from the Tailgate 1 where he had been operating a 936. The individual was Jason Trevis and he had not yet donned his Lifesaver 60 SCSR. Jason explained that he had heard the emergency message over his two-way radio. Jason had not attempted to go to the cache at 'C' seam drivehead due to it being less than a 60 minute walk from Tailgate 1, although he knew where the cache was located.

The change in conditions was explained to Jason ie. The atmosphere now contained thick smoke consisting of CO – 150 – 500 ppm, O_2 – 20.8 – 20.6%, CH_4 – 0%. He was also informed that visibility was 20 metres and was asked to put his cap lamp on low beam. Jason was told that this atmosphere would be causing him a slight headache, stinging eyes and that he would be coughing / choking from the smoke. Jason then stated he would don his Lifesaver 60 SCSR and was handed a unit to don.

Jason commenced donning his Lifesaver 60 SCSR at 1625 hours. Jason's method of donning was as per the training video except he didn't put the neck strap on first. I believe that the weight of the Lifesaver 60 SCSR would pull down on the mouthpiece and noseclip, thereby increasing the risk of toxic atmosphere entering through a broken seal.

Jason then proceeded inbye to 'C' seam drivehead to continue walking out of the pit by travelling the Belt Road ie. 2nd egress. Ken Singer accompanied Jason until he was handed over to Assessor, Trevor Hemley.

No other individuals attempted to leave the pit via 'C' seam overcast.

NOTE
At the 'C' seam drivehead there are three caches. Two of these cache's contain 25 Lifesaver 60 SCSR's each. These are for Kenmare personnel.

The third cache contained 15 x 30 minute Fenzy units which belonged to ColRoc. I did not see any other cache's other than these three.

When Jason first approached us, he advised that the controller advised him on the radio to "evacuate via the travel road – do not don your real self rescuer. Only don a unit given to you by an assessor ie. Jason would have worn his SCSR while evacuating.

Ken Singer

Induction training video at Kenmare mentioned that the MSA Lifesaver 60 can be used for talking – although not recommended as additional saliva produced while talking reduces the life of the unit.

I recall that (the fact that you can talk while wearing) this unit was the reason a mine considered this unit was an advantage over others?

IS THE MSA LIFESAVER 60 MARKETED THIS WAY?

The evacuating team that drove out of the mine (led by Dave Faith) stopped immediately outside the Portal (to communicate with control). The Portal Marshalls endeavoured to call them to the top, however, officials told them that was okay.

The Portal Marshalls were previously advised of re-circulating smoke at the Portals. They endeavoured to call them out of that atmosphere at around 5.53 pm.

The first mines rescue team proceeded underground without the authority of the surface marshalls ie. no communication from Incident Control to the Surface Marshalls.

Possibility of physical barrier at the bottom of the ramp.

Loose cog timber at portal mouths constitute projectiles (explosion from portal).

The frosted glasses allowed approximately 10 – 15% visibility. The linklines observed being used was string and holding hands.

Only one person evacuated by the main traffic road. He did not don self-rescuer as he was advised by control, "Not to don real self rescuer". Successful response after that in that he know where the cache was located, he showed the correct donning procedure and made a successful escape.

If people were advised by the controller to evacuate via the travel road, why did everyone (besides one), choose the belt road escapeway?

This is in conflict with their evacuation strategy ie. Follow the instructions of the controller or mine official ie. Is the induction adequate and what are people being told? Is this value for money induction training?

Can DAC lockout system track progress? ie. Belt lockout switches can download that information.

Trevor Hemley

At cache, I tried the goggles with the cap lamp dim and I could not see the reflective signs or tape (there was lighting overhead)
Ian Brown (taken out at change over) said that we have not been trained on change overs
Fenzy units were at cache MSA side by side and inbye on contractors work area.
Cache on floor could be hard to find during real life emergency.

Audit Tool

Emergency Evacuation System "A" to "C" Seam Conveyor

Mark Donghi Ken Singer Trevor Hemley

				COMMENT
❖ Incident received	❖ Incident received ❖ Correct message received ❖ Emergency alarm recognised	❖ Recognition of changed circumstances ❖ Attempt communication	❖ First man took approximately 45 seconds to react. He then walked to crew and repeated the message. ❖ Leader called on the two-way that did not work.	❖ Bit slow to react but did every thing else well.
❖ Incident Communicated	❖ All crew members accounted for ❖ All crew members notified ❖ Crew marshalled together ❖ Options considered ❖ Partial / Total evacuation	❖ Location of outbye workers considered ❖ Plan formulated and decided on	❖ Outbye men were at belt when notified of the problem. ❖ Discussed briefly and made plan to go from MAN AND MATERIALS Road to Travel Road and out the Belt Road (2nd egress).	❖ No attempt to look for problem.
❖ Incident Equipment	❖ Self Rescuers fitted ❖ First Aid equipment taken ❖ EBA units taken ❖ Tools required	❖ Recognition of expected duration	❖ Close to fresh air, not discussed before donning rescuer.	
❖ Escape Route	❖ Escape route determined ❖ Escape route communicated to Control room ❖ Number of people escaping ❖ Rescuer / Light numbers ❖ Appropriate route taken	❖ Recognition of deteriorating circumstances ❖ ***(Impose smoke glasses)*** ❖ Re-evaluate escape options ❖ Re-evaluate escape times and duration of SCSR's	❖ N/A ❖ Yes ❖ N/A ❖ N/A	❖ No contact was made with the Control Room. ❖ Three people were escaping. ❖ The appropriate route was not taken at first.

				COMMENT
❖ Travelling	❖ Appropriate means decided ❖ All crew travelled together ❖ Pace of travel appropriate ❖ Correct egress route was maintained ❖ Egress clearly marked ❖ Duration of self rescuers ❖ Duration of EBA's ❖ Use of lifelines, etc.	❖ 2nd egress ❖ Yes. Looking after each other ❖ Very good. ❖ Yes. Well lit area in belt drift. ❖ N/A ❖ One team	❖ Outbye men decided to go from MAN AND MATERIALS to Belt Road. ❖ I am unaware if times were watched. ❖ Structure used.	❖ They said go to the 2nd egress. ❖ In an area the 2nd egress was shorter than MAN AND MATERIALS – but had a lot more smoke?
❖ Observations	❖ Take note of circumstances and environment	❖ Duration times recorded	❖ Smoke, location, density ❖ Heat, location ❖ Gases detected, location concentration ❖ Services - Compressed air - Water - Communication - power	❖ Every one tried to keep moving and get out.
❖ Self Rescuers	❖ Self rescuers fitted correctly ❖ Fitted in sufficient time ❖ EBA's fitted correctly ❖ Fitted in sufficient time ❖ Adequate number of EBA's ❖ EBA's at station sufficient in number ❖ Crew takes spare EBA's ❖ Self Rescuers / EBA's correctly worn and used	❖ Wearing and looking comfortable. ❖ If they could find EBA at station. ❖ See if good change over in shortest time.	❖ Some looked very good. ❖ A few crew members had straps hanging . ❖ Change over was good overall. A couple had strap problems.	❖ 50 EBA's were located at station. ❖ Crew took spare EBA's with them.

				COMMENT
❖ Communication with Control Room	❖ Control room informed of location ❖ How is communication carried out? ❖ Informed on changed conditions	❖ Where was communication attempted?	❖ Was not there at the time.	
❖ Arrival on surface	❖ Muster ❖ Report ❖ Medical aid ❖ De-brief	❖ Check off at Lamp Room ❖ Report to ESO and Incident Controller ❖ Arrange medical aid and re-hydrate ❖ De-brief observations	❖ Was not there at the time.	

QUEENSLAND MINES RESCUE SERVICE

Assessment Summary

In evaluating the performance of the Queensland Mines Rescue Service (QMRS), it must be stated that all mines rescue service personnel, team captains and team members performed admirably and should be commended for their ability to perform in difficult and trying circumstances.

In light of the lessons learnt during this exercise, it is recommended that a review of mines rescue protocols and procedures be undertaken to determine their continued compatibility with the industry change from traditional aided rescue to the current preferred strategy of self-escape. Specifically, the policies on team sizes, minimum equipment, stand-by team protocols etc. were originally developed in an environment typified by difficult walking access, poor communication systems and without underground personnel being individually supplied with oxygen self rescuers.

During the performance of an emergency response, is most certainly NOT the time to change set practices. It is, however, apparent that some existing protocols may be hindering the ability of the QMRS to achieve its goals of search and rescue. Specifically, the requirement regarding size and availability of stand-by teams. It would be beneficial to research the frequency of active rescue teams requiring the assistance of their stand-by team. In this instance, the deployment of a single ten man team backed up by direct communication with the FAB controller may have enabled the earlier and simultaneous recovery of both casualties.

Discussed earlier was the reaction of persons to smoke issuing from the belt road portal, and it is surprising that mines rescue personnel also regard this circumstance as unrealistic. This event was not only feasible, it was inevitable in the circumstances surrounding this fire and does NOT require full reversal of the airflow. In fact, it indicates neither full reversal of the airflow in the belt drift nor necessarily means that re-circulation must occur. Mines rescue personnel should be aware of the impacts of fires on ventilation and the factors involved in how and why such an event would occur in this instance.

It was again disappointing that the GAG inertisation equipment was unable to function to its capacity. The non-provision of any adequate docking facility and water supply did not allow for the GAG to be utilised. These circumstances must be addressed as a matter of priority and in accordance with the current Mines Rescue Agreement.

Assessors Comments – Ron McKenna

The assessment under this section was undertaken by Ron McKenna, Assistant Manager, Safety Superintendent Newlands Underground Mine.

Comments in the various sections were made from objective evidence, recorded as facts and not judgmental opinion.

The performance of the Queensland Mines Rescue Service was confined to the following:

- Response by service officials at Blackwater Mines Rescue Station
- Participation of the Senior Service Official at Blackwater Mines Rescue Station
- Participation of the Senior Service Official in the Incident Management Team
- Management and control by the Mines Rescue Controller at the sub-station Colliery
- Response to mutual assistance by Colliery Mines Rescue teams
- Team Captain and Rescue Team Members
- Gathering and Management of information
- Standard of and consistency of communication
- Participation and response to the scenario criteria

Response by senior officials – Blackwater Station

- Response at the station and the standard of system recording and communication transfer was excellent

Participation by senior official in the incident control team

- The S.O. participated in the I.M.T. but would have been more effective had written instructions and data sheets been utilised – most of the communication was verbal

Colliery sub-station control was managed by one service official for almost three hours before support was available.

- The system of recording rescue personnel oxy status was of a high standard and up to date accurate.
- The colliery team was not able to be deployed in less than 2 hours and had to leave with the standby team 30 minutes away
- The rescue controller was totally committed to collecting and relaying information and had no time to record events or pertinent facts. This had the potential for critical information to be missed or distorted
- The mines rescue systems utilised on the day were effective and despite the lack of some essential elements the service officials. Team Captains and team members were able to respond effectively and improvise.
- Response to mutual assistance by unaffected collieries was positive, however the assessor believes that some of the effectiveness of the call out procedure could be lost by having the effected Colliery make the call out.
- Perhaps consideration could be given to having the Rescue Service perform this element of the emergency response.
- One would believe that the effected Colliery Incident Management Team, especially with the speed of acceleration of the hazard which involves the absolute number of variables involved in this scenario, would be heavily committed and would be better served by the Rescue Service making this call.

Team Captain and Rescue team members responded positively to the simulation criteria of the exercise scenario.

- The teams whilst demonstrating appropriate urgency and professional attitude to the challenges, this assessor considers that several scenario elements could have been better presented and made more realistic.

- Any assessors who participate in this type of exercise should remain as inconspicuous as possible – **they are not there!**
- Should a need to communicate information pertaining to the scenario be deemed necessary, there should be no verbal interaction
- Past experience teaches many lessons. There should only be written communication in the form of short factual messages, participating individuals and teams should be thoroughly briefed on this issue.
- Far too often in the past have we confused the issue by inconsistent interaction by assessors

The gathering and managing of information and maintaining a high standard of consistency in the communication is always challenging. On the day this was demonstrated by the amount of data that all sections of the particular groups had to absorb.

- In the Colliery sub-station at the hub of the Mines Rescue activities it was demonstrated that one man was totally committed.

- Even when assistance was available there was only time for verbal communication. The experience of the Mines Rescue Service officials and assistance was able to cope with the operational demands of data collection and transfer but it was impossible for them to maintain any form of concise – consistent recording.

Participation and response to the scenario in the area of this Assessors observation was of a high standard.

- It is always difficult to devise a scenario that in hindsight could have been better presented to make it more realistic.

- The utilisation of past emergencies has some merit because of authenticity but how can we slow the scenario elements down to a realistic pace and still get the right participation is the challenging question.

- The issue of a fire having such intensity that it has the ability to reverse the ventilation in a roadway with plus 100m3 / second was very demoralising and inconceivable to the participants in the rescue teams

- The presence of high concentrations of Carbon Monoxide (CO) ranging from 18,000 ppm (1.8%) to 32,800 ppm (3.28%) did not appear to the assessor as though it was given or recognised as a significant hazard which should have actioned some form of risk assessment and additional controls implemented and ideally some trigger levels set for operational Rescue Teams.

- The issue of coming across two persons both of whom can no longer self escape will always pose serious decision making challenges. The assessor has great difficulty in accepting that in real life a rescue team with radio communication would decide to take one and leave one.

- This issue demands further consideration as to what equipment a rescue team actually takes with it on a search and rescue mission.

Murray Bird and Paul Mackenzie Wood of the New South Wales Mines Rescue Service have researched the first response elements of self escape, assisted escape together with systems to manage and minimise the hazards that underground mine workers can be exposed to in order to reach a place of safety.

Where irrespirable atmospheres, poor visibility and damaged infrastructure are involved, complicated by the pressure of the fire, the short comings of the oxy self rescuer have been well researched. Numerous technical papers and workshops have further highlighted the issues.

The best case response time by the Queensland Mines Rescue Service has been demonstrated to be in excess of (2) two hours and in some cases (3) three hours.

An underground mine in a first response situation must rely upon the hazard management / self escape equipment in the immediate areas of the mine.

The integration of the long duration (C.A.B.A.) compressed air breathing apparatus ad quick fill facilities has been researched and documented.

The advantages that 90 min C.A.B.A. offer can be included in the first response in seam evacuation hazard management strategy.

High risk zones can be identified and by applying a philosophy of having people properly trained to manage the hazard and having the right equipment in the right places, the self escape mechanisms for escape to a place of safety can be greatly enhanced.

We must continue to strive for excellence in our emergency response management and it is by continued vigilance in planning, training and utilising the technological advances available to us that we will eventually demonstrate that **successful resolve is achievable.**

Log of Events

	SUMMARY OF KEY EVENTS
1619 hrs	Emergency call from Kenmare Colliery • Fire underground • Smoke in 'A' seam and 'C' seam Superintendent L. Anderson briefed A. Hazeldean (Asst Supt)
1623	Kenmare control update • Fire in interseam drift • Information noted in call out documents • A. Hazeldean assumed duty cards 2-4-5 emergency van
1624	Superintendent L. Anderson • Call to Dysart Station – on standby notice • Superintendent D. Ryan
1625	Superintendent L. Anderson • Called out Mines rescue duty card No. 1 R. Hartland Superintendent L. Anderson • Kenmare confirmed mines rescue contact • Suggested mobilising GAG • Update of underground atmosphere • 'A' seam shaft 159 L/Min CO • Longwall maingate 2 return 75L/ Min CO • Thick brown smoke at inner seam drift Q. Are there any persons out of the mine yet? How many do you know are still underground? Superintendent briefed Assistant Superintendent
1628	Emergency van ready to leave station to go to Kenmare
1635	Call from K. Falconer to Station Superintendent L. Anderson • Contact Manager Kenmare – Gary Evans (4980 5522) Status Report • One Deputy and some contractors not contacted • Rest of persons are on way out – contacted
1637	Assistant Superintendent L. Anderson leaves Blackwater Mines Rescue Station with Landcruiser and Emergency Trailer • Units checked via duty card check lists
1642	Call from Laleham Colliery to Mines rescue Duty Card 1 • Rescue members - Craig Marney - Paul Stuart

	SUMMARY OF KEY EVENTS
	Leaving Laleham to go to Kenmare
	Superintendent L. Anderson • Briefed the Station Duty Card 1
1643	Superintendent Anderson leaves Blackwater in Landcruiser to go to Kenmare
1730	Kenmare Colliery:-
1737	Blackwater Police notified that the issue was emergency exercise only
1750	Superintendent Anderson in the Incident Management Team. Assistant Superintendent Anderson Rescue Substation Control • Information 6 man team on site 5 men coming
1755	Assistant Superintendent Hazeldean • Mines Rescue personnel checked off for current oxy time rating. **<u>Note:</u> This is a process which is updated monthly and reflects the training status of individual rescue members. It should also be noted that the Mines Rescue Service does not call out rescue team members – this is the responsibility of the affected Colliery.**
1800	Assistant Superintendent Hazeldean – Substation Controller • Sourcing appropriate mine plans – non in station • Strategic plan being discussed • Awaiting detail from I.M.T.
1802	Superintendent Anderson briefs Assistant Superintendent Hazeldean • Assessment of known gases • Location of where one man could be • Standby team coming but not known who
1805	• Operation Team briefed by Superintendent and Assistant Superintendent • Standby team on its way ETA Kenmare 1830 hours
1807	Manager Evans Undermanager Muir Updated team brief – Captain Richard mills • Discussed location of missing persons • Given details of personnel • Strategic Plan constructively discussed
1810	Critical issues of team brief • 3 missing persons • One will be out of oxy SR time at 1830 hours • Last known location marked on plan
	Comments by Superintendent

	SUMMARY OF KEY EVENTS
1815	• Assess condition of persons as you locate them • Don't try to do too much • There is an oxy SR cache at 5 cut-through – marked on plan **Note: Team brief was verbal only - Captain made written notes of pertinent issues** Captain brief to team • Well done – concise & accurate • Demonstrated sense of urgency • Team dressage and Captain's checks – professional • Superintendent Anderson assisted with dressage and generally instilled confidence • Plan of 'A' seam arrived and was given to Captain Mills **Note: One man has oxy available only until 1630 hours** Assistant Superintendent Hazeldean Brief: D. Smith – Surface fresh air base controller G. McLean – Surface First Aid Officer
1817	**Note: Surface fresh air base was to be the Stone Dust Storage shed at mine energy portals. Team brief was verbal only - Captain made written notes of pertinent issues** • Sub-station control – Assistant Superintendent A. Hazeldean • Surface sub-station control – D. Smith • First Aid ambulance – G. McLean • No.1 Rescue Team Captain – R. Mills Conducted radio check Summary: • Noted that some areas will be difficult to maintain communication with radio • Stone Dust Shed – surface F.A.B. has phone No. 567 • Team is entering irrespirable atmosphere of 38,000 ppm CO inbye of No2 cut-through • D. Smith surface F.A.B. control instructed to drive the transport with the No. 1 team coupled up and under oxy. **Stop at Stone Dust Shed – man surface F.A.B. Then No. 1 team to drive vehicle to 2 cut-through and stop at fresh air – irrespirable fringe.** **Leave vehicle at No. 2 cut-through continue inbye to search and rescue known survivors!** Standby team arrived at surface Rescue Control – Sub Station • Reported to A. Hazeldean • Briefed by A. Hazeldean • Status checked – one man out of oxy time Crinum team notified control that a team of 6 men were assembled and standing by in Emerald.

	SUMMARY OF KEY EVENTS
1830	Note: Emerald is approximately 110 km from Kenmare Colliery Blackwater Station Duty Card 1 update Cook Colliery has 3 trained – current rescue members underground at Cook
1833	Note: Oxy status checked by A. Hazeldean C. Glazbrook arrived to support surface substation controller Briefed by Assistant Superintendent A. Hazeldean
1835	Standby team – radio check F.A.B. to sub-station control Standby team suit up – Captain check Team updated brief by Assistant Superintendent A. Hazeldean
1841	I.M.T. message to Assistant Superintendent A. Hazeldean • U/G gas levels 18,000 ppm CO
1850	Surface F.A.B. reports • One person found by search team No. 1 – deceased
1853	**<u>Note:</u>**
1900	**Now two Mines Rescue representatives at surface sub-station control.**
1905	**This reduced the information overload that the controller A. Hazeldean had been enduring.** **C. Glazbrook now actively involved and maintaining communications.** Sub-station Control lost contact with surface F.A.B. – radio and telephone A. Hazeldean goes to investigate C. Glazbrook maintains control at sub-station **<u>Question</u>: What happened to Des Smith who was sent to maintain control at Stone Dust Shed F.A.B.** **<u>Report:</u> I.M.T. has report that D. Smith went underground with No.1 team in transport and has not been sited by F.A.B.**
1910	• Undermanager Steve Gordon instructs standby team to go to surface F.A.B. • Standby team Captain refuses to go to F.A.B. until Mines Rescue Controller A. Hazeldean instructs him to do so. A. Glazbrook now manning sub-station Sorted out an anomaly with a B.G. 174 test which has not been dated. Wearer and Team Captain were briefed and the issue was resolved. **<u>Note:</u> At this point in time the impact of the high levels of CO ranging from 18,000 to 38,000 ppm (1.8% to 3.8%) were not fully appreciated. This issue was positively addressed by C. Glazebrook and suit was re-tested ok.** • **This was a point well noted**

	SUMMARY OF KEY EVENTS
1915	Report from No. 1 Team • Trevor Lane lamp / rescuer No 66 on stretcher and to fresh air • Second man alive but unconsciousness left in irreparable atmosphere with oxy self rescuer on (SSR 90) Team ready to go underground – No 2 team briefed by Undermanager N. Marshall Route of travel Team dispatched to recover unconscious person Three man stand by team on site Three men left Emerald 1830 hours Cook have three men available
1922	**Note: (3)Emerald and (3)Cook Mines Rescue were not actually dispatched but were recorded as phantom participants**
1925	Some confusion developed at this time. Communication links with underground radios were causing spasmodic and belated messages.

1930	• Conflicting reports on status and location of gas analysis
	• Statement
	  • Ventilation is still normal
	  • Appears that fire gases are being diluted and taken away from us
	  • Ventilation in the conveyor heading has reversed and smoke now Coming out of the surface
	  • A. Hazeldean stopped Team 2 from leaving sub-station until Samples were collected and analysed.
	
	Note: Hazard of recirculation had been recognised
	Confusion due to lack of knowledge by Rescue personnel as to the location of gas sample bags
	
	• Gas sample analysis insisted upon by A. Hazeldean
	• Gas sample collected from belt heading
	
	• No. 1 underground team arrives at surface F.A.B.
	
	Note: Des Smith, who found himself underground with the No.1 team came out with the team
	
	Bag samples from belt drift sent to Laleham Chromatograph for analysis
	
	• Analysis results from Laleham confirmed
	• Comparison of rescue team mine gas with bag sample analysis

1951	Bag sample results — Minnie gas CH4 0.8% — 0.1% CO 3.28% (32,000 ppm) — > 1000 ppm CO2 10.8% — N/A

	SUMMARY OF KEY EVENTS
2000	O2 7.6% 15% H2 0.8% (8,000 ppm) N/A A. Hazeldean implements bag sample collection / analysis regime – every 15 minutes
2024	• No.1 team debriefed – written report • No.1 Team Captain and A. Hazeldean brief No. 2 team
2034	• No. 2 team leave surface F.A.B. • G.A.G. Superintendent requested 3 men to assist with setting up to inertise • No. 2 team M. Fenner Captain • No. 3 team collecting bag samples operating from Stone Dust Shed – surface F.A.B. • Underground active team No. 2 update on progress • At top of drift 'C' seam • Operating on underground radio channel 1 • Confirmed with surface control – no radio contact in belt drift
2040	• At 1900 hours G.A.G. Superintendent requested trained G.A.G. operators be released to set up the unit
2057	A. Hazeldean refused the request due to priority of missing men At 2100 hours these men were released to the G.A.G.
2105	• Radio communication lost contact with No. 2 team sub-station <> surface F.A.B. <> surface control • Steve Goldman notified – lack of communication
2122	• Store Dust Shed – phone contact No. 567 • Missing person located by No. 2 team
2123	• Control updates A. Hazeldean at surface F.A.B. • A. Hazeldean arranges with R. Mills to brief Team 3
2134	• No. 2 team coming up MX5 drift carrying stretcher • No. 3 team assists with stretcher carry Communication difficult due to second hand message transfer rapid to phone & return
2135	Decision to take P.J.B. to M & S drift to meet stretcher team I.M.T. report U/G team is outbye of 0 cut-through. Anemometer readings and air quantity evaluation made by rescue team members and communicated to I.M.T.
2145	Request A. Hazeldean to Kenmare Ventilation Officer area of belt and M & S portal to assist with quantity calculations
2150	

	SUMMARY OF KEY EVENTS
2153	Request A. Hazeldean via L. Anderson relief back-up from Don Ryan – Superintendent Dysart Rescue Station • All known survivors were accounted for • Request by I.M.T. for another rescue team to recover body of deceased was refused by A. Hazeldean <u>Quote:</u> A. Hazeldean
2205	• Can't use these teams • If body recovery is a priority we need to get other teams • Believe priority should be to control the fire before exposing any more teams Rescue team reports on portal ventilation area difficult to measure manually.
2240	Man and supply portal Velocity 4.02 m/sec Belt portal Velocity 3.32 m/sec Total quantity calculated 240m3 / second
2241	All rescue teams out from underground
2245	Hazeldean contacted L. Anderson **Greg Rowan terminated exercise** **Requested the I.M.T. consider 'what action from here on'**

EXTERNAL AGENCIES

SIMTARS

TO: MR PAUL HARRISON – MANAGER OHECC SIMTARS

FROM: MR COLIN HESTER – PRINCIPAL CONSULTING SCIENTIST

SUBJECT: TRIAL EMERGENCY CALL OUT – KENMARE COLLIERY, 7/09/99

DATE: 8 SEPTEMBER 1999

PURPOSE
The Department of Mines and Energy, Safety and Health Division, were involved in a trial coal mines emergency call out partly in order to test the provisions of the DME Emergency Response Manual (Revision 41). As a nominated provider of technical expertise and monitoring equipment to industry and the Department, SIMTARS was required to assist in accordance with procedures described in the Emergency Response Manual and SIMTARS instruction Describing Mine Emergency On Call Provisions.

STRATEGY
The trial call out was intended to be conducted in a manner reflecting the situation that may occur during an actual incident. All communications normally required under the Emergency Response Procedures and SIMTARS Instruction Describing Mine Emergency On Call Provisions were entered into. SIMTARS Redbank On Call Team co-ordinated communications with all necessary parties to ensure an efficient operation in which key SIMTARS personnel at Redbank and Mackay, and the Inspectorate were fully aware of the progress of the emergency response.

SIMTARS Redbank On Call Team ultimately did not travel to site, but proceeded in accordance with the requirements of the Emergency Response Manual to the point of travel prior to being stood down. Note that SIMTARS Redbank On Call Team have trialed the capability to mobilise resources to the Brisbane Airport on a number of occasions.

Mackay office personnel and equipment, particularly the mobile laboratory and associated equipment were included in the emergency response as required.

DISCUSSION
The log of events recorded by SIMTARS Senior On Call Officer are provided in Appendix 1. These provide a summary of the actions and responses taken as a requirement of the Emergency Response Procedure and the escalation of the trial incident.

As mentioned above, all communications normally required by the Emergency Response Procedure were performed during the trial emergency call out. In all cases the outcome was satisfactory with regard to achieving the desired outcome, however, the trial did highlight a number of small ways in which the communications may be improved. SIMTARS officers have previously recommended that the original pager message should include some reference to the words “Department of Mines and Energy, or Emergency, or Inspectorate” to confirm that the call is bona fida. Additionally, in the case of this call out the message was sent direct from the minesite to SIMTARS rather than via the DME Duty Officer. SIMTARS officers recommend that the pager number be available only to DME officers and that the SIMTARS procedure be modified to include the requirement for SIMTARS to notify the Duty Officer of such developments should the minesite neglect to also notify the Duty Officer. This action was performed on the occasion of this trial.

The revised SIMTARS Instruction Describing Mine Emergency On Call Provisions proved useful and accurate except for the after hours contact for the Police Headquarters (re: arrangement of air transport and escort). This will be corrected before 16/9/99, when the revised instruction will be provided to the Quality System Co-ordinator.

The previous recommendation to handle much of the SIMTARS communications with the Senior On Call Officer via pagers proved most successful and will continue to be adopted.

RECOMMENDATIONS

1. SIMTARS officers suggest that the original pager message should include some reference to the words "Department of Mines and Energy, or Emergency, or Inspectorate" to confirm that the original call is bona fida.

2. Continuation of the previously adopted practice of responding to pager messages by sending a pager message to the Senior On Call Officer rather than telephone.

3. Recommendation that the Departmental pager number only be available to the Departmental officers.

4. Recommendation to include in the call out instruction a requirement that the Duty Inspector be advised of any emergency calls for assistance made direct to SIMTARS rather than via the Inspectorate.

COLIN HESTER
Principal Consulting Scientist
Occupational Hygiene, Environment & Chemistry Centre

Trial Call Out Log of Events

Date	Time	Action
7 September 1999	16:52	SIMTARS Officers paged by David Boyd – Kenmare Minesite.
		D Boyd advises that an incident has occurred at Kenmare Colliery.
		SIMTARS response will be required.
	16:59	SIMTARS Senior C/O Officer pages Duty Inspector.
	17:00	SIMTARS Senior C/O Officer advises Manager P Harrison of Kenmare request for assistance.
		P Harrison notifies S Bell, Director of Kenmare request for assistance.
		S Bell notifies P Dent, Director, Health and Safety Division of Kenmare request for assistance.
		Senior C/O Officer calls Duty Inspector pager service and is advised by receptionist that Wal English is the Duty Officer contactable on 0417 707 958.
	17:01	R Bancroft calls P Harrison to confirm requirement at Kenmare and advises that the Duty Officer is Wal English.
	17:04	Senior C/O Officer receives return pages from GH and DS acknowledging pager call. D Brady fails to respond due to location in CQ.
		Senior C/O Officer advises Mackay officer of destination for the mobile lab.
	17:09	Senior C/O Officer calls Duty Inspector (Wal English) to advise that SIMTARS will mobilise lab from Mackay and Redbank. ETA's are provided. 5 hours for Mobile and 3 hours for SIMTARS Redbank staff to be on site. Senior C/O Officer requests information as per Instruction for Mine Emergency On Call Provisions. Duty Officer advises that SIMTARS will have to provide transport and to meet R Bancroft at Bris A/P (Govt Air Wing).
	17:15	Senior C/O Officer requests P Harrison to organise air transport through the Police Headquarters contact number. P Harrison provides this service.
		Senior C/O Officer contacts the Kenmare control room and organises transport from Blackwater airport to the minesite.
	17:23	Advised Kenmare control of ETA's for mobile lab and Redbank officers, and of the equipment that would be made available at this time.
	17:25	D Brady calls to Manager OHECC.
	17:28	Mackay officer advises that the mobile lab is ready to leave Mackay for Kenmare.
	17:35	Senior C/O Officer advises Duty Officer that SIMTARS Redbank officers are leaving for the airport and that the mobile laboratory is now travelling to Kenmare.
	20:30	D Boyd contacts Senior C/O Officer on mobile to request SIMTARS intervention on Safegas. C Hester confirms that this possibility and refers caller to L Ryan home telephone number. D Boyd requests SIMTARS peruse CAMGAS traces. C Hester advises that this would be possible (contact needing to be made with remaining officers).

ACKNOWLEDGEMENTS

This exercise could not have been conducted without the significant contributions by a number of organisations and people.

To:

South Blackwater Coal Limited and Kenmare Mine, in particular Jim Randall and Bryn Morrall for not only the spirit in which they offered their organisation and mine but also the significant expenditure in resources, manpower and lost production incurred.

The members of the Emergency Exercise Management Committee and their respective organisations:

Greg Rowan	Senior Inspector of Mines	Qld Department of Mines and Energy
Greg Dalliston	District Union Inspector	CFMEU
Randall Freeman	Mine Manager	North Goonyella No. 1 Mine
Gavin Taylor	Mine Manager	Crinum Mine
Greg Hunt	Safety Superintendent	North Goonyella No. 1 Mine
Norm Gow	Inspector of Mines	Qld Department of Mines and Energy
Bevan Kathage	A/State Manager	Qld Mines Rescue Service
John Rowe	Safety and Training Advisor	German Creek Southern Colliery
Bryn Morrall	Production Manager	South Blackwater Coal
Shane Shephard	Safety and Training Advisor	German Creek Central Colliery
Martin Ryan	Mine Manager	German Creek Southern Colliery
Kirrily Star	Technical Officer	Qld Department of Mines and Energy

The underground assessors and their respective organisations:

Ken Singer	Kestrel Coal
Adrian Best	North Goonyella No. 1 Mine
Mark Donghi	Kestrel Coal
Trevor Hemley	North Goonyella No. 1 Mine
Neil Winkleman	German Creek Southern Colliery
Col Klease	Crinum Colliery
Andrew Monaghan	Cook Colliery

Thanks also goes to the following people:

- David Cliff, Sean Cory, Jan Oberholzer, SIMTARS for their untiring efforts in the production of detailed pre and post event gas analysis and their extraordinarily useful data presentation in the form of colour coded isopleths.
- Ron McKenna, Newlands Coal for his assistance at short notice.
- Sergeant Turner, Blackwater Police

and all those people who were at, or called to attend Kenmare Colliery during the exercise, please accept our gratitude and appreciation.

APPENDIX I

Appin Colliery Belt Drift Fire

by

R J Kininmonth and A R J Fisher

ABSTRACT

On Sunday morning, 7 November 1976, at approximately 2.25 am, smoke was discovered issuing from the 1912 metre long belt drift at Appin Colliery. A Clouth steel cord rubber belt approximately 940 mm in width had been installed in the drift in 1963 on the basis that no fire resistant steel cord belt was then available to operate on a single lift at the load and on the 16° gradient of the drift.

Investigation showed that the belt drift was on fire and the usually downcasting drift was upcasting. Immediate fire fighting and rescue operations were instituted and the drift was sealed off. High expansion foam was pushed into the drift form the surface and the fire was brought under control. Recovery work resulted in the fire being put out and the drift open for walking traffic by 8.00 am, on Wednesday, 10 November 1976.

The experience gained during the fire fighting and recovery operations led to recommendations in regard to future use of high expansion foam.

INTRODUCTION

Appin Colliery is situated behind the Illawarra escarpment approximately 36 km from Wollongong. The Bulli Seam, approximately 3 metres thickness is the only one currently worked. The seam lies 510 to 570 metres below the surface and access to it is gained by two vertical shafts 5.1 metres in diameter and two drifts at a gradient of 16°.

A Davidson Sirocco 2.9 mm diameter double inlet centrifugal fan normally exhausting approximately 225.0 cms at 1% methane and 200 mm water gauge is situated on one of the shafts. The other shaft and both drifts are intakes. One of the drifts is used for track haulage of men and materials and the other has a belt conveyor installation for coal transport.

The colliery development is by continuous miners which block out areas for longwall retreating. Coal transport is by conveyor belt to a 500 tonne underground bin which acts as a surge to the belt drift.

BELT DRIFT

The belt drift is approximately 3.2 metres wide and 2.5 metres high at a gradient of 16° over its 1912 metre length from the surface to the Bulli seam. It is supported by roof bolts with mesh in the shale beds and is gunnited throughout its length except for the concreted portal. A total of 101 manholes approximately 20 metres apart have been built into the sides of the drifts.

The rail crack laid for sinking was used as a support based for the conveyor structure which consisted of two idler troughed sets at 15° for the bottom belt and three idler sets troughed at 20° for the top belt. A water supply pipe was built into the structure and this partially prevented easy cleaning beneath the belt. A Clouth steel cord rubber belt approximately 940 mm in width was installed in the drift in 1963. Approval to use the rubber belt had been granted by the then Chief Inspector of Coal Mines on the basis that no fire resistant steel cord belt was then available to operate on a single lift at the load and on the gradient of the Appin Drift. That belt was still in use at the time of the fire.

Coal is crushed to minute 150 mm size and fed to the drift belt from the underground bin by Syntron Feeders and the belt is run intermittently depending on production levels. A small amount of coal is usually left in the bin at all times and the bin is left at its low level at the end of the evening shift.

The layout of the drift bottom is illustrated in Figure 1 which shows isometrically the belt drift, the bin, the bin elevator drift tot he top of the bin and the emergency fire doors.

The emergency door in the connecting road between the two drifts was of steel construction, and blocked the whole of the airway except for a small concrete drain. The partial door in the bin elevator drift was of steel construction and only sealed between the rib on one side and the conveyor belt leaving a gap over and round the belt itself and round a vent tube running the length of the bin elevator drift. There was, in addition, a door situated at the surface portal of the belt drift. This was made in two parts and fitted round the conveyor belt and structure.

It is essential that an 18 mm water gauge difference existed between the top and bottom of the belt drift. The top of the bin was connected by a vent line direct to the returns so that a flow of air of approximately 5 cms could be maintained up the bin elevator drift to the top of the bin.

The belt was designed to run at 3.05 m/sec but had been approved as an emergency man riding facility with a winding speed of 1.02 m/sec.

EVENTS PRIOR TO FIRE

On Wednesday, 3 November 1976 at approximately 10.00 pm, smoke was noticed at the bottom of the belt drift and an assistant electrical engineer travelled up the drift and found a hot idler which was later reported to be 79 manhole. He put water on the hot idler and removed it. He noticed glowing coal and threw water by hand onto it. Two other workmen went separately up the drift under instructions to replace the damaged bottom idler but even with their combined efforts could not lift the belt to replace the idler. One of the workmen threw aside three of four shovel fulls of coal from under the belt where the idler was to be replaced. The matter was reported to the assistant undermanager, but no further immediate action was taken. The missing idler was reported on an inspection report on Thursday night and was included on a maintenance shift work sheet for dogwatch on Saturday morning, 6 November.

Early on Saturday morning after the completion of production a normal shutdown inspection of the belt was carried out and maintenance crew men began work in the belt drift. When a maintenance crew man arrived at 79 manhole he could not find which idler was missing.

The belt was run on Saturday morning 6 November, between 5.00 am and 5.45 am, at man riding speed to transport old belt idlers out of the drift. Dayshift workmen from other parts of the mine came out at 2.00 pm, on Saturday on the usual man transport and no personnel were below ground from that time until after the fire was discovered.

DISCOVERY OF FIRE

At approximately 1.40 am on Sunday, 7 November 1976, the Manager of Appin Colliery found evidence of smoke in the air close to the mine. After some preliminary investigations during which time it was assumed that electrical switchgear at the surface was on fire it was found that the belt drift was up-casting and heavy smoke was being emitted. Emergency procedures were set in motion. The Rescue Station was notified at 2.25 am, and Rescue Station personnel arrived at the mine at approximately 3.00 am.

The Mutual Assistance Scheme operated by the Southern Mines Rescue Station and involving rescue teams from the collieries in the district was brought into operation. Rescue teams were sent to the colliery or placed on standby.

FIRE FIGHTING

Immediate fire fighting consisted of an attempt to convey water to the site of the fire by using fire hoses directed onto the top and bottom belts at the surface. The Campbelltown Fire Brigade had been called to the colliery and materially helped in this matter.

At 4.20 am, a rescue team travelled into the mine on the haulage in the men and materials drift in which the air was downcasting as normal. They returned at 6.53 am, having closed and sealed the fire door in the connecting roadway near the bottom of the belt drift, broken and sealed the vent line leading to the top of the bin and closed and sealed the part door in the bin elevator drift.

Sealing of the belt drift at the surface was improved by throwing bags of stone dust and loose dust against the partial doors around the belt. At 9.45 am, a National DP 70 foam generating machine capable of producing 3.3 cms commenced pushing high expansion foam into a small access door in the concrete portal of the belt drift.

The Department's Mobile Gas Laboratory had been called to the mine and took readings at the top of the belt drift from 1.30 pm onwards. Their initial readings indicated approximately 0.39% CO and 0.45% CH_4. By 6.15 pm, the readings were 0.45 and 0.8% respectively.
At 7.00 pm, both readings had dropped to zero which was taken to indicate that the foam plug and the stone dust seal were being effective. It is probable also that the air being forced in with the foam formed a fresh air zone at the top end of the drift.

RECOVERY

Sunday, 7 November 1976

To aid in recovery work, a decision was made to break into the belt drift portal at the surface and at 4.30 pm, work started on the building of an access door. A steel frame was bolted in place and a hinged door fitted in case of emergency while the access was broken through the concrete wall.

At 9.10 pm, readings taken at the upcast shaft confirmed that the products of combustion were not being transmitted to the upcast shaft. Readings at the shaft at that time were:

- Methane 1.1%
- Carbon Dioxide 0.04%
- Carbon Monoxide not detectable

At 11.00 pm, two teams travelled into the mine via the men and materials drift and found that foam had reached the bottom of the belt drift. At that time, readings of 1000 ppm of CO were taken at the bottom of the belt drift and it was found the 4% CH_4 could be detected at the edge of the foam plug.

The foam generating machine was stopped at 11.55 pm, having used 3700 litres of foam compound in just over 14 hours of use.

Monday, 8 November 1976

At 1.45 am, a team started to knock down the foam with fire hoses and advance down the drift. During this time there was only a slight drift of air outbye and the newly made access door was left open. At 2.30 am, a team also began advancing up the belt drift from the pit bottom leaving the fire doors open.

From 3.45 am onwards, changes in gas composition were recorded by the Mobile Laboratory on the surface and during the next 45 minutes CO built up from 0.098% to 0.49% ie. from 98 to 4900 parts per million and CH_4 from 0.15% to 0.97%.

By 4.30 am, teams had travelled from the surface down to No. 10 manhole and from the bottom up to No. 94 manhole but the changing gas percentages gave cause for alarm and all teams were withdrawn. The drift was resealed and foam machine restarted at 5.00 am.

By 10.00 am, the machine was stopped because it was apparent that the drift was full of foam. At this time, the air was found to be downcasting to the drift. Thereafter foam was run one hour on and one hour off.

At 4.30 pm, a team travelled to the pit bottom by the men and materials drift and found that foam had filled the belt drift and been pushed up into the bin. A bag sample taken by them at the bottom of the belt drift showed 1100 ppm CO and 0.45% of methane. It was decided to continue foaming one hour on and one off throughout the night.

Tuesday, 9 November 1976

Teams started recovery from the top and bottom of the belt drift from 8.30 am onwards, and this time the ventilation doors at the pit bottom were kept closed. The teams from the bottom travelled up to No. 79 manhole where they found evidence that the belt had been burnt out. Readings in excess of 5% CH_4 were taken with a methanometer and because of this and the difficulty of access it was decided to work only from the top down.

Progress was somewhat slow and by 2.00 pm, the No. 2 manhole had been reached. At 3.30 pm, inspection at the pit bottom using hand held instruments indicated the presence of 3000 ppm CO and 4%CH_4. Bag samples taken at this time indicated up to 3600 ppm CO and 2% CH_4. There was no smoke but considerable haze.

The decision was made to open the fire doors at the top and bottom of the drift and to allow the drift to intake normally. The rescue teams were withdrawn and the drift was left. At 5.15 pm, a team which had been sent to investigate conditions at the bottom of the drift reported that there was a strong flow of air and that the carbon monoxide and methane had dropped to 340 ppm and 0.2% respectively.

Teams started again from the top and the bottom to wash down the foam. At 7.00 pm, a team exploring down the drift returned to the surface and reported active fire between 40 and 58 manhole. The immediate reaction was to re-seal and put foam on again but after a short discussion it was decided to fight the small fires from the top. Rescue teams left the surface with hoses and proceeded to quench what were a series of localised fires in coal spillages.

By 10.30 pm, two members of the first team reached the pit bottom and after a further mopping up operation, a full team passed through the drift and reached the pit bottom at 2.25 am on 19 November.

INVESTIGATION

After the fire, the following information was obtained regarding the extent of the fire.

Belt

The belt was found to be almost completely burnt out between 34 manhole and 82 manhole. The top belt had parted at a splice just above 81 manhole and the bottom belt at a splice between 82 and 85 manhole. In addition to the above, there was partial damage to the belt from 30 manhole down to 34 manhole.

The belt below the broken splices had run down and piled up at the bottom of the drift. It is perhaps fortunate that the fire had caused reversal of ventilation in the drift otherwise the fire may have spread into the workings in the Bulli seam.

There were a number of patches of bottom belt above the broken splices which were not burnt out. The patches are shown on the accompanying Figure 2. They appeared to be protected by coaly material which stopped the burning. It seems probable that the coaly material was washed onto the belt by water applied during fire fighting and indicates considerable burning of the belt after fire fighting started.

Structure

There was major damage to the structure in the fire area from 34 manhole down to 82 manhole. Minor damage was also suffered above that zone.

Fire Fighting Range

This consisted of a 50 mm galvanised steel pipeline with victaulic joints. Hydrants in the top third of the drift were of the three way valve type and below that were of the pressure reducing orifice type with shut off valves every 36 metres.

The pipeline was unusable without replacement of the rubber seals in all those joints which had been in the fire area.

The heat deterioration of the victaulic joints caused leakage which became an obvious and serious problem during the last mopping up fire fighting. To reach the small active fires it was necessary to run fire hoses from the three way hydrant at 30 manhole.

Roof

Isolated roof spall was observed from No. 5 manhole down through most of the drift with most damage between 45 and 82 manholes where roof spall had seriously weakened or destroyed the contact between the roof bolt plates and the roof. Considerable re-gunniting appeared to be necessary.

Spillage

There was an excessive amount of coaly material in the drift and a large number of bottom idlers surrounded by spillage. In some places the spillage had been piled up by the flow of fire fighting water. There was evidence of burnt coal in many places in the drift but it appeared that only small areas had been affected by more than a surface burn. There were a few patches where the fire had burnt deep into the spillage.

Cause of Fire

During investigations after the fire, a bottom idler was found to be missing just above No. 80 manhole. A new idler was found lying against the rib at that point. It was assumed that the heated idler reported on Wednesday, 3 November, had occurred at 80 manhole was coked and was concluded that the area had not been cleaned out properly after the heated idler had been found on Wednesday, 3 November.

Despite the fact that the belt was inspected on each shift between Wednesday, 3 and Saturday 6, and a maintenance crew worked in that area on the Saturday without detecting any signs of smoke or heating it is concluded that:

1. There was a residual deep seated smoulder left after the faulty bottom idler was removed on Wednesday, 3 November.
2. The residue gradually burnt into nearly spillage until it came in contact with and set the stationary belt alight.
3. The burning belt developed sufficient heat to cause reversal of airflow in the belt drift and resulted in smoke being transmitted to the surface.

Assessment of Incident

The following matters are considered of some special interest in assessing the overall effectiveness of the fire fighting and recovery operations.

Detection

The incident illustrates the need for fire detection facilities. Subsequent installation of a Corex tube bundle system at the colliery incorporates carbon monoxide detection points at the surface, partway down and at the bottom of the drift.

Access

The difficulties of fire fighting in long drifts without intermediate access were highlighted during the incident. Subsequently, two such access drifts 2 metres wide and 2 metres high have been excavated between the men and materials and belt drifts and these are fitted with steel fire doors which are kept secured in the shut position.

Foam

The high expansion foam successfully quenched the fire. A total of 7274 litres of foam concentrate were used. Experience gained indicates that for an extensive fire foam should be kept on the fire zone for at least twenty four hours. When the area has been filled a one hour on one off would seem to be a suitable means of replacing foam broken down in the active fire zone. If foam is not replaced a build up of carbon monoxide, and in certain circumstances, methane can occur when and if the fire reactivates.

Fire Range

Fire ranges should be fitted with an adequate number of shut off valves so that water flow can be cut off to a damaged section, and fire fighting continued from outbye that point.

This is particularly important where victaulic joints are used as they are subject to severe deterioration by heat in the fire zone.

CONCLUSIONS

The heat from a collapsed belt idler may cause smouldering which is difficult to detect but which may last several days in coal spillage and result eventually in development of open flames.

High expansion foam has been shown to be effective in controlling a fire in a belt drift, but the foam which is broken down by the heat in the active fire zone should be replaced regularly and the foam maintained for twenty four hours if the fire is deep seated.

The circumstances outlined highlight the need to report and fully investigate the need to report and fully investigate even seemingly minor incidents of localised hot spots near coal spillage.

ACKNOWLEDGEMENTS

The Authors wish to acknowledge the permission given by Australian Iron and Steel Pty Ltd, and the Department of Mineral Resources to publish the information contained in the paper.

APPENDIX II

Case Studies

Given the physical design of an underground mine, it is easy to see why the threat of fire is among one of the underground miner's greatest fears.

Once a fire breaks out, the ventilation system can accelerate a small fire into a major abnormal concern quickly spreading toxic combustion products throughout the complex.

Ventilation is the key to understanding the effects of fire on the underground environment. At first, the ventilation system provides plenty of oxygen to the ignition area, accelerating the fire growth, while pushing the heat and flames downstream. As the fire and heat builds, the volume of the air is expanded and acts like a damper, increasing the resistance of the drift against the flow of air.

With a decreased oxygen supply, the fire becomes fuel rich, and incomplete combustion produces a greater volume of gases.

Generally this combustion product will be composed of 18 to 20 percent carbon dioxide (CO_2), five to eight percent carbon monoxide (CO), two to five percent hydrogen (H_2), less than one percent oxygen, and a fraction of a percentage of several other gases also carrying particulate matter.

As the resistance in the drift continues to grow, the rising heat will carry the smoke and gases to the top of the drift, creating a separate layer on top of the incoming air that can be pushed by convection currents back upstream against the ventilation spreading smoke and gases into areas far back on the intake side of the fire.

Tests of this "reverse stratified flow" in model tunnel fires have demonstrated that the reverse flow can actually exceed the velocity of the intake air in some instances.

But while a drift fire usually slows down or "throttles" air velocity, a fire in an intake shaft or raise can actually reverse the direction of ventilation, blowing out fans and changing the mine's entire ventilation system.

In any case, miners on both the intake and return side of a fire can be quickly overcome by harmful toxic combustion products.

Media reports often misleadingly attribute fire deaths to "**smoke inhalation**". Although smoke can be a severe irritant, it is composed of small particles of **soot** and **tar** and is not considered to be an asphyxiating substance by itself. Smoke combined with the gases produced by the chemical action of the pyrolysis process constitutes the real threat, and of these gases, **carbon monoxide** (CO) is most often the first to kill.

Carbon monoxide (CO) combines more readily than oxygen with the haemoglobin of the blood, and it only takes a very small concentration of CO to asphyxiate a victim. Specifically, a 0.05 percent of CO, or 500 ppm (parts per million), can be fatal in as little as three hours. Exposure to 0.4 percent or greater can be fatal in less than one hour, and a few short breaths of a 1.0 percent concentration will kill in seconds.

The concentration of carbon monoxide in a mine atmosphere over a given period of time is, of course, dependent on the size of the fire, the mine and the ventilation system.

Given that the combustion products of a fuel-rich fire can contain as much as eight percent of CO, it is understandable how a lethal concentration can quickly build.

The early detection of a fire and immediate evacuation of underground personnel is imperative in any mine fire scenario. In large operations, the problem is compounded by the necessity for underground workers to travel great distances from remote areas, with complex ventilation systems.

The following elements were present in the worst known underground metal mine fire at the **Braden Copper Co.'s block-cave copper mine in the Chilean Andes** in June 1945.

Though details remained hazy, investigators conjectured that a maintenance man who had been told to grease some ore cars on the day shift decided to warm a can of grease that had congealed in the cool mountain air by placing it near a blacksmith's forge just off a main intake airway.

The unattended grease soon ignited, eventually touching off a blaze that soon spread to nearby timbers and to a repair shop where kerosene, paint and grease were stored.

At 0740 hrs, a chief mechanic spotted the blaze and telephoned officials on the surface. Twenty minutes later, while the evacuation was still underway, an explosion ripped through the repair shop, blowing out bulkheads and fire doors partially damaging an underground winze hoist. The ventilation in this main escape shaft, normally upcast, suddenly reversed, motivating clouds of smoke and heavy concentrations of toxic gases down into lower levels, effectively blocking the shaft as an escape route.

Soon the underground hoist rooms of two other winze shafts filled with smoke and were abandoned. Of the 1,000 miners who worked that morning, 630 escaped, another 25 who had barricaded themselves and survived on air from compressed air lines were later rescued, with **355 miners dead** of carbon monoxide poisoning.

Major underground mine fire disasters within the past 25 years have dramatically illustrated how a variety of fire protection shortcomings can have tragic results.

At **Cargill Inc.'s Belle Isle salt mine on the gulf coast of Louisiana** in 1968, some miners wrongly believed that the single, wood-lined shaft was relatively fire resistant thanks to the fine salt particulates which had impregnated the timber surfaces.

Late on the night shift of March 5, 1968, the hoistman received a telephone call from the surface maintenance man who was performing routine maintenance on the skip at the 1,100 level shaft station underground. "Come on down with the north side, the shaft is on fire!"

Shortly after the skip arrived, a miner called out "the skip is on fire, we can't get on it," he yelled. Paul Granger, the underground foreman, cut in. "Go to the radio, get some help.....get a lot of help," he was reported to have said. A voice broke in and kept repeating, "Pour some water down the shaft..."

The relief hoistman shouted to run water down the shaft. When he approached the water line just a few feet from the shaft, he discovered the water hose missing.

The crew of an oil company boat who had landed at the island shortly after spotting the smoke was sent to shore and returned in a few minutes with a hose. Unfortunately, when the hose was finally attached to the water line and the valve was turned on, nothing happened.

Somehow the pump had lost its prime. When company officials arrived an hour later, the pump was fixed and water began to trickle down the 16-foot diameter, 1,250-foot deep shaft - two hours after the fire had first been reported.

Fire equipment that had arrived in the night from the mainland continued to pour water into the shaft until the fire was quenched.

For the 21 men trapped underground, it was too late. The coroner's report issued weeks later fixed the time of death for 20 of the men at 0600 hrs, about six and one-half hours after the last phone call from underground.

The other man had died of a skull fracture shortly after the fire started, the coroner said.

His quick death was probably a merciful one. Though equipment abandoned around the shaft station indicated that the miners had desperately fought the fire for a while, rescuers discovered their bodies huddled in two groups far back in the mine where they had slowly succumbed to the terrifying effects of a gradual carbon monoxide poisoning.

The specific cause of the fire was never determined, but, investigators deduced from the evidence that the fire had started somewhere below the 1,100-foot level shaft station and then had rapidly spread like smoke up a chimney, quickly burning through the plywood partition that divided the shaft into two compartments.

The absence of adequate fire protection and fire fighting facilities at and in the shaft coupled with the **lack of a second escape route** had doomed the miners from the beginning, investigators concluded.

A standard requiring two main escapeways to the surface, or a refuge station in lieu of the second escapeway in mines under development, was promulgated in February 1970. It was a standard that could well have saved the miners at Belle Isle.

For miners at the **Sunshine Mining Co.'s massive underground silver** operation in a little canyon in northern **Idaho**, it made little difference.

The Sunshine mine had two escape shafts. The primary man-hoisting Jewell shaft was the mine's main intake air shaft and it serviced both the 3,100-foot and 3,700-foot levels of the operation.

The Silver Summit shaft, once the main shaft of an adjacent silver mine, now served as an exhaust airway, located about two and one-half miles from the Jewell and about one and one-half miles from the underground No. 10 shaft.

The No. 10 shaft winze began on the 3,100-foot level and serviced all workings on down to the 5,800-foot level, a development area.

Though no raises connected 5,400, the 5,600 and 5,800-foot levels to workings above, several raises did serve as secondary escapeways, for miners working in the 4,800-foot level up.

In any case, it was a long climb up even in fresh air, and the No. 10 shaft offered the only quick access to the 3,100-foot level and to the Jewell shaft.

For the 173 miners who went underground on the morning of May 2, 1972, the shift began like any other. An hour before, two night-shift repairmen smelled what they thought was smoke as they rode on a mantrip toward the Jewell shaft station.

Seeing no smoke, they concluded an electrical motor or somebody smoking a cigarette. Not until around 1145 hrs did miners in several locations of the 3,700-foot level being to smell and then see smoke curling into their work areas.

When it came, it came fast.

Two foremen near the No. 10 shaft station on the 3,700-foot level decided to investigate and followed the smoke to the 910 raise several hundred feet away where smoke was coming down the normally upcast raise from the 3,400-foot level.

When they returned twenty minutes later to the No. 10 shaft station, one of them telephoned the surface and gave instructions to activate the mine's stench alarm system. Meanwhile, smoke had rapidly filled lower levels. For many miners working there, there would be no escape.

The No. 10 shaft was equipped with two separate man hoists. At the 3,700-foot level, a 9-person single drum "chippie hoist" serviced all levels below.

Shortly before 1155 hrs, the "chippie" hoistman was driven from the hoistroom by smoke. That left a double drum counterbalanced skip hoist on the 3,100-foot level the only other chance for escape.

Hung below the two skips were small cages capable of hauling nine people each. The shaft foreman who earlier had given orders to evacuate consulted with the hoistmen and the two agreed that using both skips would slow down the evacuation because of the extra braking and clutching required. Only one skip remained to lift miners from the workings below.

Over the next half hour, several miners reached their respective level shaft stations and were hoisted to safety.

Still others decided to go back into working areas to alert miners while waiting for the cage to return. Many had broken into the underground caches of the filter-type self rescuers, but for most, operation of the devices was a mystery.

Miners who finally determined how to use the self-rescuers passed them back and forth to others who had none. As men began to drop from exhaustion and the effects of carbon monoxide, many still on foot made futile efforts to drag their partners to safety.

Unable to continue in the smoke, the No. 10 shaft hoistman turned over his duties to the relief hoistman, at 1235 hrs. One of the several cage tenders who had volunteered to remain underground to help with the rescue entered the hoistroom minutes later. Finding the relief hoistman shaking with weakness, he gave the hoistman a self-rescuer and told him how to use it.

Sometime after 1300 hrs, the last time the cage came up to the 3,100-foot level, the hoistman was overcome by carbon monoxide and later died.

The last means of escape for those below was now blocked. The cage tender was the last man to escape from the mine that day.

Earlier, a miner escaping from the 3,700-foot level through the Jewell shaft thoughtfully removed lagging which had covered a borehole in hopes that fresh air from the nearby shaft would be drawn to miners at the other end of the borehole on the 4,800-foot level.

Seven days later, Ron Flory and David Wilkinson were rescued from that location. **Of the 173 men who had gone underground that day, 80 escaped, two were rescued, and 91 had died of carbon monoxide poisoning.**

Among the dead were several who had initially escaped but had returned to participate in the rescue effort. Still others had deliberately remained underground to aid their fellow workers.

The magnificent displays of courage tragically demonstrated the unwritten code of kinship shared by underground miners, but too often these events also reveal a great lack of knowledge about what to do in a mine emergency.

Bureau of Mines investigators concluded that the fire probably originated in an abandoned area adjacent to an exhaust airway on the 3,400-foot level. These areas had been mined more than 20 years before, were backfilled with waste rock, timbers and other refuse and bulkheaded off from the rest of the workings.

Supplied by air that leaked through into the area, the fire slowly spread and eventually reached the bulkhead where it burned through.

Thanks to the 95,300 cubic feet per minute ($45m^3/s$) of air that was coursing through the exhaust airway, the fire grew rapidly, releasing great amounts of smoke and gas which then short circuited into nearby raises and eventually into the 3,100 and 3,700-foot levels and workings below.

The heavy concentrations of carbon monoxide measured during the rescue efforts and days afterwards were evidence, Bureau officials believed, that the fire had been a fuel rich one that could have smouldered for weeks before its discovery.

The failure of mine management at the **Wilberg underground coal mine** to remove a faulty air compressor from service was the primary cause of a fire which caused the **death of 27 miners** in an underground coal mine in 1984. That was the conclusion of the MSHA investigation team in its final report.

While the report closes a two-and-a-half year investigation into the cause of the accident and its resultant fatalities, the agency continues to investigate possible criminal violations of mine safety standards.

Investigators concluded that the air compressor located on the section where the fatal fire began was not properly installed or maintained.

Ventilation of the air compressor station was not adequate to prevent the recirculation of cooling air to the compressor. The over-temperature safety switch was intentionally by-passed and the on/off switch linkage was disconnected so that the air compressor had to be turned on and off at the 5th Right belt drive power centre. In addition, the air compressor was not frequently examined or tested to identify potentially dangerous conditions.

"The air compressor was inadvertently turned on and operated continuously for about 69 hours before the fire started. The fire quickly spread with the airflow and caused the early failure of the aluminium intake/belt overcast blocking the other designated escapeway", concludes the final report.

The report also lists nine factors which contributed to the severity of the accident. These factors included: an increased number of miners present on the section due to an attempt to set a production record; **failure to respond to the first notification of smoke in the intake entry; and inadequate training in the use of self-rescue devices, fire fighting procedures and evacuation.**

The fire which began at about 2100 hrs on December 19, 1984 claimed the lives of 8 supervisors and 19 union miners. Initial fire fighting efforts failed to control the fire which hampered rescue attempts. By December 21 the fire had been contained enough for rescue teams to enter the section and account for 25 of the 27 miners. Nine bodies were located only 200 feet beyond the fire.

Rescue teams were withdrawn from the mine as the fire burned out of control. In an effort to extinguish the fire, the mine portals were sealed.

After 11 months of numerous varied attempts to reach the fire area, crews successfully mined new entries into the 5th Right section where the miners had been working when the fire broke out.

Twenty five bodies were recovered during the first seven days of November, 1985. The locations of the other two bodies were still unknown.

On December 17, 1985, the remaining two bodies were located some distance apart from each other further back in the mine. With the bodies recovered, MSHA turned its attention to determining the cause of the fire.

In September, 1986, MSHA issued preliminary findings which indicated that the faulty air compressor was the cause of the fire. This conclusion was not readily accepted by either the United Mine Workers, who represented the miners at the Wilberg Mine, or Emery Mining Corp. who was the operator of the mine. Both groups believed that further investigation was necessary.

During the investigation 34 citations were issued for violations of MSHA standards. Nine of the violations were believed to have contributed directly to the fire. Six of these violations were assessed at the maximum penalty of $10,000 each. The total assessed penalties for the nine contributing violations was $77,000. The combined total for the other 25 violations was $34,470.

At the time the final report was issued, 7 additional citations were issued for violations which did not contribute to the mine fire.

Earlier in 1987, survivors of the victims of the Wilberg Mine fire reached an out-of-court settlement with Utah Power and Light Co., owner of the Wilberg Mine. While the exact amount of the settlement was not disclosed, the settlement sum was estimated to be about $22 million.

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Information sourced from Ontario Mine Rescue and the Mine Safety Digest.

APPENDIX III

Gas Evolution Isopleths

MINIGAS:	CO = OF, O2 = 18.6-13.0%, Ch4 = 0.15-1.0%
ENVIRONMENT:	Very thick black smoke. Visibility nil (smoke glasses + low beam). Ventilation evident.
EFFECT:	Lethal if side-breathe.

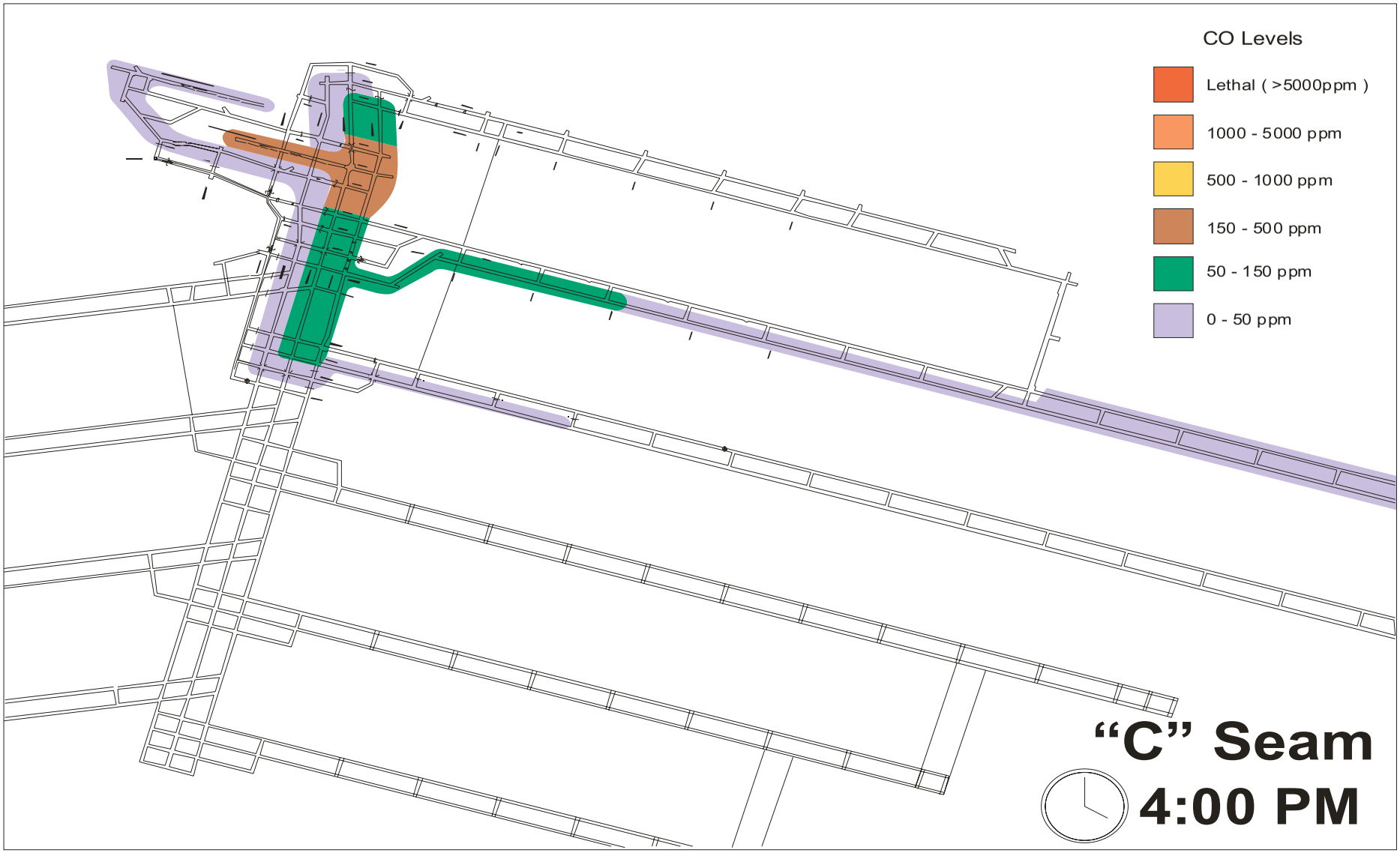
MINIGAS:	CO = OF, O2 = 20.4 - 18.6%, CH4 = 0 - 0.15%.
ENVIRONMENT:	Very thick black smoke. Visibility nil (smoke glasses + low beam). Ventilation evident.
EFFECT:	Collapse if side-breathe for more than one minute - lethal.

MINIGAS:	CO = 500-1000ppm (in alarm), O2 = 20.6 - 20.4%, CH4 = 0%.
ENVIRONMENT:	Thick smoke. Visibility 10 metres (smoke glasses + high beam). Ventilation evident.
EFFECT:	Dizzy, severe headache. Choking from smoke.

MINIGAS:	CO = 150-500ppm (in alarm), O2 = 20.8-20.6%, CH4 = 0%.
ENVIRONMENT:	Thick smoke. Visibility 20 metres (low beam). Ventilation evident.
EFFECT:	Slight headache. Coughing, choking from smoke. Eyes stinging.

MINIGAS:	CO = 50-150ppm (in alarm), O2 = 20.8%, CH4 = 0%.
ENVIRONMENT:	Steady smoke, strong smell of coal burning. Visibility reasonable. Ventilation appears normal.
EFFECT:	Coughing due to smoke.

MINIGAS:	CO = 0-50ppm (alarm at 30ppm), O2 = 20.8%, CH4 = 0%.
ENVIRONMENT:	Slight odour, wisps of smoke above 20ppm. Visibility normal. Ventilation appears normal.
EFFECT:	Nil.


CO Levels
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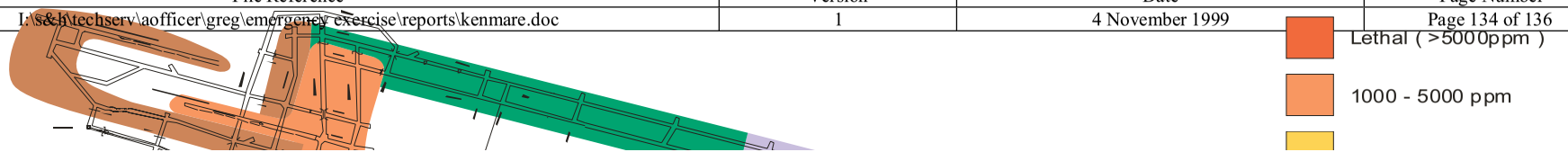
1000 - 5000 ppm
500 - 1000 ppm
150 - 500 ppm
50 - 150 ppm
0 - 50 ppm
"C" Seam
4:00 PM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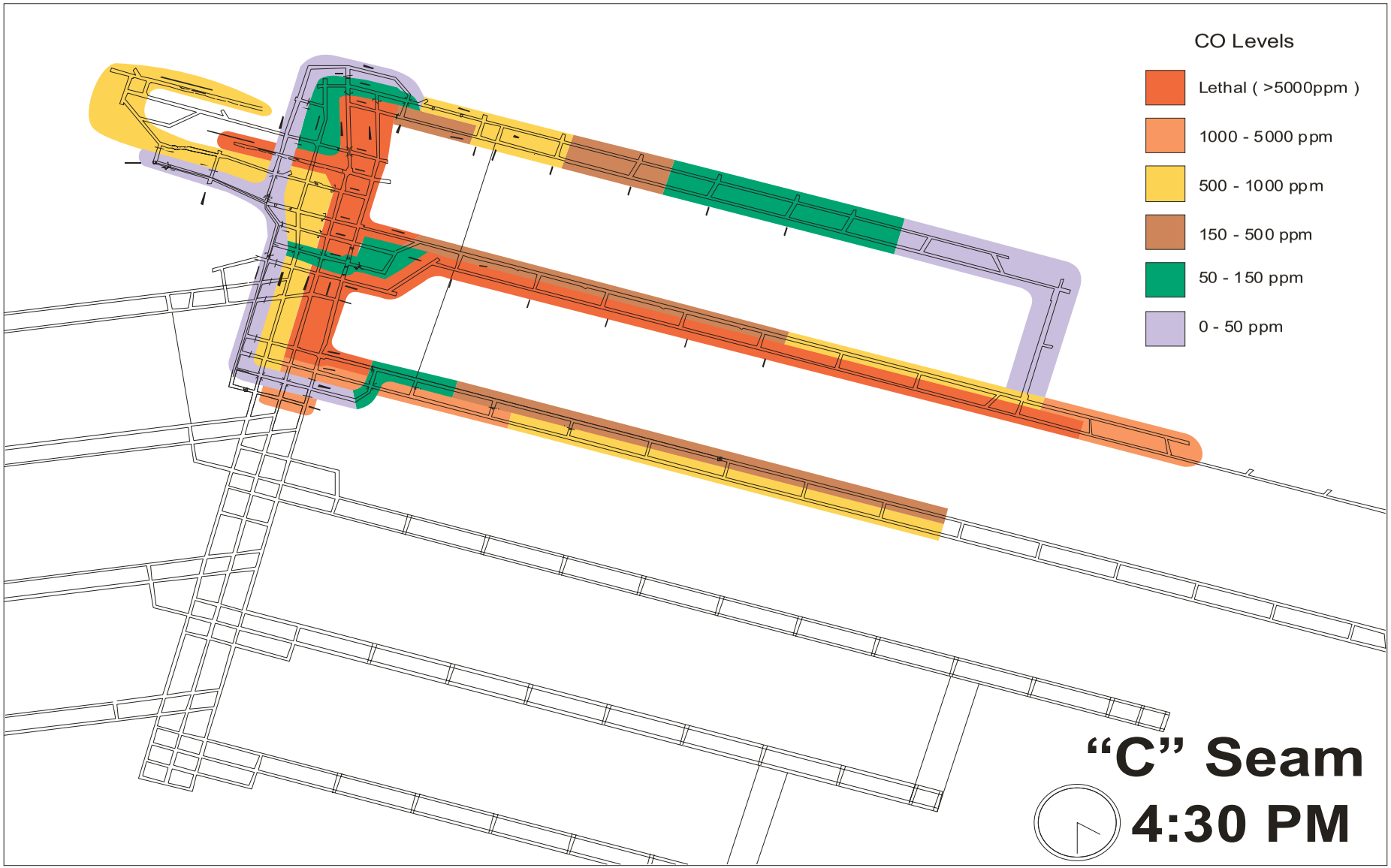
1000 - 5000 ppm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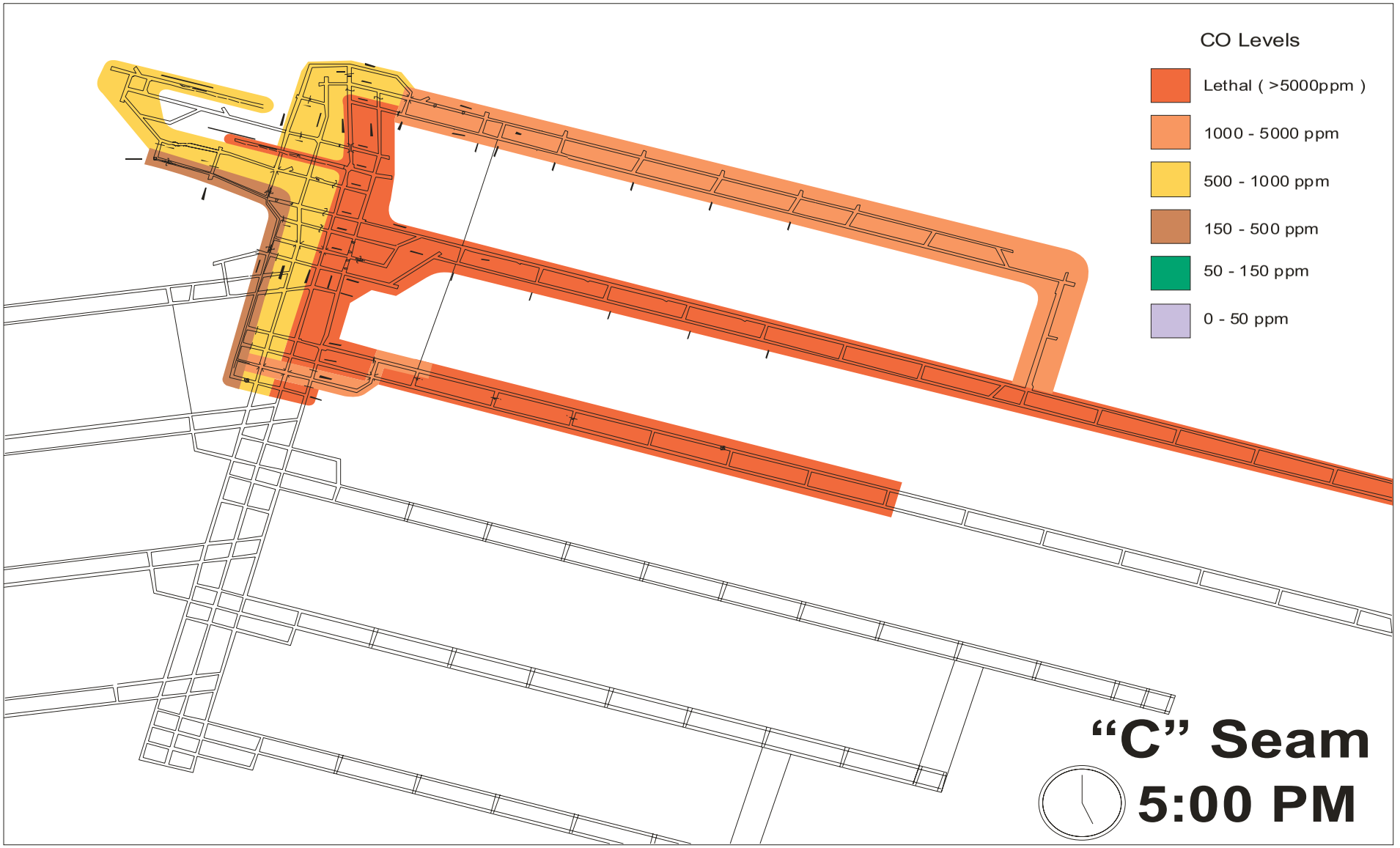
50 - 150 ppm
0 - 50 ppm
"C" Seam
4:30 PM


CO Levels
Lethal (>5000ppm)
1000 - 5000 ppm
500 - 1000 ppm
150 - 500 ppm
50 - 150 ppm
0 - 50 ppm
"C" Seam
5:00 PM