Queensland Government
Natural Resources and Mines

Report on an Emergency Exercise

Kestrel Coal Mine

27 November 2001

EXECUTIVE SUMMARY

Having focussed the previous 3 exercises on the testing and validation of the Self-Escape philosophy, this year's exercise concentrated its efforts on an evaluation of the other major component in an integrated emergency preparedness and response system – Aided Rescue. While still maintaining its coverage of the evacuation protocols, this exercise moved the attention away from the surface control room with its flood of gas alarms and emergency calls, into the Incident Management Room and the Mines Rescue Service's Fresh Air Base.

The scenario provided a studied look at the decision making processes used by the Incident Management Team during its emergency response and the ability of the Incident Management Team to accurately pass on critical information to a replacement team. Additionally, the exercise provided for the full and extended deployment of mines rescue teams charged with the search and recovery of missing and injured workers in hot, humid and difficult circumstances.

The scenario itself involved a significant fall of ground in and around the newly formed goaf of a longwall panel. The strata collapse resulted in the injury of 1 person, severe restrictions to the airflow onto the longwall face, the blocking of access to the intake escapeways and the contamination of the face and tailgate return with large (although non-lethal) concentrations of carbon dioxide and methane. The only access to the injured worker was via the 3.3klm length of the tailgate return with real-event temperatures of approximately 29.5°C Wet & 31°C Dry. The initial methane concentration exceeded 2.5%, prohibiting the use of diesel vehicles in the recovery.

The Incident Management Team and the Mines Rescue Service were thus challenged with the development and selection of options for the recovery of the missing worker/s – a most rigorous task given the circumstances. The results of the exercise demonstrated a well-conceived and (more importantly) well-practiced emergency preparedness and response system. The solution by the workers on the longwall face when confronted with the imminent loss of their oxygen supply, was first class, ingenious and worthy of congratulations.

As always, the exercise provided a number of learning opportunities both for Kestrel in the application of its internal systems, and for the industry in general as we continue the process of continuous improvement in emergency management.

This report details some 50 Recommendations for consideration and provides an extensive assessment of the activities that occurred. As a further aid, included as an Appendix to the report are some brief descriptions of a number of proven decision making process techniques that can be used for the generation, capture and analysis of options and solutions.

In conclusion, the assessment team found the entire Kestrel workforce to be most professional, willing and capable in the approach and application of their emergency response. I would like to thank them, and the assessment team, for their contributions and trust that this report will further add to the growing pool of experiences in our industry's emergency response capability and that it will act as a starting point for the debates regarding Aided Rescue protocols that I trust will be generated by its publication.

Greg Rowan
Senior Inspector of Mines
Chairman – Emergency Exercise Management Committee

20 December 2001

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SCENARIO

Longwall panel 205 is a 3.5km block with a 250-metre face-line. It had only recently commenced extraction and by Tuesday, 27 November 2001 had advanced some 120 metres. Primary caving of the goaf had occurred as usual for the mine.

At 2131 hours on Tuesday evening 27 November 2001, a major fall of ground occurred in the "A" heading belt road of the 205 maingate associated with significant secondary caving of the newly formed goaf.

At the time of the fall, the face line was approximately 50 metres inbye of cut-through 33 and the fall extended from the No. 1 chock on the longwall face to a point some 20 metres outbye of cut-through 33 and approximately half way through cut-through 33 itself. The fall was some 5 to 6 metres high with the lips of the fall being broken, heavy and continuing to fret. The fall restricted the ventilation entering the longwall face to 6.3 m^3/s at 0.4 m/s and made maingate entry or egress from the longwall face impossible.

The secondary caving in the goaf expelled large quantities of goaf gas onto the face and significant distances up the tailgate return. These contaminants measured 6.3% CO_2, 2.51% CH_4 and 11.8ppm CO along the face. Slowed by the restricted air velocity due to the maingate fall, this plug of contaminants would not reach the tailgate CONSPEC or Tube Bundle monitoring points located at the head of the 205 tailgate for 91 minutes (2302 hours).

As a result of the fall onto the longwall BSL and pan-technicon, power was tripped back to the panel isolators, phones were cut and DAC communications were not possible back to the 205 panel drive-head. Air and water services in the maingate were disrupted and all computer communication data links from the longwall to the surface control were lost.

There were 6 persons working on the wall at the time, 1 person was seriously injured with a broken femur suffered as he fell.

The temperatures in the tailgate of 205 panel are (typically) approximately 29.5°C wet, 31°C dry. As the evacuating crew members travel down the 3.5 km length of this roadway, they become increasingly dehydrated and distressed. At 15 cut-through, tailgate 205, one of the crew members can continue no further and remains behind.

No other parts of the mine were effected.

SCENARIO OPTIONS

Assessor: Greg Rowan

This scenario was developed deliberately to challenge the decision-making processes of the Incident Management Team. That is not to say that the circumstances surrounding the event were in any way "artificially" enhanced – quite the opposite, considerable effort is expended to ensure that the circumstances that evolve during the conduct of these exercises are as realistic as possible. In fact, should a fall of ground such as this occur at Kestrel, it will generate precisely the same circumstances that the IMT grappled with during this exercise.

In searching for the "solution" to this scenario, it was anticipated that the following options would be considered

Option 1 The IMT knew that the injured worker/s were located on the longwall face – some 3.3klms from the panel entrance. They also knew that the only road into the face was via the tailgate return currently carrying 6.3% CO_2, 2.51% CH_4 and with ambient temperatures of approximately 29.5°C Wet and 31°C Dry. It was quickly identified that Mines Rescue Teams were the only way to retrieve the workers, but that there was no way a team could walk in and carry out an injured patient.

Thus Option 1 was the deployment of a Mines Rescue Team driving a flameproof diesel vehicle through the contaminated return airway.

The unknown implications for

- the increase in engine and exhaust manifold surface temperatures certain to arise from a diesel operating in such a fuel rich, oxygen deficient atmosphere
- the probability of engine "run-on" in such an atmosphere
- time delays in hand held gas detector sensor heads would not provide sufficient warning of the vehicle driving from the 2.51% general body into a 5% (LEL) body

As such, the Exercise Assessment Committee did not consider Option 1 as feasible – at least until the CH_4 concentrations had been reduced.

Option 2 Breaching the seal across "B" heading 33-34 C/T. This would provide an additional ventilation path onto the face via "B" heading supply rd → across 34 C/T → up along the pillar side rib line in "A" heading belt road → around No1 chock and onto the face. It was considered reasonable to assume that given the intense primary roof support installed along the "A" heading belt road and the proximity of the face line to 34 C/T, that a reasonable air path would still exist along the rib line.

The Exercise Assessment Committee considered that this option provided the fastest means of getting fresh air onto the face line. It also had the added benefit of the increased ventilation flow diluting the CH_4 levels in the tailgate to less than 1% - thus allowing vehicles to enter the tailgate and complete the recovery of the missing workers.

Option 3 Reverse the ventilation flows down the tailgate and convert it to intake. The facility and infrastructure existed that would allow for the (relatively) simply reversal of the ventilation flow in the tailgate.

If successful, this option would provide for the contaminants to be diluted such that a diesel vehicle could be deployed down the tailgate to complete the recovery of the missing men. The IMT knew that the maximum airflow available in the tailgate (due to the severe restrictions placed by the fall) was 0.4 m/sec.

The Exercise Assessment Committee considered that the approximately 50,000 m^3 of hot, humid, heavy CO_2 already filling the tailgate return would not be easily shifted by this method. Coupled with the syncline lay of the tailgate roadway, it was considered that an airflow velocity of 0.4 m/sec would more likely result in simple bi-laminar airflow and not provide any real flushing potential. Altering panel regulators (see Option 4) would have increased the airflow velocity to approximately 0.58m/sec, but it was still considered unlikely for this airflow to flush the tailgate of the contaminants – at least in the short term.

Option 4 Alter regulators to provide increased ventilation pressures across the fall. This option was considered viable by the Exercise Assessment Committee, although of itself having limited effect.

Other Options

- Access to the face via the BSL tunnel
- Surface bore hole recovery
- Rib/pillar boreholes
- Fall support, clean-up and recovery

All these options were considered by the Exercise Assessment Committee as being outside the time-line parameters of this exercise.

Conclusion

The Exercise Assessment Committee considered that a combination of Options 2 and 4 followed by Option 1 (once atmosphere had cleared) provided the best “solution” to this scenario.

PLANNING AND CONDUCT OF EXERCISE

A number of 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 Kestrel mine.

All mine atmospheric and ventilation monitoring data was provided through the mine control room, in real time and in a format compatible to computer assisted analysis and system interrogation. As in previous years, the software program developed by SIMTARS proved invaluable in the provision of this data. The data was presented in formats identical to those used at Kestrel and with which the personnel at Kestrel were familiar.

It was anticipated that the exercise would be attacked on four fronts:

1. In-seam self escape of personnel using self-rescuers.
2. Detailed planning, risk assessment, options and decision analysis for the search and rescue of missing persons.
3. Establishment of appropriate re-entry protocols.
4. Search and Aided Rescue by Queensland Mines Rescue Service teams.

No constraints were to be placed on the extended deployment of the Queensland Mines Rescue Service teams, or the mine's internal emergency response teams, other than those imposed by their own respective internal policies and procedures.

The practice previously adopted by the Emergency Exercise Management Committee of providing advance notice of the "window" during which the exercise was to be conducted was continued, and advance notice was provided to all stakeholders, including the police, community, media and emergency services.

In recognition of the international interest now being generated by these exercises, the Exercise Management Committee has been requested to detail the names, qualifications and experiences of its members. It is imperative that these exercises be conducted with the greatest regard for transparency and it is with pleasure that I include this information as an Appendix to this report.

In variance to the previous exercises, this year's scenario did not involve the deployment of the GAG inertisation device. In deference to the *Approved Standard for the Conduct of Emergency Procedures Exercises* it was deemed by the Exercise Management Committee that the requirements of this standard had been previously met by a recently completed *Inertisation Inspection Report* conducted by the Queensland Mines Rescue Service. An extract of this report is included as an Appendix to this report.

SCOPE

To conduct an Emergency Exercise in accordance with the *Approved Standard for the Conduct of Emergency Procedures Exercise* as established by the Moura Inquiry 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;
- Recognise 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 that 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:

- A strategy was developed for establishing the systematic initiation, control and assessment of the exercise;
- A scenario was development strictly in accordance with the hazards present at Kestrel mine;
- The exercise was conducted on the afternoon shift of Tuesday, 27 November 2001 commencing at 9:31pm;
- QMRS, police, media, senior company officials, SIMTARS, Department of Natural Resources and Mines, Industry Safety and Health Representatives, hospitals and ambulances were involved;
- Formal risk assessments were conducted at the inaugural meeting of the Emergency Exercise Management Committee held in Emerald on Wednesday, 26 September 2001. This risk assessment covered risks at the mine and risks to the general community;
- Formal audit tools were developed and validated by members of the Emergency Exercise Management Committee. Formal de-briefings of assessors and Kestrel personnel were conducted to evaluate the results. This report is the result of this audit and evaluation process;
- Inertisation equipment was NOT called to site.

All audit and assessment tools were developed against the internal procedures of the agencies involved and in line with accepted practice 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 was done using risk assessment methods.
- Test the ability of the current Mine Emergency Procedures, to meet the desired outcomes of an emergency response.
- Demonstrate a coordinated response involving both Kestrel permanent employees and external contractors.
- Demonstrate a coordinated response involving Kestrel, QMRS, NR&M, Industry Safety and Health Representatives, SIMTARS, Emergency Services and other stakeholders.
- Enhance the confidence and ability of personnel to respond to an emergency.
- Allow for a performance analysis and debrief to occur following the exercise, with the outcomes recorded and relevant information disseminated to industry.

To meet these objectives, audit and assessment tools were developed to cover the following functions:

- Emergency Initiation;
- Emergency Response Plan, including the Duty Card System;
- Incident Management, Emergency Control and Incident Management Team Change-Over;
- Emergency Evacuation;
- In-seam Emergency Response;
- QMRS – ability to respond, mutual assistance, Mandatory Performance Criteria;

THE ASSESSMENT

ASSESSMENT OF CONTROL ROOM OPERATIONS

ASSESSOR: MARTIN WATKINSON

Modelling of the scenario was conducted by the use of two simulations of the gas monitoring system. The Conspec system was modelled by a PowerPoint simulation indicating the modelled gas readings at the outbye end of 205 tailgate.

Modelling of the situation was undertaken by utilising the mine ventilation model and simulating the gases as a pollutant so the anticipant alarm times were derived from the resultant gas velocities.

The other system used for modelling the environmental monitoring system was to utilise the existing Safegas system and the SIMTARS program Safesim which simulates the situation and sends the relevant gas readings to an exact replica of the mines Safegas system all functions of the Safegas system are available to the mine management. Both models run independent of the existing mine environmental monitoring system.

The incident was initiated some 2½ hours after the start of the Control Room Operator's (CRO) shift, providing the opportunity for the him to adjust to the fact that the incident was being conducted on his shift. The incident was initiated by handing the CRO a card with the following information:

Kestrel Emergency Exercise

You have just received an alarm from the longwall informing you that the BSL is stopped. The power has tripped and you have no computer information from the Longwall.

The CRO then tried to contact the longwall to investigate and was given the following information:

Kestrel Emergency Exercise

You cannot reach the longwall face by DAC or telephone..

The CRO then contacted the nearest mine deputy to go and investigate. As communications were made with the other mine officials he made them aware of the developing situation on the longwall. This meant that as this incident developed the rest of the mine was well informed of the situation. The CRO declared an incident at 2234 hours after he had heard from the investigating Deputy. At 2309 hours, after telephone discussions with the Mine Manager, a mine evacuation was ordered.

The CRO explained the logic of his actions as he was searching for information and confirmation of the situation on the longwall so the actual initiation of the incident was realistic.

Due to the scenario and the location of the gas monitoring points, the first gas monitoring alarm from the Conspec system occurred at 2302, some 91 minutes after the incident and tube bundle information was available some 25 minutes later.

There was only one period when the CRO had two phones in his hand and a gas alarm at the same time and at no time was he overwhelmed by information as the incident developed. Frustration was experienced due to the CRO continuously having to log back into Safegas to acknowledge alarms.

During the incident there was a problem with the mine Conspec system. *This was not part of the exercise and happened in real time.* The CRO was able to deal with this due to the fact that he had assistance from the Gas Chromatograph Operator and there were not a lot of different gas alarms coming into the control room. (This was effectively dealt with and the system was up and running at 0207).

The CRO was well assisted by the arrival of the night shift with one of the Deputies being rescue trained and he initiated the deployment of personnel to cover the lamp room, mine entrance and to both portals.

The coverage of the portals was most effective and no one was allowed underground without confirmation from the control room. However, on some occasions, after the arrival of IMT and the dispatch of rescue personnel underground, the CRO had not been informed of the intended movements of all personnel.

Once the IMT had arrived on site various duty card holders came into the control room and verified the actions which had been taken. At some stages the CRO had to confirm actions and status to more than one duty card holder.

Information from the IMT was given to the CRO by different duty card holders, including the briefing of the CRO by the Mines Rescue Co-ordinator who used the Gas Chromatograph Operator phone to communicate to the FAB, leaving both control room phones free.

The control room is seen at the mine as the focal point for information, sometimes the fact that mines rescue personnel were going underground had not been given to the CRO and he had to confirm that these personnel were to be allowed underground.

Two-way information from the pit bottom and the FAB was communicated very effectively and equipment was prepared as required.

Due to the lag between alarms the Safegas system had logged the CRO out and frustration was felt having to re-log in to accept alarms whilst briefing other personnel about the situation within the mine.

Some of the stages and actions to be carried out were not fully explained to the CRO. After the ventilation changes were initiated (breaching of the seal at 33-34 cut-through and alteration of the panel regulators), pressure was put on the CRO for gas monitoring information, which would only be available after the pollutants had been able to clear the tailgate. The longwall was approximately 3300 metres in and the effects of a velocity of 1.07 m/sec (resulting from the above ventilation changes) will only be seen some 51.4 minutes after the velocity change has been affected.

Too many people use the control room as a stopping-off point. Members of the IMT passed through the control room checking on gas readings. The Mine Ventilation Officer used the trending facility of Safegas to plot Ellicott diagrams and gas trends. This information was relayed to IMT. Print outs were developed from the mock-up system. These were checked periodically throughout the incident.

On the whole, the CRO and the Gas Chromatograph Operator conducted the exercise in a very professional manner following due procedures and relaying information as they knew it. The fact that the Gas Chromatograph Operator was available enabled the CRO to maintain the control of the incident and was able to relay information as required.

Recommendations

1. IMT to ensure that CRO informed of intended actions so that he can confirm actions as required. This should be done by one of the duty card holders. This way the CRO only gets information from one person in contact with the IMT.
2. Limit access to the control room to stop people wandering in and out.
3. Extra phone point for personnel with duty cards so as not to use control room as a telephone room.
4. Modify Safegas so that login time lasts for the shift duration of the CRO. CRO to log out should he leave the control room. This will reduce frustration on accepting alarms.
5. Gas Chromatograph Operator was useful as backup to CRO although he was not required to take a large number of bag samples due to the scenario.
6. Ensure that duplicate tasks are not given to duty card holders and that duty card holders stick to their duties.
7. Consider increased and more regular use of the PED to send messages to trapped personnel. Short, **accurate** messages can often provide a moral boost and (perhaps) can also be used to provide advice/directions. *NB. Some messages sent by the Exercise Assessment Committee members to the underground assessors did NOT get through. The impacts of the broken ground above the goaves adjacent to LW 204 and LW 205 need to be investigated in regard to this.*

ASSESSMENT OF LONGWALL 205 FACE CREW ESCAPE

ASSESSORS: TIM JACKSON, PETER BAKER, WARREN PENDLEBURY, GREG DALLISTON AND JAMES MARSHALL

Commencement Time of Incident 2931.

The Longwall 205 face crew were given the following scenario –

"You have just felt a severe air blast / pressure change with a drop in the ventilation quantity and heard a major fall in the goaf. The air is thick with dust. You are experiencing increased respiration, severe headache and are feeling confused"

At the time of the incident, five members of the 205 crew were at 24 chock and the Deputy / Supervisor was at the tailgate of 205 longwall.

One of the crew was injured during the initial incident and suffered a fractured leg. The remainder of the crew became aware that a fall had occurred when they attempted to go out through the maingate. The crew administered first aid to the injured person from the first aid kit that is kept at the 205 tailgate. The fact there were trained first-aiders in the crew enabled a reasonable level of first aid to be carried out, including vital sign observations.

The initial donning of the fenzy units was carried out efficiently, but there was some confusion over whether the fenzy units should have had goggles (they do not). Four crew members were given trainer units and two were asked to don their belt-worn units. One trainer did not have a nose clip. All crew members, apart from the first casualty, changed over to real SSR90 units. On two of these units, the goggles were broken when they were pulled off the neck strap.

During the time the crew was evacuating the face, delays were experienced by the crew because of the need to communicate using pens and notebooks. Some members became frustrated with this and created the situation where the crew tried to talk through the mouthpieces. The decision to leave the first-aider with the casualty was a tough call and may have been influenced by the injured person going unconscious when the crew attempted to walk him out on the AFC. To leave a fit person with an injured person does contravene the self-escape philosophy set up by industry. The decision for that person to stay may have been influenced by the fact that the event was an exercise. This may have not been so conclusive in a real emergency.

The five fit crewmembers initially escaped to 30 cut-through (Tailgate 205) where the first-aider was given two SSR90's to return to the injured person on the face. The crew were not exposed to any visibility restraints and made their second SSR90 change over at 20 cut-through 57 minutes after the initial donning. At 15 cut-through one team member was overcome by the conditions and a decision was made to leave him under a temporary air shower from the compressed air line. When the crew reached the cache at 10 cut-through they obtained the three SSR90's and kept walking outbye. There were no SCSR's left in 205 return after the crew had evacuated. The hot and humid environmental conditions in the 205 returns were extremely taxing on the crew during their evacuation.

The crew supervisor should be congratulated on the way he handled the situation. He gave clear direction to his crew and constantly checked on their condition. He also instructed the crew on the availability of compressed airlines as they crossed the tailgate, which was later used by the 2 men on the face.

He was also instrumental in deciding to leave the heat stressed person at 15 cut-through and left clear instruction on what to do to keep himself as comfortable as possible until rescue returned. The supervisor had trouble contacting control once they had escaped because the phone 757 was not working other than by using the emergency dial. *This was not part of the exercise and requires investigation by the mine.* Once the supervisor was able to get through to the underground control room operator he gave a factual report on the situation and requested further instructions.

Recommendations

8. The mine re-investigates the escape time-lines and distances between cache locations in longwall returns – particularly where poor visibility may be experienced.
9. Investigate the number of SCSR in the longwall return caches. In this scenario there were sufficient numbers, but there were only six people on the face. If there had of been one more person on the face, there were no spare units in the caches. The escaping crew expressed concerns during the debrief of this point. Self-escape routes need to be planned and serviced by sufficient SCSRs for the maximum number of personal in the panel in both primary and alternate routes.
10. During the refresher training for SCSR, mines must ensure that duration times of at work and at rest are explained to wearers.
11. Communications using pens and notebooks, and not talking through mouthpieces, should be adopted as an industry standard.
12. Trial the use of walking sticks in areas of excessive rib spall. The trial to consider the appropriateness of using “candy cane” shaped curved handles, or the current right angled “elbow” shaped handles.
13. Treat any person who ‘escapes’ in the hot and humid conditions as a patient to ensure they recover from the experience – particularly in the rehydration of persons.

ASSESSMENT OF FIRST AID RESPONSE – LONGWALL 205 FACE CREW

ASSESSOR: JAMES MARSHALL

The initiation of the exercise at the longwall face occurred smoothly. The casualty broke his leg at chock 24. After becoming aware that he was suffering the affects of CO_2, the casualty correctly donned his Fenzy. The remainder of the crew came across the casualty after their investigation of the maingate end of the longwall face. The casualty was grasping his broken thigh and groaning through the mouthpiece of the self-rescuer. The first-aider took control of the situation. He use his notepad to find out what was wrong with the casualty and instructed the other crew to get the first aid kit from the tailgate.

The first-aider began inspecting the suspected broken leg. Firstly, he tried to feel the thigh, but the casualty groaned in pain and pushed his hands away. He then wrote a message to ask if the casualty could feel his toes, to which he indicated positively. He also confirmed that it was not an open fracture. He then pulled the pants leg out of the casualty's boots to check the skin colour. The first-aider wrote to the Crew Supervisor that they need to support the leg and get a stretcher. He also queried the location of the first aid kit and when the SSR90's were to arrive because 15 minutes had already elapsed. The Crew Supervisor wrote that another person had gone to retrieve it. He remembered that there was a first aid kit at chock 7 and quickly retrieved it. The Crew Supervisor and first-aider then opened the box. The first-aider looked at the first aid kit contents list and tried to find appropriate bandages to splint the leg.

At 2154 hours, the SSR90's, 2 x blind man sticks and the tailgate first aid kit arrived at chock 24. The blind man sticks were too long to be used as a splint and one of them was broken to an appropriate length. The SSR90's were donned completely by all crew by 2159 hours. The leg was then bandaged with the splint in place using 2 wide bandage with the ends taped off. These bandages were not appropriate for the situation and were not applied tight enough for actually splinting the leg. This would have increased the realism of the exercise.

The first-aider then checked that the casualty's toes did not have pins and needles. This message was written ambiguously and first-aider had to confirm the answer. Thumbs up questions were asked from time to time of the casualty to check that he was okay. The second blind man stick was checked for its length to be used as a crutch. The first-aider then bandaged a couple of dressings to the top of the piping so that it wouldn't cut into the armpit of the casualty.

The Crew Supervisor then checked the temperature of the casualty and had the casualty squeeze his fingers to check for strength. The crew then lifted the casualty over the spill plates onto the AFC. This was done with some rough handling. At 2206, the crew began moving the casualty out of the longwall face. He was being carried by two crew members.

It soon became apparent that the injured person was not going to be carried out the whole length of the tailgate (3.5kms). The casualty then became unconscious and the decision was made to leave the casualty at chock 53. The remaining 5 crew were to travel out the tailgate, however, the first-aider was to retrieve some more SSR90's from the first cache in the tailgate and then return to the casualty on the longwall and wait for assistance.

During this part of the exercise, the first-aider and assisting crew need to be congratulated for their professional attitude and urgency to improvise and reduce the impact of the broken leg on the casualty. Their response was also effective in terms of the time taken to perform the first aid, attempt assisted escape and evacuate the area.

Set up of Air Shower

On the return of the first-aider to the casualty at the longwall face (2050 hours), he brought two SSR90's from the 30 cut-through cache. He also brought the tailgate stoneduster air hose down the face as a secondary air supply. The air hose extended to 61 chock, whilst the casualty was located at 53 chock. The first-aider had to drag the casualty along the AFC to the air hose.

At 0345, the first-aider and casualty were notified that they had 15 minutes of use left from their SSR90's. Despite there being one last SSR90, that the first-aider planned to use to escape down the tailgate, leaving the casualty with the air hose. He had not considered that there would not be any SSR90's at any of the caches as he moved down the tailgate because they were taken by the rest of the longwall crews on their escape.

The first-aider and casualty were prompted by the assessors to work out how both could use the air hose or SSR90 for fresh air. The first-aider removed two of the chock legs protective gaiters from the nearest chock and proceeded to velcro the two together to make an "air-tent". The crutch that they had made earlier was used as a tent pole when they placed the leg gators over themselves, sitting on the AFC.

The use of a spanner to hit against the AFC pans to attract attention to their location was also good.

Recommendations

14. Mine personnel should spend some time brainstorming / training sessions to utilise available equipment innovatively to make air showers, barricades etc. This will improve the likelihood that panic won't set in should some personnel be unfit to facilitate self-escape. It would be particularly beneficial where there is more than one person to use the airline.
15. Mine personnel need to consider taking more time to ensure that the correct message is written on notepad communication.

ASSESSMENT OF INCIDENT MANAGEMENT AND EMERGENCY CONTROL

ASSESSORS: DAVID CLIFF AND MALCOLM SMITH

Introduction

Two assessors were assigned to witness and record the activities of the Incident Management Team (IMT). The assessors were charged with recording the techniques and emergency plans utilised during the emergency exercise at Kestrel Coal.

Formation and Structure of IMT

The IMT was formed shortly after the arrival of the mine manager (refer event log for time) who assumed the role of Incident Controller (IC) from the Control Room Operator (CRO). The mine manager arrived on site with Duty Card 4 – Rescue Co-ordinator. The IMT consisted of the seven principal duty cardholders. Other duty cardholders arrived shortly after this, except for Duty Cardholder 7 – who arrived approximately 30 minutes later. He brought with him a clerk to record the essential details for the event log.

There needs to be more control over access and movement into and out of the IIMT room. On a number of occasions the decision making process was suspended or interrupted due to the unexpected absence (or arrival) of individual members of the IMT.

First briefing of IMT was held at 0015. IMT function included external advisors – NR&M Mines Inspector and Industry Safety and Health Representative.

Internal Functioning of the Team

The IMT was led by the IC. The first issues outlines were the processes and protocols to be followed for decision-making. Risk Management and Change Management were the tools to be utilised.

The risk management process followed the basic flow: hazard identification, issues associated with hazards and controls. Later on this process was extended to include the proposed sequences of work. The risk management process was applied to each potential work sequence associated with the rescue process separately. No documented comparative analysis was undertaken of the benefits and costs, of the various rescue options. The disjointed flow of people (and information) into and out of the IMT made it difficult for any risk management assessments to actually reach their conclusions.

It was good to see that, on several occasions, members of the IMT, other than the IC, forced the decision-making process to be rigorous and not take short cuts. On several occasions a course of action was decided upon, only to be overturned by a late question, which then caused a shift in focus and initiation of a risk management on a different scenario.

The members of the IMT demonstrated thorough and accurate knowledge of the mine and its systems to deal with the situation. As previously stated, decision-making was impeded by the repeated movement in and out of the IMT by various members without being directed to do so by the IC. In addition, decision-making would have been improved with a stronger sense of urgency, direction and focus – best provided by a clearly stated (and written-up) set of Goals, Objectives and Priorities.

There appeared to be little urgency for the limited oxygen supply available to the persons left underground. A number of suggestions for action were not recorded and thus could not be followed through and evaluated. They were not considered until repeated some time later.

The fatigue of the IMT became evident in the early hours of the morning and the ability to make decisions and carry out analysis was demonstrably slowed.

Overall, it is the opinions of the assessors, that IMT functioned well as a team and deserves high praise for their teamwork, thought process and clarity of instructions. In particular, the IC should be complimented on keeping the diverse group functioning for such an extended period of time given that most would have not had any sleep for over 24 hours.

The Emergency Response Procedures, including check lists were not referenced.

The IMT room was inadequate for its function, both in size and in the way it was equipped (see audit sheets for details). This hampered effective operation of the IMT and caused unnecessary delays to the decision-making process.

External Communications to the IMT

In general, the communications into and out of the IMT was adequate. The lack of direct computer connection to the mine environment monitoring system caused delays in updating key gas concentrations and on several occasions information became garbled in the transfer.

The IC carried out an effective debrief of key staff and acquired the necessary facts quickly. Thus he was able to brief the rest of the IMT appropriately and in a timely manner.

The IC ensured that surface personnel were kept informed of events.

The duty card system seemed to function effectively and the use of briefcases to contain all the relevant documents and support material was effective.

There was only one telephone into the IMT which was an internal phone. This had positive as well as negative impacts. No one individual was assigned the responsibility to monitor the phone. This became an issue when calls were being received by the IMT, where different individuals answered and passed messages to the IC. It limited the number of extraneous contacts that would cause the IMT to divert from its key function, but also meant that communications had to be verbally transferred to the control room or other key areas to be relayed to the desired target. The IC had a radio but there was no attempt to use it.

The reliance on verbal communications was a major concern to the assessors due to the probability of mis-information transfer. The capabilities of the IMT to cope with external agencies, in particular the media and miners families, was not evident.

Positive Points noted by the IMT Assessors

- The positive attitude by all Kestrel personnel we dealt with.
- The quick establishment of the decision making protocols.
- The effective organisation of the relief IMT and implementation of the changeover.

- The provision of dedicated clerical support to the IMT freed up the IC and others to focus on the key issues rather than be bogged down in record keeping. However, it needs to be recognised that having clerical people taking records can lead to "over-recording" of information because they do not know what is important and what is not. It is often better to have the IC or another IMT member put the main information on a white board so everyone gets to see it and it is only this information that is recorded prior to being erased. An interesting check for Kestrel would be to go back and review the information recorded (through the sterling efforts of the person concerned) with this in mind.
- The systematic approach of the IC to the IMT process. There were regular information updates. The IC tried to implement risk management and change management processes.
- The instructions were issued clearly and the IC checked to make sure that they were understood.
- The absence of friction between IMT members.
- The degree and currency of knowledge, by all members of the IMT, of the layout and operation of the mine.
- The exercise was treated as though it were the real thing.

Recommendations

16. The decision making process needs more focus and each option needs to be driven to completion before allowing digression.
17. All IMT members need to be encouraged to actively participate in the decision making process.
18. Duty card holders need to recognise the need to remain with the IMT unless authorised to leave. This is especially true if there is an exchange of roles.
19. Computer access to the mine environment monitoring system in the IMT is essential. Ventilation simulation software should also be on this computer.
20. Communications between the IMT and CRO should be better documented.
21. A systematic process for evaluating fatigue should be implemented rather than rely on the individuals to notify the IC of their status.
22. Calculators should be included in the duty card briefcases.
23. A mine plan in the IMT should show monitoring locations.
24. There needs to be more white boards / areas to display key information for immediate reference.
25. Suitable techniques should be used to capture ideas, generate alternatives and evaluate the different options to allow for systematic comparison.
26. There needs to be more urgency in decision making when retrieving persons underground who are injured or have limited life support equipment available.
27. The environment conditions merit closer monitoring due to the impact of effective temperature on the effective duration time of rescue teams using BG174's.
28. Ventilation flow sensors in key roadways would enable more accurate interpretation of makes and effects of changes in ventilation.

ASSESSMENT OF INCIDENT MANAGEMENT TEAM CHANGE-OVER

ASSESSOR: GREG ROWAN

The need to establish a change-over mechanism was identified as early as 3.50am (6hrs 19mins into the exercise) by the original Incident Management Team - IMT1. It was determined that the change-over was to occur at 7.30am the following morning and all IMT1 members were to notify their designated replacements to be on site prior to that time for a formal briefing.

The change-over meeting for IMT2 commenced at 6.41am and consisted of the Incident Controller IMT1 providing a verbal overview of the circumstances that had occurred during the previous 9 hours. The meeting was held in the crowded IMT room with limited reference to a mine plan and little reference to any written record of previous events. In this instance, the IC's recollection of events was substantially accurate, if not entirely so, however it would not be good practice to suggest that such would always be the case.

The lack of white-boards and/or notice sheets hindered the transfer of information, as did the lack of a set of Goals, Objectives, Priorities, Resources and Status board. The IMT2 had no Information Check Sheets to refer to in order for them to assess whether they had all the relevant information and the detailed status of each of the elements of the emergency response.

The change-over meeting concluded and IMT2 took charge at 7:15am. The underground exercise was terminated at 7:30am once Mines Rescue Team 3 returned to the FAB with the last of missing workers. A desktop exercise involving the IMT2 continued until 8:28am. During the desktop exercise, IMT2 were questioned on their understanding of previous events, the current status of the deployment and availability of current resources (personnel and equipment) and their proposed future courses of action. It is well recognised that information in the possession of IMT1 may have been interrupted in its passage to IMT2 by the termination of the underground exercise. Nevertheless, when questioned IMT2 was of the opinion that IMT1 had passed onto it all the information it required.

However, some of the information that was not passed on, or was incorrectly gathered, included:

- the time that the fall of ground occurred
- the exact locations of the missing / injured workers – were they in transit, on the surface, at the hospital etc
- the status of family notifications
- the exact location of the seal that had been breached – further confused by the lack of a mine plan
- the exact nature of the changes that had been made to the underground regulators
- the phone at the FAB (Tailgate 205) was not working and they were using a phone some 100 metres away
- the status of the SSR90 caches, first-aid kits and trauma kits in the panel where people were being deployed as well as the status of non-working phones underground and the status of the mines rescue resources, suits, O2 bottles etc

The new IMT personnel need not only to gain the information from the previous team, they also need to maintain the momentum of the IMT and the group dynamic. This is often best achieved through a staggered change-over. This staggered change-over can commence as early as the 5 hour mark with the IC usually the last to change out. The IC cross over may take up to 2 hours as the IC is often very difficult to move on.

The replacement IC needs to be aware to look for fatigue and monitor the decision making processes during the change-over – this should be included on the Duty Cards of the IC and the backup IC.

Recommendations

29. That the IMT members change-over be conducted on a staggered basis with no more than 2 persons being shifted at a time. This will provide for much more cohesion in the team and limit the possibility of loss of information
30. That there be a greater use of aids such as mine plans, whiteboards, flipcharts etc to display relevant information. A written record of the status of resources is vital to the change-over of any command structure.
31. A written chronological record of milestone events be kept, updated regularly and referred to
32. Consideration be given to allowing the display of this information (through windows) so that persons can update themselves without having to constantly interrupt the IMT discussions with questions
33. A series of Check Sheets be developed for IMT2 to act as memory prompts in the same way as a Debriefing Officer ensures capture of information. The prompt sheets could include such things as:
    - options discussed and reasons for not doing and/or doing
    - current goals / actions with expected outcomes, responsibilities and timeframes
    - any alternative or secondary thrusts being investigated
    - any limits established … time, gas levels, temperatures
    - problems or difficulties experienced to date

ASSESSMENT OF IN-SEAM INTERVENTION – QUEENSLAND MINES RESCUE

Assessors: Peter Baker, Warren Pendlebury and Greg Dalliston

The effort and commitment of the members of the QMRS (staff and volunteers) to respond to a simulated emergency at this time of night needs to be congratulated. Most had worked long shifts on the day of the incident and were called out after very little, if any, sleep and many traveled long distances to participate.

The problem with conducting simulated underground mines rescue events is, and always has been, creating the realism necessary to keep adrenaline high for all participants. Addressing these realities requires a balance in the practicalities of simulating an underground emergency environment, with the need to ensure realistic time frames are incorporated into the simulation.

The hot and humid conditions in the 205 panel return (31°C Dry and 30°C Wet) ensured that this exercise was conducted in close to actual conditions. Although the ventilation flow of 2.4 m/sec was six times that which would have been present if the scenario presented was real.

The purpose of this section of the Level 1 Emergency is to assess the practices and procedures adopted by the Mines Rescue teams in comparison to the mines rescue training provided – in order to assess the adequacy of the procedures and protocols themselves and the understanding of those procedures by the teams.

The first response from Kestrel rescue trainees was limited by the number of proficient trainees available and the number of persons who held senior positions (such as Ventilation Officer), and who were members of the IMT. Of the mines rescue trainees on site, only one team could be deployed, and hence, could not be deployed into the tailgate without a backup team. This slowed response to reach the first casualty located at 15 cut-through:

- One member was out of oxygen time.
- Two members had worked the previous 12 hour shift, and it was decided that they were not fit to respond.
- One member was sick.
- Others members on site were part of IMT, the Ventilation Officer and FAB person.
- The mine geologist was deployed in MRT 1 when the known incident related to a major roof and goaf fall. This person may have been valuable in IMT in evaluating the ground conditions around the fall.

While the response to call out by mines rescue members was timely, the deployment of teams from the surface to underground could have been improved. This was highlighted by the need to MRT 1 to be on standby for MRT 2 after directly being deployed in hot and humid conditions themselves.

The QMRS activities conducted and co-ordinated underground were done so in a professional manner. The use of QMRS Station Superintendent as the FAB Controller ensured that there was excellent control of operations:

- All tasks assigned were achieved.
- Communication to Team Captain and team members was of a high standard.
- Use of flameproof diesel vehicle was delayed even when CH_4 was at 1.25%.

The set up of the fresh air base (FAB) was done efficiently, although the minimum equipment required was not met in total. Spare oxygen cylinders for the BG174's were not available and this could have impacted on the exercise if MRT 1, who had previously been deployed in hot and humid conditions, were on standby for MRT 2. This left MRT 1 with suits which had oxygen cylinders less than full pressure.

The deployment time for hot and humid conditions as derived from the QMRS protocols is an important control to minimise effects on mines rescue team members. This was spelt out when MRT 1 went over their deployment time of 55 minutes by some 45% (24 minutes), and as a result had two team members visibly effected by the conditions.

The MRT's knowledge and application of first aid displayed, including the level of information about pertinent conditions by teams at change-over was of a high quality. The MRT's did not appear to be aware of the position and content of the mines first aid and trauma kits. One of these kits was at 205 tailgate double-doors crib room, some 20 metres from the FAB. This equipment including air splints could have been used on the casualty on longwall face, who was known to have a broken leg.

The distance from the FAB phone connected to the surface limited the ability to influence the IMT by the FAB Controller who was vastly experienced in rescue and was on the pointy end of the information chain.

The long distance to the casualty on the longwall through irrespirable atmosphere was identified and thus the fact that aided response on foot was impossible. The use of a diesel vehicle to reach this area was identified early but hesitation to use this once CH4 level reached 1.25%. (The requirements for use of flameproof diesels under legislation are 1% withdraw vehicle and 1.25% shut vehicle down.)

FAB Controller stressed that irrespirable atmosphere was anywhere that the gas levels are > the legislative limits. Ventilation station in 205 tailgate was not clearly marked on the plan used by QMRS and was poorly marked on the rib at the station.

Recommendations

As an outcome of these assessments, it is recommended that:

34. There be a review of the Kestrel Mines Rescue System in the early part of surface intervention (i.e. when minimum persons are available).
35. Mines rescue teams are to ensure all team protocols are adhered to – even in the absence of reality, it is good practice (e.g. communications and information left with the FAB Official, Captain / Team checks on equipment etc.)
36. An expert working party be established to research the use of flameproof vehicles in atmospheres containing levels of flammable gases in excess of the current legislative requirements, and guidelines be developed on how and when they may or may not be used in life threatening scenarios. The outcome of this research may result in changes in the wording of legislation.
37. The rescue efforts appeared hampered by a lack of effective communications between the FAB and the surface. The use of a phone some 100 metres away, while in direct line of site appeared to minimise communication from the FAB to

IMT. The availability of phone and lines as part of the mines emergency equipment to allow a line to be run from permanent phones to FAB positions should be assessed as part of the mines emergency system. Mines should have a phone and line available to run from FAB to mine communication system to minimise the hazard of incorrect communication, information breakdown and ensure timely communication to surface for input to IMT.

38. Queensland Mines Rescue Service and mines through their mines rescue agreement should ensure that competencies are developed and persons trained for the key positions of Fresh Air Base Controller and Substation Mines Rescue Controller so that in the event of QMRS staff members not being available, competent persons will be available for these key roles.
39. While QMRS have developed controls to attempt to minimise the effects on mines rescue personnel deployed in hot and humid conditions these controls (administration controls) are low on the list of hierarchy of controls. It is recommended that QMRS investigate modern control methods to minimise this hazard. Some controls may include cooling vests, cooling of breathing tubes etc.
40. When developing Mines Rescue Team tasks, position, status and content of the mine's emergency equipment which may be relevant to the task being undertaken should be marked on the plan and communicated to MRT teams and FAB Controller.
41. ***And perhaps most importantly, the exercise clearly showed that the better the escape systems (and therefore survival systems) in place at a mine, the more likely it is that mines rescue teams will be required to enter and search for survivors some of whom may be at distances not able to be covered on foot within the time constraints placed by use of self contained breathing apparatus– the industry as a whole needs to ensure we are ready for this.***

ASSESSMENT OF SURFACE AND MINES RESCUE CONTROL

ASSESSORS: MURRAY BIRD AND TONY DE SANTIS

From the outset, when the emergency exercise was first triggered the response of the mine site personnel was in line with the type of situation that was presented to them and was treated with the required level of urgency.

One of the problems that has been commonly identified in other simulated exercises is the lack of support available for the Control Room Operator when the emergency happens outside of "normal" working hours. On this occasion the night shift crew was starting work just as the emergency was starting to escalate and were therefore able to lend assistance.

One of the deputies on the oncoming shift was rescue trained and was the first to assume the role of Surface Controller. He was able to gather the necessary information and disseminate it to the nightshift crew.

The critical roles of Portal Sentries, and Gate Security were also allocated along with clear instructions to the Lamp Room Attendant to make sure he kept an accurate record of who was in the mine and names of anyone who came out of the mine.

The way that the callout procedure has been established at Kestrel allowed the Control Room Operator to focus on getting information to and from the underground, rather than being pre-occupied with making numerous external calls. The only external phone call he had to make was to the Mine Manager. It was then the Mine Manager who was responsible for making additional calls, including the mine-site Mines Rescue Co-ordinator. With the use of mobile phones, the Mine Manager and the mine-site Mines Rescue Co-ordinator were able to utilise their time whilst driving to the mine to contact other members of the IMT and to mobilise mines rescue teams and QMRS personnel.

It wasn't long after the Mine Manager and the mine-site Mines Rescue Co-ordinator arrived that the mines rescue brigadesmen started to arrive. This ensured that an operational team was available by the time the IMT had decided to send them underground. Once the QMRS Assistant Superintendent arrived, the Mines Rescue Co-ordinator assumed a support role to the Superintendent. This may have been by design or based on the fact that the initial Mines Rescue Co-ordinator had to be replaced when he went into the mine with the first rescue team as an operational team member. Both the QMRS Assistant Superintendent and the Mines Rescue Co-ordinator spent time alternating between the IMT room and the rescue room.

Once the extent of the emergency became clear, the Mines Rescue Co-ordinator realised that he was going to need more than just the one Kestrel mines rescue team he had available. The decision was made to instigate the Mutual Assistance Scheme and mines rescue personnel from the neighbouring Crinum Mine were called out. The call out started at 1:10am with 16 team members on-site by 2:41am. Overall, the callout procedure and response of rescue team personnel was handled extremely well.

The overall response from QMRS was handled very well. The Blackwater Mines Rescue Superintendent and Assistant Superintendent and GAG Jet Co-ordinator (with GAG Jet) all arrived on-site within a short time of each other, approximately 2½ hours after the call to evacuate the mine had been initiated.

These roles are critical to ensure clear communication channels between the IMT, the rescue teams on the surface, the FAB and the operational teams. The purpose of this part of the assessment was to review the effectiveness of the surface response and liaison between mines rescue personnel, IMT and surface control.

Observations

- Initial response to incident was handled well by the mine site personnel.
- Deployment of QMRS personnel and mines rescue personnel was handled extremely well - although the briefings of the first 2 teams was not handled as well as it could have been and appeared rather ad hoc
- The IC was regularly updating those on the surface, but not Mines Rescue Teams going underground. This seems at odds with priorities
- The first 2 teams were briefed only by the Mines Rescue Coordinator – who, in turn, had not been fully briefed. Not all the information was passed on and teams asked a number of background questions to which answers were not known.
- There was up to 90 minutes between the IMT determining that rescue teams were needed and the first team leaving the surface. The first team was ready well before they were briefed
- Team equipment preparation was slow with only 1 brigadesman initially available. Once the QMRS arrived the process became most efficient. However, only the minimum amount was prepared, for example, when the decision was made to send 8 man teams instead of 6 – more time was spent on readying the extra gear
- The use of QMRS Superintendent at FAB assisted in communication flow between surface and rescue teams.
- The role of the QMRS in the IMT was not clearly defined - appeared to be part of the decision-making team within the IMT but not formally part of IMT.
- Information flow from the Control Room, including gas alarms, appeared disjointed / ad hoc.
- Instructions to rescue teams were verbal and passed on from IMT to QMRS Superintendent to rescue teams. Sometimes instructions can lose something in the translation.
- Some written instructions were issued (although somewhat vague) after the verbal instructions given.
- Mine plans not available for rescue teams.
- Cap lamps and rescuers not identified until the rescue teams were told that they were ready to go.
- The team from Crinum brought their own equipment, even though the Mutual Assistance protocols did not require it. This worked well and saved time later on in the exercise

Recommendations

42. The IC, or senior IMT member, should brief Mines Rescue Teams or at least be present to ensure that all information is being passed on and that questions can be answered by somebody familiar with the mine.
43. Testing of Mines Rescue Equipment should be continued until all of it is completed.
44. Greater concentration on getting the first team off the surface properly briefed and equipped is needed as this is the hardest thing to do in reality. Once the actions and limits as set by the IMT, this must become the priority.
45. Basic mine and incident information should be written up on a white-board in the Mines Rescue Room. An enlarged Captains Information Sheet could suit the purpose.
46. Review Mutual Assistance protocols in relation to additional equipment being immediately dispatched from adjacent mines.
47. The role of the QMRS within the IMT should be clearly defined – for example, formally recognised as part of the decision-making team and / or advisory and / or implementation.

48. It should be a consideration to set up a gas-monitoring terminal in the IMT room so that gas trends can be continually monitored.
49. Clearly defined instructions to be issued to rescue teams. One way of doing so could be writing the instructions on the electronic whiteboard in the IMT room and giving the printout to rescue teams.
50. The role of preparing and issuing plans during an incident should be clearly defined. Additional plans will always be required. This may be a role for the Mine Surveyor.

THE TIMELINE

KESTREL TIMELINE – SURFACE AND UNDERGROUND

		Event Time
2131	Roof fall 205 longwall panel ➢ power off ➢ DACs and telephones lines cut ➢ ventilation restricted to 6.53m3/s ➢ no entry/egress possible from the Maingates ➢ no computer communications to control room	0:00
2131	Control Room Operator (CRO) advised ➢ lost power to the longwall ➢ lost computer data-links to longwall ➢ 205 panel conveyor stopped ➢ unable to contact longwall face via phones or DACs	0:00
2133	CRO contacts 204 Panel asking to speak to Deputy	0:02
2135	All longwall 205 face crew have donned Fenzy's and commenced first aid on Casualty #1 (broken leg) at Chock 24	0:04
2143	Incoming call from 204 Panel Deputy to CRO. Deputy advised of status and requested to travel to 205 and investigate Two longwall face crew dispatched to tailgate for first aid equipment and SSR90's	0:08
2150	204 Deputy contacted CRO from 205 drivehead and informed them of slower air velocity. Still no contact with longwall crew.	0:19
2157	Outbye Deputy called CRO from 207 panel and advised that 737 phone not working and was provided with brief on status.	0:26
2159	Change over to SSR90's complete for all 205 face crew at 24 Chock.	0:28
2206	Longwall crew began to move Casualty #1 towards tailgate along AFC. ***(AFC had been positively isolated – Assessment Team)***	0:35
2207	204 Deputy arrived at 33 cut-through 205 panel and found the fall. Checked ventilation.	0:36
2212	204 Deputy tried to ring CRO from crib room at B Heading, 205 Maingate but was advised there was no power or communications.	0:41
2215	204 Deputy went around to A Heading and found fall. Tried shouting to crew – no response. Checked the general body for gas readings and ventilation.	0:44
2218	PED message from CRO to 204 Deputy to contact CRO.	0:47
2220	204 Deputy left 205 panel.	0:49

		Event Time
2225	Longwall crew struggling to carry Casualty #1 along face. Decided to leave Casualty #1 at chock 53 with a first -aider and 4 SSR90s (to be retrieved from Tail Gate cache at c/t 30)	0:54
2231	Concern expressed in control room about still no contact from 204 Deputy.	1:00
2232	204 Deputy no-roaded B Heading (transport road) 205 maingate outbye 0 cut-through.	1:01
2234	CRO declared incident and commenced incident log.	1:03
2235	204 Deputy contacted CRO from 204 tailgate entrance. Advised ▪ roof fall 5 – 6 metres (which was impassible) in belt road 33 cut-through, 205 maingate ▪ all power off section ▪ no sign of men ▪ two vehicles in 205 maingate panel ▪ ventilation slow due to fall, fresh air readings at lip of fall ▪ checked all stoppings along 205 homotropal belt – in tact ▪ no DAC communications along 205 belt road Five of the six longwall crew leaves 53 chock. Casualty left with 3 x SSR90's	1:04
2240	CRO arranges for vehicles to go to tailgate 205 in case crew walk out the 205 panel via the tailgate	1:09
2241	Longwall crew arrived at SSR cache, 30 cut-through tailgate	1:10
2242	Longwall crew departed cache with 4 men heading outbye (with one SSR90 and plan) and first -aider returned to Casualty #1 on the face with 2 x SSR90's	1:11
2243	204 Deputy decided to enter 205 tailgate in vehicle in search of missing crew. Loaded trauma kit, first aid kit and stretcher from 205 tailgate cribroom and took panel first -aider and gas detecting equipment.	1:12
2246	All persons accounted for except for 6 persons missing at longwall 205	1:15
2247	CRO opened Duty Card 1 briefcase and assumed the role of Incident Controller.	1:16
		1:17
2250	204 Deputy in company with an experienced mine worker, entered tailgate return through double doors. Deputy taking CO2 readings with 21/31 drager tubes	1:19
2256	204 Deputy and first -aider reached 4 cut-though, 205 tailgate and were advised that they were suffering from respiratory distress (10.4% CO_2). Donned self rescuers, took readings and withdrew.	1:25
2257	Longwall crew (4 men) arrived at 20 cut-through cache. Three SSR90's at cache and 1 carried from 30 cut-through cache. Change over completed and crew left at 2301	1:24
2301	▪ 204 Deputy called from phone 757 at 205 tailgate cribroom. Normal phone did not work – had to used emergency line (*not part of this exercise)*. Advised the CRO of the following readings: 4.1% CH4, 19.6ppm CO, 17.8% O2, 10.4% CO2, ventilation 0.4 m/s taken from the velometer – need to make corrections. Temperature 30°C dry, 29°C wet ▪ Suggested mines rescue personnel required to enter the area.	1:30

		Event Time
2302	First gas alarm on CONSPEC. Tailgate 205 sensor between 0 and 1 cut-through : 8.7 ppm CO, 2.15% CH4	1:31
2305	Second CONSPEC alarm at 205 tailgate : 19.6ppm CO, 4.17% CH4	1:34
2308	▪ Member of longwall crew stops through exhaustion (Casualty #2) ▪ Decision made to leave him resting under improvised air-shower 10 metres outbye 15 cut-through, 205 tailgate	1:37
2309	▪ CRO contacted Mine Manager (in transit to minesite) on mobile – update of situation with gas readings. ▪ CRO instructed to evacuate the mine	1:38
2310	▪ CRO informed Outbye Supervisor to act as Pit Bottom Marshall.	1:39
2312	▪ 204 Deputy and crew left panel for surface ▪ CRO has accounted for all personnel and security established on surface.	1:41
2320	▪ Longwall crew arrived at 10 cut-through cache. Picked up all 3 SSR90's to carry but did not don.	1:49
2333	▪ Longwall crew arrive at fresh-air, double doors 205 tailgate. ▪ Longwall deputy contacted CRO using emergency phone at 757. Provided detailed briefing of events up to that time	2:02
2341	QMRS Blackwater Superintendent phoned in to CRO requesting brief	2:10
		2:14
0015	Underground Mine Manager briefed IMT of incident. Decision making process determined, meeting protocol determined, risk assessments / change management procedures set in place.	2:44
0016	Industry Site Safety and Health Representative arrived on site.	2:45
0024	Inspector and Mines Rescue Superintendents arrive on-site.	2:53
0025	Three of the missing longwall crew arrived on surface.	2:54
0026	Longwall crew debriefed on surface – no hydration checks	2:56
0035	Incident Controller debriefing 204 Deputy in IMT – no plan was used.	3:04
0041	Site Senior Executive arrived on site.	3:10
0043	IMT reconvened. Ventilation Officer provided ventilation readings from Conspec and tube bundle of tailgate return. Ventilation Officer advised tube bundle readings had been confirmed by the GC and were: 11.8ppm CO, 2.51% CH4, 19.11% O2, 6.31% CO2.	3:12
0107	Mine Site Mines Rescue Co-ordinator initiated mutual assistance call.	3:36
0108	▪ IMT detailed discussions on options for recovery of missing persons Option 1 – Drive vehicle straight down tailgate now (CH4 2.6 %) Option 2 – Reverse airflow in tail-gate Option 3 – Breech seal inbye 33C/T 205 Maingate Option 4 – Load out and extricate over fall Option 5 – Boreholes	3:37

		Event Time
	▪ NR&M Inspector prohibited the use of diesel vehicle in the return at CH4 concentrations of 2.5%.	
0130	▪ IMT discussions on risk assessment to recover the casualty from 15 cut-through tailgate. Triggers for the back-up team to assist and established transport availability. ▪ NO SENSE OF URGENCY despite the fact that the IMT had identified SSR90 expiration time approximately 3:00am. Expiration time for casualties on longwall was 3:00am, casualty at 15 cut-through, tailgate was 12:30am.	3:59
0136	Instruction given to prepare 2 x EIMCO's and 3 x PJB's to pit bottom.	4:05
0140	GAG arrives on site.	4:09
0145	Continued discussions in IMT on options for recovery. No decisions yet made. No team yet deployed.	4:14
0152	Blackwater Station Superintendent arrived on site.	4:21
0155	IMT discussion on ventilation options. Safe working periods for mines rescue teams, number of teams available. Mines Inspector's comment "Gentlemen, time is ticking, it's time to do something'.	4:24
0205	IMT told to reconsider ALL options by assessor.	4:34
0213	CRO expressed concern about the men underground whose air was to run out at approximately 3:00am.	4:42
0216	Confirmation of EIMCO's and PJB's ready.	4:45
0218	▪ QMRS Team 1 ready to go underground. ▪ Continued discussion on Option 3 and associated hazards.	4:47
0227	QMRS Team 1 leaves surface tasked with recovery of longwall crew member at 15 cut-through, 205 tailgate.	4:56
0238	First PED message sent to trapped men – 'Help is on it's way'.	5:07
0240	Further IMT discussion regarding knocking over the seal in maingate Option 3. Discussion is bogging down. IMT advised by assessors "too much subjective opinion, not enough objective proof".	5:09
0241	Crinum mines rescue team members arrive on-site.	5:10
0245	FAB established at 205 tailgate by Mines Rescue Team 1.	5:14
0253	Mines Rescue Team 1 (8 men) departs FAB. Notified by CRO that MRT 2 were suiting up on surface.	5:22
0304	IMT discussion on sequence of work required for the Options 2 and 3 identified.	5:33
0305	CRO advised that Crinum Mines Rescue Team 2 ready to be deployed when needed.	5:34
0316	IMT were advised that QMRS Team 2 (8 men) were ready to go.	5:45
0318	▪ QMRS Team 2 left surface tasked as standby for QMRS Team 1. ▪ QMRS Team 1 have reached patient at 15 cut-through	5:47
0322	IMT settle on Option 3 to breach the seal inbye 33 cut-through, Maingate 205 B Heading and turn off the gas drainage points 22 and 26.	5:51
0332	QMRS Team 2 arrived at FAB – 8 men	6:01
0343	QMRS Team 1 radioed FAB asked for QMRS Team 2 for assistance	6:12

		Event Time
0350	▪ QMRS Team 1 arrived at 9 cut-through TG205, radioed FAB and that they had left patient with SSR90 and under compressed air flow as they were running out of working time. QMRS Team 1 were returning to FAB. ▪ Mine Manager directed IMT to the change-over with IMT#2 at 7.30am. Established a 1 hour timeline to pass over information to their alternate, and the change over to be completed by 7:30am.	6:19
0352	MRT 2 preparing to leave FAB. Discussed leaving 2 team members to carry out air readings.	6:21
0357	CRO was informed that casualty was on his way out and QMRS Team 2 requested assistance.	6:26
0402	QMRS A/Superintendent reported to IMT that QMRS Team 3 (8 men) were on surface	6:31
0403	IMT convened – risk analysis regarding reversing the ventilation.	6:32
0404	▪ QMRS Team 1 and QMRS Team 2 met at 4 cut-through TG205 and exchanged detailed information concerning patient. ▪ One member of QMRS Team 1 suffering heat distress.	6:33
0411	204 Deputy and EIMCO drivers despatched to breach seal at 205 maingate and closing the regulator at 205 block I Heading.	6:40
0414	QMRS Team 2 reached casualty at 9 cut-through.	6:43
0435	▪ QMRS Team 2 patient condition deteriorates at 5 cut-through – becomes stretcher case. ▪ 204 Deputy arrived in 205 panel with 2 x EIMCO's and operators.	7:04
0455	QMRS Team 2 arrives at FAB with patient.	7:24
0457	▪ QMRS Team 3 leaving surface tasked with conducting ventilation change, close regulator in 204 panel return and open doors inbye FAB. ▪ CRO informed that MRT 2 patient was out and okay.	7:26
0500	204 Deputy finished knocking down seal 33 C/T 205 Maingate "B" Hdg	7:29
0502	QMRS Team 1 depart FAB with patient heading in vehicle to surface.	7:31
0510	QMRS Team 3 arrive at FAB.	7:39
0516	204 Deputy informed CRO that seal at 33C/T had been knocked down at 0500.	7:45
0519	▪ IMT advised that seal had been broken at 0500. ▪ Second ventilation reading taken in tailgate return – ventilation rate doubled. ▪ Mine Manager briefed IMT to contact alternates for management change over.	7:48
0520	QMRS Team 1 reached the surface with casualty.	7:49
0532	Ventilation information relayed to CRO that the ventilation was 1.07 m/s and quantity 16.9 m^3/s.	8:01
0535	IMT debate on differences of information regarding the ventilation readings – contradictory advice of velocity 1.70 m/s or 1.07 m/s.	8:04
0540	Furious debate – fatigue issues becoming apparent. IMT members frustrated.	8:09
0547	Conspec information at 205 tailgate: 0.97% CH4, 5.4ppm CO.	8:16
0549	IMT informed of methane levels in tailgate 205 now below 1%.	8:18

		Event Time
0550	Mine Manager discussed with IMT do we have teams available. Mine Manager asked A/Superintendent, QMRS, on availability of mines rescue teams, where are they. IMT discussed the use of vehicles for the rescue of people on the longwall.	8:19
0555	204 Deputy notified FAB that regulator closed in I Heading 205 block.	8:24
0558	▪ Ventilation survey in 205 tailgate, airflow of 1.07m/s determined. ▪ FAB Controller briefed all personnel at FAB about plan. CH4 now below 1%, QMRS Team 3 to be despatched in a vehicle down tailgate and retrieve 2 persons off the longwall. ▪ QMRS Team 4 (6 men) ready to go underground.	8:27
0615	QMRS Team 3 departs FAB in Driftrunner.	8:44
0622	IMT informed CO on Conspec was 15.4ppm CO.	8:51
0625	Tired debate in the IMT on the source of the increased CO make	8:54
0641	IMT commenced change over meeting with IMT 2.	9:10
0651	IMT debate over confusion regarding the time of QMRS Team 3 was due back at the ribbon ie., 0717 or 0727	9:20
0657	QMRS Team 3 arrived at the two men (casualty + first -aider) on longwall face.	9:26
0705	QMRS Team 3 left 61 chock with casualty and first -aider.	9:34
0716	IMT 2 assumed control.	9:45
0724	QMRS Team 3 arrived at 9 cut-through and informed FAB that they had all members of team plus casualty and first -aider.	9:53
0727	IMT 2 decided to deploy QMRS Team 4 in search of QMRS Team 3.	9:56
0730	▪ IMT advised by CRO that QMRS Team 3 had arrived at FAB in PJB – all persons accounted for. ▪ Exercise terminated.	9:59
0747	IMT 2 debriefed by assessment team regarding desktop exercise to continue mine recovery.	10:16
0828	Desktop exercise terminated.	10:57

THE AUDIT TOOLS

LONGWALL CREW ESCAPE AUDIT TOOL

ASSESSORS: PETER BAKER, WARREN PENDLEBURY, GREG DALLISTON AND JAMES MARSHALL

		DETAILED ACTIONS AND COMMENTS
2131	All Longwall Crew (except Deputy) gathered at chock 24 and explained incident trigger.	Triggers given to crew was a statement read out by the Assessor "You have just felt a severe air blast and heard a major fall in the goaf and maingate. The air is thick with dust, negligible ventilation". They were also told they were experiencing violent panting and headaches (effects of CO2)
2135	Crew donned Fenzy's and began first aid treatment of injured employee.	As part of the scenario, the crew were informed that due to the severity of the wind blast, one of the crew had been knocked over and injured their lower leg.
2137	Caught up with Deputy (doing inspections near tailgate) and gave him the same information as the crew had received.	Deputy had already received a PED message from CRO to contact him urgently. He did so BEFORE he was aware that the exercise had begun, though the conversation was interrupted by incident assessor.
2143	Deputy and crew now together at chock 24. Two men dispatched to the tailgate to get first aid gear and SSR90's.	The communication difficulty created by wearing self rescuers was substantially reduced by the use of note pads and pens. Communications between crew and Deputy were sufficient to ensure that no critical information was overlooked – while this method takes time, it is very thorough and creates a permanent record of the discussions taking place and the decisions being undertaken.
2154	First aid equipment and SSR90's arrive at chock 24 and Deputy explained to crew that they were going to do a changeover from Fenzy units to SSR90's.	Longwall Deputy was very aware of the limited duration of the belt worn fenzy unit and the amount of time that was required to administer first aid and prepare to evacuate.
2159	Changeover to SSR90 completed by all members of the longwall crew (including casualty).	Changeover techniques were conducted competently. One crew member appeared unsure though did not put himself at risk – he simply watched the crew members. Two SSR90's had goggles which failed as soon as they were donned. It appeared that the rubber had deteriorated.
2206	First aid treatment completed and crew began extrication of injured patient along AFC.	At this point it was the obvious intention to take the casualty with the crew. Difficulty and reduced speed of travel had not appeared to be considered as yet.

		DETAILED ACTIONS AND COMMENTS
2225	Decision made to leave casualty on face line and leave a first aid attendant with him.	As the casualty was transported along the AFC, his injured leg was knocked time and again on the AFC flight bars. This would have almost certainly rendered the casualty unconscious due to shock from the pain. No stretcher was available as this was located at the maingate. Crew had moved approximately 30 chocks in 15 minutes (including initial lift onto AFC).
2235	Longwall crew leaves casualty at chock 53 (with three spare SSR90's) and starts moving to cache at 30 cut-through.	It was difficult for the Deputy to explain to his crew what his intentions were. This led to a long delay in departing BUT it was important that all crew members (including the casualty) had a good understanding of what the plan was – some frustration appeared within the crew due to this difficulty in communicating.
2241	Longwall crew (5 men) arrived at cache at 30 cut-through.	There were three SSR90's at the cache at 30 cut-through. The first aid attendant took two of these and returned to the casualty on the longwall face. The remaining four crew members (including the Deputy) took the one remaining SSR90 and the mine plan which was also there, and continued outbye.
2257	The longwall crew (now four men) arrived at 20 cut-through cache. There were three SSR90's at this cache and the crew had carried one with them from the cache at 30 cut-through. Crew changed over from SSR90 to SSR90.	On route to this cache, the Deputy had continually checked and assessed the condition of the crew members and the atmospheric conditions. The number of SSR90's available had been calculated. The changeover was conducted very well and had been well practiced.
2308	One crew member physically distressed due to the stress and humidity. Could not continue with escape.	A decision was made quickly that the exhausted crew member would have to be left where they were. The Deputy took the crew member 10 metres further outbye to a compressed air outlet and explained to him (in writing) to stay under the improvised 'air shower' (with ear plugs in(, keep his SSR90 on and stay in an upright position. Deputy then turned the air shower on and tested the atmosphere to determine the effectiveness of the air shower.
2312	Deputy and two remaining crew members leave 15 cut-through (leaving exhausted crew member) and continue outbye.	

		DETAILED ACTIONS AND COMMENTS
2320	Longwall crew arrived at 10 cut-through cache. Three SSR90's were available. The crew picked up one each to carry but did not do a changeover.	It was not considered necessary to do a changeover at each of the caches because at the speed the crew were travelling at they were sure they would make it back to fresh air in the time they still had in the unit they had on (training was to changeover after 60 minutes use). This was a valid decision but assessors were not sure if the crew member at 15 cut-through was considered when all three SSR90's were taken from the 10 cut-through cache.
2333	Longwall crew arrived at the double doors and determined they were now in fresh air.	When the crew arrived at the doors the Deputy used his gas detector to confirm fresh air and the crew were instructed that it was safe to remove their SSR90's after they passed through the doors.
2335	Deputy contacted CRO on the emergency number from phone 757 longwall tailgate cribroom.	Deputy informed CRO of his name, location, who was with him and who he had to leave behind (and where they were). He then explained what had occurred in chronological order, discussed some options and asked what they would like him to do.
2345	Longwall crew left for the surface in a PJB that had been deliberately left for them earlier.	These men came out of the longwall tailgate in a dehydrated condition. The thought of leaving transport for them was an excellent one – **water should also be high on priorities in these situations**.

205 MAINGATE AUDIT TOOL

ASSESSOR: TIM JACKSON

		DETAILED ACTIONS / COMMENTS
2131 – 2145	Four persons at chock 22 were told that a goaf fall had occurred and that they were suffering from rapid pulse, headache and were in a confused mental state. One crew member was using a training unit that had no nose piece and goggles (continued using unit). One man was with assessor at maingate and the Deputy was at the tailgate.	Ensure that training units are complete for trainee use.
2141	Crew donned units and decided to head to maingate. When they reached the maingate they were told of an impassable roof fall and that ventilation was sluggish. The men, using notetaking and talking, decided to head to the tailgate using the buddy grip system.	Reinforcement of no talking when escape apparatus on needed.
2142	Crew located Shannon who had an injured knee and commenced assessment.	Personnel need to be made aware that SSR90's will last longer than 90 minutes if at rest.
2146	Two persons went with Assessor towards the tailgate, leaving two persons continuing assessment of patient.	
2148	Assessor left face to prepare barriers in A and B Heading.	
2155	Barriers completed.	
2205	Diesel man transporter stopped at 31 cut-through, transformer site. Deputy had stopped to check power. He explained that he had checked all stoppings on the way in. He was advised by Control to investigate the same.	
2207	Deputy checked for gas as he went into 33 cut-through B to A Heading: 20.9% O_2, Nil CH_4, 3ppm CO	
2212	Deputy attempted to ring control from cribroom in B Heading. He was advised that there were no communications and no power in section.	It is important that PED reliability is investigated to ensure working ability.
2215	204 Deputy went to A Heading barrier, Conveyor Road and tried verbal communication.	Verbal communication was unsuccessful.

		DETAILED ACTIONS / COMMENTS
2216	204 Deputy checked general body in A Heading and obtained: 20.9% O_2, Nil CH_4, Nil CO and 0.2% CO_2.	
2219	204 Deputy checked deputies statutory report book in crib room and left panel at 2220.	
2222	204 Deputy attempted to use phone at 205 Belt Road, A Heading, 31 cut-through and was advised that no communications were available.	
2230	204 Deputy attempted to use phone at 205 maingate, 0 cut-through, A Heading and was advised that there were no communications available.	
2232	204 Deputy no-roaded at 205 maingate, B Heading and fitted information tag.	
2235	204 Deputy rang Control from 204 panel and advised the following information: No contact has been made. There was two vehicles in the panel and that there could be quite a few men in the panel. Relayed the gas readings he had taken.	
2244	204 Deputy gathered 204 crew and explained the situation. Instructed the first -aider to assist the Deputy and instructed the rest of the crew to assist in gathering first aid equipment and then proceed to the cribroom and await further instructions.	
2252	PJB left 204 cribroom.	
2250	205 tailgate – ventilation double doors opened – Deputy checked general body: 0.6% CH_4 and 0.6% CO_2.	
2256	At 4 cut-through, Deputy began to feel effects of CO2 poisoning. Donned self-rescuers and detected 17.8% O2, 4.1% CH4, 19.6ppm CO and 10.4% CO_2.	Deputy had to be prompted to take CO2 reading – using multi-gas detector not continuous readings
2258	Deputy took readings at 3 – 4 cut-through, 205 tailgate: Wet bulb – 29°C Dry bulb - 31°C Velometer – 2.4 m/sec (advised 0.4 m/sec)	
2300 – 2315	Deputy tried to phone Control – engaged. Used emergency line to contact and advised CRO of gas readings and observations.	

		DETAILED ACTIONS / COMMENTS
0435	204 Deputy arrived in panel with 2 EIMCO's and two operators. He explained the plan to breach the stoppings in A Heading.	Check to see if seal was breathing in /out. 3 x SSR90's for use by personnel. Fork tyne of EIMCO to breach stopping – small hole. Deputy to monitor atmosphere at stopping and third person to act as spotter outbye EIMCO. Deputy to gradually open up stopping. Deputy to take ventilation reading.
0450	Initial hole knocked in stopping.	
0500	Complete stopping down and ventilation reading taken. Exercise terminated.	
0505	Deputy and two operators left panel.	Deputy to be commended on his efforts and evaluation of the situation.

INCIDENT MANAGEMENT TEAM AUDIT TOOL

ASSESSORS: MALCOLM SMITH AND DAVID CLIFF

				COMMENT
Emergency Control	Formation of Incident Management Team	▪ Who formed the Incident Management Team (duty card)	Incident Controller (Duty Card 1) – Statutory Mine Manager (SMM)	IMT formation process smoothly executed with Duty Card system being activated and implemented. Duty Card 4 had difficulty in locating some sub duty cards – duty cards in briefcases in special cabinet. Sub duty cards in green manilla folders in filing cabinet in control room.
		▪ Time taken to form the Incident Management Team	Incident triggered at 22:35 CRO Confirmed at 22:45 by interim IC SMM on site 23:49 IMT briefing 00:15	
		▪ Make up of team (EEHMP)	Duty Card 1 – 7 not sub cards + Industry Safety and Health Representative + DNRM Inspector, last member arrived 00:49 on site with stenographer.	Duty cards used were last updated on 19 November 2001.
		▪ Relief personnel identified	Relief personnel identified on wall plans	
		▪ Leadership established	Mine Manager clearly in charge	
		▪ Defined role of Incident Management Team	Incident Control Group function defined by Hazard Mgt Plan for Emergency Mgt	
		▪ Defined role of Incident Management Team members	Roles of IMT defined by duty cards	
		▪ Defined role of Incident Management Team support personnel	Roles defined by sub duty cards	Change over plan executed well and transition smooth – info transfer incomplete.

				COMMENT
		▪ Advisory Committee established ▪ Incident Management Team members report to Emergency Control Room	Not evident. Yes	
	The Emergency Control Room	▪ The Emergency Control Room is suitably located	Yes, adjacent to Control room and other key facilities	IMT would have benefited from electronic access to gas monitoring system.
		▪ Entry into the Emergency Control Room is controlled	Control was initially established, on a number of occasions persons entered and left without being authorised to, and there was one change of role that was not authorised or notified (Duty Card 4).	Security must be established and maintained for entry and departure from emergency control room.
		▪ The layout of the Emergency Control Room: - Size, seating - Lighting and emergency backup lighting - Environmental monitoring facilities - Display boards	The EC room was too small for duty card members to fit. There were insufficient seats (5) for members of the IMT. Only one display board available. No electronic access to monitoring data.	Information previously developed from Risk Assessment could not be referenced by all IMT members, this is important for the control of activities, assignments and contingent planning. Additional wall mounted flip charts and white boards would have assisted the IMT in referencing previously discussed information and decisions made.
		▪ Adequate suitable stationery is available: - Incident log book - Writing pens and pencils - Erasers and correction fluid - Writing pads - Flip charts - Highlighting pens - Stick-it-pages - Suitable scale rules	Duty card system provided brief cases which contained emergency personal vest for duty identification, stationery including incident log books, pens and pencils. No rulers obvious nor stick it pages, highlight pens, flip charts, erasers or correction fluid. No cases contained calculators which did cause some minor problems later in the night – CO make calcs.	Ready access to a photocopier would also enhance the ability to disseminate info to IMT members.

				COMMENT
		- Marker pens and erasers - Calculators		
Incident Management Team	The Incident Management Team is provided with sufficient information to adequately carry out its duties both underground and on the surface	The Incident Management Team is provided with: ▪ Incident background ▪ Underground personnel and location - Typical mine gas types - Typical makes ▪ Copies of Safety Management System ▪ Copies of EEHMP ▪ Up-to-date underground plans including: - Ventilation distribution - Gas monitoring points - Escape routes - SCSR changeover locations - Electrical installations ▪ Up-to-date surface plans showing: - Building locations - Road systems and gates - Location of main services isolation control equipment - Location of fire fighting equipment - Location of rescue equipment - Location of hazardous materials, including explosives	IC collected info from CRO and u/g crews and briefed IMT 00:15. Briefing included incident details, locations of personnel and process to be followed by IMT. A copy of HMPs was available in the IMT and the CR. Not accessed except TARPS by CRO. Walls of IMT contained up to date plans. Gas monitoring points not evident. No surface plans evident.	Adequate information available. Surface plans must be available for use, especially where mutual assistance has been initiated.

				COMMENT
	The Incident Management Team are provided with suitable and sufficient communications equipment.	▪ The Incident Control Room is provided with at least two (2) external and two (2) internal telephones on separate lines. ▪ Two-way radios or alternative means are provided as support between the Incident Management Team and Incident Control locations	One emergency phone connected – seemed to only have internal access. A radio was part of Duty Card 1 kit, not turned on.	External access via mobile phone in control room. Extra staff coopted as necessary to support CRO. Not formalised in Duty Card system or emergency plans.
	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 develops action plans ▪ The Incident Management Team reviews available existing information on: - Missing and unaccounted for persons - Emergency incident witness accounts - Environmental information including gas monitoring and ventilation distribution ▪ The Incident Management Team determines the preparedness of the Emergency Response Teams	00:15 initial briefing by IC, thorough without being verbose. A process of risk management and change management was instigated – see comments. Various Duty Card members carried out these functions and reported back to IMT regularly. Duty Card 4 controlled this in conjunction with MRS coordinator, and reported back to IMT	IC ensured that he was fully briefed directly by key personnel. Regular systematic updates by IC of IMT.

				COMMENT
Data Collation	The Incident Management Team ensures that all data is collected and manipulated to become useful information including the briefing and de-briefing of personnel.	▪ Data gathering process is established to ensure that all generated data is made available, including: - Gas analysis - Ventilation distribution - Reports - Observations	No formal process was established. Records kept in individual Duty Card incident log books. Occasionally tabulated on white board – lost when page scrolled through.	Informal data collection process caused some problems in accuracy of data – lack of easy display required reconfirmation of some data and a number of misconceptions were promulgated – for example: CO in % rather than ppm. Incident quoted as occuring at 22:45 rather than 21:31. 22:45 being the time the incident was declined as an emergency.
		▪ Processes are established to manage distribution of information	No process to recover previously documented discussions.	
		▪ Data is processed whenever and wherever required to ensure that it becomes useable	No formal process evident.	There was no facility to keep key data on open display as only whiteboard was dedicated to decision making process. IMT room needed more white boards and other recording devices to allow for immediate reference.
		▪ Information critical for decision making is given the highest priority	On a number of occasions CO make was not calculated until asked for nor effective temperature – vital for effective operational time of rescue teams.	
		▪ Information and decisions are captured in an operations log, with particular reference to: - Date and time - Decisions and reasons - Persons or persons taking action - Person or persons to whom action is directed	Yes. Stenographer kept details of all decisions and risk management details. Details of who is to take action not recorded, nor who directed it.	

				COMMENT
Data Verification	The Incident Management Team verifies, as far as possible, all data collected before processing and use.	▪ The Incident Management Team ensure integrity of all gas sampling points	Where possible gas concentrations from CONSPEC checked against Tube bundle and GC. No check made that sensors were where they were supposed to be or if damaged. No reason to suspect that they would be damaged.	This was generally well done. Severity of injury not clarified nor recognised in decision making process. Reliance on verbal data transfer caused several transcription errors.
		▪ The Incident Management Team ensure the integrity and calibration of gas analysers used	GC would be calibrated prior to use. Others calibrated as per policies. See above.	
		▪ The Incident Management Team ensure the validity of gas readings by checking both percentage and range	Not particularly relevant except at end when CO make used. Ellicott diagrams constructed to evaluate explosibility.	
		▪ The Incident Management Team makes use of gas ratios before and in scenario modelling	Not really relevant, relied on hand held measurements to monitor progression of ventilation improvements.	
		▪ The Incident Management Team establishes additional strategically located sampling points where possible	As appropriate.	
		▪ The Incident Management Team cross references observations and reports to validate hearsay information		

				COMMENT
Contingency Plans	The Incident Management Team efficiently develop contingency plans that identify the emergency situation and response requirements.	▪ The Incident Management Team assemble relevant data in a timely manner	IMT used regular break outs to update relevant data.	Refer to oscillating decision making process.
		▪ The data is checked by the Advisory Team	IC used IMT as advisory team.	Backup of IMT implemented and well organised.
		▪ The Incident Management Team develops the most likely emergency situation existing	IC defined likely situation. No dissent.	Fatigue management of IMT subjective and not well managed. Several adverse impacts of tired personnel occurred – eg unable to resolve high CO.
		▪ The Advisory Team is consulted and advises the Incident Controller of the emergency situation existing	Not observed. IMT utilised by IC as advisory team.	
		▪ The Incident Management Team make use of all available experts and resources	IMT has range of expertise plus Industry Safety and Health Representative and NR&M personnel.	
		▪ The Incident Management Team develop contingency plans and update as often as necessary	Contingency plans developed and changed – see comments.	

				COMMENT
Incident Management Team Decision Making	The Incident Management Team is effective in decision making	▪ The Incident Management Team makes decisions as a team ▪ The Incident Management Team follow a defined process in decision making ▪ The Incident Management Team actually uses contingency planning ▪ The Incident Management Team takes into account all options when making decisions ▪ The Incident Management Team identifies all hazards associated with the emergency	Guided decision making by IC, inadequate involve members of IMT in the actual decision making was evident. Informal discussions occurring outside IMT between small groups of Duty Card holders. Attempted to follow risk management and change management. Considered ventilation controls – what ifs. Created plans to cope with various situations e.g. air flow through seal inspection port tested prior to knocking down seal to ensure that it would increase flow not decrease it. IMT members canvassed for issues and hazards. Risk management process used to define hazards – no formal check lists relied on personal experience – subjective assessments only.	**Decision making not completely effective too much post conclusion variation and revisiting of logic. Seemingly unwilling to commit to an action path. On a number of occasions a conclusion appeared to be reached and was only then challenged, this initiated a new train of discussion. Discussion oscillated between reversing ventilation and improving existing ventilation through closing regulator and knocking down stopping in maingate.** **On a number of occasions RM not completed. Hazards identified and issues but did not progress to controls.** **No systematic attempt to do comparative analysis of options. Always worked on one at a time. Comparative analysis carried out only verbally.**

				COMMENT
	The Incident Management Team uses risk management techniques in arriving at decisions	▪ The Incident Management Team identifies the appropriate controls for each hazard	Risk management process used. Relied on skills of IMT to identify controls. No attempt to consult outside this group or any references – except in attempt to validate use of diesel vehicle in 2.5 % CH_4.	**Risk management process not fully followed too often digressions allowed and decision paths not followed through. Conclusions not confirmed and vacillation occurred.**
		▪ The Incident Management Team incorporates appropriate hazard controls and constraints in all operational decisions	Part of risk management and change management process.	
		▪ The Incident Management Team does not invoke any action that endangers life	IMT agreed on all actions and followed risk management and change management process. Followed MRS emergency guidelines.	
		▪ The Incident Management Team takes all reasonable action to rescue persons remaining underground	See comments, focus of IMT was to retrieve personnel.	
		▪ The Incident Management Team considers the safety of all persons in any decision to deploy such persons in underground rescue and / or recovery	Yes.	
		▪ The Incident Management Team take into account the fate of any missing persons in any decision to seal the mine	Not relevant.	
		▪ The Incident Management Team make provisions for recovery of the deceased persons after sealing	Not evident – not relevant – no deceased persons identified.	

				COMMENT
Incident Management Team Monitoring	The Incident Management Team monitor emergency conditions and trends continually during the emergency.	▪ The Incident Management Team ensures that it receives all information likely to effect the decision making process. ▪ The Incident Management Team regularly updates the action and contingency plans ▪ The Incident Management Team reviews operational options and decisions in line with emergency response requirements ▪ The Incident Management Team consults with the Advisory Committee when changes in operational decisions are required	Duty Card process followed. IC instructed regular updates of key gas and other information. The IMT was regularly updated on the information however, previous information was not readily accessible and this caused some confusion e.g. no. of mines rescue personnel available. Yes, but needs improvement. Vacillation in decision making. IMT members utilised as Advisory Committee.	IC called for regular update and Duty Card 5 regularly checked gas concentrations. CRO regularly rang info through to IMT.
Incident Management Team Communication	The Incident Management Team establish and maintain effective communication with all necessary internal emergency personnel.	▪ The Incident Management Team prohibits external unauthorised contact or communications with all emergency personnel ▪ The Incident Management Team maintains effective communications with all emergency response groups by: - On-line computer, if available - Telephone - Back-up facility (message) - Radio (two-way)	Access to area restricted. However entry to IMT not controlled. No computer access available Single internal telephone Paper messages used to communicate with individual members of IMT Communications between the various groups managed by the relevant Duty Card holder. Operations log maintained by stenographer. IC and Duty Card 3 carried out briefings of	IC expressed frustration at unauthorised egress of key Duty Card holders – lost integrity of IMT and associated decision making process. Information exchange between IMT and replacement IMT imperfect. Questioning of replacement IMT revealed incomplete information exchanged and data in record books incomplete – eg nature of injuries of personnel etc.

				COMMENT
		▪ The Incident Management Team maintains effective communication by: - Regular face-to-face contact - Telephone - Written message - With Mines Rescue - Recording information flow by an operation log including date and time of incident, time of all subsequent developments, time of all decisions and time of all conferences and outcome	surface work force.	
Emergency Termination	The Incident Management Team will effectively terminate emergency management requirements at conclusion of emergency.	▪ The Incident Management Team debriefs all emergency personnel before termination ▪ The Incident Management Team relieves Mines Rescue Teams from operational duty ▪ The Incident Management Team relieves all other emergency operation personnel from duty as soon as they are no longer required ▪ The Incident Management Team prepares a statement for release to the public ▪ The Incident Management Team arranges for security of all documentation before termination	Left to Duty Card 4. Yes. Left to Duty Card holders to advise sub Duty Card holders etc. Not evident. Not evident.	

				COMMENT
		▪ The Incident Management Team arranges an early meeting date to commence preparation of the Emergency Incident Report	Not evident.	
		▪ The Incident Management Team is relieved from duty	Yes IC stood personnel down.	

MINES RESCUE AUDIT TOOL

ASSESSORS: PETER BAKER, WARREN PENDLEBURY, GREG DALLISTON (UNDERGROUND)
MURRAY BIRD AND TONY DE SANTIS (SURFACE)

		DETAILED ACTIONS AND COMMENTS
2131	Scenario commences – roof fall maingate 205 longwall. Power off to longwall. No computer communications to control room. Ventilation reduced to 6.53 m^3/s. DAC's out and telephones out.	At this stage self escape was the only option for the longwall crew – see 'escape' audit sheets and summary.
2341	A/Superintendent, QMRS, contacted CRO requesting brief which he was provided. Also told will need assistance from QMRS.	As part of the Kestrel Emergency Response Plan, the Mine Manager had contacted QMRS (this was done before Mine Manager arrived on site).
2405	Rescue suits being tested.	First mines rescue brigadesman to arrive on site started to test BG174's for use by MRT 1.
2420	Mine Manager determined to set up FAB at 205 tailgate double doors.	This was a good decision – the areas at the double doors was easily accessible with transport, there was ensured fresh air and telephone communications were available on site (although telephone at tailgate doors stopped working during the shift, there was another within 100 metres).
2424	Inspector and A/Superintendent, QMRS, arrived on site.	
2448	QMRS not yet in attendance in IMT. Mines Rescue team members were identified – 8 on site, 2 in transit and 3 underground in pit bottom.	Two of the team members underground had been on afternoon shift and were therefore not used, one was ill and another was out of 'oxy time'. This left enough current team members to have one at FAB, one rescue coordinator (on surface) and one team of eight. If it were not for the quick response of the Crinum team, the fact there were only 8 team members could have lead to a delay in initiating response.

		DETAILED ACTIONS AND COMMENTS
0107	Kestrel Mines Rescue Co-ordinator initiated mutual assistance call.	This was in recognition that there would probably be insufficient brigades on site.
0116	Mine Manager briefed A/Superintendent, QMRS.	A/Superintendent then became a member of the IMT and was heavily involved in the decision making process for the recovery of the persons in the longwall.
0140	GAG arrives on site.	This incident was never going to require the use of the GAG and it appears to be a waste of resources to have it called out every time QMRS are called – this should be on an 'as needs' basis.
0152	QMRS arrived on site.	
0210	Mines Rescue team briefing by A/Superintendent, QMRS.	Briefing was verbal and backed up with a written sheet. The main aim of this team was to travel to 15 cut-through and recover the person currently taking refuge there.
0218	A/Superintendent, QMRS, advised IMT that team ready to go underground now. Discussion took place regarding knocking down of stopping and associated hazards.	This is 90 minutes from when the majority of the team were on site (12:48am). This time must be able to be reduced in a 'life at risk' situation.
0227	Mines Rescue Team 1 leaves surface tasked with recovery of longwall crew member at 15 cut-through, 205 tailgate.	All team members knew their task and the urgency required.
0241	Crinum mines rescue team arrives on site.	Mutual assistance was activated at 1:07am, which means a delay of 90 minutes should be factored in to any future plans. This was an excellent effort from Crinum considering they brought equipment with them.
0245	FAB established at 205 tailgate by Mines Rescue Team 1.	Because the phone at the tailgate doors was U/S, the FAB was established just around the corner to enable visual contact with another phone. It appeared that not all the equipment required at FAB under Procedure 8.3 of the Guidelines was in place.

		DETAILED ACTIONS AND COMMENTS
0253	Mines Rescue Team 1 (8 men) departs FAB. Notified by CRO that MRT 2 were suiting up on the surface.	As soon as FAB were told the Crinum team was ready, they were ready to go active. This team worked well together – good Captains control, good rotation of stretcher carry, tested radio after joining ribbon and ensuring team members were coping with the humid conditions.
0305	CRO advised that Crinum Mines Rescue Team 2 ready to be deployed when needed.	As opposed to MRT 1, MRT 2 were ready to go active in less than 30 minutes after arriving. The reasons for the discrepancy need to be investigated further.
0311	MRT 1 off communication ribbon at 9 – 10 cut-through, tailgate 205.	This was pre-planned with FAB. The team took 1000 metres of radio ribbon on two 500 metre spools. It would have been difficult for a team of 5 men to run the ribbon out using this method. The QMRS Guidelines states under Procedure 8.2 'If radio communication is not maintained the team should not travel beyond 30 minutes from the FAB" – this needs review.
0316	IMT were advised that MRT 2 (8 men) were ready to go.	Communications between IMT and FAB were reasonably good but would have been much improved if the phone at the doors was operational.
0318	MRT 2 left surface tasked as standby for MRT 1. MRT 1 have reached patient at 15 cut-through.	Upon arrival at 15 cut-through, the team found the patient in reasonably good condition. They placed a MARS unit on him before turning off the air shower and were then told by the patient that he had seen a light inbye – this was not part of the scenario and delayed the return departure time of the team (unintentionally). Team had taken water in for the patient and used it well for the patient and for themselves.
0332	MRT 2 arrived at FAB (8 men).	
0333	A/Superintendent, QMRS, requested two mines rescue personnel to take ventilation reading outbye of 1 cut-through, 205 tailgate.	This request was delayed due to the fact there was no anamometer available (it is not part of FAB equipment).

		DETAILED ACTIONS AND COMMENTS
0334	MRT 1 left 15 cut-through with casualty.	The casualty was able to walk with assistance and he was well treated and rested regularly on the way out.
0343	MRT 1 radioed FAB and asked for MRT 2 for assistance due to limitation of working time.	At this point the Captain realised the team was not going to be able to get the patient out in the working time allowed under the guidelines in hot and humid conditions.
0350	MRT 1 arrived at 9 cut-through, radioed FAB and left patient with SSR90 and under compressed air flow as they were running out of working time. MRT 1 were returning to FAB.	This was necessary for team safety, though it was not communicated well to the patient. Some of the team members in MRT 1 were really struggling in the humidity and this highlighted the need for strict controls on the working time of teams in these conditions.
0352	MRT 2 preparing to leave FAB. Discussed leaving two team members to carry out air readings.	It was decided that an eight man team would be required and this was a good decision.
0355	204 Deputy reported to FAB – can't breach seal until air quantity taken and no communications in 205. Instructed by FAB Controller to wait at FAB. MRT 2 depart FAB with return time of 0445.	If the ventilation monitoring at the longwall tailgate was working correctly, this task would not have been required and would have resulted in the stopping breach being done earlier. Team working time reduced due to atmospheric readings that had been radioed through. At this point there were two teams operational with the third team still on the surface. In the QMRS Guidelines this was acceptable if another team is immediately mobilised. Was MRT 3 immediately mobilised?
0402	A/Superintendent, QMRS, reported to IMT that MRT 3 (8 men) were on surface and explained why assistance was needed by MRT 1.	This was the link from the operational teams to FAB to IMT and is a necessity in an emergency.
0404	MRT 1 and MRT 2 met at 4 cut-through and exchanged detailed information concerning patient. One member of MRT 1 suffering heat distress.	The detail in this communication was excellent and worked well for the two first Aiders to converse. Again the necessity of adhering to the reduced working times in humid

		DETAILED ACTIONS AND COMMENTS
		conditions was evident.
0412	MRT 1 reached FAB.	MRT 1 had been active for 79 minutes (guidelines suggest 50 minute working time in these conditions). Two team members were obviously effected by the conditions and water was available at FAB for treatment. Exceeding these guidelines is not putting team safety as the top priority.
0414	MRT 2 reached casualty at 9 cut-through.	MRT 2 found the casualty under the air shower wearing a SSR90 (MRT 1 had put this on after MARS had run out). They were the first team (or person) to mention the possibility of using the goggles. The team moved swiftly due to time constraints.
0415	A/Superintendent, QMRS, briefed IMT regarding MRT 1 and MRT 2 activities.	Again this link was evident between FAB and IMT.
0417	Two members of MRT 1 took ventilation reading in tailgate dogleg.	While it was necessary to go only a short distance and the task was certainly not onerous, the use of team members after they have been exposed to hot and humid conditions.
0421	MRT 2 left 9 cut-through with patient.	The team moved at a good pace for the patient.
0424	A/Superintendent, QMRS, contacted additional mines rescue personnel from Oaky Creek.	It had become evident that a further extension of the Mutual Assistance Scheme was required.
0435	MRT 2's patients condition deteriorates at 5 cut-through – becomes stretcher case. A/Superintendent, QMRS, began briefing MRT 3.	Team radioed FAB and updated situation. Put MARS unit on patient, prepared stretcher and then set up for a six man carry on the stretcher (excellent idea). MRT 3 were originally briefed to make some ventilation changes but this changed in transit.
0445	Mine Manager requested MRT 3 to be briefed in IMT room.	

		DETAILED ACTIONS AND COMMENTS
0455	MRT 3 briefing complete in IMT room. Assignment identified. MRT 2 returns to FAB with patient.	MRT 2 returned to FAB after being active for 60 minutes, though had identified that they would be up to 10 minutes overtime with control. The team had carried a large person over 500 metres, though had done so relatively easily due to the 6 man carry – this was a very good effort.
0457	MRT 3 leaving surface tasked with conducting ventilation change, close regulator in 204 panel return and open doors inbye FAB. CRO informed that MRT 2 patient was out and okay.	This task changed on route.
0502	MRT 1 left FAB with patient heading in vehicle to surface.	MRT 1 was being used as a standby team for MRT 2. MRT 3 could have been used for this task after the conditions that MRT 1 had been through.
0510	MRT 3 arrived at FAB.	
0516	FAB notified IMT (via IMT emergency phone) that MRT 1 proceeding to surface. 204 Deputy informed CRO that stopping had been knocked down at 0500.	This was the only way that they could get hold of them.
0520	MRT 1 reached the surface with casualty.	
0601	A/Superintendent, QMRS, briefed IMT on MRT 3 tasks – to mobilise from FAB to longwall.	It was not evident where this instruction was initiated. The FAB Controller was in a good position to at least 'advise' in this situation.
0615	MRT 3 departs FAB driftrunner.	At this stage the CH4 level was running at 0.93%, therefore within the legal limits for running a machine. The driftrunner was necessary to travel the required 3.2km to the longwall face and back to get the two remaining men.

		DETAILED ACTIONS AND COMMENTS
0626	MRT 3 at end of ribbon contacted FAB.	This was pre-arranged with the FAB Controller and the team had been informed that if they had not contacted FAB again within one hour – a second team would be mobilised. Again the standby team was MRT 2 who had already had a workout in the hot and humid atmosphere.
0657	MRT 3 arrived at the two men on longwall face.	MRT 3 found the two men on the longwall face at chock 61. They had run a compressed air line from the tailgate and had taken refuge under an improvised canvas done. The team passed an SSR90 to each of the men and then proceeded to load the injured man in the stretcher.
0700	A/Superintendent, QMRS, informed IMT that MRT 4 and 5 had arrived on site.	
0705	MRT 3 left chock 61 with casualty and first -aider.	MRT 3 did not waste any valuable time getting mobile from the AFC back to FAB. They had to carry the casualty along the AFC (it was positively isolated), which was a difficult task but handled well.
0714	A/Superintendent, QMRS, briefed the IMT on the MRT 1 report.	
0724	MRT 3 arrived at 9 cut-through and informed FAB that they had all members of team, casualty and first -aider.	The radio message was received and understood by FAB, yet the IMT were discussing the need to deploy MRT 4 three minutes later. The message had obviously not been passed on.
0727	IMT 2 decided to deploy MRT 4 in search of MRT 3.	Had IMT contacted FAB recently for an update?
0730	MRT 3 out of tailgate in PJB – all persons accounted for. Exercise terminated.	The use of the vehicle meant that MRT 3 returned in very good condition and the men were extricated rapidly. Could this have been deployed earlier?

QUEENSLAND MINES RESCUE SERVICE – PERFORMANCE CRITERIA AUDIT TOOL

ASSESSORS: MURRAY BIRD AND TONY DE SANTIS

				COMMENT
QMRS Performance Criteria	Written Mines Rescue Agreement	Existence	Current mine rescue personnel listed on notice board.	Did not personally see Mines Rescue Agreement.
	Did corporation meet its obligations under the Agreement	Mutual Assistance ▪ Superintendent ▪ 14 Team Members ▪ 3 GAG Operators ▪ Equipment Duty Cards Station Action Sheets / Time Logs	Yes.	
	Annual Exercise	Participation Emergency Exercise Committee Assessment	Yes. CEO part of Emergency Exercise Committee.	
	Appropriate Training	Did Trainees and GAG operators ▪ demonstrate ability to use BA / GAG ▪ demonstrate ability to use rescue equip ▪ demonstrate familiarity with rescue Procedures and protocols Demonstrate confidence in ability to render aid demonstrate professional conduct	Yes. All teams appeared to be conversant with equipment and protocols.	
	Equipment	Maintained Available Tested Certified	Yes. Yes. Yes. Logged into book.	Sufficient equipment made available.

				COMMENT
	Mutual Assistance	MR Call Out Procedure - ▪ Effective ▪ Deployment of personnel ▪ Arrived in specified time frames	Yes – response time was good.	
Operational Efficiency	Operational Mine Inertisation	▪ Arrival of GAG ▪ Arrival of support vehicles / services ▪ Fabrication of GAG ▪ Hook up of GAG ▪ Operation of emergency seals ▪ Control / Monitoring of Atmospheres ▪ Predictive analysis ▪ Control of Fans / Vent Quantities / Velocity ▪ Operation of GAG ▪ On-going continuous operation – operators – support services	GAG arrived on site, but was not required.	
	Duty Card Holders	Mines Rescue Superintendent ▪ Receives call from non-affected mine ▪ Issues Duty Cards ▪ Participates in Incident Control Fresh Air Base Controller ▪ Links FAB to Superintendent MR Surface Controller ▪ Surface facilities	 Yes. Yes. Good.	▪ Appeared that Mines Rescue Assistant Superintendant assumed role as part of IMT. ▪ With QMRS person at FAB, communication with surface and rescue team improved. ▪ Initial Surface Controller went in with MRT 1 team. Responsibility handed over to alternate.
	Underground Deployment	As per assessment –		

QUEENSLAND MINES RESCUE SERVICE RESPONSE AUDIT TOOL

ASSESSORS: MURRAY BIRD AND TONY DE SANTIS

				COMMENT
Minesite *(Prepare for active team deployment)*	• Official in charge is identified. • Rescue team preparation area is identified.	• Positive and timely identification of official in charge (may be QMRS or Company) and designated operating areas.	Rescue teams reported to rescue room where they were briefed.	
	• Equipment is unloaded at designated area.	• Due care of equipment when unloading.	Emergency vehicle parked in car park. Additional gear that was required was carried by hand to Emergency Rescue Room.	
	• Prescribed checks and tests on equipment are carried out and results recorded.	• Prescribed checks and tests are completely and confidently carried out and recorded.	Test carried out and recorded on log books.	At first, tests were slow with only one operator. However, as more team members arrived the 2nd RZ25 was used.
	• Teams of required numbers are formed.	• In and absence of a Rescue Station Official, control and authority is exercised.	Mine Rescue Co-ordinator assumed this role well.	
	• Team captains and vice captains are appointed.	• Team procedures are demonstrated competently.	Yes.	
	• Team briefings are received and understood.	• Input and receipt of information at the team briefing is relevant and positive.	Relevant questions also asked by the teams.	
	• Extra equipment, if required, is identified and prepared for use.	• Time management is efficient.	Once they were informed that they were going operational urgency improved.	Lamps and rescuers were not identified until team was told to get ready to go.

SURFACE COMMUNICATIONS AUDIT TOOL

ASSESSORS: MURRAY BIRD AND TONY DE SANTIS

				COMMENT
Data gathered and disseminated	**IMT** Does everybody in the Incident Management Team know what happened and what is now occurring?	▪ Information from initial incident. ▪ Additional data wanted / requested ▪ Witnesses interviewed	Initial briefing of IMT was good. Had to be repeated a number of times as people arrived later.	Could have utilised whiteboard to list sequence of events.
	Technical Support Team Do they know basically what happened, what information is now required, what to look for and why	▪ Information from initial incident. ▪ Additional data wanted / requested ▪ Frequency of updates ▪ Appropriate personnel and equipment prepared	Yes – generally handled well.	
	Mines Rescue Teams Do they know basically what happened, what information is now required and preparing for what they may need to do.	▪ Information from initial incident ▪ Additional data wanted / requested ▪ Frequency of updates ▪ Appropriate personnel and equipment prepared	▪ Mines Rescue Superintendent passed information onto teams. ▪ Only basic information and at times lacking in detail.	Did not know when team went operational, where they were, no plans and limited written instructions.
Priorities established	**IMT** Does everybody in the Incident Management know what the group's priorities are and clear on why?	▪ Discussions of priorities ▪ Documented or on whiteboard ▪ Planning done inline with them ▪ Periodic review of them to determine that they are still appropriate and are being achieved.	▪ Meeting protocols established at the start. Priorities / objectives not written up.	Could have utilised the whiteboard to list out what the objectives and priorities were.
	Technical Support Team Does everybody in the Technical Support Team know what the group's priorities are?	▪ Discussions on priorities ▪ Information dispatched and reacted too in line with them. ▪ Periodic review of them to determine that they are being achieved.	Technical Support team were members of IMT.	

				COMMENT
	Mines Rescue Team Does everybody in the rescue teams know what Incident Management Team's and the mines rescue priorities are and clear on why?	▪ Discussions on priorities ▪ Documented or on whiteboard ▪ Planing done inline with them ▪ Periodic review of them to determine that they are still appropriate and they are being achieved.	General understanding of incident was okay. They were given verbal instructions which were then followed up by written notes which generally lacked detail.	Instructions should have been agreed in IMT and written up prior to issuing to MRT.
Group Dynamics	**IMT** How does the IMT function as a group?	▪ Interpretation of new or ongoing information and how it is used? ▪ Decision making methods used in determining action plans. ▪ How is consensus achieved? ▪ Interaction of team members?	Underground Mine Manager led all discussions. Good contribution from other members. Alternatives discussed, path chosen and decision made - if there were no objections.	No real formal decision making.
	Technical Support Team How does the Technical Team function as a group?	▪ Interpretation of new or ongoing information and how it is used? ▪ Decision making methods used in determining how, who, what and when information is required and dispatched. ▪ How is consensus achieved? ▪ Interaction of team members?	Information presented to IMT for decisions.	
Succession Plans and Chang-over	**IMT** How does the IMT prepare for a change-over of participants?	▪ Planning in advance ▪ Appropriate personnel identified ▪ Cross–over periods ▪ Information exchanged ▪ Documentation	▪ Hand over was planned well in advance and decision made as to when people would call their replacements. ▪ Exchange of information done one-one rather than as a team.	
	Technical Support Team How does the Tech Support personnel prepare for a change-over of participants?	▪ Planning in advance ▪ Appropriate personnel identified ▪ Cross–over periods ▪ Information exchanged ▪ Documentation	▪ Hand over was planned well in advance and decision made as to when people would call their replacements. ▪ Exchange of information done one-one rather than as a team.	

				COMMENT
	Mines Rescue Personnel How does the Rescue personnel prepare for a change-over of participants?	▪ Planning in advance ▪ Appropriate personnel identified ▪ Cross–over periods ▪ Information exchanged ▪ Documentation	▪ Planned as per IMT. ▪ Did not actually take place.	
	Other Support groups (Security etc) How does the groups prepare for a change-over of participants?	▪ Planning in advance ▪ Appropriate personnel identified ▪ Cross–over periods ▪ Information exchanged ▪ Documentation	Organised by Surface Controller. Changeover did not take place.	
	Mines Rescue Team How does the Mines Rescue Team function as a group?	▪ Method of updating personnel ▪ Interpretation of new or ongoing information and how it changes current arrangement ▪ Decision making methods used in determining how, who, what and when teams and equipment are required and dispatched. ▪ How is this consensus achieved? ▪ Interaction of team members from total group, not just a single mines rescue team.	▪ Teams were briefed as a group. ▪ Updated information not relayed to operational teams. ▪ Did not witness any detailed planning or decision making.	
Interaction between Groups	How well do the three groups interact and communicate with each other?	▪ Method of communication – verbal, written etc. ▪ Frequency of communication ▪ Are communications one way or two-three way? ▪ Is the critical information being clearly communicated? ▪ Is there too much 'nice to know' information being communicated?	▪ Verbal communication on a needs basis. ▪ Critical information was relayed, however as mentioned above, changes in condition not communicated to operational team.	Need to ensure that information is relayed to operational team.
Recording of Information	How well do the groups record critical data and events?	▪ Who recorded information? ▪ Method of recording? ▪ Is it easily reviewed by group members?	▪ All Duty Card holders had a book which they recorded information on.	

				COMMENT
		▪ Does it fulfil the needs of the exercise? ▪ Would it fulfil the needs of an inquest?	▪ Scribe allocated to IMT. ▪ Tape recorder also used in IMT.	
Reality of Exercise and Roles filled	**IMT** Do participants react to the exercise the same way that they would in reality?	▪ Do participants clearly understand the dangers and priorities? ▪ Are participants just following prompt cards? ▪ Are decisions and actions being implemented in a timely manner? ▪ Are participants more worried about making a mistake rather than solving the problem?	▪ Dangers and priorities clearly understood. ▪ No. ▪ The team clearly wanted to come up with a workable solution which would not endanger others.	▪ Although they realised that SSR90's would run out at 3:00am. The level of urgency in getting a rescue team in to retrieve employees was lacking.
	Technical Support Team Do participants react to the exercise the same way that they would in reality?	▪ Do participants clearly understand the dangers and priorities? ▪ Are participants just following prompt cards? ▪ Are decisions and actions being implemented in a timely manner? ▪ Are participants more worried about making a mistake rather than solving the problem?	Technical Manager and Ventilation Officer were part of IMT.	Did not observe a separate technical team
	Mines Rescue Teams Do participants react to the exercise the same way that they would in reality?	▪ Do participants clearly understand the dangers and priorities? ▪ Are participants just following prompt cards? ▪ Are decisions and actions being implemented in a timely manner? ▪ Are participants more worried about making a mistake rather than solving the problem?	Yes. No. Yes. No.	

SITE RESCUE CO-ORDINATORS EFFECTIVENESS AUDIT TOOL

ASSESSORS: MURRAY BIRD AND TONY DE SANTIS

				COMMENT
Protecting and assisting persons involved in First Response first aid	The Site Rescue Coordinator maximises the safety of personnel in coordinating any first aid response	▪ Assess any risk in any first response. ▪ Minimise exposure to risk	Site Co-ordinator took a secondary role once the QMRS Superintendent took over.	Site Rescue Co-ordinator Role was handed over to an alternate as first one went in with MRT 1.
Protecting and assisting persons involved in aided escape	The Site Rescue Coordinator maximises the safety of personnel in coordinating any aided escape response.	▪ Initiates QMRS call out if necessary. ▪ In conjunction with Site Emergency Controller and QMRS assess risk of any rescue team deployment.	▪ Travelled to the mine with Mine Manager. ▪ Calls made form the car	Risk assessment for rescue team deployment was part of the discussions held in IMT.
Provision of the necessary emergency equipment and services	The Site Rescue Coordinator ensures that sufficient rescue equipment and medical services is available and in readiness on site during an emergency.	▪ Sufficient serviceable rescue equipment is available on site. ▪ Sufficient emergency medical treatment capability is available on site.	▪ Well done, however, it appeared to be slow. ▪ Emergency ambulance on-site.	
Planning to provide for any escalation of the emergency	The Site Rescue Coordinator ensures that a suitable response can be implemented for any escalation of the emergency through proper planning.	▪ Liaises with Incident Control Committee ▪ Liaises with QMRS ▪ Liaises with external assistance agencies	▪ Well done – part of IMT. ▪ Yes. ▪ N/A.	

TECHNICAL SUPPORT TEAM AUDIT TOOL

ASSESSORS: MURRAY BIRD AND TONY DE SANTIS

				COMMENT
Level and detail of technical information collated, coordinated and communicated by the Technical Team to the Incident Management Team	Once briefed by Incident Controller, what level of support was co-opted?	▪ Number of persons co-opted? ▪ Technical expertise of persons? ▪ Knowledge level of Kestrel – layout, personnel and systems?	▪ A number of persons were co-opted to assist the IMT. ▪ Knowledge level was good.	Technical Team not officially established due to nature of incident. Gas Chromatograph Operator nominated. Ventilation Officer and Technical Manager were part of IMT.
	Was the technical support team assembled appropriately to address the level of emergency and the type of emergency?	▪ Technical expertise of persons co-opted in the type of emergency being faced.	Yes.	Technical expertise appropriate for the emergency.
	Standard of information prepared for Incident Team?	▪ Did the detail and format allow the Incident Team to formulate decisions or was more detail required?	Information on gas concentrations and movements relayed to IMT as events unfolded.	All information transfer was verbal.
	Transfer of information to Incident Management Team	▪ Verbal, written or a combination of both. ▪ Was the time interval between information transfer adequate? ▪ Were all responses from the Incident Controller for information met and in a timely manner?	Transfer of information was verbal. Time interval was adequate but not always all encompassing.	IMT members regularly sent out of IMT room to gather more details, particularly gas levels.
	Were the type and standard of outside services appropriate for the emergency?	▪ What outside services were activated? ▪ Did the level of expertise called	QMRS, Ambulance and hospital were contacted. The level of expertise called was	Police were not contacted.

				COMMENT
		address the requirements of the emergency?	adequate.	
	How were the outside services briefed?	▪ Written, verbal or a combination? ▪ Was this information recorded?	This was done verbally over the phone.	Apart from QMRS, other emergency services were not mobilised.
	Was the briefing to the outside services appropriate?	▪ Was the briefing accurate? ▪ Did the level of information provided permit the service concerned to act in an appropriate and effective manner?	Generally. Yes.	
	What was the standard of technical detail required?	▪ Throughout the exercise was the information accurate and sufficient for the Incident Management Team	Generally.	Communication flow appeared to falter as the exercise dragged on.
	How was that technical detail acquired?	▪ What sources were utilised for information? ▪ Were more accurate sources available? ▪ Were the sources of information verified and authorised prior to issue?	Good use of all available resources.	Conspec and tube bundle gas readings verified by Gas Chromatograph Operator.
	Was the standard and format of detail prepared adequate for the Incident Management Team?	▪ Did the Incident Management Team question the information or method in which it was presented?	Clarified and discussed but did not really question.	Generally well done.
	How was the accuracy of the information prepared for the incident team checked and authorised prior to issue?	▪ Did the Technical Officer verify and authorise all information prior to it being issued?	No. Technical Manager was a member of IMT.	
	How were documents controlled and information recorded and filed?	▪ View evidence of documents being prepared and filed.	A scribe allocated to take notes in the IMT. Tape recorder was also used.	No evidence of any other written form of communication.

				COMMENT
	What was the level of interface with other areas in the collation and dissemination of information?	▪ View how team interfaced with other individuals during the exercise.	Team broke up on a number of occasions to disseminate information.	
	Was ventilation detail accurate and current?	▪ Method by which Ventilation Officer collected an collated his information. ▪ Use of gas chromatograph ▪ Use of SafeGas ▪ Use of SIMTARS personnel ▪ Interval between checking SafeGas for explosive atmospheres and the trending thereof.	Information flowed from Control Room to Ventilation Officer located in the IMT Room. Interval appeared to be suitable.	Good use of available information.
	How was ventilation data recorded and disseminated?	▪ Was the information recorded and presented in such a manner that it was easily referenced into trends? ▪ Did the Ventilation Officer cross reference with "Ventsim" or another program? ▪ Did the Ventilation Officer cross reference actual conditions underground with De-briefing Officer? ▪ Was ventilation detail readily authorised by the Ventilation Officer or the Technical Officer?	No, but not needed. Yes. Yes. Not always.	Ventilation simulation carried out to determine effects of proposed ventilation change. Information flow directly from Control.

				COMMENT
	Was the ventilation information in a format, and of sufficient detail, for the Incident Management Team to make informed decisions?	▪ Was the Incident Management Team able to digest the information without constant reference to the Ventilation Officer? ▪ Was current information easily referenced by the Incident Management Team into previous information provided?	Yes. Yes.	
	Was the strata detail including location of boreholes available and accurate?	▪ What strata plans and geological information were available? ▪ Were boreholes clearly and accurately marked?	Not utilised.	
	Was the type and number of mine plans available current and contain the level of detail required?	▪ Currency of plans to be checked. ▪ Did all plans provide the level of detail and information required?	The plans in the IMT room were up-to-date. Position of mine plan on the wall made it difficult for all to view when talking about area around longwall face (300mm off the floor)	Mines Rescue Team plans not readily available.

SUMMARY OF RECOMMENDATIONS

These recommendations have been compiled from the assessment, audit tools and summaries of the Emergency Exercise Management Team.

CONTROL ROOM OPERATIONS

1. IMT to ensure that CRO informed of intended actions so that he can confirm actions as required. This should be done by one of the duty card holders. This way the CRO only gets information from one person in contact with the IMT.
2. Limit access to the control room to stop people wandering in and out.
3. Extra phone point for personnel with duty cards so as not to use control room as a telephone room.
4. Modify Safegas so that login time lasts for the shift duration of the CRO. CRO to log out should he leave the control room. This will reduce frustration on accepting alarms.
5. Gas Chromatograph Operator was useful as backup to CRO although he was not required to take a large number of bag samples due to the scenario.
6. Ensure that duplicate tasks are not given to duty card holders and that duty card holders stick to their duties.
7. Consider increased and more regular use of the PED to send messages to trapped personnel. Short, **accurate** messages can often provide a moral boost and (perhaps) can also be used to provide advice/directions. *NB. Some messages sent by the Exercise Assessment Committee members to the underground assessors did NOT get through. The impacts of the broken ground above the goaves adjacent to LW 204 and LW 205 need to be investigated in regard to this*.

LONGWALL 205 FACE CREW ESCAPE

8. The mine re-investigates the escape time-lines and distances between cache locations in longwall returns – particularly where poor visibility may be experienced.
9. Investigate the number of SCSR in the longwall return caches. In this scenario there were sufficient numbers, but there were only six people on the face. If there had of been one more person on the face, there were no spare units in the caches. The escaping crew expressed concerns during the debrief of this point. Self-escape routes need to be planned and serviced by sufficient SCSRs for the maximum number of personal in the panel in both primary and alternate routes.
10. During the refresher training for SCSR, mines must ensure that duration times of at work and at rest are explained to wearers.
11. Communications using pens and notebooks, and not talking through mouthpieces, should be adopted as an industry standard.

12. Trial the use of walking sticks in areas of excessive rib spall. The trial to consider the appropriateness of using "candy cane" shaped curved handles, or the current right angled "elbow" shaped handles.
13. Treat any person who 'escapes' in the hot and humid conditions as a patient to ensure they recover from the experience – particularly in the rehydration of persons.

FIRST AID RESPONSE – LONGWALL 205 FACE CREW

14. Mine personnel should spend some time brainstorming / training sessions to utilise available equipment innovatively to make air showers, barricades etc. This will improve the likelihood that panic won't set in should some personnel be unfit to facilitate self-escape. It would be particularly beneficial where there is more than one person to use the airline.
15. Mine personnel need to consider taking more time to ensure that the correct message is written on notepad communication.

INCIDENT MANAGEMENT TEAM

16. The decision making process needs more focus and each option needs to be driven to completion before allowing digression.
17. All IMT members need to be encouraged to actively participate in the decision making process.
18. Duty card holders need to recognise the need to remain with the IMT unless authorised to leave. This is especially true if there is an exchange of roles.
19. Computer access to the mine environment monitoring system in the IMT is essential. Ventilation simulation software should also be on this computer.
20. Communications between the IMT and CRO should be better documented.
21. A systematic process for evaluating fatigue should be implemented rather than rely on the individuals to notify the IC of their status.
22. Calculators should be included in the duty card briefcases.
23. A mine plan in the IMT should show monitoring locations.
24. There needs to be more white boards / areas to display key information for immediate reference.
25. Suitable techniques should be used to capture ideas, generate alternatives and evaluate the different options to allow for systematic comparison.
26. There needs to be more urgency in decision making when retrieving persons underground who are injured or have limited life support equipment available.
27. The environment conditions merit closer monitoring due to the impact of effective temperature on the effective duration time of rescue teams using BG174's.

28. Ventilation flow sensors in key roadways would enable more accurate interpretation of makes and effects of changes in ventilation.

INCIDENT MANAGEMENT TEAM CHANGE-OVER

29. That the IMT members change-over be conducted on a staggered basis with no more than 2 persons being shifted at a time. This will provide for much more cohesion in the team and limit the possibility of loss of information
30. That there be a greater use of aids such as mine plans, whiteboards, flipcharts etc to display relevant information. A written record of the status of resources is vital to the change-over of any command structure.
31. A written chronological record of milestone events be kept, updated regularly and referred to
32. Consideration be given to allowing the display of this information (through windows) so that persons can update themselves without having to constantly interrupt the IMT discussions with questions
33. A series of Check Sheets be developed for IMT2 to act as memory prompts in the same way as a Debriefing Officer ensures capture of information. The prompt sheets could include such things as:
    - options discussed and reasons for not doing and/or doing
    - current goals / actions with expected outcomes, responsibilities and timeframes
    - any alternative or secondary thrusts being investigated
    - any limits established … time, gas levels, temperatures
    - problems or difficulties experienced to date

IN-SEAM INTERVENTION – QUEENSLAND MINES RESCUE

34. There be a review of the Kestrel Mines Rescue System in the early part of surface intervention (i.e. when minimum persons are available).
35. Mines rescue teams are to ensure all team protocols are adhered to – even in the absence of reality, it is good practice (e.g. communications and information left with the FAB Official, Captain / Team checks on equipment etc.)
36. An expert working party be established to research the use of flameproof vehicles in atmospheres containing levels of flammable gases in excess of the current legislative requirements, and guidelines be developed on how and when they may or may not be used in life threatening scenarios. The outcome of this research may result in changes in the wording of legislation.
37. The rescue efforts appeared hampered by a lack of effective communications between the FAB and the surface. The use of a phone some 100 metres away, while in direct line of site appeared to minimise communication from the FAB to IMT. The availability of phone and lines as part of the mines emergency equipment to allow a line to be run from permanent phones to FAB positions should be assessed as part of the mines emergency system. Mines should have a phone and line available to run from FAB to mine communication system to minimise the hazard of incorrect communication, information breakdown and ensure timely communication to surface for input to IMT.
38. Queensland Mines Rescue Service and mines through their mines rescue agreement should ensure that competencies are developed and persons trained for the key positions of Fresh Air Base Controller and Substation

Mines Rescue Controller so that in the event of QMRS staff members not being available, competent persons will be available for these key roles.

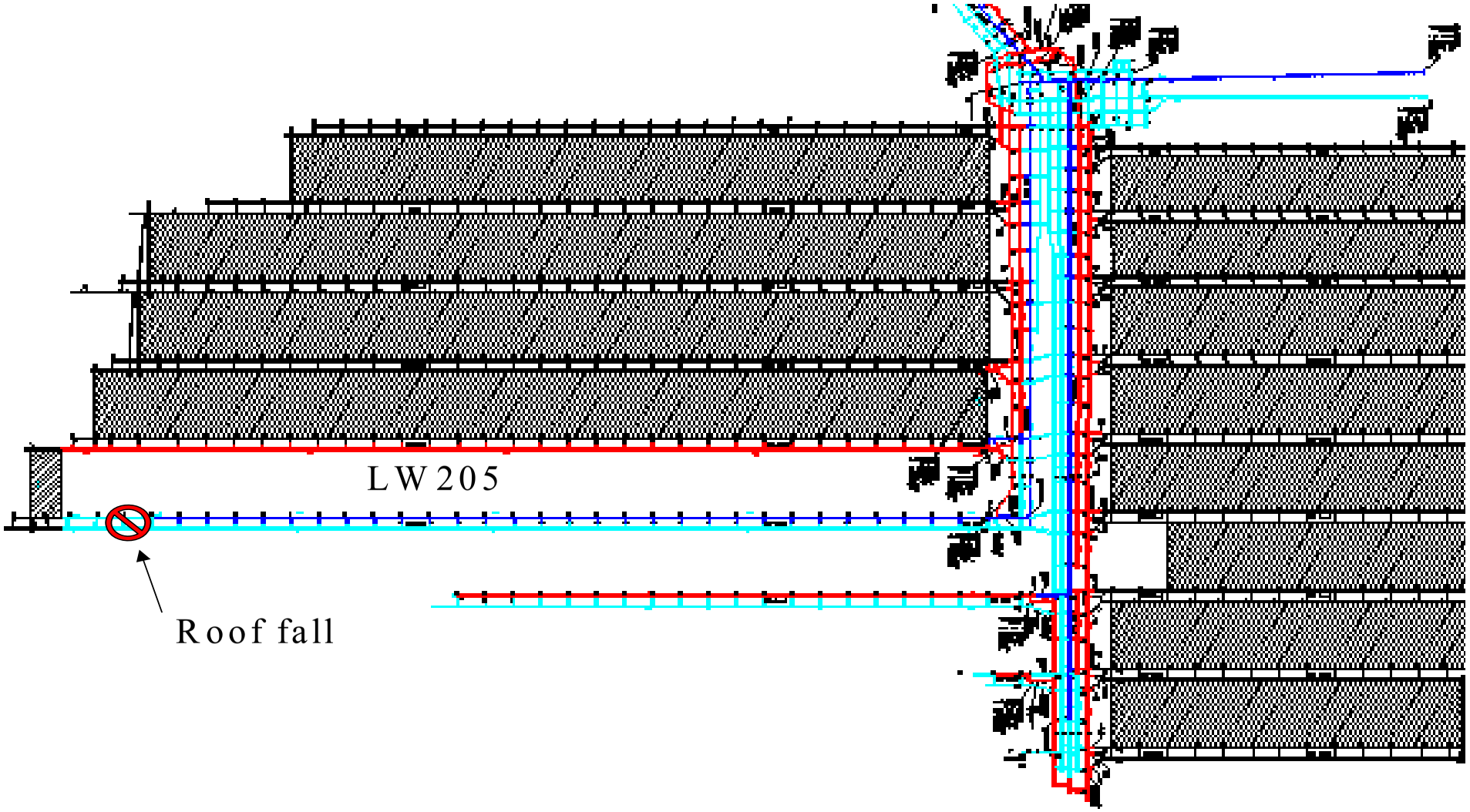
39. While QMRS have developed controls to attempt to minimise the effects on mines rescue personnel deployed in hot and humid conditions these controls (administration controls) are low on the list of hierarchy of controls. It is recommended that QMRS investigate modern control methods to minimise this hazard. Some controls may include cooling vests, cooling of breathing tubes etc.
40. When developing Mines Rescue Team tasks, position, status and content of the mine's emergency equipment which may be relevant to the task being undertaken should be marked on the plan and communicated to MRT teams and FAB Controller.
41. ***And perhaps most importantly, the exercise clearly showed that the better the escape systems (and therefore survival systems) in place at a mine, the more likely it is that mines rescue teams will be required to enter and search for survivors some of whom may be at distances not able to be covered on foot within the time constraints placed by use of self contained breathing apparatus– the industry as a whole needs to ensure we are ready for this.***

SURFACE AND MINES RESCUE CONTROL

42. The IC, or senior IMT member, should brief Mines Rescue Teams or at least be present to ensure that all information is being passed on and that questions can be answered by somebody familiar with the mine.
43. Testing of Mines Rescue Equipment should be continued until all of it is completed.
44. Greater concentration on getting the first team off the surface properly briefed and equipped is needed as this is the hardest thing to do in reality. Once the actions and limits as set by the IMT, this must become the priority.
45. Basic mine and incident information should be written up on a white-board in the Mines Rescue Room. An enlarged Captains Information Sheet could suit the purpose.
46. Review Mutual Assistance protocols in relation to additional equipment being immediately dispatched from adjacent mines.
47. The role of the QMRS within the IMT should be clearly defined – for example, formally recognised as part of the decision-making team and / or advisory and / or implementation.
48. It should be a consideration to set up a gas-monitoring terminal in the IMT room so that gas trends can be continually monitored.
49. Clearly defined instructions to be issued to rescue teams. One way of doing so could be writing the instructions on the electronic whiteboard in the IMT room and giving the printout to rescue teams.
50. The role of preparing and issuing plans during an incident should be clearly defined. Additional plans will always be required. This may be a role for the Mine Surveyor.

APPENDICES

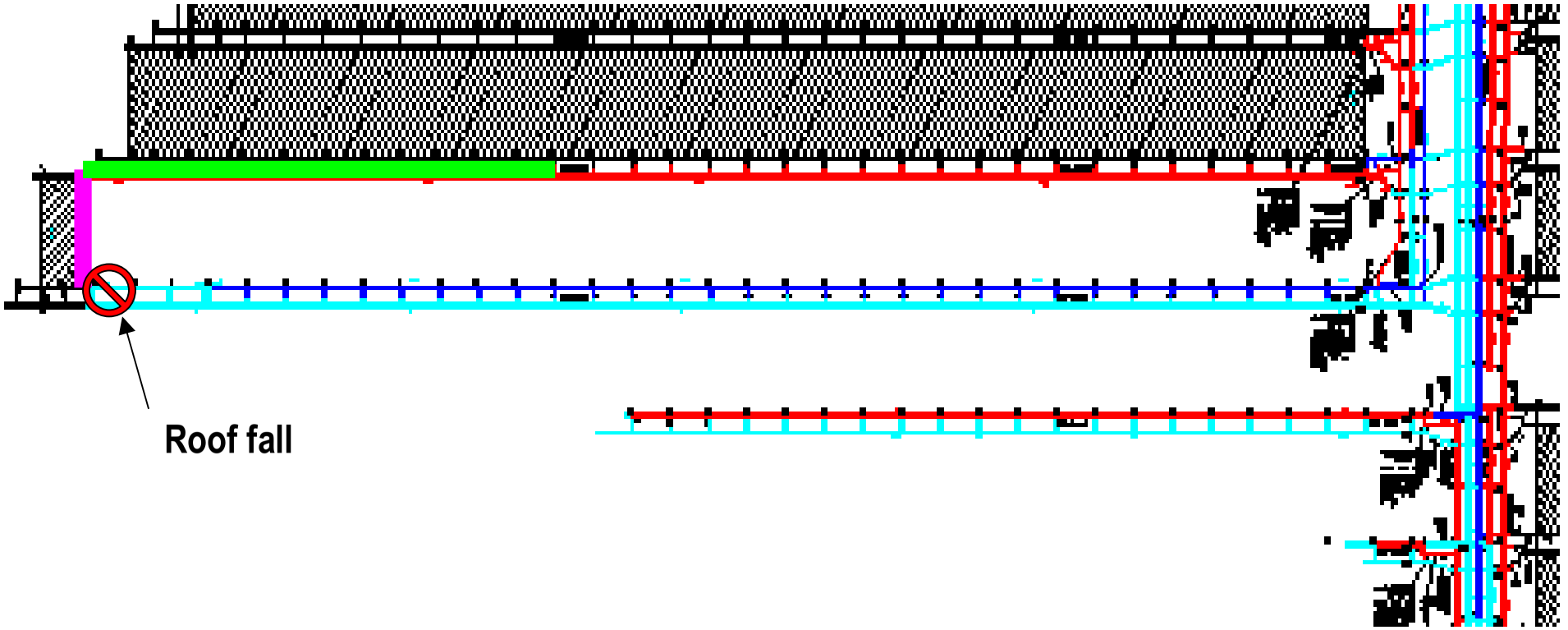
APPENDIX 1 - VENTILATION CONTAMINANTS OVER TIME



9:31 PM

6.3% CO2
2.51% CH4
11.8 PPM CO
Face

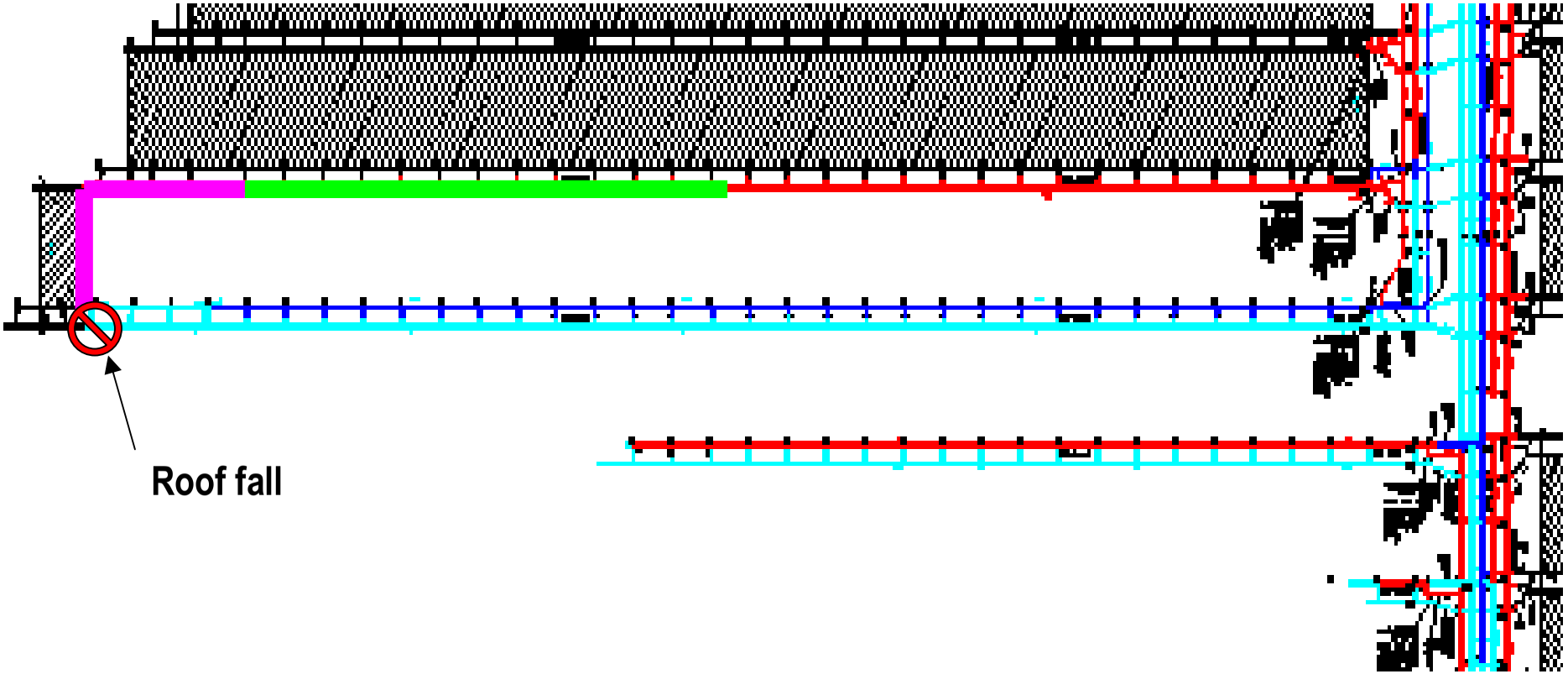
10.5% CO2
4.17% CH4
19.6 PPM CO
Inbye 22 cut-through



9:45 PM

6.3% CO2
2.51% CH4
11.8 PPM CO
Inbye 29 cut-through

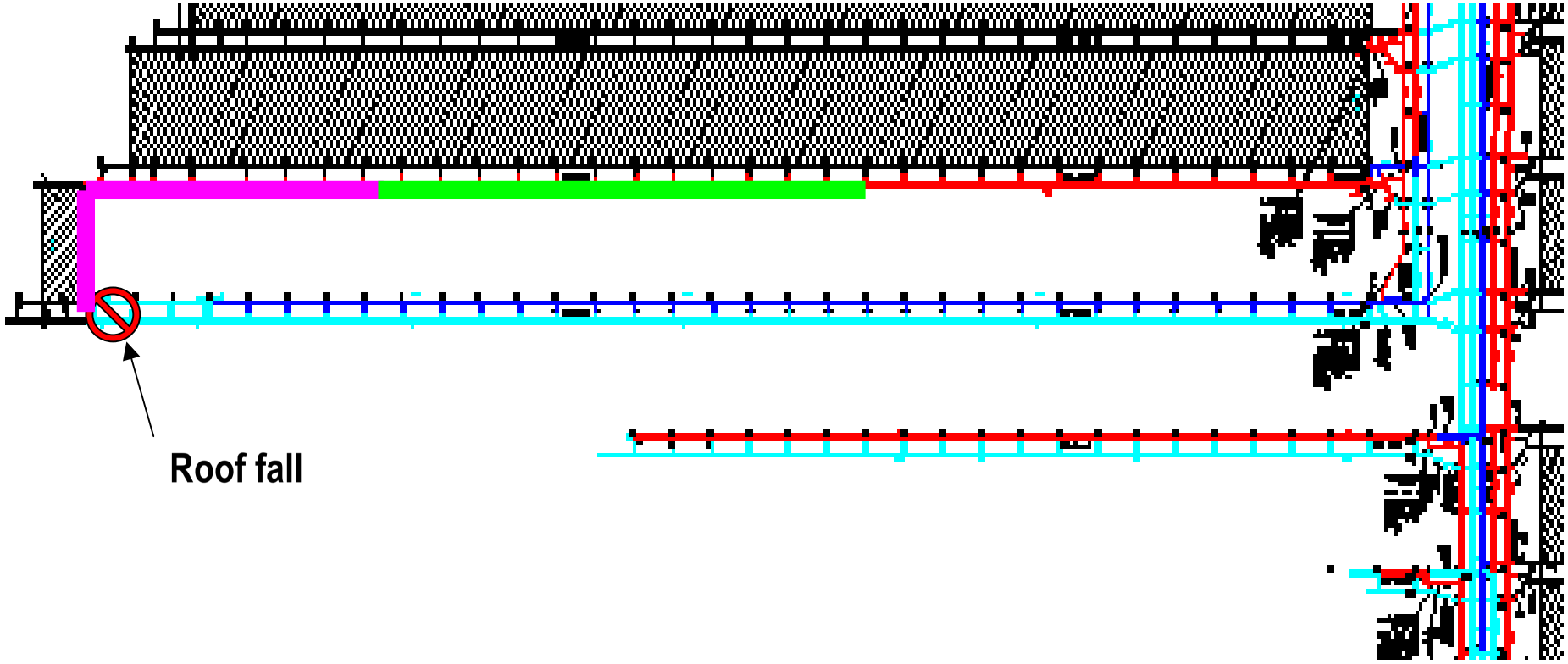
10.5% CO2
4.17% CH4
19.6 PPM CO
Inbye 18 cut-through



10:00 PM

6.3% CO2
2.51% CH4
11.8 PPM CO
Inbye 26 cut-through

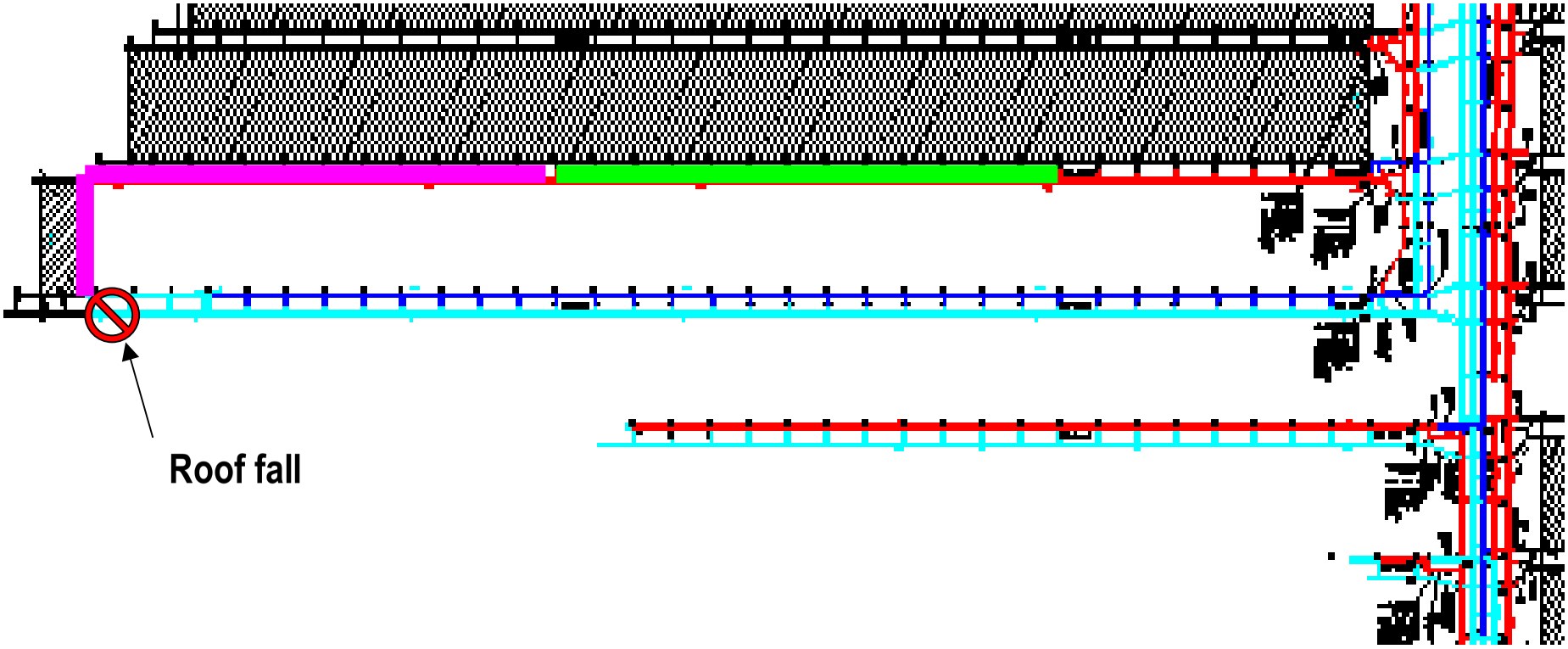
10.5% CO2
4.17% CH4
19.6 PPM CO
Inbye 15 cut-through



10:15 PM

6.3% CO2
2.51% CH4
11.8 PPM CO
Inbye 22 cut-through

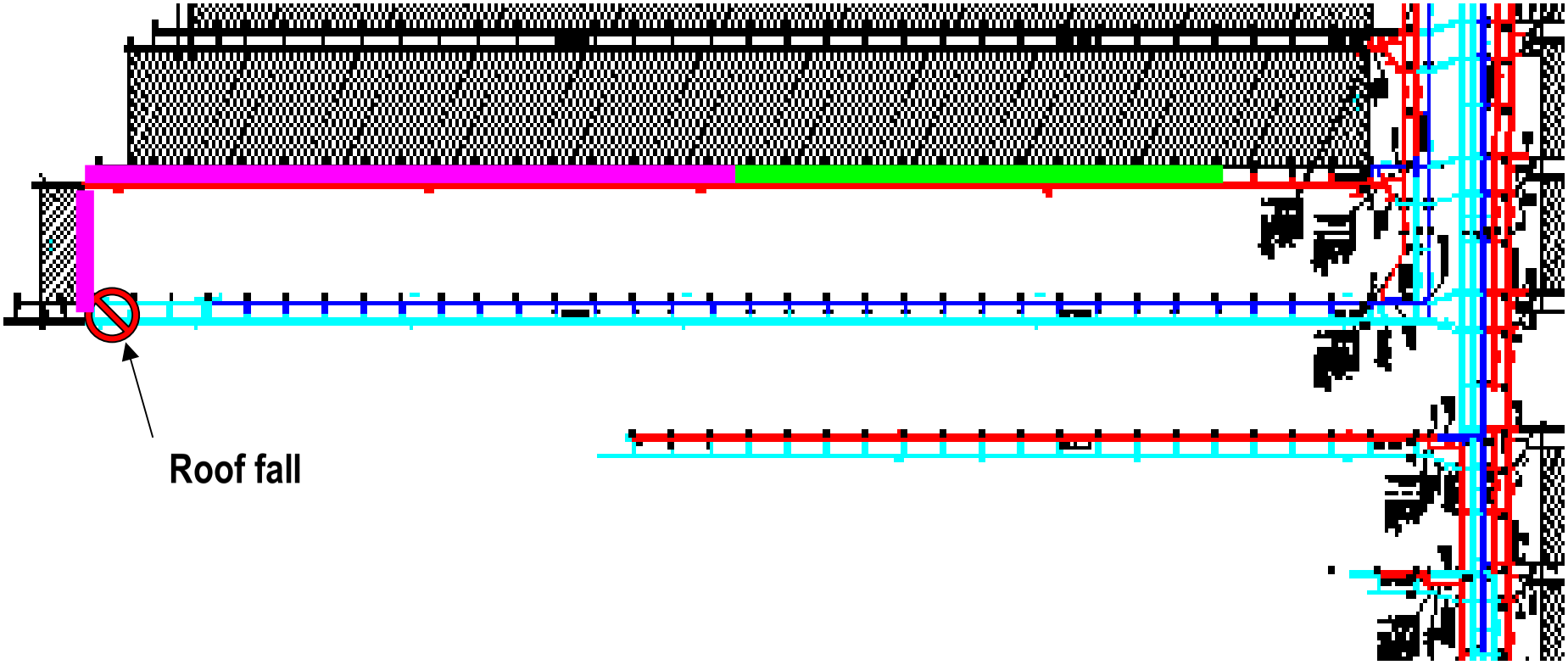
10.5% CO2
4.17% CH4
19.6 PPM CO
Inbye 11 cut-through



10:30 PM

6.3% CO2
2.51% CH4
11.8 PPM CO
Inbye 18 cut-through

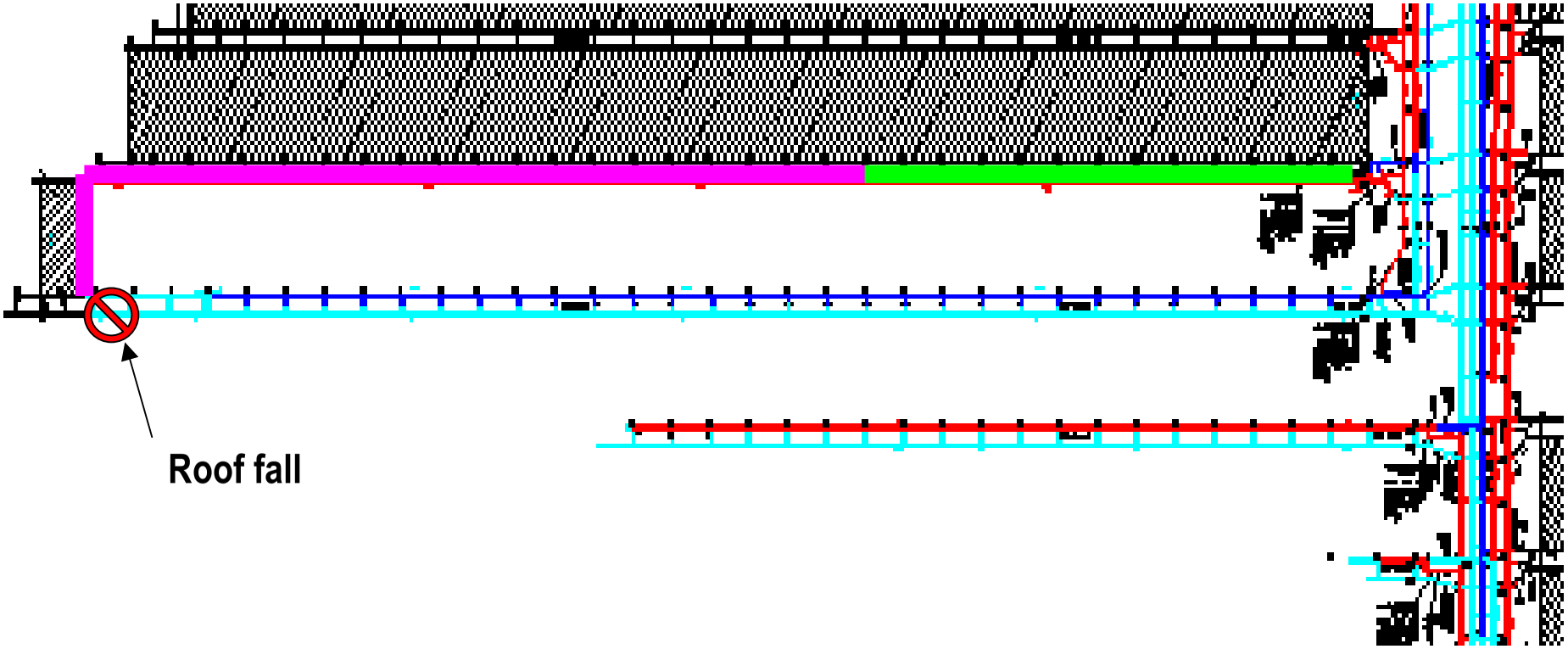
10.5% CO2
4.17% CH4
19.6 PPM CO
Inbye 7 cut-through



10:45 PM

6.3% CO2
2.51% CH4
11.8 PPM CO
Inbye 15 cut-through

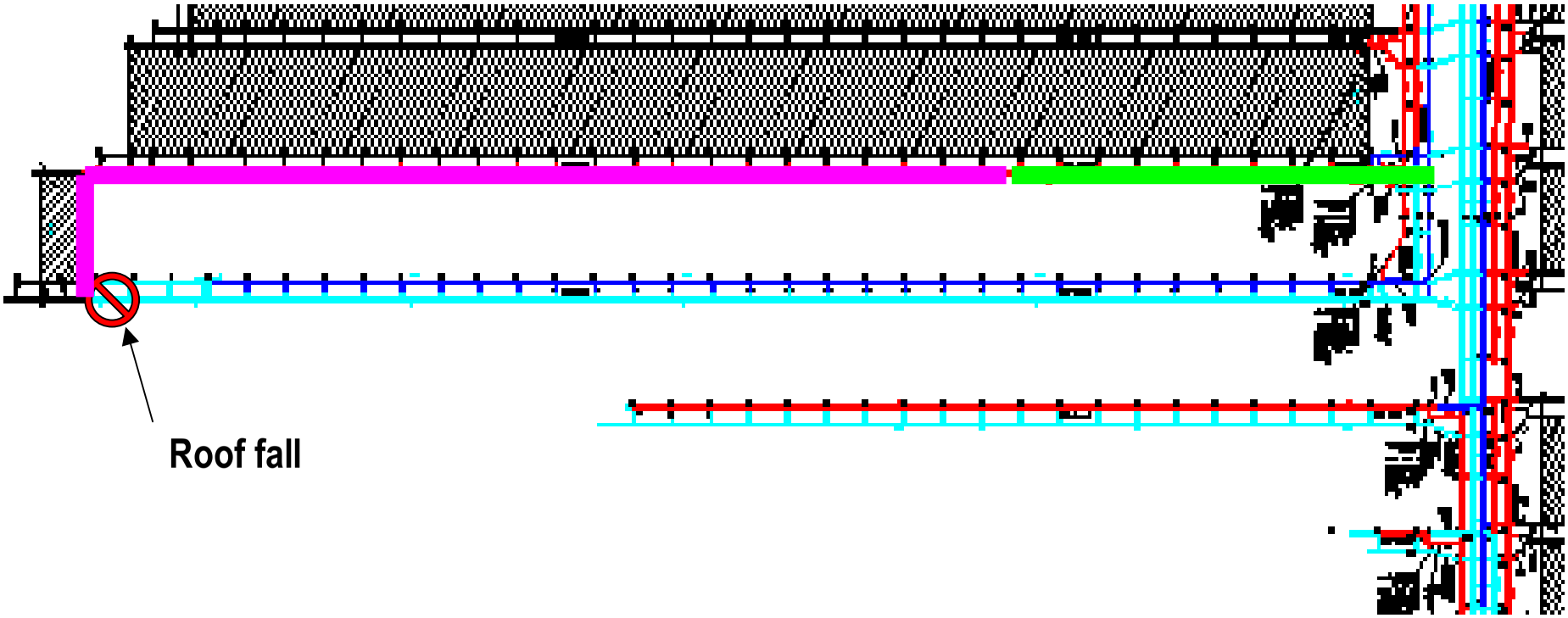
10.5% CO2
4.17% CH4
19.6 PPM CO
Inbye 4 cut-through



11:00 PM

6.3% CO2
2.51% CH4
11.8 PPM CO
Inbye 12 cut-through

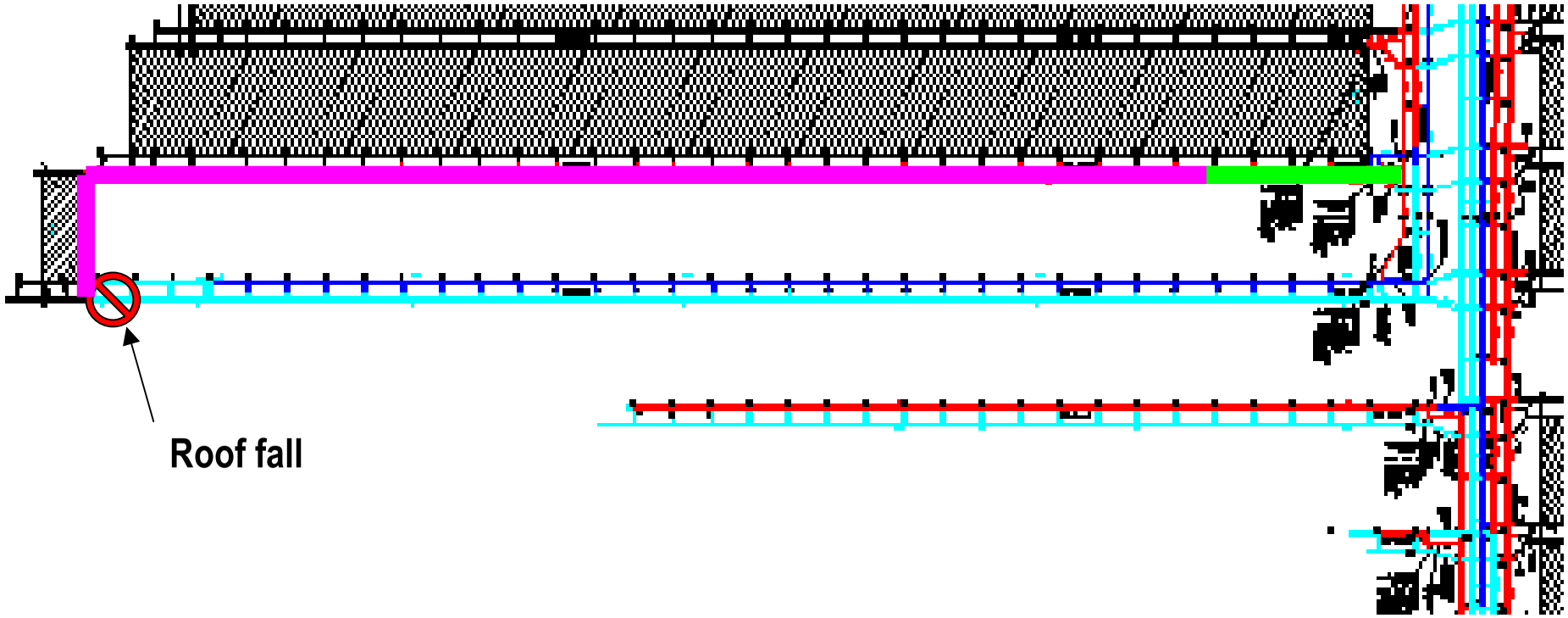
10.5% CO2
4.17% CH4
19.6 PPM CO
Inbye 1 cut-through



11:15 PM

6.3% CO2
2.51% CH4
11.8 PPM CO
Inbye 8 cut-through

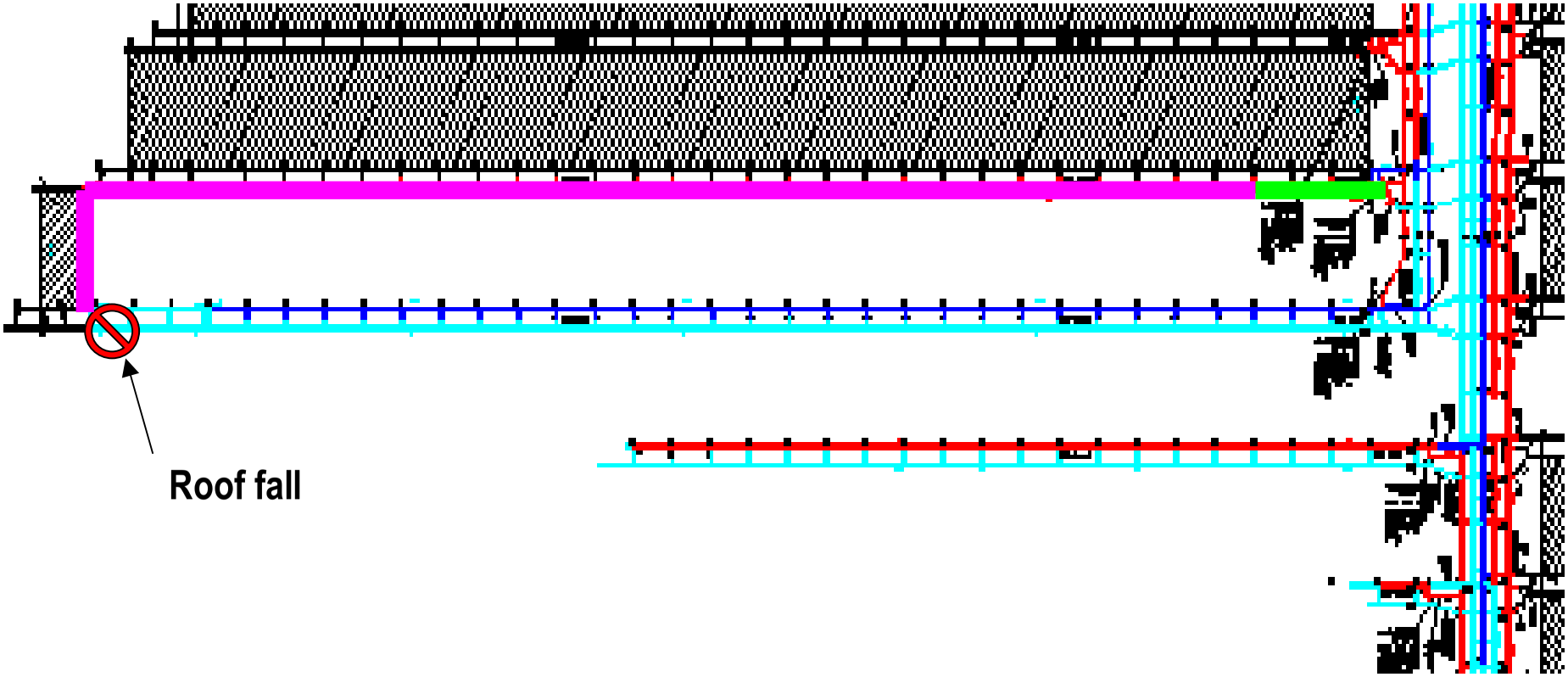
10.5% CO2
4.17% CH4
19.65 PPM CO
TG205 Inbye I Heading



11:30 PM

6.3% CO2
2.51% CH4
11.8 PPM CO
Inbye 4 cut-through

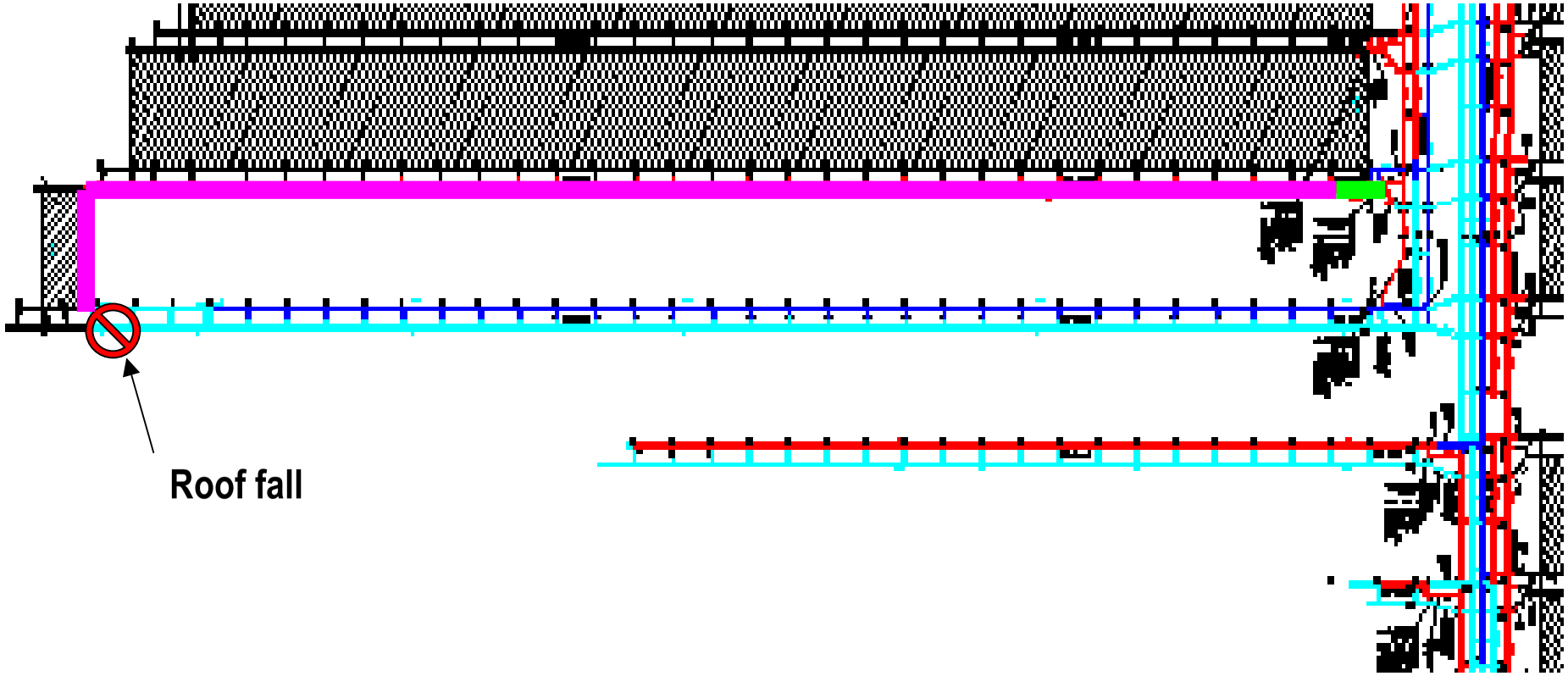
10.5% CO2
4.17% CH4
19.6 PPM CO
TG205 Inbye I Heading



11:45 PM

6.3% CO2
2.51% CH4
11.8 PPM CO
Inbye 1 cut-through

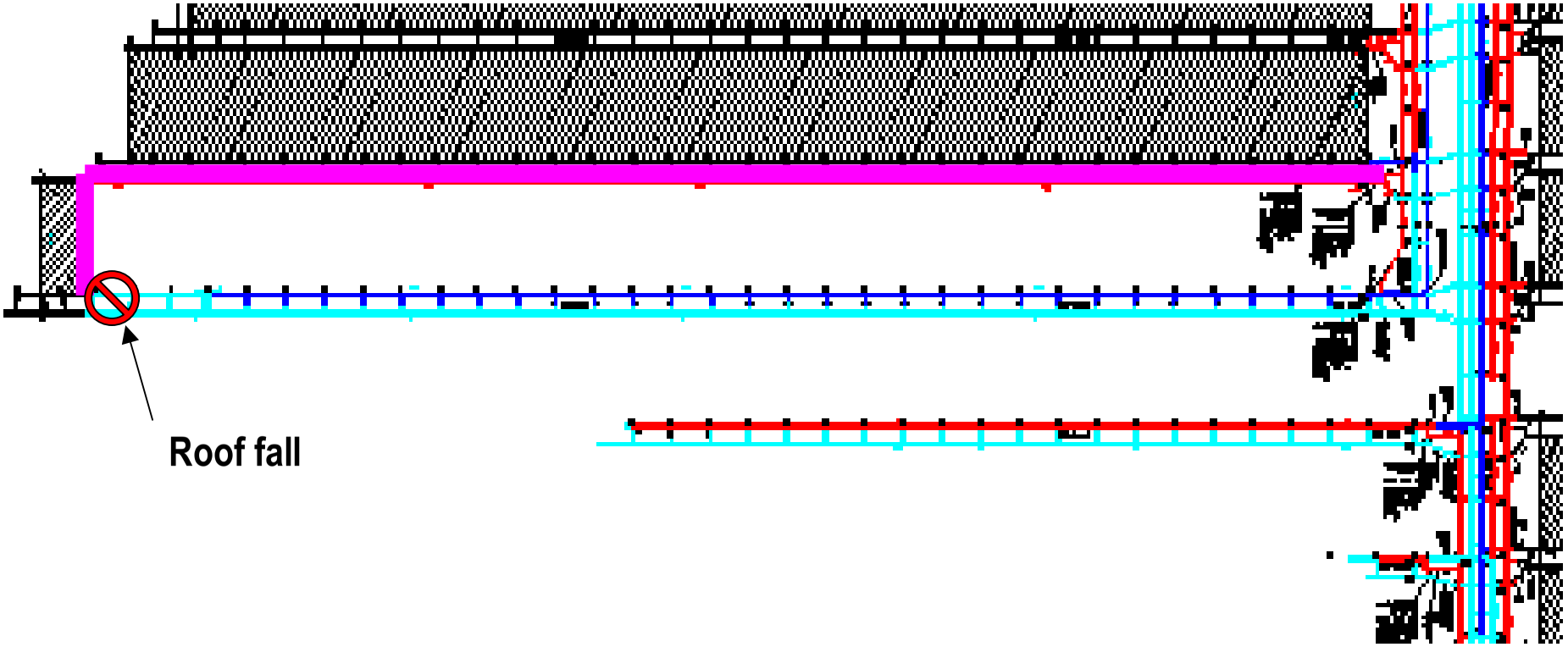
10.5% CO2
4.17% CH4
19.6 PPM CO
TG205 Inbye I Heading



12:00am onwards

6.3% CO2
2.51% CH4
11.8 PPM CO

10.5% CO2
4.17% CH4
19.6 PPM CO



APPENDIX 2 - VENTILATION AND GAS READINGS

	GAS LOCATIONS
9:31pm	Event – Velocity 0.4 m/s, Gas inundation = 1100 metres
9:31pm	Tailgate alarm / velocity sensor HIGH then LOW / gas inundation to 19 cut-through.
9:40pm	1316 metres
9:50pm	1556 metres (240 metres / 10 minutes)
10:00pm	1796 metres
10:10pm	2036 metres
10:20pm	2276 metres (cut-through names at time intervals are yet to be determined)
10:30pm	2516 metres
10:40pm	2756 metres
10:50pm	2996 metres
11:04pm	3300 metres (gas reaches mains / Conspec alarm / gas starts moving up tube bundle)
11:16pm	Survivors reach mains / one group continues to walk out – others do as they would in the emergency ie. contact help
11:44pm	Tailgate tube bundle alarm

GAS MAKE

Make CH_4 m^3/s – 0.158417

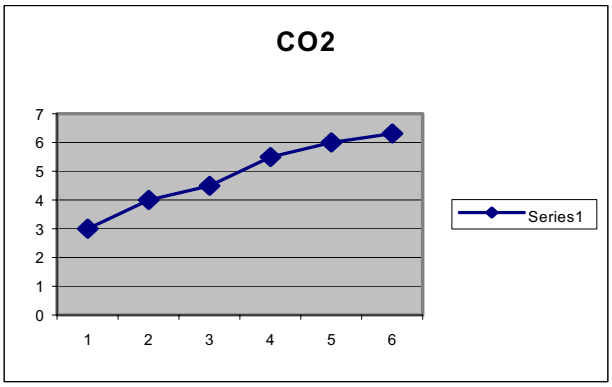
			VELOCITY
5.7	6.976474	2.779246	0.390411
5.8	6.85619	2.731328	0.39726
5.9	6.739983	2.685034	0.40411
6.0	6.62765	2.640283	0.410959
6.1	6.519	2.597	0.417808
6.2	6.413855	2.555113	0.424658
			0.431507
6.4	6.213422	2.475266	0.438256
6.5	6.117831	2.437185	0.445205
6.6	6.025136	2.400258	0.452055
6.7	5.935209	2.364433	0.458904
6.8	5.847926	2.329662	0.465753
6.9	5.763174	2.295899	0.472603
7.0	5.680843	2.2631	0.479452
7.1	5.600831	2.231225	0.486301
7.2	5.523042	2.200236	0.493151
7.3	5.447384	2.170096	0.5

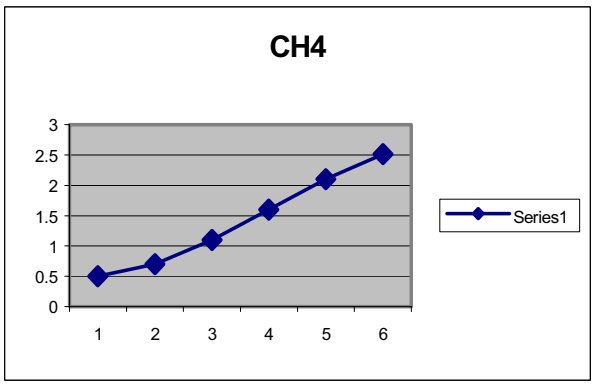
			VELOCITY
7.4	5.37377	2.14077	0.506849
7.5	5.30212	2.112227	0.513699
7.6	5.232355	2.084434	0.520548
7.7	5.164403	2.057364	0.527397
7.8	5.098192	2.03987	0.534247
7.9	5.033658	2.005278	0.541096
8.0	4.970738	1.980213	0.547945
8.1	1.90937	1.955765	0.554795
8.2	4.8495	1.931915	0.561644
8.3	4.791072	1.908639	0.568493
8.4	4.734036	1.885917	0.575342
8.5	4.678341	1.863729	0.582192
8.6	4.623942	1.842058	0.589041
8.7	4.570793	1.820885	0.59589
8.8	4.518852	1.800193	0.60274
8.9	4.468079	1.779966	0.609589
9.0	4.418433	1.760189	0.616438
9.1	4.369879	1.740846	0.623288
9.2	4.32238	1.721924	0.630137
9.3	4.275903	1.703409	0.636986
9.4	4.230415	1.685287	0.643836
9.5	4.185884	1.667547	0.650685
9.6	4.142281	1.650177	0.657534
9.7	4.099577	1.633165	0.664384
9.8	4.057745	1.6165	0.671233
9.9	4.016758	1.600172	0.678082
10.0	3.97659	1.58417	0.684932
10.1	3.937218	1.568485	0.691781
10.2	3.898618	1.553108	0.69863
10.3	3.860767	1.538029	1.705479
10.4	3.823644	1.52324	0.712329
10.5	3.787229	1.508733	0.719178
10.6	3.7515	1.4945	0.726027
10.7	3.716439	1.480533	0.732877
10.8	3.692028	1.466824	0.739726
10.9	3.648248	1.453367	0.746575
11.0	3.615082	1.440155	0.753425

GAS PROFILE ACROSS FACE

GAS PROFILE ACROSS FACE		
LOCATION	**CO2**	**CH4**
Maingate	3	0.5
50	4	0.7
100	4.5	1.1
150	5.5	1.6
200	6	2.1
Tailgate	6.31	2.51

Q	32.33
%CH4	0.0049
% CO2	0.0123
Make CH4	0.158417
Make CO2	0.397659





DISTANCE CALCULATIONS

Longwall	3300 metres (inundation = 20016 m3)
Walking Speed	2000 m/hr (goaf cave distance = 20 metres)
Air Speed	0.4 – 1440 m/hr
Walk to Mains	1.65 hr
Air to Mains	2.29 hr
Difference	0.64 = 38.50 minutes
Gas Inundation	924 metres
Let Inundation	1100 metres
Gas time to Mains	1.53 – 1hr 27 min
Walk time to F/A	1.65 – 1 hr 36 min

APPENDIX 3 – EXTRACT FROM INERTISATION ANNUAL INSPECTION REPORT

5 July 2001

The Mine Manager
Kestrel Mine

Inertisation Annual Inspection Report

The scheduled Inertisation training for June was conducted at Kestrel Mine with the view of testing systems already in place at the mine.

A two page summary is attached to this letter for your reference.

The results are as follows:-

Day 1:- Incoporated unpacking the flexible connection and attach to all available GAG docking facilities to check sizes, ease of connection and interface of connection surfaces.

Day 2:- Involved pressurising the water system, connecting the GAG ready for use and running the engine for some 25 minutes. **(Time taken 2.9 hours)**

Day 3:- Was the reverse of Day 1 with the exception that once again the engine was operated for a period of 32 minutes. **(Time taken 2.5 hours)**

The average of the training days would indicate a set up time in the order of **2.71 hours** at Kestrel Mine. This would reasonably indicate a time frame of approximately time of 2.5 hours from arrival at Kestrel operating under the present conditions. This coupled with a 2 hour travel time would give a time frame well under the (10 hour window) from call to ready to operate at Kestrel Mine. It is envisaged that this would considerably reduce as the works discussed are completed.

During the course of the training conducted and inspections carried out during the time at Kestrel the issues highlighted below were identified:-

DOCKING FACILITY No. 2 (BELT DRIFT)

MRA SCHEDULE 3 SECTION 6

(a) Emergency Seals and Air Locks:-
Similarly the existing seal arrangements would appear to be adequate under normal mine conditions. However, the 12,000 pa exerted on them by the GAG system with 83°C temperature at 100% humidity is the unknown and would need to be assessed to ascertain whether the GAG in full operational status would perform to expectations.

(b) Docking facilities:-
The facilities did match to the GAG connection with the exception that an elbow to change direction will need to be fitted prior to GAG arrival on site:-

1/ The mutual assistance group and group leader for your mine are aware of this and will ensure that the elbow is fitted.
2/ The recommendation is that a set of securing bolts should live with the elbow to permit efficient utilisation of time to effect this connection.

MRA SCHEDULE 3 SECTION 7

(c) Water supply:-

The existing water pressure and flow arrangements from the raw water supply is adequate for safe utilistation of the GAG unit at Kestrel. However, the same condition as with portal one would water supply would be preferable, ie a 6" Vitaulic coupling point to the main fire line with an isolation valve would be ideal (also see Annexure 3 MRA Section 2).

Waste Water:-

Controlled waste will be in the order of approximately 50°C. (Does this impact on the drain system in place?).
The nuisance water loss should run away without any foreseeable problems as was found on the days of training.

APPENDIX 4 – DECISION MAKING TECHNIQUES

> *Decision making is at the center of our very being. A thousand times each day we make decisions, sometimes casually, almost without thought, responding to long-established routine. Who we are as decision makers is no more or less complex than who we are as people……Now place five or six, or ten or twenty such complex individuals together, attempt to develop an agreed decision, and the potential differences seem almost beyond comprehension.*(Napier & Gershenfeld. 1999:318)

With this in mind, it is any wonder that decision-makers have (for centuries) been searching for tools, aids or processes to help them make the "correct" decision.

Listed below are a number of short descriptions for different techniques commonly used as decision-making tools - each with their own benefits and shortcomings. Also listed are a couple of techniques that maybe useful in the generation of ideas and/or solutions to issues.

The Stepladder Approach. Two people begin a problem-solving task by exploring the nature of the issue and possible alternatives. After some time, the two are joined by a third person, with the notion of educating the new participate about the issue - but intentionally holding back any specific solutions. The new participant explores their own viewpoint and puts their solutions. Then the solutions of the first two people are thrown in and discussed. After a further period of time, the three are joined by a fourth person and the process continues.

Rational Problem Solving. A linear, six stage process:

1. Problem Identification
2. Diagnosis
3. Generation of Alternatives
4. Selection of Solution
5. Implementation
6. Evaluation and Adjustment

Pareto Analysis, also known as the 80/20 Rule - named after the Italian economist Alfredo Fredrico Damaso Pareto (1848-1923). In the course of his study on unequal distribution, Pareto discovered that 80% of the wealth was controlled by 20% of the population. The essence of the Pareto method is identifying that vital few to which corrective action can be applied where it will do the most good, the most quickly.

Intuitive Problem Solving. The most creative decisions often result from some unexpected thought, an aside tossed off in jest, a moment when the defenses were down or at a point of exhaustion, frustration or exasperation that could never have been programmed or anticipated. There are several techniques which can allow a new perspective and the freedom for people to consider alternatives not yet accessible. For example:

1. *Brainstorming*. Most people are familiar with the concept of brainstorming but - there are a number of critical rules to be applied if it is to work effectively
2. *Inverse Brainstorming*. What would *increase* hazards, *endanger* the workers
3. *Attribute Brainstorming*. How would this process operate if, the people-customer-worker-supervisor etc were stronger-weaker / female-male / taller-shorter / stronger-weaker / younger-older / trapped-mobile etc, or if there were no money constraints or if we had perfect knowledge?
4. *Vary the Entry Point*. In trying to untangle fishing lines, it is often better to start at the fish rather than the reel
5. *Draw Analogies*. A previous solution to an old problem
6. *Change Perspective*. Think like a customer, victim, expert, novice
7. *Chain Forward*. Think as far as possible into the future – if I solve this problem, what is the next problem?

Nominal Group Technique. A 2-stage process most often used to generate goals and choose among alternatives. Individuals work separately in the first or *elicitation* stage, then work as an interactive group on *evaluating* (choosing) stage.

Computer-Interactive Groups. What happens when we are able to remove the social inhibitors that often accompany interactive groups?

Round Robin Groups. Each individual writes 3 or 4 problems they face on separate cards which are then circulated to the others in the group - who each have to propose a solution to each of the problems.

Wildest Idea. When bogged down, often a competition on who can come up with the craziest, wildest idea not only injects fun, energy and new interest – sometimes, buried in the crazy ideas, lie the seeds to a creative new approach.

Synectics. William Gordon (1961) saw the ability to speculate as the key to removing normal resistances and the stereotypical and predictable traps we often fall into. The word *synectics*, means the joining together of different and apparently irrelevant elements.

Delphi Technique. A procedure to acquire informed judgements and opinions from knowledgeable individuals. The process uses a series of questions to develop a consensus forecast (by experts) about what will happen in the future.

References

Napier, Rodney W. & Matti K. Gershenfeld. 1999. *Groups: Theory and Experience. Sixth Edition.* Boston: Houghton Mifflin Company.

Russell, Robert S., & Taylor, Bernard W. 2000. *Operations Management.* New Jersey. Prentice-Hall Inc.

APPENDIX 5 – LETTER TO QMRS FROM KESTREL COAL

KESTRELCOAL

3 December 2001

Queensland Mines Rescue
45 Garnham Drive
Dysart, 4745.

Dear, Malcolm

RE: Use of QMRS SSR90 during the level 1 exercise at Kestrel Coal.

Kestrel would like to thank QMRS for supplying 8 SSR90 self-rescuers for mine personnel to use during the Level 1 exercise held at Kestrel on the 27th of November 2001.

By using the real units our mine and those that wore them were able gain valuable knowledge into the self-rescuer. We were able to quantify that our escape philosophy of having caches of SSR90's placed in the returns will work after we make a few changes. The wearers also learnt just how hot the SSR90 gets in the hot and humid conditions.

Once again thank you for your assistance.

Yours faithfully
KESTREL COAL PTY LIMITED

Dan Teal
Site Senior Executive

KESTREL COAL PTY LIMITED ACN 079 044 689
Lilyvale Road, Emerald, Queensland 4720 Australia
PO Box 1969, Emerald, Queensland 4720 Australia
Telephone: (07) 4982 8500 Facsimile: (07) 4982 8577

APPENDIX 6 - THE EXERCISE MANAGEMENT COMMITTEE

GREG ROWAN

Starting in the mining industry in 1978 and joining the Queensland Mines Rescue Service in 1979, Greg has worked as a miner, undermanager, mine manager, project manager and in private consultancy at different operations in Queensland and Western Australia. Recruited to the Queensland Department of Mines and Energy in 1997, Greg currently holds the position of Senior Inspector of Mines and has been Chairman of the Queensland Emergency Exercise Management Committee since its formation in 1998.

Greg holds a First Class Coal Mine Managers Certificate, has post-graduate qualifications in management (GCM), holds a Masters in Business Administration from the University of Queensland and is a certified Management System Lead Auditor.

Greg is the Queensland Chief Examiner for coal mine manager's certificates, sits on the Australian National Coal Sector Review Committee, was awarded the 1999 International NEDO sponsorship, won the Boston Consulting Group Strategic Challenge in 2001 and is a Fellow of the Australasian Institute of Mining and Metallurgy.

MURRAY BIRD

Murray joined the underground coal mining industry in 1974 as a Trainee Mining Engineer in the BHP Southern NSW Coal Division. After obtaining Statutory Underground Coal Mining Certificates, he was appointed as a Deputy at Corrimal Colliery, Undermanager and Undermanager-In-Charge at Nebo Colliery, Deputy Manager at Old Bulli Colliery and Group Relieving Manager for the BHP Southern Coal Division.

Murray was appointed as Superintendent at Hunter Valley Mines Rescue Station in 1986 and was appointed Manager of the Newcastle Mines Rescue Station in 1994. Currently he holds the position of Chief Executive, NSW Mines Rescue Service which he has held since 1998.

Rescue based qualifications include Underground Mines Rescue, Open-cut Mines Rescue, Coal Mine Fire Officer, Police Rescue Operator, Vertical Rope Instructor, PADI Open Water Instructor, Class 3 Commercial Diver and NATA Auditor.

GREG DALLISTON

Greg has been involved in the mining industry for 26 years, and has gained experience in numerous areas. He started his career as a Cadet Mine Manager with the Queensland Coal Association, before working in a variety of positions within the industry, including 8 years as a mine Deputy.

Greg is employed as an Industry Safety and Health Representative, a position which he has held for the last 8 years.

Some of the roles pertaining to this position have included:

- Participating in tripartite industry committees to develop new Safety and Health legislation for the Queensland Coal Industry; Member of State and National training committees for the mining industry;
- Perform safety audits and inspections at mines throughout Queensland;
- Investigating serious and fatal mining accidents, assisting the Mining Warden as a reviewer into mining accidents;
- Member of Incident Management Teams at significant incidents, including the 1994 Moura No. 2 disaster; Performing debriefs after incidents and providing critical incident management services; and
- Development of Manager, Undermanager and Deputy Statutory National Competency Standards, including Risk Management and Emergency Response.

MALCOLM SMITH

Malcolm was born and educated in Yorkshire, England. Malcolm commenced his mining career with the National Coal Board, Great Britain on completion of mining courses at Manvers Training Centre and Mexbro Technical College.

Malcolm became an active volunteer mine rescue team member attached to the Rotherham Central Mines Rescue Station of the National Coal Board, South Yorkshire and was appointed as a full-time Mines Rescue Brigadesman, Rotherham Central Mines Rescue Station.

After emigrating to Canada, he began working with McIntyre Mines in Alberta where he initiated the McIntyre Mines, Coal Division district mine rescue competitions for surface and underground mines and trained four Alberta Provincial winning teams. In March 1987, he accepted the appointment of Manager Mine Rescue with the Ontario Ministry of Labour, Ontario Mine Rescue Organisation in Canada and in August 1999, accepted the appointment of Chief Executive Officer, with the Queensland Mines Rescue Service Ltd.

PETER BAKER

Peter is currently employed by the Mines Rescue Service NSW as Manager – Southern Mines Rescue Station. He commenced working in the mining industry in 1980 and has held various positions, including Undermanager in Charge and Relief Manager. He assisted in the development of emergency procedures at Appin and Tahmoor Collieries and audits minesite emergency plans in his current role.

He has been in Mines Rescue since 1986 and was appointed Captain in 1988. Whilst a trainee, he represented the station as Competition Team Captain at the Australian Underground Championships. Peter holds a Master of Business and Technology Degree, a Mining Engineering Degree, Coal Mining Third, Second and First Class Ticket, Underground Mines Rescue Certificate, Train the Trainer Certificate and has completed the CMQB Emergency Preparedness Course.

TIM JACKSON

Tim has 30 years experience in the coal mining industry, which includes mines rescue service and holding the position of Statutory Mine Mechanical Engineer in NSW. He holds a First, Second and Third Class Certificate of Competency, an Associate Diploma in Coal Mining Engineering (Booval) and a Master in Business and Technology from the University of New South Wales.

At the time of the exercise Tim held the position of Inspector of Mines with the Department of Natural Resources and Mines.

TONY DE SANTIS

Tony is currently employed at Moranbah North Coal as the Underground Mine Manager. Prior to that he has held the position of Mine Manager at both Appin and Elouera Collieries in the Southern Coalfields of New South Wales.

Tony started in the mining industry in 1982 and has held a number of underground supervisory roles. He was also an active member of the mines rescue service between 1984 and 1997. Tony holds a Master of Business Administration, an Associate Diploma in Coal Mining, and First, Second and Third Class Certificates of Competency.

JAMES MARSHALL

James is a recent graduate mining engineer who is currently employed by SIMTARS. James' experience has included emergency exercise ventilation modelling, frictional ignition investigations, ventilation structure and seal competency investigations, risk assessment and management systems.

James has also been a significant contributor to the Bray Park Fireworks Accident Investigation. He is a qualified shotfirer and a graduate member of the AusIMM and IEAust.

WARREN PENDLEBURY

Warren is employed as the Senior Safety Advisor for Kestrel Coal, a position which he has held for the past 14 months, and was previously employed in various safety positions in both metalliferous mining and smelting.

Warren holds a Diploma in Workplace Health and Safety and is mines rescue trained for both metalliferous and coal mining.

DAVID CLIFF

Associate Professor David Cliff is currently Director of Research for the Minerals Industry Safety and Health Centre. Prior to that he spent eighteen months as Health and Safety Advisor to the Queensland Mining Council and over 10 years at SIMTARS, the last three as Manager, Mining Research Centre where he was responsible for directing the research effort of SIMTARS. He is actively involved in promoting the awareness of hazards in the mining industry, principally focussing on the prevention of fires and explosions and health and safety promotion. He has been actively involved in spontaneous combustion research since 1989 and has investigated a number of mine fires and spontaneous combustion episodes.

David's qualifications include: a Bachelor of Science Degree (Honours) from the Monash University, a Doctor of Philosophy in Physical Chemistry from Cambridge University and post-graduate studies in Environmental Studies, Outdoor Education and Business Administration. He is a member and chartered Chemist of the Royal Australian Chemical Institute, Environmental Chemistry Section, a Member of the Combustion Institute, Member of the Safety Institute of Australia, Past President of the Queensland Branch of the Clean Air Society and a Member of the Australasian Institute of Mining and Metallurgy.