2009 Queensland Level 1 Mine Emergency Exercise

Caledon Coal, Cook Colliery
Underground Coal Mine
8 November 2009

Queensland Government

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Front cover image: Simulated fire and smoke escaping from Cook Colliery main access drift

Preface

This report has been compiled by the Level 1 Organising Committee from input provided by each of the assessors involved in the exercise.

Each assessor has written their own account of exercise observations for their area of responsibility. This results in the report containing a range of writing and grammatical styles.

The Organising Committee would like to thank Caledon Coal Cook Colliery mine management and mine workers for their assistance during the exercise.

The Organising Committee would also like to thank all assessors for their input and acknowledge the co-operation and assistance of all of those involved in the Level 1 Mine Emergency Exercise.

Executive summary

Background

Following the coal mine explosion at the Moura No. 2 Underground Mine in Queensland on 7 August 1994, the subsequent Warden's Inquiry recommended that "Emergency procedures should be exercised at each mine on a systematic basis, the minimum requirement being on an annual basis for each mine" (Windridge et all 1996).

This year's annual Level 1 Mine Emergency Exercise was held at the Cook Colliery underground coal mine on Sunday November 8 2009, between 1000 hrs and 2000 hrs.

Caledon's Cook Colliery Underground mine is an underground coal mine located approximately 30km south of the township of Blackwater, and some 180km west of Rockhampton, in Central Queensland.

Objectives

The main objectives of this and previous exercises were to:

- Test the mine's first response including self escape capability of mine workers using self contained self rescuer (SCSR) units and changeover to compressed air breathing apparatus (CABA) under simulated emergency conditions.
- Test the efficiency of the Incident Management Team (IMT).
- Test the 'deployment' of the Queensland Mines Rescue Service (QMRS).
- Test 'call out' procedures for mine personnel living remote from the mine site.
- Test mobilisation – monitoring of calls to remote resources.

Scenario - summary

In line with the exercise objectives the following scenario was chosen to test mine preparedness for a major mine emergency.

Central to the infrastructure of Cook Colliery is a decline that connects the surface with the underground operations. This decline serves many uses. It is the primary personnel and material transport route using a dolly car system, houses the main conveyor belt out of the pit and is one of two main air intakes to the underground workings. A secondary air intake is provided through a downcast shaft located approximately 400m away from the decline and mine offices.

The scenario involved ignition of coal fines around a hot conveyor belt idler, on the main decline conveyor belt, near pit bottom. As the fire grows, combustion products are drawn into the workings and at some point the belt trips. The underground shift electrician is asked to investigate and uses the driftrunner vehicle to travel from his panel to pit bottom to investigate the source of the belt stoppage. As he drives into gradually thickening smoke, he becomes disorientated and gets lost.

Both working crews, located in different parts of the mine, start to evacuate by foot towards the secondary egress shaft. During the evacuation the crews will be required to don self contained self rescuers (SCSR) and changeover of SCSRs will be required throughout the evacuation. One mine worker will be injured during the evacuation and will to be stretchered to the shaft and put into the cage on his stretcher.

Major industry recommendations

These recommendations apply to all underground coal mines and the industry in general.

1. All mines should consider establishing first aid stations including stretchers at key locations underground including secondary egress locations.
2. An industry standard should be developed for primary and secondary escapeways and caches to include signage, lifelines, non-verbal communication standards etc so every mine has the same standard.
3. Every underground coal mine needs to be able to demonstrate their current training program is effective in donning, initiating, wearing and changeover of SCSRs.
4. Mines to undertake risk management processes to identify the reasonable safe distances between cache stations through physical walkout trials wearing SCSRs and considering various levels of fitness etc.
5. All coal mines to review the callout list for Inspectorate and Industry Check Inspectors and update their internal records and proformas where necessary.
6. Maintain ‘oxygen time’ on members of the mines rescue teams.
7. All coal mines should be able to provide mutual assistance to other mines for key functions such as the ventilation officer (VO) and gas analysis personnel.
8. All mines to communicate effectively all Level 1 exercise outcomes and recommendations to all coal mine workers.
9. All coal mines to respond to Queensland Mines Inspectorate (QMI) indicating the individual mines response and actions towards Level 1 exercise recommendations.

10. All mines to develop, communicate and implement minimum standards for non-verbal communication including a code of signals. These should be displayed in critical locations e.g. at caches, change over stations and refill stations.
11. All mines to consider effective practical training and assessment routines to achieve a sound understanding of the effects of oxygen deficiency and effects of breathing in toxic atmospheres.
12. All mines to review their principal potential emergency situations and ensure risk assessments have been developed and are available in case of emergency.
13. Consideration of status of sealed areas needs to be included in the risk assessment undertaken for entry of rescue teams to the mine.
14. Industry to engage with SCSR manufactures to develop a more effective SCSR design and develop a reliable and 'fit for purpose' escape system.
15. All mines to review and maintain their signposting throughout the mine to assist mine workers and rescuers in case of evacuation.
16. Standards to be developed for construction of lifelines. Also all mines should review existing lifeline installations and consider extending them closer to the face and crib room locations, and run them to all points of egress.
17. All mines to consider the current status of sealed areas so that their status is recognised and incorporated in all risk assessments including the mines rescue risk assessment.
18. All mines should initiate the initial Mines Inspectorate callout via the standardised emergency callout number (07 3237 1696).
19. The Queensland Mines Rescue Service (QMRS) should ensure that all mine sites are provided with detailed requirements for the deployment of GAG mine intertisation system, ancillary equipment and rescue teams.
20. All mines should consider installation of whiteboards throughout the mine to help them and rescue personnel with their evacuation i.e. in the event of an incident, the miners can leave a running commentary on their plan of escape, progress, their next milestone on the way out of the mine, why certain decision were made etc. etc.
21. All mines to consider the use of a 'mass callout system' for contacting mine personnel in an emergency situation.
22. All mines to consider physical separation of critical mines services to avoid loss of all services in a fire, explosion, fall of roof etc. i.e. install separate communication phone, DAC and separate gas monitoring.
23. All mines to ensure that the surface controller is provided with the information and resources required to effectively discharge duty card obligations, including requirement to stay in the control room in an emergency. All information required can be brought back to the control room.

24. All mines to ensure that critical ventilation control activities are captured in a duty card.
25. All mines to consider backup for statutory ventilation officer (VO).
26. All mines should consider that mine monitoring systems incorporate the ability to notify when sensors are in fault and over-range. All mine personnel involved with gas monitoring systems must be able to identify where sensors are over-range.
27. Emergency response and TARPs for gas monitoring to consider appropriate analysis actions (e.g. bag sampling, GC analysis) when sensors/analysers are recording gas concentrations over-range.
28. All mines must ensure that potential emergencies are identified and risk assessments conducted with potential controls/actions developed for those to assist in the timeliness of response including that by QMRS.
29. QMRS should ensure that brigadesmen are made aware of the types of SCSRs in use at the mine at which they respond and the donning requirements for those types prior to being deployed.
30. QMRS should review their procedures for assisting team captains or brigadesmen to be able to undertake functions usually performed by QMRS officers. This could be by development of duty cards for these functions or by training of some brigadesmen in these competencies
31. QMRS need to ensure that they have a system for identifying members who are 'oxygen time proficient' and ensure that those requested to respond to an incident are proficient or are called out to undertake specific duties.
32. QMRS to finalise as soon as possible its draft system for ensuring that information required by mines in emergency incidents (and contained somewhere in their mine systems) be implemented at all underground mines. This will assist in more timely identification of conditions.
33. All mines, in consultation with the QMRS, to ensure standardised fittings are available to connect GAG to mine water outlets etc.
34. All mines to ensure that area lighting is sufficient around any GAG connection point.
35. Review the QME audit tools used for QMRS to ensure that they adequately cover all QMRS processes including deployment and operation activities for rescue and GAG.
36. MRE to all mines on recommendations and actions required to be taken.

The 2010 Queensland Level 1 Mine Emergency Exercise will be held at the Anglo Coal Bundoora Mine.

Tilman Rasche - Senior Inspector of Mines

Queensland Level 1 Mine Emergency Exercise Planning Committee December 2009

Introduction

Background

Following the mine explosion at the Queensland Moura No. 2 underground coal mine in August 1994, the subsequent Warden's Inquiry recommended that:

"Emergency procedures should be exercised at each mine on a systematic basis, the minimum requirement being on an annual basis for each mine" (Windridge 1996).

The "Recognised Standard 08 for the Conduct of Emergency Procedures Exercises" was first published In December 1996. It was subsequently revised and published in 1999 as "Approved Standard for the Conduct of Emergency Procedures Exercises". (Queensland Department of Mines and Energy Safety and Health Division 1999)

This document provided guidelines for conducting mine site emergency exercises as well as the requirement for a test of state-wide emergency response by holding a Level 1 Mine Emergency Exercise at one mine each year.

From 1998 to date, mine emergency exercises have been held annually in Queensland, Australia.

This report covers the 2009 Level 1 Mine Emergency Exercise held at Caledon's Cook Colliery underground coal mine near Blackwater Central Queensland.

Caledon's Cook Colliery is an underground coal mine located approximately 30km south of the township of Blackwater, and some 180 km west of Rockhampton, in Central Queensland.

Scoping the exercise

The 2009 Queensland Level 1 Mine Emergency Exercise was held Caledon's Cook Colliery near Blackwater, in Central Queensland.

The first scoping meeting for the exercise was held in July 2009 to determine a suitable mine for the exercise, reiterate the objectives for the exercise, propose a suitable assessor team and consider general logistics required for a successful exercise.

An initial mine site visit was conducted in July 2009 by Doug White, Tilman Rasche and Greg Dalliston to familiarise them with the surface and underground conditions and to formulate possible scenarios that would achieve the objectives of the exercise.

A number of planning meetings that included the selected mine managers were held to ensure information such as mine and ventilation plans, procedures etc. from the

mine were available to refine a single scenario and to ensure realism and applicability of the scenario for the mine and for the industry.

A full team briefing involving all assessors was held on October 20-21 in Rockhampton, covering the scenario, the teams' conduct on the day and reporting requirements.

A risk assessment was also drafted and finalised over these team meetings, ensuring any hazard associated with conducting the exercise had been captured and was managed through suitable and effective controls.

A site visit by the team was held in October 23 for site and underground inductions and general site familiarisation.

Effects of the scenario on the mine ventilation were considered, including ventilation simulation and preparation of input data for the Simtars' Safesim program, with replication of the mine monitoring system completed and installed within an hour of exercise commencement.

A number of days prior to the emergency exercise all state emergency agencies, e.g. police, hospital and ambulance services etc. were notified that an emergency exercise was going to be conducted.

Final membership of the Exercise Management Committee was:

- Douglas H. K. White - Chairman – Queensland Level 1 Mine Emergency Exercise Planning Committee, Deputy Chief Inspector of Mines (Coal), Queensland Mines and Energy
- Gavin Taylor - Chief Inspector of Coal Mines, Queensland Mines and Energy
- Tilman Rasche - Queensland Level 1 Mine Emergency Exercise Planning Committee, Senior Inspector of Mines, Queensland Mines and Energy
- Andy Fynn - Senior Inspector of Mines, Queensland Mines and Energy
- David Cliff - Queensland Level 1 Mine Emergency Exercise Planning Committee, Associate Professor, Minerals Industry Safety and Health Centre (MISHC), University of Queensland
- Larry Ryan - Queensland Level 1 Mine Emergency Exercise Planning Committee, Computer Systems Engineer, Simtars, Queensland Mines and Energy
- Greg Dalliston - Queensland Level 1 Mine Emergency Exercise Planning Committee, District Union Inspector, CFMEU Mining and Energy Division Queensland
- John Grieves - Queensland Level 1 Mine Emergency Exercise Planning Committee, Senior Project Engineer/Acting Land and Tenures Manager, New Hope Group

- Michael D. Downs - Underground Mine Manager, Bundoora Mine
- Brad Meldrum - ERZ Controller/SSHR, Broadmeadow Mine
- David Nichols - Senior Inspector Coal Mines, Industry and Investment NSW
- Paul Green - Deputy/SSHR, Moranbah North Coal
- Grant Whitbourn - Underground Mine Manager, Broadmeadow Mine
- Mark Munro - Operations Manager, United Colliery NSW
- Shaun Dobson - Underground Mine Manager, Carborough Downs
- Stephen Ellis - Compliance Superintendent, Kestrel Mine
- Mark Bulkeley - Safety and Training Manager, Baal Bone Colliery NSW
- Carissa Crozier - Logistics Coordinator, Senior Administration Officer, Queensland Level 1 Mine Emergency Exercise Planning Committee

Objectives

The detailed objectives of this and previous exercises were to:

- test the mine's first response
- test effectiveness of systems, not individuals
- test self escape capability of mine workers
- test competency in use of self rescuers
- test control room / incident room response
- test the incident management team (IMT), including rotation and changeover should the exercise continue past the end of the shift
- test efficiency of tracking of personnel underground
- test the 'deployment' of Queensland Mines Rescue
- test 'call out' procedures for mine personnel living remote to the nearest township
- test mobilisation – monitoring of calls to remote resources such as Queensland Ambulance Services etc
- test changeover of escape units i.e. self rescuer to CABA
- test the mine's stress tolerance through contact by media
- test gas analysis capability
- test possible mobilisation and use of GAG, where considered applicable

- test the mine's efforts in debriefing of mine personnel.

Scenario

Central to the infrastructure of Cook Colliery is a decline that connects the surface with the underground operations.

This decline serves many uses. It is the primary personnel and material transport route using a dolly car system, houses the main conveyor belt out of the pit and is one of two main air intakes to the underground workings. The decline is also the connection point for the GAG.

A secondary air intake is provided through a downcast shaft located approximately 400m away from the decline. This shaft also serves as emergency egress using a small man cage hoisted by a manned surface winder.

Several hours into the shift, a hot conveyor belt idler on the main decline conveyor belt causes coal fines to catch alight, near pit bottom. The fire remains unnoticed, and as it grows, combustion products are drawn into the workings and at some point the belt trips. The underground shift electrician is asked to investigate and uses the driftrunner vehicle to travel from his panel to pit bottom to investigate the source of the belt stoppage. As he drives into the gradually thickening smoke, he becomes disorientated and gets lost.

Both working crews located in different parts of the mine start to evacuate by foot towards the secondary egress shaft. The fire continues to get larger and starts to destroy vital infrastructure such as tube bundles and communication equipment.

During the evacuation the crews are required to don SCSRs and change over their SCSRs throughout the evacuation due to smoke in the mine air. During the evacuation, one worker is injured and needs to be stretchered to the shaft bottom.

The emergency is deemed sufficiently serious and assistance by the QMRS, including its GAG inertisation crew, will be requested.

The Inspectorate will also be called to complete a full investigation in to the event.

Ventilation modelling was undertaken to predict the anticipated spread of pollutants through the UG mine working. The mine's gas monitoring system was replicated prior to the exercise and interfaced to the mine supervisory control and data acquisition system. This enabled the delivery of simulated mine condition information through systems familiar to the mine staff and which they would use in a real emergency.

Assessor briefing

The following scenario was reiterated with all assessors shortly before the exercise started.

- A fire starts on the man conveyor belt in the one drift access.
- An electrician (from the furthest away panel) is sent to investigate why the main belt had tripped, becomes lost in smoke and is required to don a SCSR. He remains with the vehicle.
- Combustion products from the belt fire near pit bottom enter the UG workings and trigger evacuation of the two working crews towards the mine's second egress point.
- Tube bundles and all communications are lost as the fire rages out of control.
- The pollutants spread throughout the mine, requiring workers to don their rescuer. Both crews will be provided with spare SCSRs for donning and use during the exercise; personal SCRS are not to be used.
- The crews will also experience reduced visibility requiring tinted goggles to be worn.
- One mine worker will be injured and need to be stretchered to the shaft and evacuated on his stretcher to surface.
- The fire cannot be brought under control, triggering the GAG intertisation truck to be called to site.
- Basic communication rules were reiterated e.g. at time of exercise no '000' calls are to be made, all off mine site communications to be preceded by 'this is an exercise only'.

The following information was explained to crews before the exercise started and was also given to the assessors:

- Exercise will start when notified of conditions by the mine, or mine workers will be shown signs/pictures by the assessors.
- Mine workers are to take actions in the same manner as if a real emergency had eventuated except:
    - Mine workers are NOT to don personal belt worn SCSR – only units provided by the assessors are to be used.

- Mine workers will only be given information if the correct action which would have led to getting that information is demonstrated e.g. if a mine worker holds out a gas detector or looks at fixed gas sensors then he will be told or shown the (simulated) exercise gas readings.
- If a mine worker is asked to don a SCSR for the exercise, he may be asked to continue using that SCSR until depleted to allow him to get full experience and sensation of use.
- Information will be provided by the assessors to the mine workers as the scenario evolves.

All assessors were given laminated coloured charts showing the layout of the underground operation and pollutant spread, as shown in Figure 1.

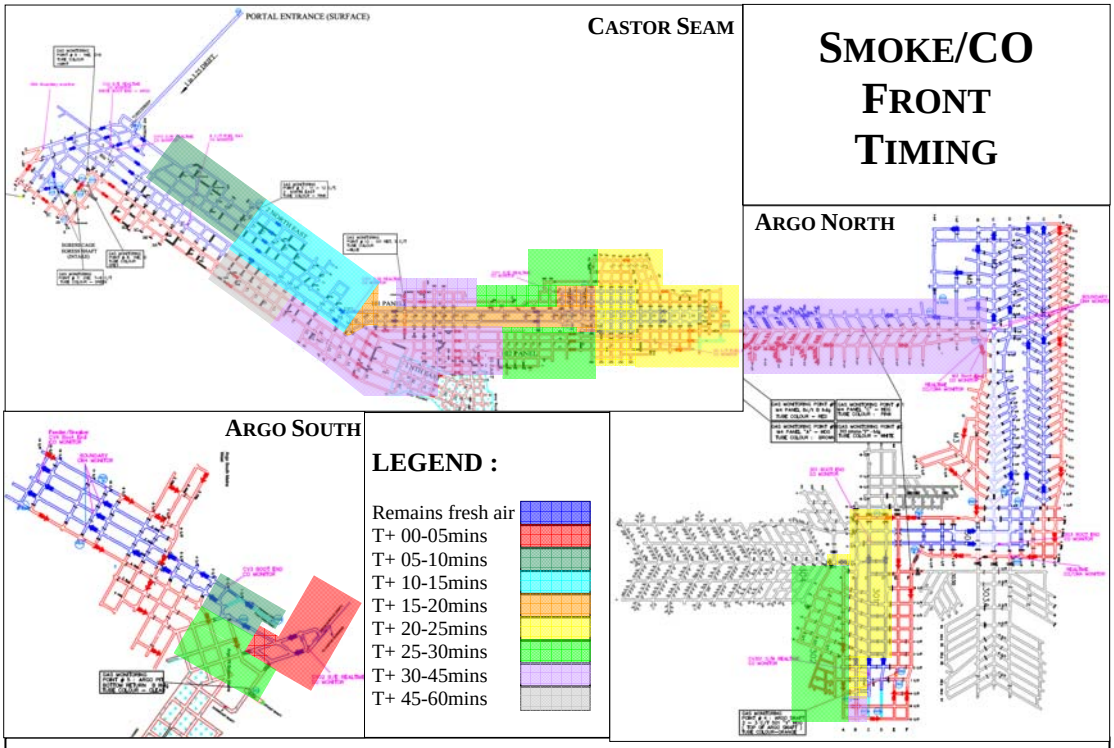

Figure 1 – Sample of laminated pollutant charts

The exercise

Exercise timeline

Table 1: Abbreviated summary of exercise timeline

Location	Event / Observation	Time	Event / Observation	Location
Control room	Belt isolated, fire has started	1107		
Surface	Call to Electrician	1110		
Control Room	Belt stopped in M and M Drift	1110		
		1135	Stopped the PJB at the diesel bay and informed the 4 personnel (3 Belt Crew and Electrician) that they were in thick black smoke. One person donned the SCSR. The rescuer activated upon the mouth piece being pulled.	8CT Diesel Bay
		1140	South panel ERZC and two crew members in Cribroom. "You smell smoke" – light goggles issued and shown gas sample – 25ppm CO – casual response from crew members.	South Mains Cribroom
		1146	ERZ Controller informed of smoke entering panel and gas levels are as per his portable gas monitor, he then sets off to face to gather crew.	M2 Crib room
Control room	Main alarm going off.	1146		
Control room	Duty cards started to being distributed by CRO.	1154		
		1155	Message from control – 4.5% CH4, 45ppm CO on Northside – No information for South Mains. South panel ERZC asked if any information required and gave local update. Told	South Mains Cribroom

Location	Event / Observation	Time	Event / Observation	Location
			control that intention to travel outbye in vehicle and look for source of smoke.	
Control room	CRO calling ERZC M2 panel to evacuate men towards pit bottom	1157		
		1200	ERZC contacts CRO who informs of a fire in the main drift, ERZC informs CRO of route he will take.	M2 Crib room
		1203	Fire identified approximately 30m outbye of the bin.	Fire Site
Control Room	Dupline and Realtime Gas Monitoring System OOS.	1205		
Surface	Mechanical Supervisor gives Planning Coordinator report of severity of fire in the drift 30m outbye of bin	1206		
		1208	Men collect walking sticks, rescuers and set off outbye.	M2 Crib room
Control room	Calls Mine Manager	1209		
Control Room	UMM (later Incident Controller) enters Control Room, gets status update – notices smoke – orders sentry be placed around portal and barricade off	1223		
Control Room	Second egress cage electrical fault.	1224		
Comms Room	OUTGOING - Call to QMRS.	1224		
Control Room	Mine Manager in Control Room, given status report.	1225		
Comms Room	INCOMING – Call from QMRS.	1232		
Control Room	Drift airflow partial reversal indicated with smoke coming out of portal - smoke increasing.	1235		
Control Room	1st call from Media	1238		

Location	Event / Observation	Time	Event / Observation	Location
IMT	Update from Mechanical Supervisor returned from fire fighting.	1239		
Comms Room	QMRS contact mine after emergency call centre activation	1242		
IMT	Notify QME and ISHR	1249		
		1250	ERZC contacts CRO via none verbal means	M2 Argo drift cache
Surface – Lamp Room	Fan monitoring changed.	1254		
IMT	Incident Controller request GAG.	1302		
		1308	Men begin to board first cage	Downcast Shaft Bottom
		1328	Men pick up installed lifeline and significantly increase walking speed.	M2 Track end area 1 NE
		1332	5m inbye of 16 c/t man goes down with CO poisoning.	M2 16 c/t Cache 1 NE
IMT	DME Rockhampton Inspector onsite.	1343		
Control Room	2nd mines rescue crew of 18 persons expected in about an hour.	1355		
Control Room	Call to CQ Rescue helicopter Mackay putting them on standby.	1358		
IMT	Mines Rescue Team has left Blackwater 20 minute ETA	1402		
IMT	Qld Mines Rescue Service Active Operations Manager now present and briefed.	1411		
Planning	Risk assessment to discuss ventilation options.	1431		
Rescue Station	Brigadesmen doing risk assessment for access to M and M.	1433		
Rescue Station	Brigadesmen ask for briefing.	1446		
Winder Surface	Two of the three men unaccounted for make it to surface in cage.	1530		

Location	Event / Observation	Time	Event / Observation	Location
Planning	2 men from belt crew now on surface brought into risk assessment to get more information.	1552		
Rescue	Risk assessment for setting up fresh air base at bottom of downcast shaft.	1600		
Control Room	Results returned after two Gas Chromatograph runs and checks ("real" value for exercise in brackets) estimated: CO: 1.3214% (1.2000%); He: 0.0000% (0.0001%); H_2: 0.6879% (1.2000%); O_2: 17.0258% (16.7000%); N_2: 78.2150% (77.0000%); CH_4: 0.4812% (0.5000%); CO_2: 2.2232% (2.4000%); C_2H_4: 0.0212% (0.0200%); C_2H_6: 0.0250% (0.0250%); Ar: 0.0000% (0.8914%).	1625		
Muster Area	QMRS Officer 1 starts formal briefing.	1628		
IMT	GAG deployment and fire fighting options discussed.	1635		
Control room	Mines Inspector 2 at front gate.	1636		
Planning	GAG jet deployment discussion. QMRS Officer 1 advised GAG jet ETA for site 19:15.	1650		
Rescue	Set up fresh air base at surface winder.	1653		
Rescue	Team 1 checks done and ready to go underground.	1717		
Rescue	Stop at 3 CT. Gas test readings fresh air, temperature 20°c wet bulb. Contact fresh air base on radio from 3 CT.	1753		
Rescue	2000ppm CO, 0.4 CH4, O^2 17%, CO^2 2.0%. Thick smoke.	1802		
Rescue	Found missing person at	1806		

Location	Event / Observation	Time	Event / Observation	Location
	8CT in PJB, no SCSR on.			
IMT	Risk assessment for setting up GAG complete.	1850		
Rescue	GAG arrives on site.	1858		
Surface	Start set up of GAG	1916		
IMT	IMT meeting to review GAG deployment and fire fighting including sealing of shaft and drift.	1946		
Surface	Gag controller advises IMT that GAG is ready to run signalling end of exercise.	1957		
1957 hrs End of Exercise				

Underground section

Exercise Element **Observation at Downcast Shaft Bottom**

Assessor(s) **Andrew Fynn**

The first persons at the downcast shaft bottom were the pit bottom crew of three, who arrived wearing self rescuers as the intake air at their workplace had become contaminated with smoke. They quickly established they would be in fresh air at the downcast shaft bottom and removed rescuers. This enabled them to use communication systems. They used phone number 596 to inform of their location and were told to await further instruction. They soon recognised the cage was at the surface and requested that the cage be sent to the pit bottom in readiness.

The south mains crew were the next crew to arrive at 12:20. They were wearing self rescuers which they removed after being told to do so by pit bottom crew, who were already waiting for the cage in fresh air.

The ERZ controller demonstrated good leadership of the situation accounting for all his team and promptly relaying information to control (phone no. 581).

The ERZ controller subsequently made numerous phone calls to obtain additional information from control which he relayed to the crew. The ERZ controller then proceeded to study the mine plans to gain greater understanding of implications of a fire in the specified location and considered the feasibility of access to the fire for obtaining information and the possibility of reversed ventilation due to the fire. This clearly demonstrated the ventilation knowledge of the ERZ controller and the concerns he held. However, the numerous phone calls made may have served to overload the control room operator within the wider scheme of events.

The ERZ controller then contacted the incident controller in the incident management team and asked if he should investigate the fire location. He was promptly told no by the incident controller and to evacuate to the surface only. In any event, considering comments made by some crew members, it was unlikely the ERZ controller would have gained any support from the crew to mount such an investigation, away from the current safety of the downcast pit bottom, especially having already utilised their SCSR.

Electrical power was lost to the lighting in the pit bottom and the winder. Information was fed back to the crew that the electrician was working on the fault and back up arrangements for a crane and pod had been made. Throughout the period of waiting it is worth noting the constant concern expressed by the south crew over the safety of the north crew, who had not at that point reached the safety of the pit bottom. This demonstrated the levels of comradeship within the workforce and typical of the underground mining industry in general.

Power was eventually restored to the winder and the crew were wound out in two separate lifts. The ERZ controller gave instructions for the first lift to wait at the shaft top for the rest of the crew before moving over to the tag board and lamp room.

The North Mains crew arrived at the downcast pit bottom at 14:13 through the

airlock to the return. The ERZ controller stated that they would now be in fresh air and instructed the crew to remove their rescuers. He promptly accounted for his crew and relayed this to the control room, including the fact he had an injured person. The injured person's condition deteriorated to the point where he needed to be placed on a stretcher. There was no first aid station or stretcher available at the downcast pit bottom. The ERZ controller decided to request a stretcher from the surface, rather than to move out from the pit bottom fresh air base to attempt to locate one underground. This obviously resulted in a delay in being able to get the casualty out of the mine for medical attention at the earliest possible opportunity. The ERZ controller selected 2 crew members to remain underground with himself and the casualty and await a stretcher, whilst the rest of the crew were wound to the surface.

When the stretcher was received at the pit bottom, a decision was made to immobilise the casualty's leg using an improvised splint from walking sticks and caution tape. Once in the stretcher the casualty was able to be manoeuvred into position on the floor of the cage easily and without tipping, with room for an additional 4 persons in the cage.

At 17:28 the rescue team, wearing breathing apparatus, arrived in pit bottom with associated rescue equipment. Directed by the captain, they effectively carried out environmental testing, established communication back to the surface fresh air base and moved out. The team arrived back at pit bottom carrying a stretcher casualty at 18:30.

During the rescue operation, a request had been made to deploy a second rescue team which had resulted in the cage being wound to the surface. The second team had not yet entered the cage when team 1 arrived back in pit bottom with the casualty. At this point the request for team 2 was cancelled and the cage sent to pit bottom empty.

The winder driver (following shift changeover) was unsure of the cage position and requested over the DAC, whether the cage was docked in position. At this point the cage was found to be at least 3m above the landing point, which raises questions over the clarity of the position indicators for the cage. The information on actual cage position was relayed to the winder driver, who promptly lowered the cage into the correct position.

Once again the stretcher was able to be manoeuvred relatively easily onto the cage by the rescue team, wearing breathing apparatus and there was sufficient room for 5 of the rescue team members to travel out in the cage with the casualty in the stretcher.

What worked well

- The recognition of shaft bottom as a fresh air base and removal of self rescuer at appropriate time by all underground crews.
- Accounting for team members and communication by ERZ controllers between surface and crews was good.
- The ability to easily manoeuvre a stretcher casualty onto the cage was

confirmed.

Points for consideration

- Position of fresh air base for rescue purposes could have been established underground
- Clarity of phone number to be used for information flow in an emergency incident situation (some using 581, some using 596)
- The clarity of cage position indicator at the winder (familiarity).
- Benefit of having a fire fighting capability at D/C shaft bottom.

Recommendations - Mine

- Establish first aid station including stretcher at downcast shaft pit bottom (Mine).
- Mine consider location of emergency services (e.g. at bottom of downcast shaft) i.e. water, compressed air, communications, gas monitoring etc.

Recommendations - Industry

- Each mine demonstrates where they have redundancy in the provision of mine services.

Exercise Element M2, then Surface with Mines Rescue

Assessor(s) Paul Green

- Surface and Underground Mines Rescue team deployment to find missing person, believed to be located at # 8C/T.
- Walk-out of the M2 crew from the panel to the down cast shaft, with 4 coal mine workers from crew donning and wearing SCSRs and 3 coal mine workers undertaking a SCSR change-over, also test the effectiveness of placing the stretcher into the cage with a injured man.

What worked well

- Mines Rescue teams well prepared
- Rescue team numbers early identify need for two teams.
- Once rescue teams briefed on incident, deployed quickly to down–cast shaft area and set up FAB.
- Once underground, rescue team clearly followed plan and communicated progress to FAB controller.

Points for consideration

- Cleary identify the person in charge of rescue teams on set up.
- Time delay in checking the tag board for personnel still underground, tag board tenant.

Recommendations - Mine

- Area lighting at downcast shaft.
- Consider repositioning of phone in the winder house due to noise from winder engine.
- Communicate to all coal mine workers on level 1 exercise outcomes and recommendations.
- Room for improvement regarding signage for primary and secondary egress, directional indicators, life-line standards.
- Housekeeping standards and rib spall in the egress walkways require improvement.

Recommendations - Industry

- Immediately debrief of personnel evacuated from underground, may have vital information on personnel missing and underground status.
- Effective PED tracker system, to indicate locations of underground personnel.
- Mines to respond to DME indicating whether they action level 1 exercise recommendations.
- Mines to undertake risk management process to identify the reasonable distances between cache stations walk out trails wearing mines SCSRs to accommodate various levels of fitness etc.
- Industry standard for primary and secondary escape ways, signage, directional indicators, life-line locations, what needs to be in cache station, reasonable area in cache station to conduct changeovers.
- Standard for training of coal mine workers in the donning and changeover of SCSRs in a mining environment.
- Communicate to all coal mine workers on level 1 exercise outcomes and recommendations.

Exercise Element	**Egress of personnel from M2 panel and IMT/ QMRS GAG implementation/mine recovery process**
Assessor(s)	**Shaun Dobson**

The exercise was initiated as per the above timeline, where there appears to be lack of clarity in communication on the initiation of the incident and the subsequent timed effects to the panel. Gas readings at the initiation were given out as back ground levels on the portable gas monitor, where they should have been at T15 or T30, which may have resulted in the earlier donning of the self rescuers. The effective donning and change over of self rescuers was tested with 4 coal mine workers donning units and then 3 of them changed over at a designated cache. Light smoke and dense smoke glasses were worn to limit visibility whilst walking out. The response of the coal mine workers to deal with an unconscious team member was tested with a team member succumbing to carbon monoxide poisoning who did not keep a closed breathing circuit. The effectiveness of non verbal communication throughout the period of time in an irrespirable atmosphere was also tested. The utilisation of the first aid capabilities of the emergency egress was tested with the use of a stretcher and casualty with a dislocated/broken ankle in the shaft egress cage.

The application of the MEMS functions was observed for their efficiency and effectiveness in implementing timely corrective actions to mitigate the risk to personnel and mine infrastructure.

What worked well

- Exposure of ERZ Controller to outbye area (normal district).
- Lifelines markedly increased walking speed of escaping team.
- Link line between team members.
- Improvised use of rear of egress plan as communication board in cache where visibility was limited.
- Use of sprayed glasses to limit visibility.
- Bungee strap pull downs on Egress lifeline.

Points for consideration

- Rotate ERZ Controllers through districts.
- Communicate the need to identify what triggers would prevent the use of vehicular transport.
- Increase frequency of self escape exercises including donning and changeover procedures.
- Identification of trigger for donning rescuers.
- Participants to be debriefed by the assessors for the group they have been observing.

- Prior to the Level 1 exercise consider what events are happening at the mine which could affect the completion/effectiveness of the exercise.
- Protocol for expediently dealing with confidential information, i.e. fatalities.
- How do we expect persons to deal with or leave an injured/sick team member in an irrespirable atmosphere?
- Effectiveness of segregated caches, air curtains, air flushing devices creating noise?
- Redundancy/alternate routes for essential services i.e. gas monitoring.
- How do we expect collieries to effectively deploy first response expediently to mitigate the consequences of an extended fire?
- MEMS structure to identify where persons are exposed to making decisions in isolation.
- Coal mine operators to provide means of transporting key team members to mine sites.

Recommendations - Mine

- Install lifelines to face areas. Ensure the same standard of lifeline is achieved throughout the mine.
- Test the effectiveness of the PED system and understand its area limitations.
- Include code of signals for none verbal communication and horn in caches.
- Improve egress and cache signage.
- Standardise cache set up.
- Improve housekeeping on egress routes.
- Change communication board in caches from being fixed to being portable.
- Standard question set/guide for any person manning the telephones in the control room to ensure that correct responses are recorded and communicated.
- Produce standard telephone listings for all required resources.
- Disciplined approach to implementing and controlling MEMS activities in all groups/areas.

Recommendations - Industry

- Installation of standardised lifelines on all egress routes.
- Develop, communicate and implement minimum standards for none verbal communication including codes of signals.
- Standardise cache installations - size and space, communications, segregation and air feeds.
- Personnel to be assessed on donning and changeover procedures in

atmosphere that will identify failure in process.

- MRE to all mines on recommendations and actions required to be taken.
- Mine design recognised standard for segregation, mines services, etc.
- Effective practical training in understanding the effects of oxygen deficiency or toxic atmospheres.
- Audit of the effective implementation of all external services required in an emergency to be undertaken. This includes risk assessments, SOPs etc for expedient implementation of these services when they arrive on site.
- All mines to review their principal potential emergency situations and ensure risk assessments have been developed and are available in case of emergency.
- Consideration of status of sealed areas needs to be included in the risk assessment undertaken for entry of rescue teams to the mine.

Exercise Element **Underground evacuation**

Assessor(s) **Mark Munro**

Pit bottom area had very little activity due to the nature of the incident (fire in the belt/M&M drift).

The 3 men in the area evacuated effectively and competently minutes after the exercise commencement.

What worked well

- The men at pit bottom (diesel bay) were well aware of the proper course of action to take. They passed on all relevant information to surface control and then immediately evacuated, using their self rescuers.
- No person or groups made their way to the M&M drift to attempt evacuation.

Points for consideration

- People in thick smoke would find it very difficult to read PED messages, especially while wearing smoke goggles and self rescuer.

Recommendations - Mine

- Improve the integrity of segregated intake stoppings and doors.
- Consider CABA self escape system.

Recommendations - Industry

- Changing over of self rescuer units is a high risk activity and a difficult procedure in a low visibility and high stress environment. Surely someone could develop a self rescuer system where the spare oxygen unit could be quick attached to the existing mouthpiece/breathing bag/harness component, to simplify this procedure.
- Industry to engage with SCSR manufactures to develop a more effective SCSR design and develop a reliable and 'fit for purpose' escape system.

Exercise Element	**Underground evacuation Main South, then Control room**
Assessor(s)	**David Nichols and Steve Ellis in Main South;** **David Nichols in Control room after Main South Evacuation**

- Evacuation went well.
- Transport used until air split to downcast found, then by foot.
- Two crew given rescuers, these were used well, no change over required.
- Deputy took control and communicated well.
- Got to DC shaft and fresh air in good time.
- Good use of phone communication.
- Delay at bottom of shaft followed by two cages to evacuate 13 men.
- No men down.
- No injuries.

Underground M Panel Expectations; The underground personnel:

- Smelled smoke.
- Saw Smoke.
- Received instructions from surface to withdraw.
- The deputy took control.
- The withdrawal route was discussed.
- The deputy talked to the surface.
- The instruction to don self rescuers was given 500m outbye when CO reached 90 ppm.
- Rescuers were donned correctly, no change over was required.
- Appropriate escape route chosen although a small deviation towards the

base of the drift occurred at an intake air split. This occurred at the top of the between seams drift to the Main South. The rapid rise in smoke and CO forced the crew back onto the correct route. It was at this point the deputy signalled withdrawal to the down cast shaft and followed that fresh air split.

- The deputy abandoned the vehicle at this point although it could have taken them further. However, the walk to the shaft from this split was quite short.
- Communications between the crew was quite effective. The deputy was able to talk because only two rescuers were supplied for us to distribute, and they were given to two of the crew. I suggest that in future exercises, where only part of the crew are provided with rescuers, the residual be provided with mouth pieces to stop them talking.
- The crew drove to the top of the between seam drift into the main south and walked to the down cast shaft from there.
- There was no change over of self rescuers.
- No one was injured.
- First aid equipment was not required. It was present and signposted in the crib room.
- The crew found their way to the escape shaft.
- The crew realised when they were in fresh air.
- There was a lack of signposting on various routes, this was an intake escape but there were two splits to choose from: one clean, one polluted. Also signs are needed to distinguish between different air splits as well as travelling roads, particularly at forks in the road. Signposting where a distinct split occurs and the routes that those offer needs to be provided. Signs needed “route to intake drift” route to down intake cast shaft/cage exit.
- It is essential that forks in the road that are also ventilation split choices need to be signposted.
- The exercise proved the value of two separate intakes into a mine.

What worked well

- Telephone communications
- Oxygen self rescuers
- Transporter
- Cage

Points for consideration

- Signposting, Signposting, Signposting, see comments above for roadways

intersections and air splits.

- Also the tube bundle had been lost at the start of the exercise because it ran along the drift belt that had been set on fire. This means that, in the terms of the exercise, there had been no monitoring of the Sealed Area for several hours when the rescue team was sent underground. This at a time when the ventilation is being seriously disrupted. I seriously question the correctness of deploying the mines rescue in light of the unknown status of the sealed area.

Recommendations – Mine

- Improved signposting.
- Standards to be developed for construction of lifelines plus extend lifelines closer to face and crib rooms.
- Improved treatment of sealed areas.

Recommendations – Industry

- Improved signposting.
- Standards to be developed for construction of lifelines plus extend lifelines closer to face and crib rooms.
- Understanding of the current status of sealed areas so that they are considered in all risk assessments including the mines rescue risk assessment.

Exercise Element Underground evacuation

Assessor(s) Mark Bulkeley

What worked well

- The men walking out did an extremely great job. Both the guys that took the lead should be commended.
- When the guys got onto the lifeline it certainly made the evacuation move a lot quicker. This may be a recommendation to take further.
- The deputy performed his duty in a professional and competent manner. On the walk out he did a number of gas readings etc.
- Interviewed three of the guys that walked out and asked them what they thought they did well / and not so well. They thought evacuating the mine they did well.

Points for consideration

- Phone messages didn't seem to work that well from underground to control room.
- Changeover of rescuers definitely needs some attention.
- On the negative side they thought they could improve donning their rescuers. Their other comment was all men should have smoked glasses and be wearing a rescuer.
- Sat in debrief with both deputies. Steve's (deputy from the South panel) only issue was that he wasn't allowed to be involved enough. The main issue for the other deputy from M1 panel was his men missed out on crib.

Recommendations – Mine

- Sat in with Mine Rescue and tech service manager while they were doing a risk assessment. It seemed to take a long time to get organised. Also when they interviewed the deputy from the M1 panel, they asked three questions. I am sure he could have given them more information if he was asked.
- In summary I think the big learning from my point of view is the industry or Cook Colliery should look at lifelines that continue all the way out of the pit. Cook Colliery should look at doing some training with rescuers.

Exercise Element Underground evacuation

Assessor(s) Stephen Ellis

Observation of exercise in South Mains, Cook Colliery. Initiation of exercise after conveyer telephone call at 1130. Crew members shown "You smell smoke" sign.

Crew evacuated on instruction from ERZC – good use of escape equipment – canes, glow sticks, leadline, lines for carrying spare rescuers – and vehicle.

First response looking for source of smoke/fire, showed initiative and a desire to assist the mine and others in the mine.

Crew to pit bottom and evacuated satisfactorily.

Use of active self rescuers on two personnel – donning procedure followed – rescuers got hot to use but then removed in fresh air.

Followed procedures well at downcast shaft.

What worked well

- ERZC took charge well, ensuring a swift evacuation. Did not allow any discussion for changing the plan.
- Good interpretation of gas levels as produced.

- Use of vehicle for evacuation enabled all persons to be evacuated quickly to fresh air.
- Good first response – looking for source of fire.
- Good exploration of issues and offers of assistance.

Points for consideration

- ERZC making too many phone calls could confuse surface personnel.
- Casual initial response by crew on seeing smoke – not responding to the mine's procedures – don rescuers immediately on seeing smoke.
- Leaving vehicle unnecessarily – could have continued to downcast shaft.

Recommendations – Mine

- Training to include communications protocol by U/G personnel.
- Clarify TARPS in terms of smoke or CO make/percentages.
- Information to U/G needs to be concise but accurate – appreciate difficulties in the scenario – but morale issues without information.

Recommendations – Industry

- Good use of two mine intakes meant an U/G FAB was available.

Surface section

Exercise Element **Communications Officer – Control Room**

Assessor(s) **Mike Downs**

After the initial declaration of the exercise commencement, activity in the control room commenced some 45 minutes later in terms of establishing a dedicated communications function.

Some confusion and ad-hoc allocation of duty cards was noted, this resulting in duties and skill sets not being optimally matched and some delay in making operating processes effective.

The person initially allocated the comms duties was re-assigned after some 10 minutes.

Some issues were noted with the duty card documentation in terms of currency and inclusions of QMRS members and telephone numbers for key infrastructure, although the comms officer persevered and worked through all issues with time.

In contacting the mine QMRS members, the comms officer was unclear what expectations were to be met in terms of response to the contact calls, leading to delays in the availability of some key information and therefore a planned

response.

The basic requirement for the comms officer, as defined by the duty card, was to contact staff people listed as a first response to the emergency. This approach basically provided a base load for this activity with other communication tasks allocated on an as needs basis. A result of this arrangement IMT directly contacted the Mines Inspectorate, ISHR and possibly other key stakeholders. In order to maintain a reliable full log of all contact to and from the mine, this area of 'disconnect' needs to be resolved.

It was notable throughout that many incoming calls to the comms officer were seeking an update or other related information on the mine status. In most cases some discussion did eventuate, indicating that the comms officer was providing some ad-hoc information that may or may not have been accurate. This indicates a more formalised system of provision of updates / issuing instructions should be considered, as well as a method to integrate all communications to site from various areas of the operation to consolidate an overall log of activity.

Activity levels in the area were intense at the start of the exercise, indicating a degree of effort and clarity of application is paramount at this time. It is likely that as various key stakeholders arrive on site, the level of activity in the comms area will significantly reduce, enabling some variation in duties / tasks undertaken in this area.

The allocation of a 2 way radio to the comms officer was considered to possibly compromise the functionality of the position on the basis of overload and the potential for ad-hoc and potentially inappropriate communication to some areas of the mine.

What worked well

- The comms officer started all communications where appropriate with "this is an exercise only".
- The comms officer remained composed throughout the exercise and generally performed well.
- The comms officer was able to work through the duty card requirements as well as undertake various ad-hoc communications work as directed.
- The comms work area was suitably separated from other areas of intense activity in the control room and this facilitated the telephone activities.

Points for consideration

- Allocating duty cards on a priority basis with other cards issued on a cascading basis.
- Allocating duty cards to persons mindful of a match of skill set and function requirements.
- Provision of some basic training in some aspects of elementary emergency management for all site personnel.

Recommendations – Mine

- Provision of basic instructions / basic requirements of the duty card to provide the incumbent with direction as to requirements for QMRS members, members of staff, etc – required / anticipated response to an emergency situation.
- Provision of a 'call centre' for on–site enquiries regarding status / advice / direction etc.
- Provision of a number recognition telephone for the main comms function in order to provide a degree of call screening.
- Review radio communications in the Control Room and possibly provide greater control and definition in this area. Possibly separate the function to the Site Controller.
- Provide a system of regular review of information incorporated / referenced in the duty card packs - telephone numbers, personnel, etc.

Recommendations – Industry

- All mines should modify their emergency response plans to contact the Queensland Mines Inspectorate via the emergency number 07 3237 1696, rather than contact directly to the "local" inspector. This means that the Queensland Mines Inspectorate emergency response can start immediately.
- Provision of basic training for some fundamental functional aspects of communication in emergency management for the general mine workforce.

Exercise Element Incident Management Process

Assessor(s) David Cliff

The Incident Management Process was placed under stress due to the limited personnel available on a weekend to undertake key roles. The management of the incident required effective interaction between the various work areas. The formal MEMS system including its documentation was not rigorously followed, in part because it was found not to work with the available resources and in part because personnel acted as they thought most effective. The value of a formal system is that it should prompt duty card holders for actions, identify and record task allocation and track completion of tasks. In addition it will offer effective control of the information requirements.

The functional area coordinators – Planning, Operations and Logistics – seemed to follow instructions from IC rather than duty cards.

Communications processes were not specific and detailed – perhaps due to lack of the formal structure.

Information management was not good – consistent with the experience in past exercises.

Examples of where the MEMS system was not fully followed, include no use of Incident Action Plan, and the limited autonomy of function Coordinator roles.

The initial information reporting and display processes not kept up – white boards not updated – except by scribe. There was no regular update reporting or display of gas monitoring information in IMT.

The Incident Management Process would have been enhanced by scheduling of regular meetings and ensuring close out of actions by specified times.

It was not evident that TARPS or emergency response flowcharts were accessed or followed.

What worked well

- The use of a scribe in the IMT room to capture information.
- The use of an event board to track information, events and decisions with colour coded post it notes for various categories.
- The use of a missing persons/casualties board.
- The prompt definition of objectives and prioritising of them.
- Restricting the number of duty cards to roles that require them
- Incident controller established control and made sure decision protocols were followed.
- Need for relief due to fatigue was recognised and changeovers were initiated though not recorded.
- QME Inspector actively involved in IMT process – acted as informal process checker.
- IC recognised increased stress levels due to duress and managed self and others accordingly.
- Use of electronic whiteboard to record and issue authorised decisions.

  Key support roles efficiently discharged e.g. OHS Manager, scribes etc.
- Mine recognised need for counselling services.

Points for consideration

- Use of tape recording of key information in times before scribes were available and where they are moved to other functions.
- Maintain the regular reporting of gas monitoring information to IMT and display.
- Consider better utilisation of coal preparation plant personnel – this may require additional training of these personnel.
- Better documentation/recording of key issues e.g. callout of mines rescue personnel – ETA, numbers etc, gas monitoring data.

- Maintain better log of who is in what role – personnel changed roles many time.
- Incident log records started when Mine Manager arrived – initial details not recorded.
- Fire products were exhausting drift – consideration should be given to the potential for contamination of surface office area (ref Moura No. 2.).
- Access to procedures restricted, time taken in printing them and creating new ones e.g. egress via shaft.
- Preparing information required by QMRS being prepared in advance rescue personnel and GAG deployment.
- Given inherent shortage of resources and personnel, initiation of callout of external agencies should be expedited e.g. QMRS not on site till 14:10 from Blackwater.
- Systematic process needed for communicating debrief information to IMT.
- Impacts of loss on mine monitoring on hazards in mine not fully recognised e.g. sealed area.
- Identification of personnel underground was less than adequate. – 12:18 everyone was apparently accounted for, then later 4 missing, then 5 missing.
- Communications need to be more systematic and structured e.g. rather than reported injured person, report who is injured and what injury is.

Recommendations – Mine

- Incident initiation process needs to be recorded.
- Use of written incident action plans to communicate status reports and key information rather than rely on memory. This would assist in briefing personnel, e.g. for changeovers. This would also enable follow through of agreed actions and allocation of responsibilities.
- Delegation of development of fire fighting plan development at an earlier stage to planning group, allow operations etc to focus on rescue – evacuation.
- Increase site awareness of mines rescue guidelines.
- Investigate potential for higher level of support from other mines and Mines Rescue Service – especially for relief of key personnel if the incident became protracted.
- Consider a more structured approach to IMT process – schedule meetings, use incident action plans.
- Initial use of whiteboard to display status should be maintained with structure e.g. gas monitoring, personnel ug, actions in process.
- Copy of debrief information should be logged into the IMT and readily accessible.
- Mine should review emergency response plan and associated documentation in light of exercise to optimise operation. For example some “official” forms

and processes not used. In addition, the designated functionality of key roles should be reviewed in light of the experience obtained during the incident.

- Duty cards should be reviewed in light of the experience of exercise to ensure that they provide practical advice to assist in the effective completion of the roles.
- The role of scribes and associated responsibilities should be defined. If scribes are an integral part of the IMT process then there must be the capacity for scribes to be available at all times.
- Improve system for tracking location of personnel underground.
- Process for delivering regular updates on status of incident should be developed.
- Improved training in gas monitoring and recognition of limits of monitoring system.
- Mine to investigate counselling service process - supposed to be always available, was in fact an answering machine and no response was received during exercise.
- Mine to include external contacts in communications duty card including priority of call out and need to report responses to calls in a timely manner.

Recommendations – Industry

- Mines inspectorate callout should be initiated via a standardised emergency callout number.
- QMRS should ensure that sites are provided with requirements for deployment of GAG and rescue teams.

Exercise Element Gas Monitoring, Ventilation Management, Control Room

Assessor(s) John Grieves and Larry Ryan

The exercise officially started (~11:10 hrs) with the stopping of the intake drift belt. A fire began to smoulder in the intake drift (approximately 30m up from the Castor Seam connection to the drift), and products of combustion began to be distributed around the mine. Within five minutes, rises in CO were presented to real time sensors located around the coal transport systems feeding the interseam bin and drift belt. The DAC system broadcasted the alarm condition but the real time gas monitoring system in the Control Room did not raise any alarms as this functionality was not available. The smouldering quickly progressed to open fire.

After 30 minutes from initiation of the fire smouldering, heat generated by the fire had caused the mine dupline system cable (running down the drift) to short, putting the entire dupline system into fault and preventing any further readings being recorded for the real time sensors. The gas monitoring system displayed

that there was a serious problem and the surface controller identified this immediately. Though the controller was not sure what the problem was, he phoned for support on the electrical side and an electrician confirmed that the dupline was down.

At this stage, the impacts of the fire were able to be detected on fan flow and pressure monitoring, with the fire effectively increasing overall mine resistance due to the buoyancy of hot products of combustion.

After 45 minutes, the heat from the fire melted open the tube bundle lines (which also ran down the drift). As the tube bundle system cycled through the tubes, the system reported diluted products of combustion from the fire across all 12 tubes. The tube bundle gas monitoring system then started to raise multiple gas alarms on each sample location, until the tube bundle system was awash with alarms. The controller identified that the tube bundle system was burnt through. At this point in the exercise, all normal underground gas monitoring was lost. Analysis of gases around the mine was now, until completion of the exercise, limited to: the tube bundle system monitoring diluted products of combustion from the fire; local real time analyser readings at the main fan shaft; handheld gas detector readings (as could be recorded by evacuating ERZ Controllers and deployed Mines Rescue teams); and gas chromatograph analysis of any bag samples that could be obtained from any of these locations.

After 60 minutes, the fire had reached such an intensity that a partial reversal of air flow in the drift occurred, with smoke from the fire now layering and rising under buoyancy to the drift portal.

The stench gas was released at 12:27 pm down the drift.

The amount of smoke coming back up the drift and the intensity of products of combustion from the fire continued to increase until reaching steady state at approximately 90 minutes after initiation of smouldering. Smoke was now billowing out of the drift and could have caused the evacuation of the Surface Buildings and areas around the drift portal, if the wind had blown in an unfavourable direction.

As the fire gained intensity, the underground phone, DAC, power, compressed air and water services were burnt through at the drift fire site and lost at 12:51pm. At this point in the exercise, all services underground were lost and the Surface Controller realised the enormity of the problem. As there was still a crew underground, the loss of communication was a major blow to the Surface Controller's ability to effect their escape. The only communication method the Surface Controller had to the crew underground was via the PED, which was one-way only and was identified as having patchy coverage. The loss of the compressed air meant that the refuge bays for the SCSR changeovers were no longer a fresh air environment.

Any adjustments to the mine ventilation system to assist in effecting a fire fighting strategy and assist evacuation of underground personnel were delayed until the Ventilation Officer reported to site and was able to assess proposals. Once on site (13:35), the Ventilation Officer was sequentially involved in: assessment of options to short-circuit products of combustion from the fire directly to return (i.e. leave personnel evacuating in fresh air); assessment of gas concentrations from the

tube bundle system (diluted drift fire products) and main fan real time sensors (with limited support from Duty Card 1.3, Gas Sampling and Monitoring, due to self-confessed limited knowledge of gas monitoring systems); risk assessment for short-circuiting of ventilation (which incorporated much discussion on how to analyse products of combustion at the drift and the best way to fight the drift fire, including use of Turbex/high expansion foam, water pouring down drift, use of GAG – this wasn't the brief for the risk assessment and reduced the expediency of the risk assessment process); planning for effective GAG jet product use (in conjunction with QMRS GAG representative); and modelling of GAG product introduction and changes required for ventilation system to effectively use GAG products to extinguish the fire.

The Ventilation Officer was called upon to discuss strategies as part of the IMT, Planning Team, independent of the Planning Coordinator and in conjunction with the Planning Coordinator, and in numerous informal meetings.

It is worth noting that quite separate to the exercise, an area of Cook Colliery (the M4 panel in the Argo seam) had recently been sealed prior to the exercise and was trending through the explosive range at the time of the exercise, assessed as a Level 1 condition according to Cook Colliery's Sealed Goaf TARP. This fact was given little consideration throughout the day.

What worked well

- Use of printing/electronic whiteboards for single, clear message
- In fullness of time, all logical fire fighting options had been considered.
- Gas chromatograph operation was of a high standard in line with training.
- The surface controller realised that tube bundle and realtime gas monitoring was compromised.
- The surface controller did well to manage the situation given that he did not have enough personnel to assign the duty cards to.
- The Surface Controller maintained self control throughout the exercise.
- There was minimal unnecessary communications out of the control room.
- Non-verbal communications between the control room and the underground personnel was effective prior to the underground communication system being destroyed.

Points for consideration

- Consider integrating critical ventilation functions into duty card system, including how ventilation analysis is managed through relevant coordinator (e.g. Planning Coordinator) for input into IMT decisions, and who is competent to handle Duty Card 1.3 (Gas Sampling and Monitoring) and any critical ventilation functions (especially in the absence of the statutory ventilation officer).
- Ventilation Officer (or person charged with monitoring and assessing the underground ventilation system and environment) needs to be afforded

appropriate time and resources to assess, analyse and consider ventilation and monitoring systems.

- The time taken to recognise the fire situation in the intake drift significantly reduced the ability of the operation to quickly and effectively extinguish the fire and recover people underground. This should be a major consideration driving considerations of improvements for real time and tube bundle monitoring.
- There was no evidence to suggest anyone except the Surface Coordinator recognised that the tube bundle system and real time CO sensors were reading at full scale value, which in reality is indicating that the values returned are at least full scale, and potentially much higher. The true values read at these locations could only on site be confirmed through gas chromatograph analysis. The gas chromatograph was not used until some 3 hours after over range readings were presented to real time and tube bundle systems, and then a routine GC analysis regime was not implemented. As such, the ability to trend progression of fire through products reporting up intake drift (flow reversal) and through the main fans was largely lost.
- As the true gas concentrations presented by the fire were not recognised, the emergency response remained oblivious to a potentially explosive atmosphere presented through recirculation of products. While this was not present in this emergency exercise, this is a real possibility with an intense fire and is obviously a principal hazard.
- Ventilation Officer (or person charged with monitoring and assessing the underground ventilation system and environment) needs to be afforded appropriate time and resources to assess, analyse and consider ventilation and monitoring systems. VO in situations like this is not the appropriate person to be facilitating risk assessments and directing operations when the VO hasn't been afforded the time to understand how the ventilation system and gas concentrations are behaving.
- Quality segregation VCDs maximises benefits of having two separated air intakes for the operation.
- Greater use of printing/electronic whiteboards or proforma action plans/risk assessments to be printed and distributed to all appropriate people for single, clear message to be conveyed.
- Differences in pressure/flow readings locally at the main fans against readings in the lamproom area were significant and would lead to confusion. Best to eliminate these differences or mark clearly at local readings if readings are sufficiently accurate.
- Much time was spent on considering how the products from the GAG jet could be used to appropriately fight the drift fire. Most of these considerations could be managed well before any emergency, leaving discussions in effecting an emergency response only to tailoring the solution for the particular incident. In particular, the operating characteristics of the GAG jet should be well known to the person managing ventilation functions in an emergency.
- The Incident Management Team and overall emergency response would likely have benefited from some additional discipline in the IMT such as: setting of

time frames for report back and conducting subsequent IMT meetings; clear objectives for the various coordinators; use of written forms distributed to coordinators and other relevant people for clear, consistent messages across the IMT; clear delineation in areas of responsibility between different IMT team members.

- With the exercise scenario presented, no consideration was given to the sealed area status.
- All information for Surface Controller to do his job be available in the control room.
- The realtime gas monitoring system must display visual and sound audible indication of gas alarms.
- The Surface Controller had to constantly leave the control room for various tasks, i.e. assigning duty cards.
- The Surface Controller was lucky to have a person on light duties in the control room to take on the communication duty card.
- Have suitability trained personnel for the allocation of all the duty cards i.e. gas monitoring and first aid. The gas monitoring duty card was given to someone with no experience at 1:55 pm (almost 3 hours delay).
- Scribe required for the control room – notes taken by Surface Controller were sparse due to elevated workload during the incident.
- The gas readings for the tube bundle system and realtime system were off scale and but unfortunately this data was generally believed.
- Separate the mines services, i.e. separate communication – phone and DAC, separate gas monitoring – realtime and tube bundle gas monitoring
- The stench gas not smelt by all personnel underground

Recommendations – Mine

- Review managing risks associated with key infrastructure running through the single mine entry (as with the intake drift): use of fire suppression systems or other effective fire fighting technologies in drift, redundancy in communications/gas monitoring systems.
- Integrate critical ventilation functions into duty card system, including how ventilation analysis is managed through relevant coordinator (e.g. Planning Coordinator) for input into IMT decisions, and who is competent to handle duty card 1.3 (Gas Sampling and Monitoring) and any critical ventilation functions (especially in the absence of the statutory ventilation officer or in the event of a prolonged emergency).
- Review emergency response system for system improvements in the areas of: setting of time frames for report back and conducting subsequent IMT meetings; clear objectives for the various coordinators; use of written forms distributed to coordinators and other relevant people for clear, consistent messages across the IMT; clear delineation in areas of responsibility between

different IMT team members.

- Provide the surface controller with the information and resources required to effectively discharge their duty card obligations, including requirement to stay in the control room in an emergency. All information required can be brought back to the control room.
- Fan information should be relocated or displayed inside the control room; this would save the Surface Controller having to leave the control room to check the fan readings.
- The realtime gas monitoring system's alarms be activated.
- Investigate and implement changes so the Surface Controller can remain in the control room during an incident as per his duty card.
- Suitably trained/experienced personnel to be available as a backup controller.
- Assign a scribe to the control room during incidents.
- Off-scale gas readings need to be identified early in the incident and be analysed by a gas chromatograph.
- Improved briefing of oncoming Control Room Operator.
- Screen external calls coming into control room during an incident i.e. media.
- Have suitability trained personnel for the allocation of all the duty cards i.e. gas monitoring and first aid.
- Investigate and implement the use of a bore hole to get the dupline and phone underground i.e. separate the 2 services so both systems can not be so easily destroyed.
- The release of the stench gas needs to be on a duty card and released immediately upon the decision to evacuate the mine.
- Investigate and ensure that a stench gas release will be circulated throughout the mine at sufficient concentration for everyone underground to smell it.
- Separate the mines services, i.e. separate communication – phone and DAC, separate gas monitoring – realtime and tube bundle gas monitoring.

Recommendations – Industry

- Ensure critical ventilation control activities are captured in a duty card.
- Consider backup for statutory ventilation officer.
- Mine monitoring systems should incorporate ability to notify when sensors are in fault and over-range. All mine personnel involved with gas monitoring systems must be able to identify where sensors are over-range.
- Emergency response/TARPs for gas monitoring to consider appropriate analysis actions (e.g. bag sampling, GC analysis) when sensors/analysers are recording gas concentrations over-range.
- Review individual mine use of automated call out/text message/e-mail systems and diversion of unnecessary external calls to reduce workloads on control

room operators/surface coordinators during an emergency response.

- Promote understanding and pre-emergency planning on use of inertisation options for sites in the case of mine fires or spontaneous combustion events. QMRS already have audit sheets to check sites for ability to deploy GAG jet, but there is further room for sites to consider, in partnership with QMRS, how the gas products of the GAG jet (and other organisations, such as Air Liquide with the floxal units) can effectively be used. This includes, as a minimum, promotion of operating characteristics (pressures/flows characteristics, gas concentration of product) of inertisation units (including limits beyond which the unit cannot operate effectively) and how the units can be incorporated into ventilation modelling packages. A precompiled site specific method of GAG operation to maximise ventilation control should be compiled. This information could be added to ventilation officer courses.
- Review effectiveness of segregation of primary escapeways from other roadways for effectiveness in different emergency scenarios presented, and take action to provide appropriate segregation in line with risks present.
- Information required for Mines Rescue to consider appropriate responses can be streamlined with the effective use of guidelines and checklists, preventing unnecessary communication and use of time once QMRS representatives arrive on site. This applies equally for Mines Rescue teams and GAG jet deployment.
- Have whiteboards throughout the mine i.e. In the event of an incident, the miners can leave a running commentary on their plan of escape, progress, their next milestone on the way out of the mine, why certain decision were made etc.
- Develop a remote foam deployment system for fire suppression in high risk areas of the mine i.e. the drift. The remote foam deployment system could be placed at say 100m intervals down the drift and be activated from the control room in the event of a fire in the drift etc.
- All mines should modify their emergency response plans to contact the Queensland Mines Inspectorate via the emergency number 07 3237 1696. This means that the Queensland Mines Inspectorate emergency response can start immediately.
- Off-scale readings on the tube bundle should trigger immediate bag sample collection. There was slow response in obtaining and analysing bag samples.
- Consider research into “text messaging” possibilities for underground phones.
- Awareness of maximum concentrations that can be measured on mine monitoring systems.
- Use a ‘mass callout system’ for contacting mine personnel in an emergency situation.
- Separate the mines services, i.e. separate communication – phone and DAC and separate gas monitoring.
- Review MDG 1029 – Guidelines for Agency Coordination during Body

Recovery at NSW mines

- Separate the mines services, i.e. separate communication – phone and DAC, separate gas monitoring – realtime and tube bundle gas monitoring.

Recommendation for the Level 1 Team

- Have camera with good microphone in control room
- Have food for the miners that escape from the mine (and have left their crib underground).
- If the gas monitoring simulation is going to use the mines infrastructure i.e. network, printers, email, etc, then install all computer equipment at least a week prior to the event so there is minimal setup time required. By installing the simulation equipment early, it reduces the risk of network access problems i.e. networking problems, account login, installing printers etc.

Exercise Element Mines Rescue

Assessor(s) Grant Whitbourn and Greg Dalliston

The mine communication officer worked well and used the callout sheets from the duty cards; there was no check on who was actually called when.

This lead to a delay in the QMRS emergency number being activated. This was 1 hour 15 minutes after the initial incident initiation.

Excluding this delay, once QMRS were called out the response was timely and 3 teams arrived at the mine. A list was available of 28 other brigadesmen who were on standby to attend.

Mines rescue brigadesmen arrived and started readying their equipment. This was done efficiently and professionally. When the preparation was completed, the teams did not appear to have direction.

While there were a number of team captains amongst the brigadesmen, in the absence of QMRS officers there was no defined leadership once equipment was prepared.

This included taking all prepared BG4s, minimum equipment and other gear to muster area which at that time had the potential to be affected by the pollutants from the M&M drift fire.

There were very few briefings provided to update the brigadesmen. Team members found mine plans and those with knowledge of the mine shared this information, including the mine layout and ventilation system with other team members prior to QMRS Officer 1's briefing.

Only 1 QMRS station officer attended for the majority of the exercise with 2 others arriving approximately 5 hours 20 minutes after activation of QMRS emergency number. This was 40 minutes after teams were deployed underground. (These officers responded from leave.)

It appears that team captains are not trained in the roles that are normally undertaken by QMRS officers. When these officers have not arrived at a mine there is no process to assist the captains or other brigadesmen to undertake these roles and thus provide leadership and direction.

A lot of time could be saved if persons coming out of the mine are tracked to ensure all persons with potential information are debriefed, information is gathered efficiently and effectively, and passed on to IMT and QMRS.

When asked to participate in risk management processes, the QMRS members provided good input.

The fact that a goaf area was recently sealed and was currently sitting in the explosive range was not heard to be raised or considered in any information when considering a fire in the mine and persons to be deployed underground. Recent changes to the mine's conditions should be reported to QMRS officers.

The detail to risk management processes held up the time for response by QMRS teams. Mine having risk assessments conducted and documented by their workforce for the potential emergency situations identified at the mine.

The FAB was set up at the surface near the winder for the downcast shaft and this caused two issues. One being the wire had to be run down the shaft and secondly, with only one roll of aerial cable available, it limited the distance that the team could travel because of running out of line.

QMRS should ensure that brigadesmen are familiar with the types of SCSRs that are used at the mines in (as a minimum) their mutual response areas.

What worked well

- QMRS brigadesmen responded in a timely manner once called out.
- 3 teams responded and 28 other brigadesmen were contacted and available for response.
- Preparation of suits and minimum equipment by brigadesmen who were first to arrive was well done.
- When asked to assist QMRS personnel added value to risk management processes.
- Fresh Air Bases (FAB) were set up to a good standard.
- Teams deployed followed the requirements set by QMRS for deployment in irrespirable atmosphere.
- Search and rescue was well done and in a timely manner.
- Communications to and from FAB were clear precise and repeated back.
- Once requested the GAG was transported in a timely manner and setup was done within 1 hour of arrival on site.
- Protocols for connecting the GAG in low visibility and contaminated atmospheres.

Points for consideration

- Call out of QMRS should be given priority when incidents could utilise their expertise to enable a timely rescue of persons.
- Any major changes in underground conditions including recent sealing of goaf should be passed on to QMRS on arrival.
- FAB positions should be positioned to consider potential hazards of incident and to maximise time under O2 as well as distance for communications.
- QMRS should consider using experienced brigadesmen to fill in for QMRS officers in key positions for coordinating surface operations until officers can attend as once equipment was prepared teams lacked leadership until briefing and deployment were undertaken.
- Rescue station should be better utilised and be the place that rescue teams assemble and are deployed from. All suits and equipment were taken to mines muster area/ lamproom and cluttered this area.
- Briefing of QMRS personnel was very infrequent and lead to members seeking information from varied sources until given briefing just before deployment.
- Requirement to do detailed risk assessments from scratch hindered the timely deployment of teams to conduct search and rescue operations.

Recommendations – Mine

Mine should review their duty cards especially in the area of call out for QMRS to ensure they are activated in a more timely manner in the event of a similar type event to the fire in the exercise.

The importance given to the debrief of persons after they have evacuated the mine in the case of an incident and this should consider the tracking of persons after exiting the mine to ensure timely debriefs. Training in debriefing be reviewed to ensure that it considers well being of persons and what is recording of information to determine critical info.

Mine should ensure that potential emergencies are identified and risk assessments conducted with potential controls /actions developed for those to assist in the timeliness of response.

Recommendations – Industry

QMRS should ensure that brigadesmen are made aware of the types of SCSRs in use at the mine at which they respond and the donning requirements for those types prior to being deployed.

QMRS should review their procedures for assisting team captains or brigadesmen to be able to undertake functions usually performed by QMRS officers. This could be by development of duty cards for these functions or by training of some brigadesmen in these competencies.

QMRS need to ensure that they have a system for identification of members being

oxy time proficient and ensuring that those requested to respond to an incident are proficient or are called out to undertake specific duties.

The process being undertaken by QMRS (currently in draft) to develop a system for ensuring that information required by mines in emergency incidents and contained somewhere in their systems to assist in more timely identification of conditions be finalised as soon as possible, and implemented at all underground mines.

Mine must ensure that potential emergencies are identified and risk assessments conducted with potential controls /actions developed for those to assist in the timeliness of response including that by QMRS.

Information required for Mines Rescue to consider appropriate responses can be streamlined with the effective use of guidelines and checklists, preventing unnecessary communication and use of time once QMRS representatives arrive on site. This applies equally for Mines Rescue teams and GAG jet deployment.

Exercise Element Emergency Winder - GAG Mobilisation

Assessor(s) Doug White

The winder developed an electrical fault (imaginary) which delayed the transport during the initial stages of the evacuation.

The winder operator, a qualified electrician, tried to rectify the problem but realised that he needed further assistance from the electrical shift supervisor. Help was a long time coming as the electrical supervisor was in control of a duty card. Eventually the winder was repaired and the evacuation of men began.

The transport of men out of the mine via the emergency shaft was conducted in a timely and efficient manner.

All protocols were followed precisely (the names of all persons were recorded and signed for) and the level of communication between the escaping men and the winder operator was good. The cage was used twice to transport injured people in stretchers, successfully on both occasions.

The GAG crew and the GAG arrived at 18:58.

The GAG operation was conducted in a timely and efficient manner.

The GAG was set up and ready to run in 57 minutes.

What worked well

- Communication between shaft top and bottom is unaffected by events in other parts of the mine.
- Good communications between the top and bottom of the escape shaft.
- Good accounting process for men at top of shaft as they come out.
- GAG was set up in a timely manner.

Points for consideration

- More urgency could have been afforded to the electrical problem at the winder. The supervising electrician was tied up with a duty card.
- Question the location of the GAG docking station. In a real life scenario with a fire of the intensity of that for the exercise, there is a high probability that the area where the GAG docks could be inundated with smoke.
- QMRS should consider if some of the manual handling needed to connect the flexible joiner to the docking station can be engineered out.
- QMRS should revisit access at the rear end of the GAG transporter.

Recommendations – Mine

- The mine should consider if the current location for the GAG docking station is the most effective location for all possible circumstances.

Recommendations – Industry

- Ensure standardised fittings are available to connect GAG to water outlets etc.
- Extend the department audit to include the GAG equipment.
- Review the QME audit tools used for QMRS to ensure that it adequately covers all QMRS processes including deployment and operation activities for rescue and GAG.

Exercise Element Control Room

Assessor(s) Tilman Rasche

It was not apparent what rationale, process or TARP was used to 'call an emergency'.

The large box located in the adjacent room to the control room containing all Duty Cards was accessed straight away by the Control Room Operator (CRO). Several duty cards were handed out while others remained in the box, given the lack of people that could have taken on those duty card responsibilities in the first instance. It was not clear to the CRO in what order/priority the duty cards should be issued.

The CRO initially used several loose sheets of paper to record an 'event log', later on he started using a bound note book to record the events of the day. It was not observed that any pre-printed sheets prompting for information were used other than a recording sheet capturing non verbal communication with the crews underground. It appeared that there was only one copy of that sheet available which resulted in the CRO re-using an already completed sheet causing confusion over injury status etc underground.

As other people arrived on site the CRO was able to issue further duty cards,

however some remained unissued until several hours into the exercise.

Good cooperation of those in and around the control room was observed throughout the exercise, the calm and focussed response by all personnel in that location is commended.

Gate security was established quickly and there was positive communication between the security gate controller and the CRO ensuring only required people were allowed to enter the site.

Also the CRO personally checked with the security person on several occasions as to who the status of crew personnel on site.

During the shift, the CRO checked the tag board on a number of occasions – he noted some concern over one person's tag and that person's potential location but appeared not to confirm the person's actual location.

Also as workers emerged from underground, there appeared to be some lag between people updating the tag board.

There appeared to be little communications between the IMT and the CRO, and people arriving on site and the CRO.

On arrival of the night shift CRO, a handover was conducted using the dayshift CRO's notes.

The presence of a person on light duty in the control room assisted the CRO with phone/communications duties; using a duty card that person was able to assume the role of communications officer as soon as the emergency had started.

What worked well

- The CRO remained calm throughout the exercise.
- Duty cards readily available.
- 'Accidental' presence of a person on light duties helped in coordinating communications using duty card.
- The CRO kept notes throughout the exercise which he used in the handover to the oncoming nightshift CRO.
- CRO maintained good control over people coming to site.
- CRO and gate security person checked several times during the day of who was on site and who had left to get accurate status of personnel on site.

Points for consideration

- Given the lack of people initially on site, the CRO was not able to deploy all duty cards.
- Also, it appeared that it was not clear to the CRO which duty cards he should have issued as a priority.
- Apparent little communication between IMT and CRO, considerable walking distance between IMT and control room.

- Non-verbal communications recording sheet was used to record several comms events leading to confusion by CRO, also the info not relayed to IMT.
- CRO had to leave the control room several times to get mine ventilation readings.

Recommendations - Mine

- Suitably trained/experienced personnel to be available as backup controller.
- Very little bench space in control room.
- Label/store/retrieve duty cards by priority order.

Exercise Element — Setup of GAG Inertisation Truck and Unit

Assessor(s) — Tilman Rasche

Arrival and setting up of the GAG intertisation truck and unit was observed.

What worked well?

- There is sufficient manoeuvring space to position GAG truck.
- Area around GAG was cordoned off quickly.
- Set up of GAG achieved in 1 hour's time 'ready to fire'.

Points for consideration

- Area lighting around GAG connection point could be improved.
- GAG truck compressor/generator is extremely noisy making verbal communications difficult.
- All personnel to be issued with helmet mounted lights, when working in low light conditions, and to raise visibility.
- Better access steps on back of semitrailer are required to make connection of the GAG outlet safer and easier.
- Connection of vent tube to back of GAG was observed to be difficult – there are no handles on either end of the vent tube or supports to hold tube in place while tube being connected.

Recommendations - Mine

- Area lighting around GAG connection point should be installed.
- Current GAG connection point is very close to portal – there is potential engulfment of GAG crew by smoke etc.

Recommendations - Industry

- Consider good area lighting around any GAG connection point, and manoeuvring space to position GAG truck.

Exercise Element **Interaction with Media**

Assessor(s) **Michael O'Meara, Acting Media Manager, Queensland Mines and Energy**

What worked well

The safety and personnel manager arrived at the ‘low water mark’ when those taking media calls at the colliery - the control room operators - were clearly absorbed by the exercise and did not wish to deal with media.

That said, the safety and personnel manager acted quickly and put in place procedures to handle the media with updates at a regular basis.

From the time of her arrival just before 2pm until the close of the exercise around 8pm, I was provided with regular updates or called if there was a change due to other circumstances. The Safety and Personnel Managers level head was evident and showed the person was clearly in control of her area of discipline.

Points for consideration

- There was the initial period of the clamp on information followed by the release of measured information once the right people were in place.
- The men in the control room, in the first instance from 12.35 to 12.50ish, made the fatal mistake of saying "nothing” or “not much is happening."
- There needed to be an ability to at least make the initial response of ‘yes there is an incident’ and ‘details are still being assembled’ and ‘I will get someone back to you with more detail soon’.

Recommendations - Mine

- Additional phone lines/ numbers would be advantageous to cope with external calls such as inquiries from the media.

Recommendations - Industry

- Updates on a regular basis should be made available during an emergency event.

Conclusions

This year's exercise was a challenge for all of the services required to contain and manage a major onsite emergency. The layout of Cook Colliery presented a number of challenges not present in most of the newer longwall mines in the Bowen Basin.

All of the mine personnel and emergency services employed on the day acquitted themselves well but as usual with these exercises there are areas where improvements can be made!

Proficiency in the wearing of self rescuers remains a major issue which industry needs to address through more regular effective training (or perhaps more frequent self rescuer training should be legislated?).

Emergency response and management systems need to be as streamlined as much as possible and not burden key people with too many responsibilities (surface controller was responsible for six duty cards at the start of the exercise). Also consideration should be given to what key personnel hold duty cards (evacuation from the mine was delayed because the electrical supervisor was tied up with a duty card).

Time taken to recover the missing person (6.5 hrs) could have been considerably reduced if a generic risk profile for major incidents had been in place that could be reviewed in the case of an event, instead of conducting risk assessments from scratch.

Communications between rescue members and supervisors broke down at times and resulted in some confusion. Similar occurrences could be avoided if QMRS was to consider management training for some of their rescue captains.

All underground coal mines should consider the recommendations in this report and identify areas for improvement at their mine.

Douglas H.K. White

Deputy Chief Inspector of Mines (Coal)

Chairman Level 1 Organising Committee 2009

Recommendations

Mine

Recommendations - Mine

- Establish first aid station including stretcher at downcast shaft pit bottom (Mine).
- Mine consider location of emergency services (e.g. at bottom of downcast shaft) i.e. water, compressed air, communications, gas monitoring etc.
- Area lighting at downcast shaft.
- Consider repositioning of phone in the winder house due to noise from winder engine.
- Communicate to all coal mine workers on level 1 exercise outcomes and recommendations.
- Room for improvement regarding signage for primary and secondary egress, directional indicators, lifeline standards.
- Housekeeping standards and rib spall in the egress walkways require improvement.
- Install lifelines to face areas. Ensure the same standard of lifeline is achieved throughout the mine.
- Test the effectiveness of the PED system and understand its area limitations.
- Include code of signals for none verbal communication and horn in caches.
- Improve egress and cache signage.
- Standardise cache set up.
- Improve housekeeping on egress routes.
- Change communication board in caches from being fixed to being portable.
- Standard question set/guide for any person manning the telephones in the control room to ensure that correct responses are recorded and communicated.
- Produce standard telephone listings for all required resources.
- Disciplined approach to implementing and controlling MEMS activities in all groups/areas.
- Improve the integrity of segregated intake stoppings and doors.
- Consider CABA self escape system.
- Improved signposting.
- Standards to be developed for construction of lifelines plus extend lifelines closer to face and crib rooms.

- Improved treatment of sealed areas.
- Risk assessments seemed to take a long time to get organised, also when they interviewed the deputy from the M1 panel they asked 3 questions. I am sure he could have given them more information if he was asked.
- Industry/ or Cook Colliery should look at lifelines all the way out of the pit. Cook Colliery should look at doing some training with rescuers.
- Training to include communications protocol by U/G personnel.
- Clarify TARPs in terms of smoke or CO make/ percentages.
- Information to U/G needs to be concise but accurate – appreciate difficulties in the scenario – but morale issues without information.
- Review managing risks associated with key infrastructure running through the single mine entry (as with the intake drift): use of fire suppression systems or other effective fire fighting technologies in drift, redundancy in communications/gas monitoring systems.
- Provision of basic instructions / basic requirements of the duty card to provide the incumbent with direction as to requirements for QMRS members, members of staff, etc – required / anticipated response to an emergency situation.
- Provision of a 'call centre' for on–site enquiries regarding status / advice / direction etc.
- Provision of a number recognition telephone for the main comms function in order to provide a degree of call screening.
- Review radio communications in the control room and possibly provide greater control and definition in this area. Possibly separate the function to the site controller.
- Provide a system of regular review of information incorporated / referenced in the duty card packs - telephone numbers, personnel, etc.
- Incident initiation process needs to be recorded.
- Use of written incident action plans to communicate status reports and key information rather than rely on memory. This would assist in briefing personnel, e.g. for changeovers. This would also enable follow through of agreed actions and allocation of responsibilities.
- Delegation of development of fire fighting plan development at an earlier stage to planning group, allow ops etc to focus on rescue – evacuation.
- Increase site awareness of mines rescue guidelines.
- Investigate potential for higher level of support from other mines and Mines Rescue Service – especially for relief of key personnel if the incident became protracted.
- Consider a more structured approach to IMT process – schedule meetings, use incident action plans, as would be demonstrated within the MEMS system.

- Initial use of whiteboard to display status should be maintained with structure – e.g. gas monitoring, personnel ug, actions in process as is used within the MEMS system
- Copy of debrief information should be logged into the IMT and readily accessible as is used within the MEMS system.
- Mine should review emergency response plan and associated documentation in light of exercise to optimise operation. For example some “official” forms and processes not used. In addition the designated functionality of key roles should be reviewed in light of the experience obtained during the incident.
- Duty cards should be reviewed in light of the experience of exercise to ensure that they provide practical advice to assist in the effective completion of the roles.
- The role of scribes and associated responsibilities should be defined. If scribes are an integral part of the IMT process then they must be available at all times as is outlined within the MEMS system.
- Improve system for tracking location of personnel underground.
- Process for delivering regular updates on status of incident should be developed as is with MEMS.
- Improved training in gas monitoring and recognition of limits of monitoring system.
- Mine to investigate counselling service process - supposed to be always available, was in fact an answering machine and no response was received during exercise.
- Mine to include external contacts in communications duty card including priority of call out and need to report responses to calls in a timely manner.
- Review managing risks associated with key infrastructure running through the single mine entry (as with the intake drift): use of fire suppression systems or other effective fire fighting technologies in drift, redundancy in communications/gas monitoring systems.
- Integrate critical ventilation functions into duty card system, including how ventilation analysis is managed through relevant coordinator (e.g. planning coordinator) for input into IMT decisions, and who is competent to handle Duty Card 1.3 (Gas Sampling and Monitoring) and any critical ventilation functions (especially in the absence of the statutory ventilation officer or in the event of a prolonged emergency).
- Review emergency response system for system improvements in the areas of: setting of time frames for report back and conducting subsequent IMT meetings; clear objectives for the various coordinators; use of written forms distributed to coordinators and other relevant people for clear, consistent messages across the IMT; clear delineation in areas of responsibility between different IMT team members and model as is the MEMS systems.
- Provide the surface controller with the information and resources required to effectively discharge their duty card obligations, including requirement to stay

in the control room in an emergency. All information required can be brought back to the control room.

- Fan information should be relocated or displayed inside the control room; this would save the surface controller having to leave the control room to check the fan readings.
- The realtime gas monitoring system's alarms be activated.
- Investigate and implement changes so the surface controller can remain in the control room during an incident as per his duty card.
- Suitably trained/experienced personnel to be available as a backup controller.
- Assign a scribe to the control room during incidents.
- Off-scale gas readings need to be identified early in the incident and be analysed by a gas chromatograph.
- Improved briefing of oncoming control room operator.
- Screen external calls coming into control room during an incident i.e. media.
- Have suitability trained personnel for the allocation of all the duty cards i.e. gas monitoring and first aid.
- Investigate and implement the use of a bore hole to get the dupline and phone underground i.e. separate the 2 services so both systems can not be so easily destroyed.
- The release of the stench gas needs to be on a duty card and released immediately upon the decision to evacuate the mine.
- Investigate and ensure that a stench gas release will be circulated throughout the mine at sufficient concentration for everyone underground to smell it.
- Separate the mines services, i.e. separate communication – phone and DAC, separate gas monitoring – realtime and tube bundle gas monitoring.
- Mine should review their duty cards especially in the area of call out for QMRS to ensure they are activated in a more timely manner in the event of a similar type event to the fire in the exercise.
- The importance given to the debrief of persons after they have evacuated the mine in the case of an incident and this should consider the tracking of persons after exiting the mine to ensure timely debriefs. Training in debriefing be reviewed to ensure that it considers wellbeing of persons and what is recording of information to determine critical info.
- Mine should ensure that potential emergencies are identified and risk assessments conducted with potential controls /actions developed for those to assist in the timeliness of response.
- The mine should consider if the current location for the GAG docking station is the most effective location for all possible circumstances.
- Suitably trained/experienced personnel to be available as backup controller.

- Very little bench space in control room.
- Label/store/retrieve duty cards by priority order.
- Area lighting around GAG connection point should be installed.
- Current GAG connection point is very close to portal - there is potential engulfment of the GAG crew by smoke etc.
- Additional phone lines/ numbers would be advantageous to cope with external calls such as inquiries from the media.

Industry

Recommendations - Industry

- Each mine demonstrates where they have redundancy in the provision of mine services.
- Immediately debrief of personnel evacuated from underground, may have vital information on personnel missing and underground status.
- Effective PED tracker system, to indicate locations of underground personnel.
- Mines to respond to DME indicating whether they action level 1 exercise recommendations.
- Mines to undertake risk management process to identify the reasonable distances between cache stations, including and based on walk out trails wearing mines SCSRs to accommodate various levels of fitness etc.
- Industry standard for primary and secondary escape ways, signage, directional indicators, life-line locations, what needs to be in cache station, reasonable area in cache station to conduct changeovers.
- Standard for training of coal mine workers in the donning and changeover of SCSRs in a mining environment.
- Communicate to all coal mine workers on level 1 exercise outcomes and recommendations.
- Installation of standardised lifelines on all egress routes.
- Develop, communicate and implement minimum standards for none verbal communication including codes of signals.
- Standardise cache installations - size and space, communications, segregation and air feeds.
- Personnel to be assessed on donning and changeover procedures in atmosphere that will identify failure in process.
- Mine Record Entry to all mines on recommendations and actions required to be taken.
- Mine design recognised standard for segregation, mines services, etc.

- Effective practical training in understanding the effects of oxygen deficiency or toxic atmospheres.
- Audit of the effective implementation of all external services required in an emergency to be undertaken. This includes risk assessments, SOPs etc for expedient implementation of these services when they arrive on site.
- All mines to review their principal potential emergency situations and ensure risk assessments have been developed and are available in case of emergency.
- Consideration of status of sealed areas needs to be included in the risk assessment undertaken for entry of rescue teams to the mine.
- Changing over of self rescuer units is a high risk activity and a difficult procedure in a low visibility and high stress environment. Surely someone could develop a self rescuer system where the spare oxygen unit could be quick attached to the existing mouthpiece/breathing bag/harness component, to simplify this procedure.
- Industry to engage with SCSR manufactures to develop a more effective SCSR design and develop a reliable and 'fit for purpose' escape system.
- Improved signposting.
- Standards to be developed for construction of life lines plus extend lifelines closer to face and crib rooms.
- Understanding of the current status of sealed areas so that they are considered in all risk assessments including the mines rescue risk assessment.
- Good use of two mine intakes meant that there was the availability of an U/G FAB.
- Mine monitoring systems should incorporate ability to notify when sensors are in fault and over-range.
- All mine personnel involved with gas monitoring systems must be able to identify where sensors are out of range.
- Promote understanding and pre-emergency planning on use of inertisation options for sites in the case of mine fires or spontaneous combustion events. QMRS already have audit sheets to check sites for ability to deploy GAG jet, but there is further room for sites to consider, in partnership with QMRS, how the gas products of the GAG jet (and other organisations, such as Air Liquide with the floxal units) can effectively be used. This includes, as a minimum, promotion of operating characteristics (pressures/flows characteristics, gas concentration of product) of inertisation units (including limits beyond which the unit cannot operate effectively) and how the units can be incorporated into ventilation modelling packages. This information could be added to ventilation officer courses.
- All mines should modify their emergency response plans to contact the Queensland Mines Inspectorate via the emergency number 07 3237 1696, rather than contact directly to the "local" inspector. This means that the

Queensland Mines Inspectorate emergency response can start immediately.

- Provision of basic training for some fundamental functional aspects of communication in emergency management for the general mine workforce.
- Mines inspectorate callout should be initiated via a standardised emergency cal lout number.
- QMRS should ensure that sites are provided with requirements for deployment of GAG and rescue teams.
- Ensure critical ventilation control activities are captured in a duty card.
- Consider backup for statutory ventilation officer.
- Mine monitoring systems should incorporate ability to notify when sensors are in fault and over-range. All mine personnel involved with gas monitoring systems must be able to identify where sensors are over-range.
- Emergency response/TARPs for Gas Monitoring to consider appropriate analysis actions (e.g. bag sampling, GC analysis) when sensors/analysers are recording gas concentrations over-range.
- Review individual mine use of automated call out/text message/e-mail systems and diversion of unnecessary external calls to reduce workloads on control room operators/surface coordinators during an emergency response.
- Review effectiveness of segregation of primary escapeway from other roadways for effectiveness in different emergency scenarios presented, and take action to provide appropriate segregation in line with risks present.
- Information required for Mines Rescue to consider how appropriate responses can be streamlined with the effective use of guidelines and checklists, preventing unnecessary communication and use of time once QMRS representatives arrive on site. This applies equally for Mines Rescue teams and GAG jet deployment.
- Have whiteboards throughout the mine i.e. In the event of an incident, the miners can leave a running commentary on their plan of escape, progress, their next milestone on the way out of the mine, why certain decision were made etc.
- Develop a remote foam deployment system for fire suppression in high risk areas of the mine i.e. the drift. The remote foam deployment system could be placed at say 100m intervals down the drift and be activated from the control room in the event of a fire in the drift etc.
- All mines should modify their emergency response plans to contact the Queensland Mines Inspectorate via the emergency number 07 3237 1696. This means that the Queensland Mines Inspectorate emergency response can start immediately.
- Off-scale readings on the tube bundle should trigger immediate bag sample collection. There was slow response in obtaining and analysing bag samples.
- Consider research into “text messaging” possibilities for underground phones.

- Awareness of maximum concentrations that can be measured on mine monitoring systems.
- Use a ‘mass callout system’ for contacting mine personnel in an emergency situation.
- Separate the mines services, i.e. separate communication – phone and DAC and separate gas monitoring.
- Separate the mines services, i.e. separate communication – phone and DAC, separate gas monitoring – realtime and tube bundle gas monitoring.
- QMRS should ensure that brigadesmen are made aware of the types of SCSRs in use at the mine at which they respond and the donning requirements for those types prior to being deployed.
- QMRS should ensure the team members are readly skilled and available to take on tasks, such as - sub station manager and similar duties as may be delegated by the Operational Manager mines rescue.
- QMRS need to ensure that the system for identification of members being oxy time proficient and ensuring that those requested to respond to an incident are proficient or are called out to undertake specific duties is utilised by the mine site coordinator.
- The process being undertaken by QMRS (currently in draft) to develop a system for ensuring that information required by mines in emergency incidents and contained somewhere in their systems to assist in more timely identification of conditions be finalised as soon as possible, and implemented at all underground mines.
- Mine must ensure that potential emergencies are identified and risk assessments conducted with potential controls /actions developed for those to assist in the timeliness of response including that by QMRS.
- Information required for Mines Rescue to consider appropriate responses can be streamlined with the effective use of guidelines and checklists, preventing unnecessary communication and use of time once QMRS representatives arrive on site. This applies equally for Mines Rescue teams and GAG jet deployment.
- Ensure standardised fittings are available to connect GAG to water outlets etc.
- Extend the department audit to include the GAG equipment.
- Review the QME audit tools used for QMRS to ensure that it adequately covers all QMRS processes including deployment and operation activities for rescue and GAG.
- Consider good area lighting around any GAG connection point, and manoeuvring space to position GAG truck.
- Updates on a regular basis should be made available during an emergency event as would be using the MEMS System.

- Training in donning and use of self contained self rescuers needs to be addressed as indicated by previous level 1 mine emergency exercises, and highlighted in recent forums in the United States of America. It is suggested to industry that a more regular effective competency based training regime be considered (rather than be legislated). Also that all mine workers have used a real self contained self rescuer or a training rescuer that has simulated heat and resistance capabilities.
- Such training MUST emphasize that talking whilst wearing SCSRs may be fatal in atmospheres containing noxious and toxic gases.
- It is suggested that some of the mine workers who wore real SCSRs assist in the development of a presentation for all other mine workers on-site on the experience and effects of wearing a SCSR in limited vision. (Note: This is the same recommendation as appeared in 2006 and 2007 level 1 exercise reports).
- Industry may want to consider installing “changeover” stations, or equivalent provisions where escaping mine workers can change over the self contained self rescuer in a less hazardous atmosphere, communicate with surface and also have the option of remaining in the station for a period of time.
- Whenever possible mine workers should utilise underground transport for evacuation purposes.
- The protocol by which mineworkers using SCSR’s for self escape, having reached a place of safety, can then offer first response duties – needs industry discussion and development.
- Look at improved ways of logging incoming and outgoing communications during an incident in control room.
- The collection and dissemination of information remains an issue that needs to be addressed in emergency response plans and associated documents.
- Mines should review the use of forms to ensure that they are appropriate for the designed function. Filling out unnecessary forms can take time that would be better occupied in other functions.
- All organisations should review the MEMS/ICS for application in emergency incident control. Key areas of interest are: discipline in adhering to the system, utilising but limiting the span of control (i.e. no greater than five particular resources per person), clear authority in authorising plans and actions and managing the communication flow.

The following in italics are from previous industry reports and are still valid as evidenced in this exercise-

- It is important that there is provision for communications out of the control room as all stakeholders must be kept regularly briefed on currency and status of events.

- It is recommended that IMT is to directly brief anybody being dispatched from the surface (mines rescue fresh air base personnel, transport drivers, mines rescue teams, etc) or at least be present during the briefing.
- It is recommended to allocate a person as surface coordinator to oversee all of the surface tasks, movement of personnel in and out of the mine and liaison with IMT.
- The control, allocation and updating of the deployment and availability of resources is a vital function of a coordinated emergency response and cannot be overlooked.
- It is recommended that a forum of stakeholders be urgently established to develop and implement a set of protocols covering the interactions between mine site first response teams and external aided-rescue organizations. Each of these practices provides specialist but separate skills and resources and it is vital that the issues involved in their interactions be identified and coordinated. There is little doubt that CABA teams will increasingly form part of emergency response capabilities in our industry and we must be prepared.
- There needs to be a review of the number of brigadesmen that the mine can supply at any time of the day or work roster. This could also be expanded to other mines in the mutual assistance group.
- Consideration is to be given to review the minimum number of mines rescue trainees. With most people working 12-hour shifts this effectively reduces the number of trainees available to respond by half (fatigue related policies), also with people choosing to live remote from mining areas response times/availability of trainees is prolonged.
- Protocols on how mines rescue trained personnel on-site are to be utilised should be developed. This can take into account the type of emergency, number available and specific duty card or other specialized needs.
- Process management (decision-making process, time wasting, verification of data, information flow in and out of the incident management room, briefings done on time, checking milestone events, interaction of members) remains a vital part of incident management and must always be at the forefront of the operations within the IMT.

Recommendation for the Level 1 Team

- Have camera with good microphone in control room.
- Have food for the miners that escape from the mine (and have left their crib underground).
- If the gas monitoring simulation is going to use the mines infrastructure i.e. network, printers, email, etc then install all computer equipment at least a week prior to the event so there is minimal setup time required. By installing the simulation equipment early, it reduces the risk of network access problems i.e. networking problems, account login, installing printers etc.

Appendices

Appendix A: Detailed Exercise timeline

Appendix B: Previous recommendations

Appendix C: Management team/assessors

Appendix A: Exercise timeline

Location	Event / Observation	Time	Event / Observation	Location
Control room	Belt isolated, fire has started	1107		
Surface	Call to Electrician	1110		
Control Room	Belt stopped in M&M Drift	1110		
		1135	Stopped the PJB at the diesel bay and informed the 4 personnel (3 Belt Crew and electrician) that they were in thick black smoke. One person donned the SCSR. The rescuer activated upon the mouth piece being pulled.	8CT Diesel Bay
		1140	South panel ERZC and two crew members in Cribroom. "You smell smoke" – light goggles issued and shown gas sample – 25ppm CO – casual response from crew members.	South Mains Cribroom
		1146	ERZ Controller informed of smoke entering panel and gas levels are as per his portable gas monitor, he then sets off to face to gather crew.	M2 Crib room
Control room	Main alarm going off.	1146		
Control room	Duty cards started to being distributed by CRO, Chris Mapleson accepts Duty Card 1.1.	1154		
		1155	Message from control – 4.5% CH4, 45ppm CO on Northside – No information for South Mains. South panel ERZC asked if any information required and gave local update. Told control that intention to travel outbye in vehicle and look for source of smoke.	South Mains Cribroom
Control room	CRO calling ERZC M2 panel to evacuate men ... towards pit bottom …if smoke is	1157		

Location	Event / Observation	Time	Event / Observation	Location
	encountered… to put rescuers on … asked which way to come out… travel road, caches … ERZC M2 advised to call CRO at cribroom..			
		1200	ERZC contacts CRO who informs of a fire in the main drift, ERZC informs CRO of route he will take and where changeovers will occur. All men are at crib room ERZC informs all men of situation and then calls CRO with numbers of men, 3 Bull gang, 4 miners, fitter, and ERZC.	M2 Crib room
		1203	Fire identified approximately 30m outbye of the bin, too big to fight with extinguishers and identified that closest fire box was inaccessible because of heat Outbye Hydrant tested for use	Fire Site
Control Room	Surface Controller phones Electrical Supervisor and reports that the Dupline is dead. Electrician reports that the Realtime Gas Monitoring System is dead and all gas readings are rubbish.	1205		
Control room	Tubeline out of action. Surface Shift Controller advises 2 men to enter drift and fight fire. Advice that gas readings cannot be relied on. Surface Shift Controller advises that raging fire in drift. Surface Shift Controller advises that 2 guys entering drift to fight fire. Surface Shift Controller advises CRO to call mines	1205		

Location	Event / Observation	Time	Event / Observation	Location
	rescue.			
Surface	Mechanical Supervisor gives Planning Coordinator report of severity of fire in the drift 30 metres outbye of bin	1206		
		1208	ERZC was given T15 gas readings. Men collect walking sticks, rescuers and set off outbye.	M2 Crib room
Control room	Calls Mine Manager	1209		
Control room	Duty cards handed out – Planning Coordinator and Mechanical Supervisor.	1209		
		1215	ERZC contacts CRO and informs him he has LHD operator.	M2 14 c/t Cache
		1220	South Mains crew arrive, Bull Gang Supervisor (already at pit bottom) informs crew they are in fresh air and can remove rescuers. South panel ERZC also discusses fact should be in fresh air. ERZ controller quickly accounts for all crew	D/C Shaft bottom
		1220	ERZC given T30 gas readings, he instructs men to don rescuers. 4 men don rescuers and light smoke glasses (issues with donning – activating units, bung in tube, adjustment of position), lead man also puts on light smoke glasses.	M2 6 c/t
Control Room	UMM (later Incident Controller) enters Control Room, gets status update – notices smoke – orders sentry be placed around portal and barricade off	1223		
Control Room	Second egress cage down electrically	1224		
Comms Room	OUTGOING - Call to QMRS, advice of exercise etc, confirmed	1224		

Location	Event / Observation	Time	Event / Observation	Location
	comms contact number			
Control Room	Mine Manager in Control Room, given status report, asks that portal be fenced off, stay away from it and sentry placed.	1225		
		1228	South panel ERZC rings the surface and asks if there is anything that can be done about the fire from "Down here" The deputy was very keen to tackle the problem. (His crew were less keen). The surface did not release him to go.	Downcast Shaft Bottom
		1230	MM checking duty card SC – crane being organised MM assigns Planning Coordinator, Operations Coordinator, and Logistics Coordinator.	IMT
Comms Room	INCOMING – Call form QMRS Duty officer 2 - Discussion of current situation – all out from South Mains – at cage. Unsure on north manning. Request to ascertain number of brigadesmen contacted and advise QMRS Duty officer 2.	1232		
Control Room	Drift airflow partial reversal indicated with smoke coming out of portal: smoke increasing.	1235		
		1237	Power, Water, phone, DAC, electronic monitoring, Tube bundle, compressed air in mine rendered inoperable due to fire burning through these in M&M drift	Fire Site
Control Room	1st call from Media	1238		
IMT	Update from Mechanical Supervisor returned from fire fighting. Gave update	1239		

Location	Event / Observation	Time	Event / Observation	Location
	Mechanical Supervisor assigned duty card 4 Smoke from portal getting worse. Unsure of power status. Surface worker delegated to meet crane and set up capsule quickly and safely. (Note crane not brought to site. Availability and time to mobilise to site were obtained) UMM set objectives- preservation of life. Communications will be made by written instruction signed by UMM Power off at 1240 UMM requires information on locations of personnel. Electrical supervisor advises of potential to loose communications from fire but shaft comms will not be affected. UMM asks what calls have been made. What people are underground and where they are.			
Comms Room	QMRS contact mine after emergency call centre activation	1242		
IMT	Notify DME and check inspector – checking phone list – not using emergency contact list, using DME contact list Planning Coordinator checking off shift roster to id people rather than checking tag board	1249		
		1250	ERZC contacts CRO, none verbal – tapping on the phone, frustration due to no confirmation of answers given and responses.	M2 Argo drift cache

Location	Event / Observation	Time	Event / Observation	Location
			ERZC then uses white board to communicate with crew. Changeover of rescuers for 3 persons, hesitancy in changing, and other members assisted who were not wearing rescuers. ERZC given T60 gas readings, 5 men put on dark smoke glasses and attach to lifeline. Time lost untangling lifeline and limited space in segregated cache.	
Surface – Lamp Room	Fan monitoring changed: Fan1:Q 0.0m3/s→0.0m3/s; P 71.5mmWG→71.5mm WG Fan2:Q77.0m3/s→74.5 m3/s;P 122.5mmWG→125.5m mWG Fan3:Q80.5m^3/s→79.5 m^3/s;P 120.0mmWG →123.0mmWG	1254		
Control Room	2nd media call	1300		
IMT	Incident Controller request to Planning Coordinator to get mines rescue to organise GAG	1302		
Control Room	3rd media call	1305		
		1308	Men begin to board first cage	Downcast Shaft Bottom
IMT	Discussing with Planning Coordinator Logistics Coordinator re short circuiting of contaminants, opening doors VO not yet on site, others lack confidence to make any analysis of ventilation related issues. Planning Coordinator tasked to develop vent model	1315		

Location	Event / Observation	Time	Event / Observation	Location
	with impacts of GAG and turning fans off- not confident he could do that need to wait for VO. Some confusion as to who has DC 4 and who has DC 5.			
Control Room	4th media call	1325		
		1328	Men pick up installed lifeline and significantly increase walking speed.	M2 Track end area 1 NE
		1332	5 Metres inbye of 16 c/t man goes down with CO poisoning, men unsure how to deal with him due to none verbal communication issues. No vital signs taken, men pick him up and carry him to 16 c/t cache.	M2 16 c/t Cache 1 NE
		1334	M2 ERZC contacts CRO, none verbal – pressing buttons on the phone frustration due to no confirmation of answers given and responses (Unaware where ERZC is phoning from etc). Instructed by CRO to exit mine via 2nd egress. ERZC sits crew down and informs them utilising whiteboard marker and rear of egress plan, this includes route to be taken and decision to leave casualty.	M2 16 c/t Cache 1 NE
Planning	Discussion Ventilation Officer, Planning Coordinator, Incident Controller regarding tube bundle lines in drift and current readings (all equal). Incident Controller notes that this isn't possible for all tubes to read identically. Planning Coordinator identifies that tubes may have melted open.	1337		

Location	Event / Observation	Time	Event / Observation	Location
	Incident Controller requests Ventilation Officer to "take time to absorb what you're being told". Incident Controller leaves. Ventilation Officer and Planning Coordinator discuss options available to divert contaminants from evacuating M2 crew (noting M2 crew's location is not known, but assumed to be 2NE panel or inbye).			
IMT	DME Rockhampton Inspector onsite Incident Controller briefs Inspector from memory - does not use his notes	1343		
Control Room	2nd mines rescue crew of 18 persons expected in about an hour.	1355		
Control Room	5th media call - Media making contact with Safety and Health manager	1355		
Control Room	Call to CQ Rescue helicopter Mackay putting them on standby. Exercise only advice given at start and end of message. (Communications Officer was diligent on this at all subsequent stand by messages to external providers).	1358		
IMT	Mines Inspector – pushing to identify where other people are and fire fighting options.	1400		
IMT	Mines rescue Team has left Blackwater 20 minute ETA	1402		
		1410	Man wearing changeover rescuer finds unit is at end of cycle.	M2 NE Return
		1410	Man wearing original	M2 NE

Location	Event / Observation	Time	Event / Observation	Location
			rescuer finds unit is at end of cycle.	Return
		1411	Passing from return to intake, lead man struggles with door to intake (different to others). Man injures left ankle – broken/dislocated (exercise) on debris and pipes at intake.	M2 Bottom downcast shaft
IMT	Qld Mines Rescue Service Active Operations Manager now present and briefed. Incident Controller invites Ventilation Officer to discuss options to short-circuit air to advantage M2 crew evacuation. Ventilation Officer reviews modelling results and short-circuiting strategy: Mines Rescue crews enter mine through downcast shaft Mines Rescue crew open 1NE 11c/t machine doors. Mines Rescue crews assist M2 crews to evacuate. Low flows inbye 1NE 11c/t as a result, and smoke will still go through inbye 1NE 11c/t Qld Mines Rescue Service Active Operations Manager asks about any boreholes that can be used for gas analysis, or availability of results from sensors. Ventilation Officer identifies Mines Rescue can set up FAB at base of downcast shaft due to	1411		

Location	Event / Observation	Time	Event / Observation	Location
	fresh air intake. Qld Mines Rescue Service Active Operations Manager wants gas concentration readings inbye drift fire. Ventilation Officer briefly discusses option to apply Turbex/high expansion foam at the drift. No further comments on this option. Logistics Coordinator advises M2 crew is at bottom of shaft (second egress cage) – 10 men, 1 with broken ankle, still missing 4 crew). Someone has been left at 16c/t 1NE. Ventilation Officer asks if deputy is in crew. Incident Controller notes priority to get crew out ASAP and debrief. Ventilation Officer identifies 1200m tube bundle line available in store to set up monitoring for underground.			
IMT Room	Information received – about M2 crew – 10 in pit bottom, one with broken ankle and 4 unaccounted for. VO wanting to sample in pit bottom.	1417		
		1425	6 men out of pit, no stretcher available.	M2 Top downcast shaft
Debriefing Room	Mines Inspector observed debriefs being carried out on individuals from South Mains by tradesman using template. Rang District Inspector	1425		

Location	Event / Observation	Time	Event / Observation	Location
	and left message.			
		1430	ERZC confirms stretcher in cage	D/C Shaft bottom
Planning	Risk assessment in meeting room for short-circuiting contaminants/changing ventilation system. Options for fighting fire canvassed: running water down drift from fire hoses, using water truck from opencut operation to send large amount of water down drift. Options for monitoring products from fire canvassed: air reversed from drift sampling.	1431		
Rescue Station	Brigadesmen doing risk assessment for access to M&M drift to get gas readings Some sent to Rescue room to prep suits and minimum equipment	1433		
Planning	Fan shaft readings returned: Results given to group ("real" readings for exercise in brackets) CO – 50ppm (1980ppm); O_2 – 19.4% (20.2%); CH_4 – 0.5% (0.16%); CO_2 – 2.0% (0.47%). Not identified that CO sensor was over-range. Confusion as to whether O_2 reading given by operator at fan shaft was 29.4% or 20.4% - no efforts made to confirm.	1445		
Rescue Station	Brigadesmen ask for briefing and QMRS Officer 1 briefed on fire in M&M drift approx 30 m outbye of bin, 3	1446		

Location	Event / Observation	Time	Event / Observation	Location
	people missing and 1 left underground by crew in known position16 c/t.			
Control Room	6th media call, first statement received. Several other statements followed during the afternoon	1455		
IMT	Risk Assessment from Planning Coordinator re gas monitoring at portal to Incident Controller for approval. Whiteboard statement signed off for approval to act upon. Incident Controller reprimanded VO and Planning Coordinator for not following instructions and going off on a tangent.	1516		
IMT	VO – Incident Controller re risk assessment re using shaft and gas concentrations at base of shaft. Incident Controller becoming tense – people should follow directions – people are changing plans outside IMT. Runner does not appear to be operating between IMT and Control Room. Deputy reported fresh air at base of shaft – retelling his story to Mines Inspector. No written report from deputy. He stated: M2 miner went down and was carried to 16 c/t about 20m. They realised he was beyond help. Used lifeline to keep men together.	1529		

Location	Event / Observation	Time	Event / Observation	Location
	Tapping system of nonverbal communications to CRO on phone did not work.			
Winder Surface	Two of the three men unaccounted for make it to surface in cage	1530		
Planning	2 from belt crew now on surface brought into risk assessment to get more information. Crew members identify that “Electrician is lost” around 8c/t 1NE (near diesel bay), around thick black smoke. QMRS Officer 1 requests plans from Ventilation Officer and asks for further information from 2 crew members as to where fresh air limits are.	1552		
Rescue	Risk assessment for setting up fresh air base at bottom of downcast shaft and search for missing mineworker,(Only 1 QMRS team member not on search) concerns from QMRS coordinator due to unknown gas makes on return side of fire, no mention of QMRS guidelines, but life at risk due to missing individual.	1600		
Control Room	Call in from mines rescue brigadesman - he is put on standby	1605		
IMT Room	Mines Inspector observed IMT team discussing Re-entry and search process.	1612		
Control Room	Results returned after two Gas Chromatograph runs and checks (“real” value for exercise in	1625		

Location	Event / Observation	Time	Event / Observation	Location
	brackets) estimated: CO: 1.3214% (1.2000%); He: 0.0000% (0.0001%); H_2: 0.6879% (1.2000%); O_2: 17.0258% (16.7000%); N_2: 78.2150% (77.0000%); CH_4: 0.4812% (0.5000%); CO_2: 2.2232% (2.4000%); C_2H_4: 0.0212% (0.0200%); C_2H_6: 0.0250% (0.0250%); Ar: 0.0000% (0.8914%).			
Muster Area	QMRS Officer 1 starts formal briefing. Task to locate the missing person. Plan to enter via downcast shaft one team on standby Prepared route of travel identified, name of person missing and his lamp number. SCSR and Lamp 68. Most recent fan and mine atmosphere readings being obtained. Smoke reported at 6c/t. There is one person reported deceased he is to be searched for and found later. Planning to address the fire by flood drift with water from hydrants. Air, water, and power are off. No idea on the mine atmosphere on inbye side of the fire. Debrief of 2 workers who came out through downcast shaft last was that it is fresh air from 6ct and heavy smoke inbye that point	1628		

Location	Event / Observation	Time	Event / Observation	Location
	Missing electrician last seen at 8c/t Search area marked on plan. Communications officer only have coms radio link to FAB. 1 Cook team brigadesman to be in team deployed underground as they know the mine. A couple of brigadesmen put their hands up and notified that they were not current on oxy time. Two teams were decided on and captains appointed.			
IMT	GAG deployment and fire fighting options discussed. Discussion on awaiting mines rescue effecting underground rescue before implementing fire fighting/GAG deployment strategy. Qld Mines Rescue Service Active Operations Manager noted monitoring from top of portal notes nothing to stop Mines Rescue teams from re-entering. Incident Controller tasks Planning Coordinator with determining appropriate fire fighting strategies. Planning Coordinator informs group that water is now being run down drift as first action to fight fire. Ventilation Officer, Planning Coordinator state that GAG is onsite at this point (it was not). Qld Mines Rescue Service GAG Jet Representative now on	1635		

Location	Event / Observation	Time	Event / Observation	Location
	site – awaiting Qld Mines Rescue Service GAG Operations Manager (who is transporting GAG to site from Dysart).			
Control room	Mines Inspector 2 at front gate.	1636		
Rescue	2 rescue teams load gear and FAB into vehicles to go to top of Downcast shaft	1640		
Planning	GAG jet deployment discussion: Ventilation Officer, GAG Supervisor, Planning Coordinator. Noted availability of curtain in the drift and separate sealing container to attach to dolly car available to seal off intake drift. Ventilation Officer noted fans are variable voltage, variable frequency and so can be adjusted to suit required duty. Ventilation Officer/GAG Supervisor noted preferred strategy to reduced air quantity down intake drift to match GAG jet output. QMRS Officer 1 advised GAG jet ETA for site 19:15.	1650		
Rescue	Set up fresh air base at surface winder. Only 1 roll of wire for radio phone inside winder shed. Run aerial ribbon out on ground toward bottom of shaft.	1653		
IMT	Rescue teams deploying underground now. No formal communication protocol to surface for rescue teams to Incident controller.	1710		

Location	Event / Observation	Time	Event / Observation	Location
Rescue	Team 1 checks done and ready to go underground. Load stretcher and minimum equipment into cage. Take spare SCSR	1717		
Rescue	Stop at 3 CT. Gas test readings fresh air, temperature 20°c wet bulb. Contact fresh air base on radio from 3 CT. Run out of radio ribbon. Notify FAB that they will be off radio comms for 30 minutes, 18.20 next contact.	1753		
Rescue	2000ppm CO, 0.4 CH4, O^2 17%, CO^2 2.0%. Thick smoke. Missing persons name discussed so that QMRS members could call out for him in low vision area.	1802		
Rescue	Found missing person at 8CT in PJB, no SCSR on. Fitted SCSR. Difficulty getting cord to ignite. Check patient. Fit to stretcher. Check lamp number – 068.	1806		
		1817	FAB controller give update to QMRS 1	Shaft
IMT	Missing man update – he has been located, now at 3 c/t in fresh air. Gas concentrations were measured and reported to IMT as 17 % O2, 0.4 % CH4, 6 % CO2, 2000 ppm @ 6 c/t	1819		
		1829	Rescue team 1 arrived back at cage U/G with missing man. Team asked for cage to be sent down so missing man can be taken to surface.	U/G
Control Room	Results returned after two Gas Chromatograph runs	1845		

Location	Event / Observation	Time	Event / Observation	Location
	and checks ("real" value for exercise in brackets) estimated: CO: 1.3562% (1.2000%); He: 0.0000% (0.0001%); H_2: 1.1587% (1.2000%); O_2: 16.7824% (16.7000%); N_2: 77.9435% (77.0000%); CH_4: 0.4741% (0.5000%); CO_2: 2.2400% (2.4000%); C_2H_4: 0.0202% (0.0200%); C_2H_6: 0.0264% (0.0250%); Ar: 0.0000% (0.8914%).			
IMT	Risk assessment for setting up GAG complete, need VO to confirm vent changes required from modelling (No RA for these changes). IC asks and is informed by QMRS that missing person is on surface.	1850		
Rescue	GAG arrives on site.	1858		
Surface	Start set up of GAG	1916		
Rescue	Wind direction change. Implemented thick smoke goggles. Team discussion on SOP for atmosphere and looking at wether or not to use CABA?	1932		
IMT	IMT meeting to review GAG deployment and fire fighting including sealing of shaft and drift. Site has existing procedures, need to review risk assessment, need to recover body.	1946		
Surface	Gag controller advises IMT that GAG is ready to run signalling end of exercise.	1957		
1957 hrs End of Exercise				

Appendix B: Previous recommendations

This appendix contains all the previous exercise recommendations and there are a number of them which have been repeated on one or more occasions.

Recommendations which are in **bold are from the 2008 Mine Emergency Exercise at the Newlands mine.**

Control Room

1. **All mines should modify their emergency response plans to contact the Queensland Mines Inspectorate via the emergency number 07 3237 1696. This means that the Queensland Mines Inspectorate emergency response can start immediately.**
2. **Off-scale readings on the tube bundle should trigger immediate bag sample collection. There is slow response in obtaining and analysing bag samples.**
3. **Look at "text messaging" possibilities for underground phones.**
4. **Awareness of maximum concentrations that can be measured on mine monitoring systems.**
5. **Have an experienced CRO(s) that can assist the CRO(s) throughout any incident.**
6. **Implement monthly leak checks (as per Australian Standard AS2290.3, Standards Australia 1990) and determination of draw times for each tube for tube bundle system.**
7. **Monitoring and logging of vacuum pressures for each sample tube to identify any compromised tubes.**
8. **Screen external calls coming into Control Room during an incident.**
9. **Look at improved ways of logging incoming and outgoing communications during an incident in Control Room.**
10. **Review radio communication channels/bands listing for site-wide communication. Review radio communications in Control Room to ensure adequate coverage of all channels operating across site.**
11. CROs should be given capability to modify tube bundle sample sequence and put tubes on hold.
12. The alarm protocols on the mine SCADA system should be improved to flag the TARP involved and what level of the TARP has been triggered. It should be possible to link the alarm to the TARP electronically and thus provide a quick prompt of required actions by CRO and senior mine officials.
13. Review non-verbal question list with those underground and CRO to eliminate questions that can't be acted on and add those that would give more information, questions such as how many people are with you should be reworded to including yourself how many people are there.

14. Review the use of non-verbal communication for larger numbers, e.g. maybe use “Are you between cut-through15 to 20?”
15. Make the list of people to contact in an emergency readily accessible.
16. Make sure the emergency response plan identifies where the police will be accommodated when on-site.
17. Investigate easy and readily available methods to transfer data in an emergency.
18. Review the use of personnel locating equipment.
19. Care should be taken when releasing the names of injured/deceased personnel to the police. Mines should have a protocol in place for this.
20. All mines should ensure that they have adequate emergency phone coverage on the mine site and should install a mobile phone repeater dish on-site where necessary
21. Look at “text messaging” possibilities for underground phones.
22. If mine site personnel are to be injured in the scenario they should be given food/extra clothing, etc. so they are looked after.
23. The computer system for the scenario should be set up on-site days prior to the actual exercise.
24. One staff member for each duty card – or cut down on number of duty cards.
25. Staff to be familiar with responsibilities on duty cards which could be assisted by making them simpler to understand.
26. Clarify the situation regarding written authority for personnel reporting underground in an emergency situation. Given that this will probably be QMRS, this should be an industry standard.
27. Reduce the number of duty cards.
28. Have duty card holders’ record their own names on a board near the duty card box in the muster area as the CRO did not have an opportunity to compile this for 75 minutes.
29. The list provided was also confusing as it listed all available duty cards not just the ones under the CRO duty card.
30. The surface marshal should coordinate the sentries, lamp room attendant and diesel attendant then report relevant information to the CRO (single point of contact avoids confusion) Rather than have an assistant CRO Duty Card this person could be the surface marshal (experience with coordinating people).
31. A camera or perhaps a manual control should be installed at the gates. The gates were of left open for 10 to 15 minutes due to CRO not knowing the remote actuator didn’t work or being busy with other tasks. (The gates were also reported as not being good enough to stop a vehicle if required.)
32. All the duty cards should have a description of what the duty is supposed to achieve as well as the specific items to check.
33. A single system of physical data transfer should be used preferably email, managed by assistant CRO (this would provide an assurance the information is received as well as accurate timeline information post event).
34. At Grasstree West some or all of the duty cards should be amended to report to the assistant CRO if ICT member is unavailable.

35. A system to transport and debrief personnel escaping to Grasstree West should be developed to rapidly take control of this resource. This would also avoid the confusion created within workers group as to their movements after escaping. It took over four hours to move these workers to Grasstree East.
36. EMT should rely on updates from ICT not Grasstree West CRO.
37. Care of the workers should be improved as it was slow and sporadic during the exercise.
38. Test CROs' workload in Level 2 and 3 Mine Emergency Exercises to ensure their workload in an incident is not too high.
39. Check the number of duty cards to ensure that critical tasks can be managed on a back shift.
40. Test call-out systems for effectiveness - time taken to call out as well as time taken for response.
41. Implement the use of speed dial for contacting mine site personnel.
42. Use the emergency number for notifying the Mines Inspectorate rather than phone their mobile phones.
43. A more structured and better resourced people control mechanism needs to be implemented for the crews when they exit the mine.
44. All mine site personnel crews need to be briefed to start all communications with "this is an exercise**".**
45. All relief CROs must get more regular exposure to the GC, perhaps running the samples once a tour, so as to keep abreast of changes with the instrument and sample introduction.
46. A system for non-verbal notification of an emergency should be developed. This may be as simple as an initial triggering of the emergency button on the phone or a non-verbal dial up code on the DAC or phone. A protocol for this type of communication should be developed with sample questions. All questions asked should be read from a written copy so that the answer options can be reviewed against the exact question.
47. To overcome the problems with providing paper based gas monitoring data, an on-line incident simulation was used that emulated the mine monitoring system. This system known as MEMS allows for modifications of the scenario in real time as the incident changes and site personnel attempt to control the situation, with changes able to be fed to the IMT via secure communications.
48. Translation of information via the phone led to a number of incorrect calls/information i.e. gas concentration levels.
49. Formal procedures need to be introduced and personnel trained in the emergency procedures for site i.e. the use of the DAC system to indicate location underground to Control Room not recognised.
50. Key personnel need to be aware of key factors of their system such as response times and analyser ranges.
51. The supply of two-way batteries for radios for surface use is insufficient to allow long term use of the sets available.
52. IMT is to ensure that the CRO is 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.

53. Limited access to the Control Room is imperative to stop people wandering in and out.
54. An extra phone point for personnel with duty cards is necessary so as not to use the Control Room as a telephone room.
55. GC operator was useful as a backup for the CRO although he was not required to take a large number of bag samples due to the scenario.
56. Ensure that duplicate tasks are not given to duty card holders and that duty card holders stick to their duties.
57. Consider increased and more regular use of the Personal Emergency Device (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. This should be further investigated.
58. A more autonomous/automatic mechanism to identify where personnel are located underground and when they have returned to the surface would be of great value.
59. Relief duty card operators need to be fully trained in their roles, responsibilities and functions.
60. CRO (or some other delegated person) should regularly continue ringing the phone. This not only provides orientation to those people lost in poor visibility, it gives a reassurance to persons who maybe able to hear it but not respond. Regular broadcasts down the DACs could have the same effect.

Data analysis, interpretation and monitoring

1. **More intelligence needs to be applied to the display of gas alarms. When analysers reach full scale, monitoring systems should recognise this.**
2. **The collection and dissemination of information remains an issue that needs to be addressed in emergency response plans and associated documents.**
3. **Mines should review the use of forms to ensure that they are appropriate for the designed function. Filling out unnecessary forms can take time that would be better occupied in other functions.**
4. Improve communications in tube bundle room. No modem connection exists for communication with Simtars for assistance during any incident.
5. Provide training and awareness for mine staff of the maximum concentrations that can be measured on a mine's gas monitoring systems.
6. Have other experienced CRO(s) that can assist the CRO(s) throughout any incident.
7. Implement monitoring and logging of vacuum pressures for each sample tube.
8. Implement monthly tube bundle integrity testing and determination of draw times.
9. Install vacuum gauges to monitor and log vacuum pressures for each tube.

10. The exercise team must ensure there is greater emphasis on the need to start all communications with “this is an exercise” is needed. One of the GC operators arrived on-site and took up duty thinking that it was a real incident.
11. Include printers with the equipment brought to site.
12. Minimise the number of assessors in the Control Room during the incident.
13. The visual display of information in the communication room could be improved. Activities and options were listed with names of responsible persons. It is important that all established facts are displayed to allow each participant and new IMT member the opportunity to view the current status of the incident. The established objectives of the group should also be displayed. Another white board could be used to list activities and allocated responsibilities. These white boards should be printable to ensure a record is kept of the IMT process. A terminal with a display of the gas monitoring system should also be present in the room.
14. Install a second phone line that supports data transfer for the GC to allow modem transfer of data, and real time support from Simtars.
15. GC - The frequency of and complexity of GC training should be reviewed. In addition the number of people available per shift competent to operate the GC needs to be reviewed. It is not appropriate to expect the CRO to run the GC during an incident.
16. A systematic regime should be established for reporting and displaying monitoring information. Without systematic recording of information it is impossible to effectively brief external bodies or undertake changeover of key personnel.
17. Safegas access should be extended to each key area.
18. There should be more personnel trained in the operation of the tube bundle systems and Safegas, including all its functionalities (especially the taking of bag samples and how they can be analysed in a timely manner).
19. Consideration should be given to installing differential pressure sensors/velocity sensors to enable changes in ventilation to be accurately monitored.
20. Consideration should be given to installing further real time gas sensors – CO and O_2, at more key points in the mine to allow characteristics of mine atmospheres to be determined. This would allow personnel underground who do not have personal gas monitors to be aware of the mine atmosphere at the sensor location. Locations could include: escapeways, caches, belts, transformers and intakes.
21. Computer access to the mine environment monitoring system in the IMT is essential. Ventilation simulation software should also be on this computer.
22. A mine plan in the IMT should show monitoring locations.
23. Ventilation flow sensors in key roadways would enable more accurate interpretation of makes and effects of changes in ventilation.
24. Off-scale readings on the tube bundle should trigger immediate bag sample collection. There is slow response to obtaining and analysing bag samples.
25. It is recommended that the functions inherent in current gas monitoring software be explored, particularly the facility to store and retrieve documents detailing required action response plans. Such software has much to offer CROs and IMT personnel.

26. Review location of types of gas detection equipment underground in light of ability to detect changes in mine gas atmosphere.
27. Review tube response times and cycle time – reduce ballast volumes.
28. The maintenance of gas monitoring after an incident should be completed to include the redundancy of sensors and tubes/borehole back-up for sampling of key areas and communications.
29. There should be a designated role of a person on the incident control team to be responsible for accurate gas monitoring information.
30. The role of Simtars when assistance is called for should be known thoroughly.
31. Safegas system should be connected to the Control Room monitors. The absence of the Safegas system means that the trending of gases from the tube bundles and any derived indicators can only be done by hand.
32. Further training needs to be undertaken by Control Room personnel regarding AMR sensors and gas concentrations and what type of reading an unserviceable, disabled or destroyed sensor would give.
33. Gas monitoring station numbers and AMR sensor numbers need to be matched appropriately.
34. Personnel would benefit from increased training and awareness in the capabilities of Safegas software, particularly in trending of gases, especially Quick Trend; SPLUS, multiple site analysis and holds on key monitoring locations; further understanding of the separate sources of lags and delays in analysis and their cumulative effect.
35. Use “Instruction” feature of Safegas for TARP implementation and recording of actions.
36. Modify Safegas so that login time lasts for the shift duration of the CRO. CRO had to log out whenever he left the Control Room. This will reduce frustration on accepting alarms.
37. A better understanding of the operation of the tube bundle sampling regime, the capabilities of the software and the computer control system is necessary to optimise the collection of relevant information.
38. It is important that samples of gas taken are labelled with the time taken and location of sample.
39. The mine monitoring system should include a facility to print a table of the latest data for all locations with date and time of all gases and be able to export to other programs or for email. This would allow error free transfer of data to other interested persons.
40. Ensure that GC analysis of the atmosphere is undertaken as soon as practicable. Utilise Simtars or other relevant expert for additional review and verification of gas data.
41. Mine monitoring systems should ensure that trend graphs include the latest data.
42. Mine monitoring systems should include a label of tube numbers as well as locations – mine plans only refer to monitoring points by tube number when doing trending and analysis.
43. When a monitor reaches full scale, it should read “full scale”, instead of displaying a value. The value -999 can be interpreted as actual.

44. The mine monitoring system should have the ability to display trends of more than one sample point at a time.

45. Nitrogen dioxide should not be monitored via the tube bundle system. Underground personal monitors should be used instead.

Debrief

1. **Debriefing of mineworkers should be improved. A facility should exist for them to talk through the trauma of any incident.**
2. **All underground crews should also be briefed to ensure that they do not do anything which is unsafe and if necessary should make their place of work safe before commencement of the exercise.**
3. **After evacuation from Grasstree West mineworkers/contractors to be given clear instructions regarding arrival at Grasstree main muster area.**
4. **The exercise committee should develop alternative methods to communicate/review exercise to industry.**
5. Consideration should be given to refreshing all employees as to what to do when they exit a mine in an emergency e.g. identify who they are, where they are and their physical condition.
6. Re-hydration should be identified as a key initial requirement of the debrief process.
7. Medical examinations by on-site medical personnel should take priority over debrief and that such examination should include objective medical observations of these persons (e.g. pulse, blood pressure, physical examination). If absolutely necessary, debrief/gathering of critical incident information could occur whilst such examination is occurring.
8. Debrief sessions must be structured with adequate resources, such as mine plans and question prompts sheets to facilitate accurate and complete capture of information.
9. There needs to be a formal debriefing procedure in place, including a scribe to record all information to ensure that there is no lost information, wrong conclusions and poor recording.
10. All personnel being debriefed need to be made comfortable, provided with adequate food and drink and given first aid as needed.
11. Security needs to be placed on debriefing rooms to control who enters and exits the room.
12. It is essential that identification of any casualties be verified and accurate prior to the release of information to outside parties.
13. Review debriefing procedures – suggest a prompt sheet be developed and/or utilised.
14. Training personnel available to debrief persons after they evacuate the mine. The knowledge evacuees have is vital to the IMT.
15. Information from debriefing sessions to be incorporated into the decision making process e.g. the operator of the vehicle may have provided useful information to assist that decision making process (the fire was relatively small, the fire was actually 20m inbye 9 cut-through). Critical witnesses

should be identified and also debriefed by IMT so that they can get a better understanding of underground conditions.

Emergency initiation

1. **Where CABA is used for first response, a system for re-hydration be investigated and implemented**
2. **It is important that there is provision for communications out of the Control Room as all stakeholders must be kept regularly briefed on currency and status of events.**
3. **It is recommended that IMT should directly brief anybody being dispatched from the surface (mines rescue fresh air base personnel, transport drivers, mines rescue teams, etc) or at least be present during the briefing.**
4. **It is recommended that a person be allocated as Surface Coordinator to oversee all of the surface tasks, movement of personnel in and out of the mine and liaison with IMT. The control, allocation and updating of the deployment and availability of resources is a vital function of a coordinated emergency response and cannot be overlooked.**
5. **It is recommended that a forum of stakeholders be urgently established to develop and implement a set of protocols covering the interactions between mine site first response teams and external aided-rescue organizations. Each of these groups provides specialist, but separate, skills and resources and it is vital that the issues involved in their interaction be identified and coordinated. There is little doubt that CABA teams will increasingly form part of emergency response capabilities in our industry and we must be prepared.**
6. **There needs to be a review of the number of brigadesmen that the mine can supply at any time of the day or work roster. This could also be expanded to other mines in the mutual assistance group.**
7. **Consideration should be given to a review the minimum number of mines rescue trainees – with most people working 12-hour shifts this effectively reduces the number of trainees available to respond by half (fatigue related policies), also with people choosing to live remote from mining areas response times/availability of trainees is extended .**
8. **Protocols on how mines rescue trained personnel on-site are to be utilised should be developed. This can take into account the type of emergency, number available and specific duty card or other specialized needs.**
9. **Process management (decision-making process, time wasting, verification of data, information flow in and out of the incident management room, briefings done on time, checking milestone events,**

interaction of members) remains a vital part of incident management and must always be at the forefront of the operations within the IMT.

10. It is recommended that the Mines Inspectorate mobilise a Simtars response in response to the exercise scenario in all future Level 1 Mine Emergency Exercises. This will test the interaction and communication process between the inspectorate and Simtars.
11. The CRO position should be a competency based position which includes knowledge of monitoring systems and gases.
12. Refuge bays/changeover stations should include communications and gas supplies and monitoring lines.
13. A computerised system should be introduced for duty card operation and logging of actions. This should also be used to check validity of duty cards for use of back shifts and practicality of operations.
14. It is recommended that one of the training rooms be set up as an incident management room, and that a person, detailed in the emergency procedures, be positioned as a door guard to prevent disruptive entry to this room.
15. It is recommended that duty card sheets are made “tick and flick” style sheets, and that senior management adhere to their defined areas. This ties in with IMT as a specific team in a specific place with defined areas.
16. All personnel should be trained, including refresher training, in the location and basic content of the emergency response plan.
17. It is essential that the incident Control Room be complete with a number of electronic whiteboards, accurate mine plans, desktop space, communication facilities – preferably with automatic call forwarding of all incoming underground phone calls, video/audio recorders, secretarial/shorthand support and security against intrusion.
18. All persons, including managers and supervisors, must be trained in the use of self rescuers and their changeover procedures in genuine environments, including underground, after heavy work and in limited visibility.
19. Rescue room needs to have up-to-date and suitable rescue plans in the room at commencement of emergency.
20. There should be a mine surface controller function to liaise with operations base and organise any requirements e.g. task allocation for personnel.
21. When using the Macroview systems, computers in the Control Room to monitor the tube bundles gas monitoring system, site personnel should have approval to move monitoring locations – not having to contact a Brisbane computer consultant to modify the diagram.
22. Alarm points in the Macroview system should be reviewed as all red alarms look the same and can be misinterpreted.
23. A log should be kept of active monitoring sites in the Control Room.
24. Utilise email system to send information between IMT and the CRO.
25. Ergonomics of Control Room to be reviewed e.g. location of DAC, 3 phones and 4 computers – with three people using these at once, no one can hear clearly or operate without distraction, increasing the risks of error.

26. It is recommended that in future the scenario be created with false alarms and staged introduction to allow for more realistic response from site personnel.
27. A mine must have an established, structured and comprehensive system for managing an emergency with a trained, disciplined response team. Duty cards are not a comprehensive system; they are simply a functional aid for the overstressed cognitive processes of the human brain in the early stages of an emergency.
28. All organizations should review the ICS for application in emergency incident control. Key areas of learning are – discipline in adhering to the system, limiting the span of control (i.e. no greater than five particular resources per person), clear authority in authorizing plans and actions and managing the communication flow.

First response

1. Consideration should be given to have a ladder or some other implement available to reach the isolation valves in an emergency.
2. Consideration should be given to implementing a first response system at the mine to deal with emergencies until professional help arrives and can be deployed to assist. Industry needs to seriously address the issue of first response by way of clearly identifying what a first response team is expected to do i.e. fight the fire plus any other identified duties and what equipment they require. This will also mean that intensive fire fighting training and other associated training will be required ASAP.

Self escape

1. **Training in donning and use of self contained self rescuers needs to be addressed as indicated by previous level 1 mine emergency exercises, and highlighted in recent forums in the United States of America. It is recommended to industry that a similar competency based training regime to that proposed by the United States mining industry (at refresher intervals of 3 months) is implemented as well as ensuring that all mine workers have used a real self contained self rescuer or a training rescuer that has simulated heat and resistance capabilities. (Note: This is the same recommendation as appeared in 2006 and 2007 level 1 exercise reports).**
2. **Not only should training in the use of self contained self rescuers be reviewed, but also the option of installing "changeover" stations, or equivalent, where escaping mine workers can changeover the self contained self rescuer in a less hazardous atmosphere, communicate with surface and also have the option of remaining in the station for a period of time.**
3. **It is recommended that a forum of stakeholders be urgently established to develop and implement a set of protocols covering the interactions between mine site first response teams and external aided-rescue organizations. Each of these practices provides specialist, but separate, skills and resources and it is vital that the issues involved in their interactions be identified and coordinated. There is little doubt**

that CABA teams will increasingly form part of emergency response capabilities in our industry and we must be prepared.

4. **The protocol by which mineworkers using SCSR's for self escape, having reached a place of safety can then offer first response duties – needs industry discussion and development. Completion of Fight or Flight group seminars.**
5. **Training in the donning and use of SCSR in low visibility conditions should be conducted as recommended in previous exercise reports and highlighted in recent forums in the United States of America with 3-monthly training intervals being suggested. This training should also cover what actions to take should the nose clips be lost during donning of the SCSR.**
6. **It is recommended to industry that a similar competency based training regime to that proposed by the United States mining industry (at refresher intervals of 3 months) is implemented as well as ensuring that all mine workers have used a real self contained self rescuer or a training rescuer that has simulated heat and resistance capabilities. (Note - This is the same recommendation as appeared in 2006 and 2007 level 1 exercise reports).**
7. **Not only should training in the use of self contained self rescuers be reviewed, but also the option of installing "changeover" stations, or equivalent, where escaping mine workers can changeover the self contained self rescuer in a less hazardous atmosphere, communicate with surface and also have the option of remaining in the station for a period of time.**
8. **Industry needs to define the requirements for aided escape, i.e. how will injured/incapacitated personnel be dealt with. Completion of Fight or Flight group seminars.**
9. **Evaluation of the options for fitting wheels to stretchers/stokes litter**
10. Provide training in the donning, wearing and changeover of SCSRs to all underground mine workers.
11. Provide training and familiarisation in the use of the changeover bay.
12. CABA training should be provided for a minimum of four persons on every crew.
13. Grasstree should ensure that it is possible to travel all evacuation routes without complication
14. All changeover bays should be checked to a schedule as part of ERZ Controller's inspections
15. Continued focus is required on donning and changeover of SCSR which is critical in ensuring personnel are able to effect self escape.
16. Establishment of standard cross industry non-verbal communication practices, e.g. two beeps for no and three beeps for yes, in similar fashion to cap lamp signals would supply a common knowledge necessary due to the transient nature of many mine workers in Queensland.
17. Where mines have CABA deployed and available for use underground personnel should be trained in its use for evacuation purposes

18. Industry should review first response capability and define what actions can be taken in first response. First response activities should be subject to risk assessment and competencies of the responding personnel.
19. Continued use of real SCSRs gives the persons involved an excellent experience.
20. There should be continued focus on training in the donning and changeover of SCSRs.
21. This is critical in ensuring personnel are able to effect self escape/survive in an irrespirable atmosphere.
22. Non-verbal communication – suggest to add four beeps for “Do not know/cannot answer”.
23. The photo showing the collapsed hose on the SCSR should be distributed to all mine sites and added to the training package for the unit.
24. Injured personnel could have simulated injuries to increase realism for responding QMRS personnel.
25. The layout of the changeover bays should be reviewed to ensure that congestion at the entrance is eliminated and the availability of floor space is maximised.
26. Program a schedule of works to ensure the main escape-way between Grasstree and
27. Grasstree West is kept in a trafficable condition.
28. There should be confirmation of the standard practice for evacuees in a changeover bay. There is a risk that changeover bays are assumed to be mandatory fresh air and that it is okay to take off an SCSR once inside.
29. Increase the frequency of training in the application of SCSRs to ensure that this skill is available when required under adverse conditions.
30. When training SCSRs are to be used, assessors must be instructed in their use. The training SCSRs should also be opened and assembled immediately prior to use - not set up in advance.
31. A system for effective transport of persons from Grasstree West to Grasstree needs to be provided.
32. Continued focus is required on donning and changeover of SCSRs which is critical in ensuring personnel are able to affect self escape.
33. Mineworkers require training and need to demonstrate competency in the evacuation protocols of their mine.
34. All mine sites should implement a personal tracking and recording system or a process to identify who is where at what time. Systems are under development but industry and testing/approval processes should be improved to encourage private investment in further development and cost reductions.
35. Training in donning and use of SCSRs needs to be addressed as indicated by previous Level 1 Mine Emergency Exercises, and highlighted in recent forums in the United States of America (USA). It is recommended to industry that a similar competency based training regime to that proposed by the USA mining industry (at refresher intervals of 3 months) is implemented as well as ensuring that all mineworkers have used a real SCSR or a training rescuer that has simulated heat and resistance capabilities.

Not only should training in the use of SCSRs be reviewed, but also the option of installing “changeover” stations, or equivalent, where escaping mineworkers can changeover the SCSR in a less hazardous atmosphere, communicate with surface and also have the option of remaining in the station for a period of time.

36. Whenever possible mine workers utilise underground transport for evacuation purposes.
37. Serious consideration should be given to providing a SCSR (or equivalent) with a face mask that would allow communication. This does not necessarily mean to every worker, but of sufficient numbers to facilitate reasonable communication.
38. SCSR training to include information on non-verbal communication and the dangers of talking through self rescuers.
39. Consideration should be given to installing a pull-down lifeline (on bungee cord) with directional cones, positioned above the wheel ruts, which formed a natural track.
40. Consideration should be given to attaching some type of chime (like a wind chime) to a lifeline or similar device, which would be activated by the movement of people as they approach the cache.
41. All mines conduct an audit of their evacuation routes to identify and rectify any defects that may be found.
42. It is recommended that cache layouts should be standardised and lifelines provided which lead directly to the cache box.
43. Consideration should be given to supplying simple hook on ropes in each emergency breathing apparatus (EBA) cache, or training in an alternative hook-on method, such as using the cap lamp cables (each person hooking on the lamp of the person behind—forming a chain).
44. Well designed changeover stations similar to some current “refuge chambers”, included in EBA cache areas, would have helped safeguard workers during the SCSR process or would facilitate refuge for those in difficulty. Such changeover stations would allow for mineworkers to rest, change SCSR in fresh air, plan their method and route of escape and, as a last resort, leave an injured person(s) who cannot travel to await rescue. Audible signs (chimes) would have assisted workers identify their location and the proximity of key emergency infrastructure.
45. Review protocols for donning and changeover of SCSRs and provide appropriate training to all personnel.
46. Review footage of self-rescuer changeovers from the exercise as a learning tool.
47. Review time frame for removal of MSA Lifesaver 60.
48. Develop a standard evacuation protocol that includes:
    a. Use of transport
    b. When to change self-rescuers
    c. Non-verbal communication
    d. Route of travel

49. Consideration should be given to the provision of whiteboards at muster points to assist with non-verbal communication.

50. Mine personnel should spend some more time in 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.

51. Escapeways, and their alternatives, must be walked regularly until all personnel are familiar with them.

52. All personnel, including managers and supervisors must undertake regular genuine emergency evacuation incorporating poor visibility to best test the adequacy of the current systems and accurately determine emergency preparedness.

53. There must be an integrated approach to emergency evacuation focusing on enhancing survival covering: self rescuer changeovers to occur in safe havens; safe havens to be fitted with lighting, drinking water and mine plans of where you are and routes of travel to the next haven and explosion proof communication channels; distances between safe havens to be spaced for worst case scenarios of zero visibility; signs and arrows pointing to escapeways, oxygen caches, doors or roadways, delineated by hanging lanyards from the roof, must be visible and all escapeways must be maintained in good order free from excessive walking hazards.

54. It is recommended that the provision of audible call sirens be installed in the safe havens in the face areas to help lead people to them. This would allow a full accounting of persons and the provision of appropriate breathing apparatus and the ability to render any necessary first aid.

55. It appears almost impossible for a changeover of self rescuers to be done under duress without the protection of a safe haven.

56. Audible signals may be the best method to guide personnel back to face area safe haven.

57. Safe havens can be used as 'hubs' from which guidelines can extend, at a reachable height, to a number of escape ways.

58. Safe havens to contain suitable compressed air breathing apparatus that may be utilised to provide 'search capability' or 'first aid' and 'fire fighting'.

59. Explosion proof communication systems such as buried telephone lines should be explored.

60. It is strongly recommended that the process of self rescuer changeover be closely investigated and through consultation with the manufacturer, a standard procedure for the changeover of these sets be formulated to minimise the problems associated with the donning of self rescuers.

61. The mine should re-investigate the escape timelines and distances between cache locations in longwall returns – particularly where poor visibility may be experienced.

62. Investigate the number of SCSRs in the longwall return caches. In this scenario there were sufficient numbers, but there were only six people on the face. If there had been one more person on the face, there were no spare units in the caches. The escaping crew expressed concerns during the debrief on this point. Self escape routes need to be planned and serviced by

sufficient SCSRs for the maximum number of personnel in the panel in both primary and alternate routes.

63. During the refresher training for SCSRs, mines must ensure that duration times of “at work” and “at rest” are explained to wearers.

64. Communication using pens and notebooks, and not talking through mouthpieces, should be adopted as an industry standard.

65. Self rescuer training should focus on entrapped procedure i.e. walking with O_2 turned off, resulting in an extra 20 minutes of O_2 time.

66. Self rescuer manufacturers to investigate modifying units to have “fluoro” mouthpieces and breathing tubes; worn over shoulder; have harder mouthpieces; have wire reinforcing in breathing tubes to prevent their constriction when heavy breathing; be easier to open and handle with wet/slippery hands; have interchangeable mouthpieces...

67. Walkways over overcasts should have handrails to prevent falling off, and not have raised steps or trip hazard and ladders traversing overcasts should be lined up or have guidelines joining them..

68. The provision of water-proof notebooks for recording information underground should be investigated.

69. Trial the use of walking sticks in areas of excessive rib spall. The trial to consider the appropriateness of using “candy cane” shaped curve handles, or the current right angled “elbow” shaped handles.

70. Treat any person who ‘escapes’ in the hot and humid conditions as a patient to ensure they recover from the experience – particularly re-hydration of the patient..

71. It is recommended that the ergonomics of the CABA main valves be reviewed and modified (if possible). The need to turn two valves in different directions using different hands will inevitably give rise to circumstances where both cylinders are not fully operated.

72. Access and storage of CABAs could be improved to enable easier donning of the units; review the number of CABA units and accessories (buddy masks); review pre-start checks – is the one minute high pressure leak test necessary?; training on CABAs to include oxygen cylinder use philosophy – turn one on, when warning whistle sounds turn the other on (as used in search and rescue).

73. Protocol to be developed for information transfer in an emergency – should prompt any user about the important points to be communicated.

74. Link-lines between members of the group would prevent separation of members. Link-line would need to consider distance between members e.g. buddy mask line is a limiter. A life-line would facilitate escape speed and route.

75. Indication required at cut-throughs (both sides and ribs) to identify escape facilities such as telephones, DAC and caches. Suggest that only two levels of demarcation/indication be used – one for communications and one for escape apparatus.

76. Review CABA training to ensure contingency actions are known and rehearsed. This should cater always for the unexpected. Review maintenance program to ensure that CABAs are maintained in a state of operational readiness – the program should meet, as a minimum,

manufacturer's recommendations. Back-up facilities to any escape system/apparatus are required in the event of equipment failure.

77. Review emergency escape protocols to ensure the issues of how many units to carry and when to changeover are clearly outlined. It is recognised that people in a stressful situation are liable to follow their instincts.

78. Review entry barrier to Quick Fill Station – the single pogo stick hung horizontally could be split into 3 – 4 lengths to allow easier negotiation. Quick Fill Station orientation to be reviewed to enable easier and quicker access and also facilitate the use of the multiple refill points – recommend that the station be turned 90°so that the refill points are in line with the cut-through and do not face the rib. Main valve operation on refill side of the Quick Fill Station should be reviewed – is it required? Can it be arranged to turn on when any quick fill outlet is operated? Maintenance and inspection program to be reviewed to include external fittings and their operation.

79. To assist in locating phones in thick smoke, phones should give an audible beep on a regular interval.

80. When the Deputy or ERZ Controller is taken away from the crew there is no gas detection capability to determine the necessity of continuing to wear self rescuers. The provision of a fixed station's visible display of gas readings e.g. at positions in the primary escape roadway may be worth investigating. The potential for the provision of multi-gas detectors and relevant tubes in caches and training in their use should be investigated.

81. The introduction of changeover stations to the mines should be evaluated. This would allow verbal communication with the surface en-route and provide a place to leave injured persons if required. It also allows a safer environment for the changeover of SCSRs.

82. Instructing crews to discuss escape options and to have a plan and to nominate a leader prior to starting escape.

83. Consideration should be given to developing procedures and systems that allow:

    - Competent persons to use more than one fire extinguisher prior to it being classified as a major emergency. The standard operating procedure allows no objective way of risk assessing and managing the fire. Consequently, there is a reluctance to assess a fire and take other appropriate action. There are situations where more than one fire extinguisher is required to douse a fire. That does not necessarily increase the risk profile.
    - Competent persons (other than mines rescue trained teams) to be deployed in inspecting and/or fighting fires with water hoses (e.g. ERZ Controller). In some cases it is an acceptable risk to allow persons to inspect fires. The time taken to deploy mines rescue teams allows fires to increase in intensity.

84. Personnel that have evacuated to the outbye side of a fire (subject to appropriate health and fitness checks) to inspect or participate in fighting fires under the guidance of a suitably trained person.

85. Resources to be used to fight fires to be identified prior to mobilizing fire fighting teams.

86. Personnel assigned fire fighting duties should be competent and adequately briefed of the risks and their duties. The fire watch team was not considered competent to perform their duties to standard.
87. Training for personnel working alone in the mine for the discovery of fires, incidents and their actions to minimise the affects to the underground environment.
88. A realistic fire gallery should be used to train mine personnel in fire fighting.

Communication and decision-making

1. Review maintenance of personal emergency devices (PEDs) and remove faulty PEDs from service.
2. Review CRO evacuation procedures to include a general PED message to all personnel required to evacuate.
3. Review training of statutory officials (and other personnel who may be required to lead in an emergency e.g. rescue personnel, leading hands) to include decision-making, leadership, communication and accounting for personnel.
4. There must be established a central, clearly identifiable, decision-making process, based on risk assessment principles.
5. All underground communications should be capable to being call-forwarded to the incident Control Room with automatic recording devices attached.
6. Accurate information flows must be established to minimise decisions that may result in catastrophic consequences.
7. It is important that there is provision for communications out of the Control Room as all stakeholders must be kept regularly briefed on currency and status of events.
8. The lack of a formal recording system would be seen as a major discrepancy by a Warden's Inquiry in the process of determining true nature and cause as vital information can be lost.
9. Communication between the Control Room and IMT needs improvement regarding: access of people in and out of Control Room; phone systems installed; how information is passed on, etc.
10. There must be clear authority of exactly who is in command and how decisions will be made with a definition of the composition of the incident control team.
11. Implement a communication system to the surface from each of the main cache locations for tracking of crews escaping and one-way communications from Control for updates etc.
12. Implement a system to ensure ALL personnel underground receive notification of an emergency as quickly as possible.
13. The communications interaction between the various operation areas needs to be systematically organised such that all operational areas are provided with the necessary information and updated regularly. Consideration should be given to undertaking this electronically to minimise the disruption of phone calls.

14. Provision of at least two telephones with people assigned as scribes to take incoming calls and make outgoing calls. One telephone should be assigned for incoming calls and one telephone assigned for use by the IMT for outgoing calls only. Lines of communication need to be clearly defined so that 'closed loop' communications can be achieved, with automatic feedback. Lines of communication will curtail some telephone traffic to the IMT and allow improved operation.
15. IMT needs to have direct communications to all critical personnel and functions. This may include debriefing of key witnesses, briefing initial team, briefing persons/teams for a critical tasks and getting direct updates from crucial areas underground. The more important the person's/team's task is to a successful outcome, the more direct the communications need to be with IMT.
16. There needs to be a clearly defined decision-making and validation process in place for all decisions, particularly those of the IMT.
17. The decision-making process needs more focus and each option needs to be driven to completion before allowing digression.
18. All IMT members need to be encouraged to actively participate in the decision-making process.
19. There needs to be more urgency in decision-making when retrieving persons underground who are injured or have limited life support equipment available.
20. An automated emergency callout system should be utilised and triggered from the CROs computer, with a voice message to land lines and SMS to mobile phones.
21. Improve information flow back to the communication officer. The system needs to specifically address how communication is to flow around the site and to which particular team members or individuals.
22. Communication via the emergency button on the phones was difficult, neither the underground evacuees nor control could understand each other. An adequate means of communication needs to be implemented.
23. Consider using electronic reporting systems.
24. Incident action plans should be developed and documented with time and date on them to enable all persons to be briefed on current situation and for clear understanding of required actions by operational teams.
25. If the mines drift block lights are used as an additional means to stop personnel from entering the mine the underground light should remain green to enable personnel to exit to the surface. Normal controls will be needed when a mine re-entry or deployment of vehicles from the surface is undertaken.

Incident management and control

1. Revise procedures regarding number of people and locations on the mine sites,

2. Revise response to emergency on the surface whilst nearly all personnel are below ground and few if any are available on the surface.

3. **Revise and run mock-up exercises following your site documentation. This will highlight unnecessary complexity of the system which should be modified for all to understand,**
4. **Be aware that help may not be readily available at certain times and locations. Revise your response systems to allow efficient response.**
5. **All organisations should review the MEMS/ICS for application in emergency incident control. Key areas of interest are: discipline in adhering to the system, utilising but limiting the span of control (i.e. no greater than five particular resources per person), clear authority in authorising plans and actions and managing the communication flow.**
6. **Process management (decision-making process, time wasting, verification of data, information flow in and out of the incident management room, briefings done on time, checking milestone events, interaction of members) remains a vital part of incident management and must always be at the forefront of the operations within the IMT.**
7. The functions of key personnel and duty cards of the emergency management plan should be revised in light of the outcomes of this exercise to remove anomalies, duplication and streamline operations. For example, the duties of the Planning
8. Coordinator included participation in face-to-face debriefing of personnel, maintaining an information update service and coordinating the development and dissemination of the incident action plan. These functions were actually carried out within the ICT room, except debriefing. The duty cards need to consistent with the role outlined in the Emergency Management Plan (EMP) – Preliminary EMP.UGOP.002.
9. The number and use of forms should be revised in light of what documents were actually used and for what purpose, e.g. incident action plan was the basic document used in conjunction with personal event logs. Communications logs, etc. were generally not used.
10. The potential to use a video link between the EMT and the ICT should be explored.
11. This would remove the need for information transfer and phone calls. However the connection would have to be managed and not continuous as it is recognised that this may otherwise facilitate disruption of the ICT process and then contribute to the tendency for the EMT to be too involved in ICT activities
12. The QMRS should investigate whether or not MEMS should be modified to include a formal role for a process checker and also the streamlining of the forms used.
13. The use of audio recordings should be investigated to supplement the paper system especially at times where multiple functions are being carried out and there is no time to complete logs. Software exists to digitise this and transfer it to text (better than 90% accuracy).
14. Access to and exit from ICT should be controlled to maximise focus of ICT personnel.

15. Clocks should be provided in functional areas to assist in timing and data entry into logs.
16. The objectives identified by the ICT should be better defined and prioritised, e.g. rescue underground workers, identify nature of incident, restore mine ventilation., etc.
17. Gas monitoring information should be available electronically rather than requiring manual transcription.
18. The mine should consider larger white boards better placed in the room, a table with plans under perspex to allow for easy reference, ability to place signs to limit access to room during meetings and a single point of contact to get information into meeting.
19. Provide printers connected to simulation computers or provide access to site networked computers.
20. Care needs to be taken to ensure communications are prefaced with “this is an exercise only”.
21. The simulation system should emulate the process that the Ventilation Officer would have used to transfer gas data from one system to the other for analysis.
22. A balance of skills should be put in place in the teams in order that they can fulfil the requirements of MEMS.
23. Grasstree continues to practice and improve on its incident management processes.
24. The facilities in the planning room should be improved to include display of mine plans and other associated information.
25. The mine review the skills make up of the three teams planning, logistics and operations
26. The facilities in the operations room should be improved to include the electronic access to forms, mine plans, etc.
27. Systems should be established for conveying of information on issues relating to other groups roles when identified within a different group.
28. In the event of an emergency the Emergency Management Team should report to the Incident Controller.
29. Grasstree should modify their emergency response plan to include the call out of an SSHR in the event of an incident/emergency.
30. A mines inspector and ISHR should respond and attend all Level 1 Mine Emergency Exercises. The Mines Inspectorate and the ISHRs should have fatigue policies in place to ensure that attendance can be undertaken without compromising personal safety.
31. All mines must modify their emergency response plans to contact the Mines Inspectorate via the emergency number 07 3237 1696. This means that the Mines Inspectorate emergency response can start immediately.
32. Incident Management Process—in recent years the mining industry has started to adopt the ICS training provided by the Queensland Fire and Rescue Service or the mining version called MEMS. Mine sites need to clearly evaluate which system they are going to utilise to cope with emergency response (including the conventional systems already in place). Each mine must then ensure that their staff are trained, practiced and

competent to fulfil their roles and responsibilities as identified in their own system.

33. ICS - The personnel need to be trained in the functions required for the ICS system to work. This training relates not only to the functions of an individual but also to the recognition of the roles and responsibilities of others and the appropriate interaction mechanisms.
34. The Planning Group is also required to maintain an information service. This is critical to ensure that we are dealing with accurate information and that all groups are dealing with the latest and validated information.
35. Allocate activities based on the functional grouping of the ICS.
36. Risk assessments must be documented and structured for all actions and decisions being undertaken.
37. Develop a procedure or a list of questions to maximise the most of this type of interaction, and to ensure accurate information is obtained.
38. Mine site Level 2 exercises should be carried out to test the practicality of personnel to carry out designated functions with available resources.
39. Personnel should consult duty cards to ensure functions required were carried out. Duty cards should reflect required functionality. By implication duty cards specify the roles of key personnel – if function is not listed it is not part of role – e.g. what is role of Ventilation Officer? – part specified by duty card 2, but clearly the role extends beyond this.
40. Do not carry out informal or non-documented risk assessments.
41. Structure - Follow a structure for risk assessments and discussions to ensure that conclusions are reached and digression does not occur. Personnel in the Planning Group need to follow the discipline of the meeting process to ensure effective operation of the Planning Group.
42. Review the Emergency Response Principal Hazard Management Plan (PHMP):
    a. Review of the base risk assessment to ensure it covers the mine's current risk profile
    b. Documented standards for cache layout and design and for egress marking
    c. Initial response to a fire
    d. Early warning of fire through the correct location and alarm levels of real time monitor, and TARPs for gas monitoring alarms that provide for a graduated response
    e. Defined review periods/triggers for the PHMP and associated TARPs and Standard operating procedures (SOPs).
    f. Set KPIs suitable for management review to determine the health of the PHMP such as training compliance, audit and review compliance and audit results
    g. Determine the appropriate training, assessment and retraining scheme for senior management, CRO, mining officials and duty card holders in the PHMP and associated protocols.
    h. Determine the appropriate training assessment and retraining scheme for all underground personnel in escape equipment and

consider the action to be taken when persons are not in training compliance.

i. Review the duty cards. Consider the provision of a simple duty card system for the CRO to assist in the direction of initial response and the tracking of personnel underground in an emergency. The current numbered duty cards (No. 1 to 8) should be reviewed as a result of and taking into account the results of the exercise.

43. Consideration should be given to the processing of incident information and decision making online so that all parties, including SSE and QMRS have all information readily available.
44. Succession plans must be developed and implemented – people were getting tired.
45. Emergency duty card systems must be reviewed as to achieving objectives using realistic numbers of personnel.
46. There must be a central, clearly defined incident control team.
47. An adequately resourced incident Control Room from which to exert central control is absolutely essential.
48. Recording and logging of events is essential and must be maintained throughout an emergency.
49. Provision must be made for impounding and securing evidence i.e. Deputy or ERZ controller mini-gas instruments.
50. Gathering of experts to provide specialist advice – proximate cause, predictive analysis, options and choices, process control experts specifically to ensure essential process occur/flow.
51. It is essential to have an evacuation trigger point flow chart on the Control Room wall, similar to the call-out procedure flow chart.
52. There must be clearly defined goals, objectives and priorities established by the Incident Control Team including the establishment of an action plan.
53. There must be effective recording procedures, especially by the Incident Control Team of any actions taken, decisions made and reasons/evidence supporting these decisions.
54. Operational base membership should be pre-planned and have identification vests on and have pre-designated times for reconvening for updates on situation.
55. Urgent need to improve the water collecting/dividing manifold.
56. A central point is needed where all current duty card holders are identified with name, location and contact phone number and possibly have something to identify them to outsiders who come to the site.
57. When duty card holders change, this needs to be identified formally. Handover procedures for the Incident Management Team and a range of suitable personnel to fill various roles should be defined.
58. Numbers of people in Incident Management Team room needs to be reduced, maximum should be 5 or 6, not 13 as was the case at various times. Possibly only have sufficient seating for the main players.
59. Process management (decision-making process, time wasting, verification of data, information flow in and out of the incident management room, briefings done on time, checking milestone events, interaction of members) remains a

vital part of incident management and must always be at the forefront of the operations within the IMT.

60. Authorities between the Underground Management Room and the IMT need to be revisited and operational effectiveness analysed.
61. The Mine Manager should be part of the IMT.
62. Reviews and assessments of critical issues need to be done in a coordinated manner and followed through to completion.
63. IMT members should not be going in and out of the room while the IMT is meeting.
64. Fire Officer to review quantities of low expansion foam held on-site and the first response capability of people with respect to fire fighting.
65. Develop improved incident management aids for the IMT to assist the application of a disciplined system for information management, recording and decision-making. Possibly pre-designed whiteboards on the back of the day-to-day whiteboards, that is, flip them over and they are laid out ready.
66. Develop a structured 'decision' (authority) delegation tool for assisting the IMT to remain strategic.
67. Emergency incident management training is to be considered for mid and upper level management.
68. The creation of a position of "Emergency Officer" specifically to address and facilitate expertise in emergency management, fire fighting, chemical hazard management and emergency safety training and systems (not simply another hat but a specific position). The Health and Safety Officer is a different role from this position but they would work with each other.
69. More frequent simulated exercises in atmospheres of impaired vision should be conducted. Everyone in the industry should be exposed to this scenario.
70. Ensure that the number and balance of the IMT is correct. This is a question of fatigue and how long a team should remain constituted until relieved.
71. Ensure that key personnel can be contacted at all times. The location of the Ventilation Officer was incorrectly logged and it was only when the Underground Mine Manager was contacted that the Control Room officer became aware of the Ventilation Officer's location.
72. The system to record the names and location of personnel below ground needs improvement as when some personnel evacuated the mine their tags were not relocated on the tag board causing confusion.
73. All personnel must remove tags or replace lamps, dependent on the system of accounting for personnel when they are safely on the surface.
74. At one point the contact numbers of persons to be notified in case of emergency for the contractors still underground was discussed and how they could be acquired. If the contractor log books had been in use at the mine, as had previously been agreed to by all underground mines, the details would have been readily available.
75. Develop a card system whereby sufficiently training personnel are available to conduct the tasks required by the duty card list.
76. The impact of unstated intrinsic objectives such as – complying with established written procedures, mitigating legal liabilities and favourable judgment of performance by peers against attaining extrinsic objectives such as – saving lives, protecting property and recovery operations as research

indicates that incident management systems have little, if any, impact on the survival rates of underground personnel in the first two hours following a major event.

77. Consideration should be made towards the 'closeting' of the IMT for the greater part of the exercise. This may mentally reduce the potential of individuals to develop independent and innovative solutions due to long periods of intense pressure and an increase in the likelihood of developing a 'group think' mentality.

78. Duty card holders need to recognise the need to remain with the IMT unless authorized to leave. This is especially true if there is an exchange of roles.

79. A systematic process for evaluating fatigue should be implemented rather than rely on the individuals to notify the Incident Controller of their status.

80. Calculators should be included in the duty card briefcases.

81. Suitable techniques should be used to capture ideas, generate alternatives and evaluate the different options to allow for systematic comparison.

82. The IMT members change-over should 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.

83. A written chronological record of milestone events be kept, updated and regularly referred to.

84. 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.

85. A series of check sheets should 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.

86. It is recommended that IMT is to directly brief anybody being dispatched from the surface (mines rescue fresh air base personnel, transport drivers, mines rescue teams, etc) or at least be present during the briefing.

87. It is recommended to allocate a person as surface coordinator to oversee all of the surface tasks, movement of personnel in and out of the mine and liaison with IMT. The control, allocation and updating of the deployment and availability of resources is a vital function of a coordinated emergency response and cannot be overlooked.

88. It is recommended that whiteboards for IMT be pre-formed and ready to be filled in with information like: goals, priorities, location of men underground, known facts, assumptions or data to be confirmed (and how to confirm), gas trending, intervention activities, contingency plans (who and what), etc.

89. The CRO cannot be the first aid attendant at the same time during an incident.

Mines rescue

1. **Key personnel evacuating from underground should be debriefed for all relevant information by experienced mine site personnel. This should be passed on to QMRS teams entering the mine.**
2. **QMRS should streamline the approval process and paperwork for the briefing of rescue teams entering the mine.**
3. **QMRS should formalise their guidelines by using a risk based approach to develop a set of mine re-entry TARPs based on explosibility rather than percentage of UEL and lower explosive limit (LEL) of explosive gases.**
4. **Mine sites should have streamlined processes for re-entry whereby QMRS and other personnel entering the mine in response to an incident are recorded.**
5. **Mine sites should develop their own first response teams as mines rescue deployment take a minimum of 5 hours in the Level 1 Mine Emergency Exercises**
6. **Mines rescue risk assessment process needs to be streamlined to mitigate risk but also be able to provide a prompt response to mineworkers in need.**
7. Consideration should be given by QMRS to review its communication methods with operational teams – this equipment is outdated.
8. Consideration is to be given to review the minimum number of mines rescue trainees – with most people working 12-hour shifts this effectively reduces the number of trainees available to respond by half (fatigue related policies), also with people choosing to live remote from mining areas response times/availability of trainees is prolonged.
9. Site based mines rescue personnel should be trained in mines rescue protocols to provide mines rescue input into the Planning Group/IMT before mines rescue arrive on-site.
10. Review response protocols for QMRS.
11. QMRS need to consider response times to all underground mines and factors which may affect this.
12. It is recommended that further efforts are implemented to ensure that all team members are aware of the task they have been asked to perform and each person's role in the team (there appeared to be confusion on team roles when the original team captain was reassigned to mines rescue fresh air base control).
13. It is recommended that consideration be given to the use of 'ex-brigadesmen' in roles such as mines rescue fresh air base officials to allow full use of "BA current" men (this is particularly relevant when rescue volunteers are few).
14. QMRS 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 FAB official, captain/team checks on equipment, etc).
15. A formal log be kept of the location and status of all rescue equipment (this task is probably best done by surface control, although it requires input from

mines rescue fresh air base officials). This becomes particularly important when two types of breathing apparatus were available for use.

16. Guidelines be developed and implemented for use of vehicles in potentially poor visibility.
17. Emergency communication protocols be reviewed. The rescue efforts were hampered by a lack of effective communications between the mines rescue fresh air base and the surface. The solution presented by the rescue controller to cut the telephone lines at 2 cut-through and install a phone was prevented by the assessment team. In the scenario, this would have cut communications to the remaining survivors underground – and in reality, it would have severed communication to the rest of the mine (some sections of which were still operating). There should have been better options.
18. An expert working party be established to develop and implement a set of guidelines on the protocols for a combined mine site and QMRS intervention effort (i.e. when is it okay to keep a panel crew on breathing apparatus? When should mines rescue teams take over? How should these two groups interact with each other? What are the potential risks?).
19. A need exists to clarify the call out process to mines rescue mutual assistance to ensure that not every trainee is called to attend the site immediately and that only those required be called initially.
20. The Mines Rescue Superintendent has a responsibility to obtain information and keep his personnel fully informed of the status of events, not just wait to be told.
21. The use of home answering machines interfered with the mines rescue call out procedure.
22. A reference system needs to be introduced to ensure that only those trainees current under medical and oxygen time are placed on active duty.
23. Mines Rescue Superintendent vehicle should have 'hands-free' provisions to answer calls and received updates whilst in transit to an emergency.
24. Station Superintendent should be part of operations based team to assist management on mines rescue, gas interpretation, ventilation, fire fighting, escape systems and intervention strategies.
25. Mines rescue key staff need to be identified and should have colour identification jackets on.
26. Mines rescue and team captains need to be present at witnesses debriefings or read their reports.
27. Mutual assistance standard needs to be looked at as call out response times were outside the one hour limit.
28. 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 to 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.
29. QMRS and mines through their mines rescue agreement should ensure that competencies are developed and persons training 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.

30. Whilst QMRS have developed controls to attempt to minimise the effects on mines rescue personnel deployed in hot and humid conditions, these controls (administrative 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.
31. 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 the mines rescue teams and fresh air base controller.
32. 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.
33. It is recommended that a forum of stakeholders be urgently established to develop and implement a set of protocols covering the interactions between mine site first response teams and external aided-rescue organizations. Each of these practices provides specialist, but separate, skills and resources and it is vital that the issues involved in their interactions be identified and coordinated. There is little doubt that CABA teams will increasingly form part of emergency response capabilities in our industry and we must be prepared.
34. It is apparent that some protocols may be hindering the ability of the QMRS to achieve its goals of search and rescue, therefore, it is recommended that a review of mines rescue protocols and procedures be undertaken to determine their continued compatibility with the industry change from traditional aided rescue to the current preferred strategy of self escape. This should specifically cover the policies on team sizes, minimum equipment, stand-by team protocols, etc.
35. There needs to be a review of the number of brigadesmen that the mine can supply at any time of the day or work roster. This could also be expanded to other mines in the mutual assistance group.
36. Consideration could be given to training more of the workforce in basic fire fighting.
37. Protocols on how mines rescue trained personnel on-site are to be utilised should be developed. This can take into account the type of emergency, number available and specific duty card or other specialized needs.
38. Protocols need to be developed regarding what inseam personnel can and cannot do while they are still underground. This commences with a company protocol and leads to a mines rescue guideline on actions and barriers that are required for inseam intervention e.g. could the mine's three rescue trained personnel coming out of the mine have gone to the fire and put it out?
39. Greater effort and focus from key mine and mines rescue personnel needs to be given to getting the first team off the surface.
40. Whiteboards should be developed for use in the rescue room which clearly show: locations and state of critical equipment; team membership and their

equipment; captains type board with basic emergency information and team deployment information and critical times.

41. Risk assessment of critical and/or hazardous activities should be undertaken e.g. when Team 1 decided to fight the fire – how many men should they have had; what BA should they have had (there was CABA on the surface also); what communications should they have had; what turnout gear and first aid equipment do they have; method of fire fighting; active times, etc.
42. The Incident Controller 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 debriefed and equipped is needed as this is the hardest thing to do in reality. Once the actions and limits are set by the IMT, this must become the priority.
45. The role of the QMRS within the IMT should be clearly defined e.g. formally recognised as part of the decision-making team and/or advisory and/or implementation.
46. 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.
47. 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.
48. It is recommended to allocate a designated coordinator to the critical area underground to oversee operations and to communicate directly to IMT – this is especially critical when there are multiple groups operating in one area.
49. It is recommended that a clear decision and instruction on what breathing apparatus is to be used by persons, that is, BG174 or CABA, when both are available.
50. It is recommended that the mines rescue briefing room have schematics indicating location (surface and underground), type, quantity, pressures of all breathing apparatus equipment that can be used. This schematic could include poor visibility walking times between caches and CABA locations.
51. It is recommended that the mines rescue room have a wall prompt indicating priority actions for QMRS personnel as they arrive and when allocated to rescue room duties.
52. Use QMRS cards rather than having to make up visitors' cards for rescue teams.
53. Mines rescue activities should be coordinated through the operations team with a clear communication strategy between mines rescue teams and operations centre, then onto the IMT and Incident Controller.
54. Mines rescue must be fully briefed on who and where people are expected to be underground.

GAG

1. Time delay for the arrival of the fuel tanker for the GAG engine (5 hours) is unacceptable.
2. Maintenance on the GAG was poor in the following areas: fuel leaks around the afterburner injectors; requirement to clean spark plug should not be performed at deployment.
3. It is essential that enough water pressure be available to safely operate the GAG unit.
4. The circumstances regarding the GAG inertisation equipment must be addressed as a matter of priority and in accordance with the current mines rescue agreement in the provision of adequate docking facilities and water supply.
5. Site provisions for use of GAG and mobile laboratory to be investigated and documented to include provision of power, communications to incident control team, parking and the ability to connect the tube bundle systems and other sample locations.

Media coverage/crisis communication

1. To ensure effective management during a crisis a communication spokesperson should be identified.
2. No matter how comprehensive your crisis communication plan becomes, it is vital that it is reviewed and updated on a regular basis.
3. Your first media release should include, as a minimum, the who, what, where and when of the situation. Only provide facts that are from reliable sources and have been confirmed.
4. The industry should develop a communication strategy to reduce fear of the exercise by mine site personnel (to reduce avoidance by mine operations personnel).

Appendix C: Management Team/Assessors

Douglas H. K. White

(Chairman – Queensland Level 1 Mine Emergency Exercise Planning Committee)
Deputy Chief Inspector of Mines (Coal), Queensland Mines and Energy

Douglas has 30 years of underground coal mining experience in the United Kingdom and Australia.

He has managed a number of mines in the Bowen Basin, and has over 10 years of mines rescue experience. He also holds a first class mine managers certificate of competency.

Gavin Taylor

(Assessor)
Chief Inspector of Coal Mines, Queensland Mines and Energy

Gavin commenced his mining career in the southern coal field of New South Wales upon leaving high school in 1967.

He worked through various roles gaining his statutory qualifications and has worked as a deputy, undermanager, mine manager and general manager. He also has qualifications in mines rescue and this will be his fifth level 1 exercise having taken part last year, and in the initial three exercises.

Tilman Rasche BE, MSc

(Queensland Level 1 Mine Emergency Exercise Planning Committee)
Senior Inspector of Mines, Queensland Mines and Energy

Tilman works for Queensland Mines and Energy in Brisbane and was appointed to assist in facilitation of this year's level 1 exercise.

He has 18 years experience in the Australian mining industry, as a trained mining engineer, supervisor, mine superintendent and health and safety manager for a midsized contractor group.

His particular experience lies in developing programmes in health and safety, risk assessments, catastrophic risk management, operations and business improvement, training and quality assurance in this country as well as several overseas operations.
He also has an MSc in Safety Engineering Reliability and Risk Management from University of Aberdeen with specialised skills in advanced risk and reliability methods.

In his spare time he is working towards his PhD with the University of Queensland in safety, risk and reliability engineering and also provides part-time lecturing in risk analysis at University of Queensland's Minerals Industry Safety and Health Centre.

Larry Ryan
(Queensland Level 1 Mine Emergency Exercise Planning Committee)
Computer Systems Engineer, Simtars, Queensland Mines and Energy

Larry has been involved in the development of Safegas, Segas Professional, Ezgas Professional and other gas monitoring software for the coal mining fields for 9 years.

During the level 1 mine emergency exercise, Larry was involved in the actual running of the software simulation on the Safegas software.

Larry has developed, tested, installed and commissioned the Safegas gas monitoring software at mine sites in Queensland, New South Wales, New Zealand and the USA.

Michael D. Downs
(Assessor)
Underground Mine Manager, Bundoora Mine

Mike Downs commenced in 1970 with the North Durham area of the National Coal Board and has extensive experience in most coal mining techniques having worked at numerous mines in the UK, NSW and Queensland, including periods with Thyssen (GB), Barclay Mowlem and the Queensland Mines Inspectorate.

Mike holds first class certificates of competency for the UK, NSW and Queensland, a BSc (Mining) from London University, Associateship of the Royal School of Mines, MBA (Cranfield University), and is a member of the IMMM and a chartered engineer.

Mike is currently a colliery manager in the Bowen Basin and originally underwent training as a Mines Rescue brigadesman at the Houghton le Spring (South Durham) station in the mid seventies using Aerolux and Proto breathing apparatus.

Brad Meldrum
(Assessor)
ERZ Controller/SSHR, Broadmeadow Mine

Brad has worked in the underground mining industry for 17 years with 7 years being in metaliferous (Mt Isa Mines) and 10 years in underground coal . He currently works as an ERZ controller and has held the position of site safety and health representative at the mine for the last 4 years.

David Cliff
(Queensland Level 1 Mine Emergency Exercise Planning Committee)
Associate Professor, Minerals Industry Safety and Health Centre (MISHC), University of Queensland

David's primary role is the undertaking of applied research and consulting in health and safety in the mining industry.

Previously David was the safety and health adviser to the Queensland Mining Council, and prior to that manager of mining research at the Simtars. In these capacities he has

provided expert assistance in the areas of health and safety to the mining industry for over nineteen years.

He has particular expertise in emergency preparedness, gas analysis, spontaneous combustion, fires and explosions.

In recent times he has also devoted a lot of energy to fitness for duty issues particularly fatigue management. He has been a member of the organising committee for the level 1 emergency exercises in Queensland underground coal mines since their inception in 1998. He has also attended or provided assistance in over 30 incidents at mines.

David Nichols
(Assessor)
Senior Inspector Coal Mines, Industry and Investment NSW

David Nichols has 34 years experience in underground coal mining and currently holds a first class honours degree in mining engineering, second class honours degree in law, gas testers certificate, mines rescue certificate, deputies certificate, undermangers certificate, and a managers certificate.

He is currently employed as a senior inspector of coal mines and is the area manager for northern NSW for coal mining, gas and petroleum leases and exploration sites, and for metals mining and extractives industries.

He was also a mine manager for 6 years and has been a mines inspector for over 20 years.

Paul Green
(Assessor)
Deputy/SSHR, Moranbah North Coal

Paul has had 12 years experience in the underground coal mining industry and is currently employed by Moranbah North Coal. He holds a deputy certificate of competency and also has held the position of site safety and health representative at the mine for the last 5 years.

Grant Whitbourn
(Assessor)
Underground Mine Manager, Broadmeadow Mine

Grant currently holds his coal mine certificate from Belment TAFE, NSW undermangers certificate NSW, and his mine managers certificate. He is also a graduate mining engineer from the University of Sydney.

During his career, Grant has been a coal mine worker at Wallsend Borehole No. 2 colliery, shift undermanager at Foybrook Pykes Gully and Hazeldene Collieries, a tunnel engineer at Malabar and North Head Ocean outfall Tunnel Projects, project engineer/manager for small projects in NSW coal mines, mining engineer North Goonyella Coal Mine, technical services manager for Celtite (Strata support manufacturer), contracts engineer at Broadmeadow, and is currently the underground mine manager at Broadmeadow Mine.

Greg Dalliston

(Queensland Level 1 Mine Emergency Exercise Planning Committee)
District Union Inspector, CFMEU Mining and Energy Division QLD

Greg has been involved in the mining industry for 34 years, and has gained experience in numerous areas. He started his career as a cadet mine manager with the Queensland Coal Association prior to working in a variety of positions within the industry, including eight years as a mine deputy.

Greg is employed as an industry safety and health representative with the CFMEU, a position that he has held for the last fifteen 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 mining industry;
- Member of state and national training committees for the mining industry;
- Conducting safety audits and inspections at coal mines throughout Queensland;
- Investigating serious and fatal mining accidents and assisting the mining warden as a reviewer into mining accidents;
- Conducting debriefs after incidents and providing critical incident management services;
- Development of manager, undermanager and deputy statutory national competency standards, including risk management and emergency response;
- Role in organising the 2006 Fight or Flight Seminar from which industry best practice is being developed for mine emergency response;
- Member of the Queensland Level 1 Organising Committee since its inception in 1998; and
- Member of the Coal Mines Safety and Health Advisory Council and Inspectorate Review Committee.

Greg has been part of study tours to look at issues including emergency response, risk management, international mine disasters and associated legislative changes to USA, Canada, UK, NZ and Philippines.

Mark Munro

(Assessor)
Operations Manager, United Colliery NSW

Mark is currently the operations manager of United Colliery, a 3Mtpa longwall operation located in the Hunter Valley of NSW.
He has a first class managers certificate of competency and a graduate diploma in mine ventilation from UNSW. He has also worked as a surveyor, undermanager, development coordinator, ventilation officer, strata control engineer and gas drainage engineer during his 33 years in the mining industry.

Shaun Dobson

(Assessor)
Underground Mine Manager, Carborough Downs

Shaun is currently the underground mine manager at Carborough Downs. Previously he was employed by North Goonyella Mine as underground mine manager.
He has 10 years experience in Australian underground coal mining at various mines in Queensland (predominantly) and NSW working as a deputy, undermanager, longwall coordinator, development manager, longwall superintendent, and longwall manager.

The majority of his previous working life was spent in the UK in underground coal mining working as a fitter, face worker, deputy, and undermanager.

Stephen Ellis
(Assessor)
Compliance Superintendent, Kestrel Mine

Steve was born in the UK, where he graduated in mining engineering at Doncaster. He achieved his first class mine manager's certificate of competency in 1983 and worked in operational and technical roles in several underground coal mines in the UK both as a contractor and in senior management roles, before relocating to Australia in 2006.

Steve started his career in Australia as superintendent of development, where he achieved his ventilation officer certificate in 2007 and advanced diploma in underground mine management during 2009. He has been in operational and technical roles, including ventilation officer at Kestrel. He and his family became Australian permanent residents in 2009 and Steve is currently studying to achieve his first class mine managers certificate of competency in Australia.

Andy Fynn
(Assessor)
Senior Inspector of Mines, Queensland Mines and Energy

Andy joined the Mines Inspectorate in 2009 from the UK, where he had been working for the past 5 years as a project manager for the government, dealing with public safety and subsidence issues associated with abandoned coal mines.

Prior to this he worked as assistant mines manager at an underground gypsum operation and HSE manager for the associated large surface manufacturing operation. He also has 16 years experience in underground coal, where he progressed from operator level, through to undermanager. Andy is a chartered engineer (UK), has an MBA and also holds a UK first class certificate of competency.

John Grieves
(Assessor)
Senior Project Engineer/Acting Land and Tenures Manager, New Hope Group

John Grieves is a degree qualified mining engineer (UQ) who is currently working with the New Hope Group in their resource development department, developing long term mining projects.

John is completing a master of mining engineering (Mining Geomechanics - UNSW), has completed a graduate diploma in mine ventilation (UNSW) and was previously senior mining engineer and ventilation officer at North Goonyella Coal Mine. Prior to North

Goonyella, John worked at Central Colliery and South Blackwater's underground operations in mining engineering and relief supervisory roles.

John was a Queensland Mines Rescue member for six years, has completed the QMRS MEMS course and participated in a number of emergency exercises, including Queensland's Kenmare's Level 1 exercise in 1999.

Mark Bulkeley
(Assessor)
Safety and Training Manager, Baal Bone Colliery NSW

Mark commenced his mining career in 1975 in the NSW western coal fields. He is currently working as the safety and training manager at Baal Bone Colliery and has been with this mine for the past 23 years.

Mark has worked in various roles, some of these being underground operator, training officer, colliery fire officer and mines rescue team member.

Mark has coordinated a number of onsite underground emergency scenarios; these have included input from the Western Mines Rescue.

Mark has been involved with Mines Rescue over the past 25 years as a Mines Rescue team member conducting activities such as coordinating mines rescue teams and training.

Currently Mark is studying business management through the Queensland University.

Carissa Crozier
(Logistics Coordinator, Queensland Level 1 Mine Emergency Exercise Planning Committee)
Senior Administration Officer, Queensland Mines and Energy

Carissa migrated from the South Island of New Zealand to Australia in 2007, having previously lived in Australia between 2001 and 2004. Prior to this move she had been working for a New Zealand law firm.

She commenced with Queensland Mines and Energy in June 2007, and leads the Safety and Health Administration team in the Rockhampton branch together with assisting the Central Safety and Health Manager, Deputy Chief Inspector of Mines (Coal) and Mines Inspectorate in the Central Region.

She has worked on several strategic committees and open forums for the Department including the Health Improvement and Awareness Committee, Sealing Workshop Planning Committee and Industry EEM Meetings.

Carissa commenced working with the Queensland Level 1 Emergency Exercise Planning Team in 2008.

Glossary

Term	Definition
AMR	A brand of gas detector
Approved standard	A standard made for safety and health under the repealed Coal Mining Safety and Health Act 1925 stating ways to achieve an acceptable level of risk to persons arising out of coal mining operations.
Armoured flexible (face) conveyor (AFC)	A chain conveyor that conveys coal along the longwall face and transfers it to the beam stage loader.
AusAID	Australian Government's overseas aid program
Beam stage loader (BSL)	A chain conveyor which transfers coal from the armoured flexible (face) conveyor to the gate conveyor.
Bleeder heading	An underground roadway in a mine where air is allowed to circulate around a working longwall face.
Blind man stick	Plastic conduit bent into a hook and used to guide persons who have no or limited visibility in the same way that a blind person uses a white cane.
Brattice	Plastic sheet material made from fire resistant antistatic material used to construct temporary ventilation control devices in an underground coal mine.
Brigadesman	Mines rescue team member
c/t or CT	Cut-through
CABA	Compressed air breathing apparatus
CD	Compact disk
CFMEU	Construction, Forestry, Mining and Energy Union
CH_4	Methane
Changeover bay	A place for the changeover of one self contained self rescuer to another, possibly with ventilation to ensure that

Term	Definition
	this can be achieved with no exposure to contaminated air.
CO	Carbon monoxide
CO_2	Carbon dioxide
Continuous miner	Coal cutting machine used to develop new roadways in a mine.
Crib room	Location where mineworkers eat, and a meeting station for the ERZ Controllers.
CRO	Control room operator
Cut-through	A passage cut through the coal, connecting two parallel entries.
Cylume stick	Plastic sleeved stick containing two chemicals which, when combined by twisting the stick, produce light as a result of the chemical reaction.
DAC	Underground intercom system also referred to as the tannoy
Deputy	Mine worker responsible for safety inspections. This is the name given under old Queensland legislation. See also ERZ Controller.
EBA	Emergency breathing apparatus
Eimco	Brand name of a flameproof mechanical shovel
EMP	Emergency management plan (interchangeable with ERP)
EMT	Emergency management team
E/IM IAP	Emergency/Incident Management Incident Action plan
ERP	Emergency response plan (interchangeable with EMP)
ERZ	Explosion risk zone
ERZ Controller	Mine worker responsible for safety inspections traditionally referred to as a Deputy.
Face	The exposed surface of a coal deposit in the working place where mining is proceeding.

Term	Definition
Face-road	Underground roadway on which the longwall equipment is installed. Usually wider than the normal roadways driven underground.
Flameproof	An explosion protection method. In relation to underground coal mine vehicles flameproof means the vehicle and engine have been modified and fitted with extra safety equipment to ensure it will not propagate or generate flame or sparks which could initiate an explosion of the surrounding atmosphere.
Flaps	Brattice sheets hung from the mine roof used as a ventilation control device.
Fresh air base	A continuously monitored station for dispatch or return of rescue teams in close proximity to irrespirable zones.
GAG	A device based on a Polish military jet engine used to produce large quantities of inert exhaust gas for extinguishing underground mine fires
Gas chromatograph.	A laboratory instrument used to analyse the composition of gas samples.
Gate conveyor	The gate conveyor is the belt conveyor which conveys the coal from the BSL to the outbye conveyors
GC	Gas chromatograph
“Go Line”	An assembly area on the surface where mobile plant is left after servicing and when available for use.
ICS	Incident control system
ICT	Incident control team (term is interchangeable with IMT)
IMT	Incident management team (term is interchangeable with ICT)
Inbye	Mining term for into the underground mine (away from the surface) from the point of reference
Industry safety and health representative	A person who is appointed under Section 109(1)5 of the Coal Mining Safety and Health Act 1999 to represent coal mine workers on safety and health matters and who

Term	Definition
	performs the functions and exercises the powers of an industry safety and health representative mentioned in Part 8, Division 2.
Inertisation	The act of decreasing oxygen concentration in the mine atmosphere by the introduction of other gases such as nitrogen or carbon dioxide to prevent a possible explosion
ISHR	Industry safety and health representative
Key performance indicator	A measure of performance against a required outcome.
LEL	Lower explosive limit
Level 1 mine emergency exercise	State level mine emergency exercise to test the mine's emergency response system; test the ability of external services to administer assistance and provide a focal point for emergency preparedness in the state.
Level 2 mine emergency exercise	A major mine site exercise to test the mine's emergency response system and communication with external services.
Level 3 mine emergency exercise	A minor mine site exercise to ensure all personnel are familiar with the mine's emergency evacuation plan and provide practical training in emergency response including evacuation.
Longwall face	A method of mining flat-bedded deposits, in which the working face is advanced over a considerable width at one time.
Lower explosive limit	The concentration in the atmosphere of an explosive gas or vapour that must be reached before an explosion of that gas can occur. Below this concentration there is insufficient quantity of fuel to propagate a reaction.
Macroview	A brand of mine SCADA system.
Maingate	The principal or central heading along which the coal is conveyed from the longwall face.
Man transport	Vehicle used for transporting men into and out of the mine.
MARS	Manual and automatic resuscitator system
MEMS	Mine emergency management system

Term	Definition
MG	Maingate
Mines Inspector or District Inspector	Official employed to make examinations of and to report upon mines and surface plants for compliance with mining laws, rules and regulations, safety methods
Mines Inspectorate	The organisation who control the mines inspectors
Mines rescue fresh air base	Location established by mines rescue when entering the mine which is known to be fresh air, i.e. uncontaminated.
MISHC	Minerals Industry Safety and Health Centre
MSHA	Mine Safety Health Administration, USA - Department of Labour
Mole	Name used to refer to the mine site representative on the organising committee for the level 1 mine emergency exercise.
NMA	Nominated Medical Advisor
Non-verbal communication	Method of communicating using beeps on a telephone or DAC similar to morse code.
NSW	New South Wales
OCE	Open Cut Examiner
O_2	Oxygen
Outbye	Mining term for out of the underground mine (towards the surface) from the point of reference.
Panel	The working of coal seams in separate panels or districts; e.g., single unit panel. A longwall face is sometimes referred to a panel.
PED	Personal emergency device, a short message sent or received using a personal emergency device is also called a 'PED'.
Personal emergency device	Ultra low frequency through-the-earth communication system used for paging. Originally developed to provide a fast and reliable method of informing underground miners of emergency situations. Due system enhancements and the

Term	Definition
	ability to readily contact personnel wherever they are underground, PED is also sometimes referred to as Productivity Enhancement Device.
PHMP	Principal hazard management plan
PJB	Flameproof diesel powered man-riding vehicle carrying up to 12 personnel
Portal	The surface entrance to an underground mine
Portal guard	Person on security at the surface preventing unauthorised entry into the mine in an emergency and reporting all personnel evacuating from the mine
ppm	parts per million
QMRS	Queensland Mines Rescue Service
Principal hazard	As defined in the Coal Mining Safety and Health Act 1999, a principal hazard is a hazard at the coal mine with the potential to cause multiple fatalities.
Principal hazard management plan	A plan developed to manage a principal hazard as required by Section 62 of the Coal Mining Safety and Health Act 1999.
Radio ribbon	The radio wire pulled out by mines rescue to use as a conduit of radio communications between the active rescue team and the fresh air base.
Recognised standard	A standard made for safety and health under the Coal Mining Safety and Health Act 1999 stating ways to achieve an acceptable level of risk to persons arising out of coal mining operations.
Reflective droppers	A plastic strip hung from the roof in the mine with a reflective strip used to highlight the location of a changeover bay.
Rib	The solid coal on the side of a gallery or longwall face; a pillar or barrier of coal left for support.
Rib spall	The action of the ribs breaking down and breaking off in flakes.
Safegas	Brand name of a mine gas monitoring system (developed by

Term	Definition
	Simtars).
Safesim	Brand name of gas simulation software used to input simulated gas values into Safegas (developed by Simtars).
SCADA	Supervisory control and data acquisition
SCSR	Self contained self rescuer
Self contained self rescuer	A respiratory device used by miners for the purpose of escape during mine fires and explosions; it provides the wearer a closed-circuit supply of oxygen for periods of time usually less than 1 hour.
Shearer	Mechanical device used for cutting and loading the coal on to the AFC on the longwall face
Simtars	Safety in Mines Testing and Research Station
Site safety and health management plan	Refer to principal hazard management plan
Site safety and health representative	As defined in the Coal Mining Safety and Health Act 1999, a site safety and health representative is a coal mine worker elected under Section 93 by coal mine workers at the coal mine to exercise the powers and perform the functions of a site safety and health representative mentioned in Part 7 Division 2.
Site senior executive	As defined in the Coal Mining Safety and Health Act 1999, a site senior executive is the most senior officer employed by the coal mine operator for the coal mine who— (a) is located at or near the coal mine; and (b) has responsibility for the coal mine.
Smoke glasses	Light weight goggles sprayed with paint to wear over normal safety glasses to reduce visibility to simulate possible conditions after an explosion or fire
SOP	Standard operating procedure
Spall	Flakes of a coal that are broken off a larger solid body of coal.
SSE	Site senior executive

Term	Definition
SSHR	Site safety and health representative
Standard operating procedure	As defined in the Coal Mining Safety and Health Act 1999 a standard operating procedure is a documented way of working, or an arrangement of facilities, at the coal mine to achieve an acceptable level of risk, developed after consultation with coal mine workers.
Stopping	A ventilation control device which stops ventilation flow
Stowage	In longwall mining the space from which the coal has been extracted and which has been filled with waste. Sometimes containing coal and other waste material.
Supervisory control and data acquisition	A system that collects data from various sensors at a factory, plant, mine or in other remote locations and then sends this data to a central computer which then analyses and manages the data and uses it to control the process being monitored.
Surface controller	Person in charge of surface operations in an emergency
Surface marshal	Person responsible for coordinating personnel in an emergency
Tag board	Peg board where underground personnel place a token to indicate their presence in a section of the mine.
Tailgate	A subsidiary gate road to a conveyor face as opposed to a main gate. The tailgate commonly acts as the return airway and supplies road to the face
TARP	Trigger action response plan
UEL	Upper explosive limit
Trigger action response plan	A documented plan which details actions to be taken when some predetermined trigger point is reached, e.g. the actions to be taken if increasing concentrations of carbon monoxide in a mine reach a predetermined limit.
Upper explosive limit	The concentration in the atmosphere of an explosive gas or vapour that once exceeded ensures that an explosion of the gas cannot occur. This results from the explosive gas displacing sufficient air such that there is not enough oxygen

Term	Definition
	to promote a reaction.
Undermanager	Mineworker who is in charge of the mine on a shift basis, i.e. shift supervisor.
USA	United States of America
Winder	An electrically driven engine for hoisting a cage or cages up a vertical mine shaft.

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