MINE SIMULATED EMERGENCY EVACUATION EXERCISE

at

SOUTHERN COLLIERY

TUESDAY 27TH OCTOBER 1998

INDUSTRY REPORT

Executive Summary

Southern Colliery on the night of 26th – 27th October 1998 was no place for the untrained, the halfhearted or the dainty.

An emergency exercise was being conducted specifically designed to test not only internal and external emergency systems but further, to explore and test the physical and technical limits of the personnel involved.

It was not a competition, there were no correct solutions and it was deadly serious.

The exercise was timed to commence at 12.05am, specifically because

- there would be the least number of Duty Card personnel available
- historically, the least experienced (or junior) personnel work this shift
- the designated Incident Control Team personnel would be sleep deprived
- after hours call out procedures would be fully tested

On the surface

- a constant stream of alarms and sensor failures were instigated, in real time, over many hours
- an incessant deterioration of circumstance and increases in potentially catastrophic consequences
- all underground communications systems were destroyed inbye of the "event" area
- absolutely NO information was provided unless persons physically undertook the action that would provide that information

Underground

- persons had their visibility severely impaired through the use of "*smoked glasses*"
- all persons were required to wear self rescuers and could not talk
- they were forced to navigate unfamiliar areas of the mine for many hours whilst virtually blind
- they were required to walk long distances through extremely challenging conditions
- ANY mistake in an Emergency Breathing Apparatus changeover had lethal consequences

And, there was no respite.

There were no offers of "*hints or solutions*", no "*near enoughs*", no "*taken as done*", not even offers of transport for exhausted crew members.

Given these parameters then, and the fact that this was the first full-scale test of the **Self Escape** philosophy conducted , it is understandable that the exercise produced such a high mortality rate.

Understandable yes, acceptable no.

This report contains detailed analysis of the strategies involved in the conduct of the exercise, together with the observations and findings of the Assessment Team.

I commend the report to you and request you view its material most seriously, and thoughtfully consider the application of the lessons learnt during this exercise for incorporation into your own enterprise.

Yours faithfully

Greg Rowan - Inspector of Mines (Coal)
CHAIRMAN : EMERGENCY EXERCISE MANAGEMENT COMMITTEE

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Scope

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

These guidelines proposed that exercises

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

In recognition of these guidelines

i. a Strategy Document was produced establishing the systematic initiation, control and assessment of the exercise
ii. mines signed to provide mutual assistance were required to supply mines rescue trainees and GAG operators sufficient to meet the exercise minimum needs i.e. 14 trainees and 3 GAG operators
iii. a Scenario was developed strictly in accordance with the hazards present at Southern colliery and events which have previously occurred at the mine
iv. the exercise was conducted on the dogwatch shift commencing 26th October 1998
v. QMRS, police, media, senior company officials, SIMTARS, DME, district check inspectors, hospitals, ambulances and doctors were involved
vi. formal audit tools were developed and validated by all members of the Emergency Exercise Management Committee. Formal de-briefings of assessors and Southern colliery personnel were conducted to evaluate the results. This report is the result of the comprehensive audit and evaluation process
vii. formal risk assessment was conducted at the inaugural meeting of the Emergency Exercise Management Committee held in Mackay on 10th September 1998. This risk assessment covered risks at the mine and risks to the general community
viii. inertisation equipment was called to site and operated. Surface airlocks, emergency seals and the connections for the GAG were not evaluated due to heavy overnight rain introducing unacceptable risks in the transport of the GAG and ancillary equipment to the tunnel mouth.

All audit and assessment tools were developed against the internal procedures of the agencies involved. These documents include Southern Colliery Evacuation Management Plan, CAPCOAL Emergency Response Plan, QMRS Emergency Preparedness and Mines Rescue Guidelines, the DME Emergency Response Manual and the Approved Standard for the Conduct of Emergency Procedures Exercises.

Objectives

The objectives of the exercise were to

- Ensure no personnel injury, equipment damage or introduction of additional risks. Note: Design of the emergency exercises must be done using Risk Assessment Methods.
- Test the ability of the current Mine Emergency Procedures Plan to meet the desired outcomes of an emergency response.
- Relate to the principle hazards identified as being integral to the mine itself.
- Demonstrate a coordinated response.
- Assess all the elements and personnel involved and identify any additional training needs.
- Avoid any community alarm/apprehension,
- Enhance the confidence and ability to respond to an emergency.
- Involve all shifts at some stage through the year. The intent is that the emergency preparedness of the mine is tested for any time of the day or night.
- Allow for a performance analysis and debrief to occur following all major emergency exercises (types A and B) with outcomes recorded and relevant information disseminated to the industry.
- To test the ability of external agencies to respond to an emergency.

To meet this objectives, and additional to the steps outlined in the previous section

- Audit and Assessment tools were developed to cover the following functions
  - Emergency Initiation
  - Duty Card System
  - Emergency Control
  - Emergency Evacuation
  - QMRS – Ability to Respond, Mutual Assistance
  - Accounting for Personnel
  - De-briefing of Personnel
  - QMRS – Performance Criteria
  - External Agencies – Ability to Respond

- External agencies were involved in the risk assessment process i.e. Dept of Emergency Services and Police District Disaster Coordination Officers
- All media outlets were informed in advance through Police and Ministerial media advisers. This information was held under embargo by the media
- Wide community notification of the “window” for the exercise

Emergency Exercise

Scenario

During the last 5 months, the ventilation branch resistance in Longwall 703 has reduced considerably as the longwall retreated. Similarly, as MG 704 and the 700 Mains continued development, their respective ventilation branch resistance's increased accordingly. Such changes in resistance result in significant increases in air quantities in LW 703, and subsequent decreases in air quantities in the development panels. The degree of change in branch resistance may have been exacerbated by the availability of only one return roadway from the Fan Shaft to Cut/Thru 20 Main Dips – a pillar inbye of maingates for LW 703.

The conditions in the Longwall are "*too bloody windy"* and the troops are being "*sandblasted*". The development sections are *"hot as hell"* and "*never seem to get enough air".*

On Monday afternoon 26th October 1998, during a particularly hot, humid and uncomfortable afternoon, "*person or persons unknown"* restricted the regulator on the LW 703 return. This indeed had the desired effect of decreasing the windstorm blowing along the longwall face AND increasing the air quantities available to the development sections.

But that's not all…..

First Inspection 4.50 p.m.	Ventilation *"More than Adequate*" Gas "*0.1% CH4 at Maingate" "0.4% CH4 at Tailgate" "Nil Elsewhere"* Roof and Sides *"Roof hanging up behind chocks" "Sides Secure"* Other Danger *"None Apparent"*
Unauthorised Closure of Regulator at Ventilation Station 16	Decrease in Air Quantity across Longwall 703
Decrease in Air Quantity across Longwall 703	Loss of Air Velocity Loss of Dilution Ability Loss of Layering Protection
Severe tropical storm around dusk	Sharp drop in barometric pressure Sudden cooling down of air temperature on surface
Sharp Barometric Pressure Drop	Fresh air fringe behind the chocks shrinks Goaf Gas, mainly CH4, breathing out Velocity not sufficient to dilute Layering occurs
Second Inspection 8.45 p.m.	No evidence of increased gas in general body OR within safe distance behind chocks *"Same as Previous Inspection*"

Goaf gases continue to migrate	Fresh air / explosive fringe now at chock line Layering along entire face Incorrectly OR Improperly OR Inappropriately erected brattice wing across tailgate prevents build up being detected by sensor or tube bundle
Shift change occurs	Final Inspection performed 3 hours prior to shift change – no gas detected, Nothing to report Shift change occurs as usual
Production continues 12.05 am (prior to next Inspection)	Shearer Located at Tailgate Frictional Sparking on Roof Stone Gas Layer Ignites Flame travels like a fuse into the fresh air / explosive fringe IGNITION
IGNITION	Devastating explosion of large volumes of methane / air [approx. 2500 m;] Major Percussion Wave along longwall to maingate and out along MG supply road and homotropal belt road Lesser Percussion Wave up along tailgate roads Coal and coal dust is burnt along all roads although dust explosion is NOT propagated
Blast Wave Travels Outbye both Maingate and Tailgate Roadways	Coffin Seal @ MG703 Belt Rd 1→2 C/T — DESTROYED Overcasts @ 18 and 19 C/T "E" Hdg — DESTROYED Stopping 20C/T dogleg — SURVIVED Overcast @ 15 C/T "E" Hdg — SEVERELY DAMAGED Regulators @ 17 C/T — DESTROYED Regulator @ Vent Station 16 , 15→16 C/T — DESTROYED Double Doors @ 15C/T — SEVERELY DAMAGED Double Doors @ 14C/T "D"→"E" Hdg — BLOWN OPEN Brattice Screen @ 14C/T "C"→"D" Hdg — BLOWN DOWN LW 702 → LW 703 Seals — DAMAGED MAIN MINE FAN REMAINS UNDAMAGED and OPERATING
Ventilation Circuits	Main Intake airflows short-circuiting into return at C/T's 15, 18 and 19 LW 703 airflow *"draw only"* into tailgate and return — REDUCED BY 95% 700 Mains airflow — REDUCED BY 75 % MG 704 airflow — TOTALLY DISRUPTED

Atmosphere	Large percussion wave has lifted dust into all airways throughout mine Thick Smoke and Haze around LW 703 C/Ts 12 →19 Mains Visibility C/T 1→12 CLEAR C/T 13→19 Mains Decreasing from 25-30meters at C/T 16 to ZERO LW 703 ZERO Around 700 Mains 5 to 10 meters Around MG 704 75 to 100 meters
Gas Monitoring Devices SENSORS	Sensors 1 FRESH AIR for 30 min then CO STEADY RISE TO OFF SCALE after 15 min Sensors 4, 18 TAKEN OUT Sensors 8, 11 STEEP CO INCREASE then OFF SCALE Sensor 10 STEEP CO INCREASE then OFF SCALE CH_4 REMAINS STABLE Sensor 9 CH_4 and H_2S CONTINUOUS STEADY RISE Sensor 2 CO, CH_4, O_2 DUPLICATE TUBE BUNDLE No 11 Sensor 12 FRESH AIR All Others REMAIN UNCHANGED
Gas Monitoring Devices TUBE BUNDLES	Tube 1 to 10 REMAIN UNCHANGED Tube 11 RAPID PEAK – PRODUCTS OF 2500m; OF 7% CH_4 and AIR DECREASES - DILUTED BY 225m;/sec AIRFLOW STEADIES AS PRODUCTS DRAWN OUT OF LW703 by 5% ORIGINAL AIRFLOW IN LW703 AFTER ½ HR – RAPIDLY INCREASING PRODUCTS of COAL COMBUSTION Tube 12 [destroyed to 18C/T "D" hdg] PICK UP METHANE/AIR EXPLOSION then after 15 min INCREASING PRODUCTS of COAL COMBUSTION Tube 17 [destroyed back to DD's 15 C/T] PICK UP METHANE/AIR EXPLOSION then CO CLEARS followed by CH_4 STEADY RISE (2hrs) INTO EXPLOSIVE ZONE
Services	Underground Power Tripped All communications inbye C/T 18 Mains are Dead Compressed Air Lines Ruptured at C/T 18 Mains Main Water Lines Ruptured at C/T 18 Mains

Coal and Coal Dust Smoldering around LW 703 D/Head and Transfer Point	Smoke Entering Airways
Large Coal Fire Develops around LW 703 Transfer Point approx. ½ hour after methane ignition. Rapid acceleration of combustion. Atmosphere after ½ hour inbye 18C/T to faces of 700 Mains and to 7C/T MG 703 contains > 10,000ppm CO	Intake Airways Outbye C/T 13 → 14 Mains remain clear Visibility deteriorates rapidly until reaches Zero at C/T19 Mains Visibility in All roadways inbye C/T 19 at Zero and full of Smoke Combustion products rapidly diluted as they enter the short circuited main return. Fan shaft air quantity increased by 10% due to decrease in mine resistance INCORRECT CHANGE-OVERS FROM OXYBOKS TO OCENCOS IN THESE AREAS HAVE FATAL CONSEQUENCES
Fire Continues to Rage around LW 703 Transfer Point Methane continues to hold within he explosive range on Tube No 17 Hydrogen Sulphide and Methane continue to climb in Sensor No 9	Scenario Reconstruction by Incident Control Team All survivors / witnesses accounted for No appearance or communication from members of LW 703 crew
GAG Inertisation used from the surface in attempt to bring fire under control	Ventilation Management Predictive Analysis

Outbye Personnel	Designated Outbye Deputies WILL TAKE NO PART IN THE EXERCISE Their function is to keep statutory inspections, belts, pumps etc running All other outbye personnel who are INBYE of C/T14 700Mains
LW 703	No Survivors For purpose of exercise, all persons shall don their SCSR (TRAINERS ONLY) and walk from the mine via their designated Escape Route ¾ hour after Ignition. They will NOT be available for debriefing once on the surface
700 Mains	Feel extreme percussion blast – Smoke and Dust cut visibility to 5-10 meters Barely noticeable air flows Power Tripped, No Communications Don SCSR (TRAINERS ONLY) wear smoked sun glasses and drive out of mine Communications only available outbye C/T 18 700 Mains Hear compressed air escaping and sounds of water flooding around C/T 18 700 Mains Visibility clears at C/T 13 → 14, 700 Mains Pick up all outbye personnel encountered on the way out Once De-briefed are/can be used as Duty Card Holders until relieved
MG 704	Feel extensive percussion Ventilation Stops, Power Trips, No Communications NO TRANSPORT AVAILABLE Don SCSR (2 ONLY REAL UNITS – OTHERS TO USE TRAINERS) and commence walk out of mine. Visibility deteriorates -Don Smoked Sun Glasses at 25C/T in MG 704 Gradual Increase in Temperature Change over to EBA's Continue walk out of mine Hear compressed air escaping and sounds of water flooding around C/T 18 700 Mains Large fire, extreme heat radiating at C/T 18 "C" → "D" hdg Visibility clears at C/T 13 → 14, 700 Mains Communication available outbye C/T 18 700 Mains

Exercise Initiation

Assessment Summary

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

A number of points of focus emerged through this Initiation Strategy

- the Control Room Operator has, in the event of an emergency, far too much to do
- misinterpreted verbal communication between the Control Room and Incident Control led to serious delays in obtaining vital information. The lack of this information may, in a real event, have had catastrophic consequences
- the ergonomics of the control room and the computer displays interfered considerably with the ability to perform duty functions and access information
- methods of recording events and logging actions must be simplified AND be better displayed. Far too much of the CRO's time was wasted in writing things down and answering "*have you done this…"* or *" what's the status of that…"*
- emergency communications systems. Underground communication systems (including DACs) are notoriously fragile and subject to disruption inbye of an "event" area. Offsite telephone switchboards (TELSTRA) appeared to malfunction due to wet weather and the role of home answering machines in stalling Call Out procedures needs serious review
- it is an essential function in any emergency response to have someone dedicated SOLELY to the collection and analysis of accurate gas monitoring information. No-one was observed checking the previous deputy reports for any information on what may have happened.
- Control Room Operations are undoubtedly competency based functions and as such must be subject to training needs analysis and skills identification

The attached Assessors Comments and Assessment Tools are provided to expand on the detail of these focus points.

Please take time to consider them carefully.

Emergency Initiation

Assessors Comments

ASSESSOR: Dr. DAVID CLIFF

Background:

My involvement in this exercise was to generate all the gas monitoring data associated with the simulated explosion and subsequent fire and then to enact the incident via the surface control room at Southern Colliery. My assessment is therefore based solely on the actions of persons that I witnessed directly either in the control room or adjacent to it and/or associated with gas monitoring. I did not have a formal audit sheet to check actions against. Such audit sheets were derived from the mine's own emergency response plan.

Qualifiers:

During the exercise there was an unfortunate miscommunication between mine personnel that lead to the incident management team believing that the tube bundle gas monitoring system was not operating. This miscommunication prevented any interpretation of the tube bundle data during the episode for the first three hours of the exercise and full use of the information that it contained.

As I understand it the message was intended to be that the control room personnel should not access the tube bundle data, as technical services personnel were to remain responsible for the data until the fibre optic link from the monitoring hut was properly checked, NOT that the tube bundle was not operating [1]. In any case I was informed that accessing the tube bundle data via MACROVIEW would only give real time data with no trending or storage occurring yet.

It is also therefore not possible to comment upon attempts to use the GC to evaluate gas concentrations derived from any potential bag samples extracted from the tubes.

Once I became aware of the error I did inform mine personnel of the situation.

Simulation of Gas Monitoring Data

Gas monitoring data could not be displayed upon the actual computer screens as this would interfere with the actual monitoring occurring at the mine. However data was generated in hard copy to reflect all possible report formats that the control room operator would generate. These reports would then be released when the control room operator demonstrated the functions on his computer screen as he investigated the alarms and/or trended the gas monitoring data. Nevertheless it was not possible to audit the actual operation of the gas monitoring system and its operators.

Data were generated to reflect both the MACROVIEW system (real-time gas sensors), the tube bundle system and any attempt to extract gas samples from the tube bundle system to analyse by Gas Chromatograph.

In addition data were provided to the underground assessors to simulate the gas monitoring data obtained from the deputies MiniGas gas detectors. This allowed for the cross sensitivity of the various sensors to other gases -e.g. the pellistor to carbon monoxide and hydrogen and the CO sensor to hydrogen sulphide.

[1] A verbal message from the Control Room that "*the tube bundle data can't be accessed in the Control Room*" was interpreted by the Incident Control Team as "*the tube bundle system isn't working*"

Emergency Initiation

The data generated simulated a frictional ignition at the face of longwall 703 which ignited a cloud of methane in the goaf. This explosion then expanded out into the gate roads destroying monitoring sites in these roads and pushing the panel belt out into the main roads where it intersected the main belt and a coal fire started in a pile of loose coal under the belt. The belt would have cut communications inbye 18 c/t in the main headings and also severed the compressed air and water lines. The ventilation would have been short circuited by the explosion damaging or destroying the overcasts at 15 and 18 C/Ts. Details of the scenario can be found in the source documents generated by Greg Rowan.

From a gas monitoring point of view, initially a plug of gas high in CO, and CO2 and low in O2 would propagate out of the active longwall panel and into the mine workings , some being swept out by the mine ventilation expelled through the fan the rest percolating further inbye as the ventilation inbye 18 c/t would be virtually non existent. The pressure wave would throw up stone dust and small amounts of coal dust reducing visibility.

The coal fire under the belt would then become significant, propagating along the rib line toward the main return, generating increasing amounts of smoke, CO and CO2 and some hydrogen and ethylene which in turn would start to enter the 700 mains development, 704 Maingate and exit up the return to the fan.

In addition due to the loss of ventilation in 703 tailgate, seam gas would seep out of the active panel and also from adjacent goafs where seals would have been breached. 700 mains also has a significant methane make and so the methane concentration would rise in this area. Hydrogen sulphide is also present in 704 Maingate and this concentration would also rise if the ventilation was curtailed into this area.

Based on comparison with previous historical data, it was **estimated that around the belt area where the fire was initiated, there would be lethal concentrations of carbon monoxide within one hour**, a steady state would exist with the fire due to limited oxygen supply within two hours. The zone of lethal carbon monoxide would gradually spread into the 700 mains and up the 704 Maingate.

If the fire was not controlled within 8 hours an explosive mixture of methane would reach the fire from the 700 mains and a second explosion would occur.

The atmosphere emanating from 703 tailgate would also be in the explosive range.

Emergency Initiation
Observations

1. In preparing for the exercise in the morning of prior to initiation, I checked the state of the MACROVIEW operating system and noticed the following:

   a) **Three monitoring locations marked on the computer screen were not as specified on the maps provided** to me. Further investigation revealed that site personnel could not move monitoring locations but had to forward a request to Brisbane where it was passed onto a computer consultancy who would modify the diagram and send it back. Control room personnel were not aware that these locations were incorrect.

   b) A number of monitoring sites were not active. These showed up on the MACROVIEW screen flashing red as the sensor input violated the low alarm point. It would be more efficient to remove or disable non functioning sensors. As was amply demonstrated later, in the heat of an incident**, red alarms all look the same and can be misinterpreted.**

The absence of SAFEGAS from the control room or other parts of the administration complex means that trending of gases from the tube bundle and any derived indicators including explosibility, Trickett's ratio etc cannot be done, except by hand.

   c) I could not establish the availability of trending software, such as SPLUS at Southern. **Gas trends are available from any Sensor on the MACROVIEW system but the graphs are not scaled correctly and need further massaging to be of much use.**

   d) **The default screen of the MACROVIEW system for gas monitoring, containing the mine plan is very busy and difficult to read accurately**. Mine personnel were prone to identify monitoring locations incorrectly from this screen unless the magnifying screen was used.

   e) **Control room staff did not know the ranges of the AMR sensors nor what would happen if the gas concentration exceeded full scale. They were also unaware of what reading an unserviceable, disabled or destroyed sensor would give.**

2. During the incident:

   a) The control room operator on night shift was only a relieving operator and not the normal operator

   b) I triggered the alarms audibly (via alarm clock) and then read out the alarm as it would appear on the MACROVIEW alarm screen. **The explosion initially triggered ten alarms of various sorts.** Where monitoring stations were destroyed by the blast low alarms were triggered (stations 4 and 18), where the station survived high CO alarms were triggered (stations 2, 8, 9, 10, and 11) and low oxygen (station 2). **There was confusion between monitoring station numbers and AMR sensor numbers. For example: an alarm would be triggered on sensor 31 but to view it you would access monitoring station 8.** Over time as the fire took over from the

Emergency Initiation

explosion and the ventilation circuit was modified other alarms were triggered using the alarm clock, again high CO (stations 1,and 2) and high methane (stations 1, 9 and 10). It was my observation that the control room operator was expecting one alarm only. He appeared overloaded by the multiple alarms and did not take full cognition of them and consequently the information that the spread and type of alarms brought out.

I cannot comment on the response of the shift undermanager except when he entered the control room to investigate the alarms. These alarms were physically reported to him and he came back to the control room to investigate. The exercise was set up to allow him to access his computer for the same information (i.e. the assessor with the undermanager had hard copy of all the information required that he could access).

d) **The undermanager and the control room operator were not aware of which monitoring stations and sensors were not in service at the start of shift and there was considerable confusion when they attempted to look at the MACROVIEW screen to identify which stations/sensors were in alarm**. The out of service alarms (Low alarms) flashed red. **They were not aware that other stations (1,10 and 15) were incorrectly located on the MACROVIEW screen**.

e) The actions of the control room operator were frenetic as he had a number of functions to enact at once including:

- **manually sounding the evacuation alarm (button must be continually depressed for alarm to sound)**
- **using the DAC**
- **trying the underground phone**
- **activating the pager system**
- **recording all actions, phone calls and conversations in his incident log**
- **accessing the MACROVIEW system to assess the alarms**
- **using the external phone**

He was not capable of effectively carrying out these functions. At one stage there were four people in the control room to carry these functions. Most of the time there were three people carrying them out.

f) **Communications to the GC room and the tube bundle room was very difficult with no phone in the tube bundle room and a mobile phone in the GC room - the number of which was unknown to the control room**

g) test bags of gas run by Capcoal personnel through the gas chromatograph returned results in good agreement with the expected values.

h) test bag results run through the SIMTARS mobile lab GC also returned excellent results.

Emergency Initiation
RECOMMENDATIONS:

For Southern Colliery:

1. SAFEGAS should be connected directly to the administration computer system rather than through MACROVIEW.
2. The duty card for the control room operator should be reviewed to ensure that it is feasible for him to carry out all the functions required.
3. Capcoal site personnel should have the ability and responsibility to modify screens in MACROVIEW to ensure that they are current and accurate.
4. The MACROVIEW screen layouts and operation should be investigated to ensure that they are ergonomically sound and easy to use in an emergency.
5. SPLUS(gas interpretation software) should be on the network computers.
6. AMR monitoring stations that are not active should not show low alarms but rather show disconnected/inactive.

For Industry in general:

1. Control room operator to be a competency based position - knowledge of monitoring systems and gases
2. Explosion resistant communications - reverse PED?
3. Maintenance of gas monitoring after an incident - redundancy of sensors and tubes/borehole back up for sampling of key areas and communications
4. Use of refuge bays/change over stations including communications and gas supply and monitoring lines
5. Computerise duty card operation and logging of actions
6. Check validity of duty cards for use on back shifts and practicality of operation
7. Ergonomics and functionality of mine monitoring system - who has access? Where? What can it do?
8. What are site provisions for use of GAG and also mobile laboratory - provision of power etc, communications to the incident control team, pad to park on, ability to connect to tube bundle system or other sample locations
9. Designated role of person on incident control team to be responsible for accurate gas monitoring information
10. Role of SIMTARS - when is assistance called for - from Brisbane and Mackay. If a mine fire or explosion has occurred with personnel missing, SIMTARS should be called out immediately by the Mines Inspectorate.

DAVID CLIFF
Manager
Mining Research Center

Emergency Initiation

Emergency Initiation

Assessment Tool

					COMMENT
Emergency Control Room Operator	Assess Incident as Presented	Commence Incident Sheet	Time Exercise Commenced **12.05am** Time Incident Sheet Commenced **12.21am**		
		Contact with Senior Surface Official Senior U/Ground Official Section 700 Mains Section LW 703 Section MG 704 Outbye Areas	Time Called **U/Manager 12.10am** **as above** **12.18am** **12.20am** **12.22am** **nil**	Actions Recorded **yes** **yes** **yes** **yes** **yes** **no**	
	Initiate Underground Evacuation		Advise of Routes of Travel **N/A** Question Transport Available **N/A** Question Conditions Encountered **N/A**		
		Initiate Emergency Alarms	Sirens **12.17am** Broadcast Dac's **Yes**		
	Activate Pagex System		Record of Actions **Yes**		
	Activate Call Out Procedure	Contact with Mine Manager **12.36am**	Record of Actions **Yes**		
	Hand over Call Out to Storeman or Alternate ESO		Record of Actions **Yes** **Shane Cross – Central Colliery**		
	Secure Communications Systems		**Yes**		

Emergency Initiation

				COMMENT
Emergency Control Room Operator (cont.)	Gather and Record Information		Record of Actions	
	Report on Results of Communications with Underground Sections		Inform Site Senior Official **No Contact LW 703** **No Contact Outbye** **No Contact 700 Mains** **No Contact MG 704**	
	Arrange Tube Bundle Gas Monitoring shed to be Manned		**No**	
	Arrange effective communication between tube bundle and CRO		**No**	
	Gather Relevant Data	Distribute Data		**Use of "Runners" Ineffective and Inefficient** **Serious Deficiency : Message from Control Room that "*Tube Bundle System does not work in control room*" was interpreted by Incident control team as *"the tube bundle system is not working"***
	Continue Collection and Dissemination of Gas Readings			**No visible "Actions Completed" board.** Resulting in further time being wasted answering *"has this been done ? "*

Duty Cards

Assessment Summary

It was entirely apparent that an industry wide review of the roles and purposes of Duty Cards is long overdue.

Firstly There is wide perception that the use of duty cards will exercise control over most emergencies.

THEY CANNOT, THEY WILL NOT and ARE NOT DESIGNED TO.

Control is exercised by trained, experienced and competent people.

Duty Cards are, at best, memory prompts incorporating a recording and reporting function. Whilst they serve a vital function in ensuring essential activities are not overlooked AND in establishing ordered roles, responsibilities and authorities, they offer neither interpretation nor solution and they do not prioritise.

Secondly Review your Duty Cards along the line of Priorities and Objectives instead of the traditional Roles and Responsibilities. For example

- Setting of Immediate, Short-term & Long-term Goals and Objectives
- Preservation of Life - Protection and prevention of further loss
- Gas Analysis, Interpretation and Scenarios of Proximate Cause
- Central Communications, Information Sharing and Recording Systems
- Development of Options, Courses of Action and Choices Available
- Decision Making and Authority

may be more relevant in the immediate aftermath of a incident than having 4, 5 or 6 Duty Cards (and 4, 5 or 6 people tied up using them) to achieve, for example, site security.

Thirdly There are too many of them. A typical Emergency Response Plan may contain anything up to 24 Duty Cards. The number of personnel available on a back shift or weekend to use them may be as few as 3 or 4.

Too many duty cards and too few people will inevitably result in the collapse of the system and duties not being adequately performed.

Further, recognise that when the best person to discharge a function arrives on site, that person MUST assume that function, displacing whoever may currently be performing that role.

Assessors Comments

ASSESSOR: IAN McDONELL

GENERAL OBSERVATIONS

- The need to be able to **RAPIDLY** calculate and trend gas makes was highlighted very early in the exercise.

  Recommend that management considers setting up a computer in the emergency management area that has a suitable trending program, and to have suitable trending program, and to have suitable persons trained in the use of these programs.

- The location and security of the Incident Management Team was not of a suitable standard.

  Recommend that one of the training rooms be set up as an incident management room, and that a person detailed in the emergency procedures as a door guard to prevent disruptive entry to this room.

- When gas chromatograph bag samples were made available for testing, there was no discussion by GC operator as to where the bags were taken from, or what the possible CH_4 content was – this is critical for spanning the GC as large errors may result.

- There did not seem to be adequate recognition of the potential problems of SCSR location and duration.

- There did not seem to be any discussion of alternatives to GAG discussed.

- The use of Duty Cards by the senior management personnel was not thorough and much crossing of duties by Incident Controller, Shift Controller and Shift Undermanager occurred.

  Recommendation is that the Duty Cards 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.

- The recording of events by senior management was not detailed or organised. While the use of white board for planning and risk assessment is ideal, event recording must be done on HARD COPY.

- The use of reflective flak (jackets with identification) was only partly used – even though available to all duty card personnel.

Shift Controller – Card 4
Shift Undermanager – Card 4a

- While both of these cards (and card 2 initially) were done by the Shift Undermanager, there needs to be a clearer division / allocation of personnel for these tasks.

Duty Cards

Front Gate Security

- To be issued with pens and a watch in the kit supplied.
- Availability of wet weather gear was questioned and operator did not know how he would have got this from store.
- Otherwise well done.

Fresh Air Base Controller

- Was not required.

Overall Comments

- All personnel appeared to know the location and basic content of the Emergency Response Plan.
- If a suitable Control / Incident Response Room is set up and tasks defined before the next trial run then I think none of the problems encountered will reoccur.
- All personnel that I observed were focussed on the **most important** tasks i.e. the safe recovery of the missing underground personnel.
- If suitable atmospheric trending had been available then the recognition of a major fire underground would have happened very early.

The exercise was a very good learning experience for all parties, both minesite and external.

German Creek Southern Colliery is to be complimented on the commitment they showed to this exercise. They will benefit greatly – as will the whole industry.

Emergency Control

Assessment Summary

It is impossible to over-emphasise the importance of establishing an effective and authoritative INCIDENT CONTROL TEAM and equally impossible to over-emphasise the importance of establishing an efficient base of operation from which it can function, the INCIDENT CONTROL ROOM.

Numerous publications and training courses are available on the make up and functions of emergency control teams. The NSW Mines Rescue Service offers courses specific to this area and most recently a Competency Unit Learning Package has been developed against the coal industry national standards.

Apart from the makeup and function of an Incident Control Team, a number of issues require to be addressed.

- there must be clear authority of exactly who is in command and how decisions will be made. There was no definition of the composition the Incident Control Team, where it would operate from or its communication channels. The sight of "runners" with scraps of note paper, wandering the corridors looking for the manager gave little confidence in effective control

- there must be clearly defined goals, objectives and priorities established. The establishment of an Action Plan should be one of the first priorities.

- establish accurate information flows. As mentioned in other sections of this report, the break down in accurate communications resulted in decisions that may have had catastrophic consequences e.g.
  - the tube bundle monitoring system was always operative and was providing vital data that was not utilised for over three hours
  - a vehicle was dispatched underground on the belief that there was only 50ppm CO present. This was simply the off-scale reporting figure of the sensor software. There was in fact over 6% CH_4 and 600ppm CO in the 703 TG when that vehicle went underground.
  - interpretive analysis of the available data would have provided the Incident Control Team with early warning of the development of a major fire, its rapid propagation AND if left untended, there was a real probability of a second explosion. In fact, the second explosion would have occurred approx. 8 hours after the first

- there must be effective recording procedures. It was particular disturbing that no records or logs were made by the Incident Control Team of any action taken, decision made or reasons/evidence supporting those decisions. There were not even notes taken during debriefing sessions.

- An Incident Control Room complete with a number of electronic white boards (for recording), 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 are not just desirable – **they are absolutely vital**

- It is equally important to have communications OUT of the Control Room. All the stakeholders must be kept regularly briefed on currency and status of events

Assessment Tool

EMERGENCY CONTROL	❖ Incident Control Room	❖ Position of Incident Control Room ❖ Layout of Incident Control Room - seating - size - display boards - lighting - emergency lighting - auxiliary power ❖ Stationary		

Duty Card No. 4 – Shift Controller (Undermanager)
Duty Card No. 4a – Shift Undermanager
Duty Card No. 2 – Incident Controller (Mine Manager)

				COMMENT
		❖ Security, only necessary persons in ICR.		
	❖ Formation of Incident Control Team	❖ Who formed ICT (duty card)		
		❖ Time taken to form ICT		
		❖ Make up of team		
		❖ Backup's identified		
		❖ Leadership		
		❖ Defined role of ICT		

	❖ Provision of resources for ICT.	❖ Nature and amount of information required by ICT(background gas makes etc) ❖ Copy of current PHMP's and SMS. ❖ Current Underground Plans including: - ventilation - electrical - gas monitoring points - escape routes ❖ Plans for surface operations indicating: - location of hazardous materials - fire hydrants - building plans - road systems and gates - main shut off valves for services. - location of rescue equipment - explosives magazine		
	❖ Communication Hardware	❖ Availability of communications in ICR ❖ redundancy of communications ❖ Internal \ external phones		

	❖ Incident Team Advisory Committee	❖ Mines Inspector ❖ District Union Inspector ❖ Police ❖ Mines Rescue Superintendent		
	❖ Debrief	❖ De-brief survivors/ witnesses Receive/ Review/ Update information		
	❖ Communication Information Flow	❖ Nature of incident - known data proven facts other facts ❖ Decimation of information - identification traceability ❖ Incident log data recording :- incoming, outgoing, decisions. ❖ Incident log:-time, date decision, by whom, issued to whom		

	❖ Decision Making	❖ Defined process ❖ Team decisions not individuals ❖ Clearly understand the type and nature of the emergency ❖ Initial assessment ❖ Identify the type and nature of information required ❖ Gather information, establish monitoring and trending of key indicators ❖ Use of risk management techniques, identify hazards, define safety and operational constraints. ❖ Specific event responses ❖ review of decisions before initiation		
	❖ Expert Advice	❖ Ventilation predictive analysis ❖ Determine nature and cause		

Emergency Evacuation

Assessment Summary

It is most worthy of note that in this exercise, only one of the crews perished in the initial explosion, the vast majority of casualties resulted from the subsequent fire.

There must be an integrated approach to emergency evacuation focussing on enhancing survival in worst case scenarios e.g.

- Self rescuer change-overs are at best DANGEROUS and most likely LETHAL, unless provision is made for change overs to occur in safe havens
- Safe havens should 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 i.e. buried telephone lines
- Distances between havens must be spaced for worst case scenarios of ZERO visibility
- Signs and arrows etc pointing to escapeways, oxygen caches, doors or roadways delineated by hanging lanyards from the roof are USELESS if people cannot see them
- All escapeways must be maintained in good order free from excessive walking hazards i.e. stowage against return doors, water swillies and slop in returns

Consideration must be given to the provision of audible call sirens to be installed on the safe havens in the face areas to lead people to them. From these havens at the face, a crew could communicate and plan, don their apparatus and progress to the next haven using designated guideline ropes.

Full accounting of persons could occur and the provision of appropriate breathing apparatus at the haven may allow a limited search of the area, facilitate the ability to render aid and perhaps even to control the event i.e. extinguish the fire. It is not reasonable or practical to expect any of these functions to be performed by persons using their own personal protective escape apparatus.

In all respects, it is abundantly clear that

- **all persons, including managers and supervisors, must be trained in the use of self rescuers AND their changeover procedures in genuine environments – underground, after heavy work and in limited visibility**
- **escapeways, and their alternatives, must be walked regularly until ALL people are familiar with them**
- **all persons, including managers and supervisors, must undertake regular, genuine emergency evacuations incorporating poor visibility to best test the adequacy of the current systems and accurately determine emergency preparedness**

Again, a number of extremely important and valid discussion points are raised in the following Assessor Comments sections. Please take time to consider them carefully.

REPORT BY: JAN OBERHOLZER : 704 MAIN GATE DEVELOPMENT CREW.

Observations With Regard To Mines Emergency Exercise At German Creek – Southern Mine.

Details during the exercise.

Prior to the actual exercise I spent time on the face. Based on the way the face was being cut, coupled with the presence of sandstone rolls in the roof an observation to the risk of friction ignitions was expressed. A more worrying matter was the lack of knowledge with regard to pick consumption or checking of picks by the crew I talked to.

The exercise was initiated by a discussion that meant that none of the initial trauma or stress was present. In terms of SCSR lifetime and distance traveled this is the best case scenario.

During the donning of the SCSRs it was evident that the majority of the crew was unfamiliar with the process. If this process had to be carried out under duress problems would have been experienced. This would have been particularly so in event of a poisonous atmosphere being present.

Although unproven it appeared as if one of the SCSR did not start. This was evidenced by the bag not inflating after being activated. It would also seem as if taking a breath from the side of the mouth consciously or unconsciously compensated for this.

The SCSR worked as they started getting hot within minutes from being activated. Activation can be done through breathing through the chemical.

The SCSR lasted for about 36 minutes, which is well within the standard as required. The pace at which walking was done was very relaxed and it could be expected that this pace in the event of a real incident would significantly faster.

The travelling of the crew can on the whole be deemed to be too slow.

When transferring from the 30 minute SCSR to the one hour sets serious problems were experienced.

The instruments opened with difficulty

No grip on them could be obtained in the mud and with wet hands.

Difficult to transfer and fit while wearing other SCSR

Breathing tubes were closed.

Workers were not familiar and it can be predicted that in a situation of no visibility there would have been serious problems.

In a poisonous atmosphere a loss of about 30% workers could have been expected due to them breathing in the atmosphere during the transfer process.

The travelling way at certain points could almost not be traveled due to mud and water. The condition of the travelling way was also not suitable for the SCSR, some of which broke during the process of going through the mud.

The deputy got lost when having to move from intake to return. It should be noted that the area was difficult.

He was not aware of where the follow-up EBA station was, and missed it.

The team ran out of breathable air before they could get to fresh air. This was mainly due to being lost, not obtaining further sets and difficulty of traversing the returns.

The crossovers over the belt as well as the aircrossings were unsuitable for travelling in conditions of no visibility.

Systematic problems identified.

There is an attitude of assisting fellow workers and the deputy taking leadership. In the event of a simulated exercise or where the team can be gathered this can be accepted. It should however be noted that the SCSRs are not designed to allow fellow workers to be assisted and could jeopardise both lives involved. It is designed for Self Rescue.

In the event of the crew being spread through the section there would not be an opportunity for the crew to do much more than gather at a safe haven. Any waiting at a gathering point could seriously affect the distance traveled even though additional air capacity may be taken with them.

The whole issue of self-rescue, safe havens and follow-up rescue needs to be revisited. There are serious doubts as well as dilemmas present in the present situation.

There is an attitudinal problem in that there is too much democracy in the process. During the exercise the deputy took a decision to escape along the intakes, This caused a problem in that it was not suitable marked. The reason for this decision was not accepted by all and can be questioned. (Could be the main reason why crew did not survive)

Too many attempts at communication were experienced.

The workers were not suitably drilled in either the donning procedure. The donning of a self rescuer should be able to be done in the dark if it is to afford the worker the required protection.
It should also be noted that this could give problems as facilities rarely exist to enable workers to train themselves to the required level of proficiency.

The workers were not suitably aware of the routes to be taken in the event of an incident.

Neither the deputy nor the workers were suitably familiar with the routes to enable them to escape.
There is a dilemma here in that there are doubts if workers should be so familiar with escape routes to allow them to escape completely form the mines. There are grave implications in using this approach.

There are doubts with regard to the usage of additional EBAs. (One person taking more than one, more than one crew using the same cache etc)

Conclusions

There is a need for the whole rescue issue to be cleared.. The present system does or could lead to serious problems. It could almost be stated that the use of SCSRs could lead to a false sense of security that could lead to more problems.

Once such a directive is established and accepted by all parties, adequate resources as well facilities should be availed to allow training to be done.

The importance of maintaining the escape routes in a suitable condition has been confirmed.
The importance of having section staff know the escape routes and how they should use them has been confirmed.

The importance of staff being well versed in using their SCSRs in adverse conditions has been confirmed.

The importance of the concept of self rescue has been confirmed.

Jan Oberholzer
SIMTARS

Assessment Tool

				COMMENT
❖ Incident received	❖ Incident received ❖ Correct message received ❖ Emergency alarm recognised	❖ Recognition of changed circumstances ❖ Attempt communication		
❖ Incident Communicated	❖ All crew members accounted for ❖ All crew members notified ❖ Crew marshaled together ❖ Options considered ❖ Partial / Total evacuation	❖ Location of outbye workers considered ❖ Plan formulated and decided on		
❖ Incident Equipment	❖ Self Rescuers fitted ❖ First Aid equipment taken ❖ EBA units taken ❖ Tools required	❖ Recognition of expected duration		
❖ Escape Route	❖ Escape route determined ❖ Escape route communicated to Control room ❖ Number of people escaping ❖ Rescuer / Light numbers ❖ Appropriate route taken	❖ Recognition of deteriorating circumstances ❖ ***(Impose smoke glasses)*** ❖ Re-evaluate escape options ❖ Re-evaluate escape times and duration of SCSR's		

				COMMENT
❖ Travelling	❖ Appropriate means decided ❖ All crew traveled together ❖ Pace of travel appropriate ❖ Correct egress route was maintained ❖ Egress clearly marked ❖ Duration of self rescuers ❖ Duration of EBA's ❖ Use of lifelines, etc.	❖ Yes ❖ Yes ❖ Yes ❖ Yes ❖ No ❖ Oxy Bok's 145 x D 36 m ❖ 1 – 89 min, 2 – 111min ❖ Yes		
❖ Observations	❖ Take note of circumstances and environment	❖ Duration times recorded		

				COMMENT
❖ Self Rescuers	❖ Self rescuers fitted correctly ❖ Fitted in sufficient time ❖ EBA's fitted correctly ❖ Fitted in sufficient time ❖ Adequate number of EBA's ❖ EBA's at station sufficient in number ❖ Crew takes spare EBA's ❖ Self Rescuers / EBA's correctly worn and used	❖ No ❖ No – 2 took four minutes ❖ No ❖ No ❖ No ❖ Yes. At crib room ❖ No ❖ No		
❖ Communication with Control Room	❖ Control room informed of location ❖ How is communication carried out? ❖ Informed on changed conditions	❖ Where was communication attempted?		
❖ Arrival on surface	❖ Muster ❖ Report ❖ Medical aid ❖ De-brief	❖ Check off at Lamp Room ❖ Report to ESO and Incident Controller ❖ Arrange medical aid and re-hydrate ❖ De-brief observations		

Qld Mines Rescue Service : Ability to Respond, Mutual Assistance

Assessment Summary

The assessment of the Qld Mines Rescue Service has been assessed in two sections.

These section deals with the ability to render aid and coordinate the Mutual Assistance program held between Southern Colliery, Central Colliery and Oaky Creek.

The second section deals with the mandatory legislative Performance Criteria required of a mines rescue service provider.

The Assessment under this section was undertaken by the Chief Executive Officer of the NSW Mines Rescue Service Murray Bird and the Assistant State Manager of the Qld Mines Rescue Service David Kerr.

Their comments in the following sections detail explicitly the performance of the Service and requires little summary here other than to reinforce that

- the service performed all the tasks required of it
- the trainees and team captains were well drilled and professional
- their was adequate equipment and apparatus provided
- the mutual assistance program provided adequate first response numbers, however the call out times were somewhat longer than ideal

It should be pointed out here, that a Mines Rescue Superintendent has a responsibility to obtain information and keep his personnel fully informed of the status of events and not to necessarily just wait to be told. This in no way is to infer that the Incident Control Team does not have an obligation to keep stakeholders informed, indeed it is duty bound to do so, only that a lack of information can, and did, lead to increased tensions and frustration and should be corrected.

It was again noticed that the use of home answering machines interfered with the call out procedure and this issue needs to be addressed.

Finally, a need exists to clarify the call out process to ensure that not every trainee is called to attend site, some will be required later and need only be placed on standby.

Further, a reference system needs to be introduced to ensure that only those trainees current under medical and oxygen time are placed on active duty.

Assessors Comments

ASSESSOR: MURRAY BIRD, NSW MINES RESCUE SERVICE

MINES RESCUE COMMENTS

- Dysart phone system needs reviewing. Answering machine cutting across emergency line. What is the back-up system if the phone is not answered?

- Superintendent vehicle should have "hands free" provisions. Answering calls whilst in transit to an emergency is dangerous.

- Two vehicles sent from Dysart to Central to check all suits, minimum equipment and men have been dispatched and made it to Southern – good system, but did not seem to be documented so that it always occurs.

- Additional equipment packed into vehicles at Dysart station. No checksheets used to make sure all required equipment was loaded.

- Once at mine – directed to Mines Rescue area. All rescue personnel sent here. Road blocked completely and led to problems. Spend ½ hour fixing / moving vehicles.

- No clear clocking on system for Brigadesmen. Owen putting persons into teams as he sees them. Also no clear clocking off system.

- Station Superintendent should be part of Operations Base Team. His role is to assist management, especially on mines rescue, gas interpretation, ventilation, fire fighting, escape systems and intervention strategies. Another important role is to obtain raw data that can be transferred into briefing information for teams.

- A good practice is to bring the first two team captains into Operations Base so that they are obtaining basic data as it is being obtained. This reduces briefing time by 90%. This practice is **NOT** always suitable, it depends on the occurrence.

- Too many people in rescue room testing and preparing equipment. It was difficult / impossible to determine what gear had and hadn't been tested. A more structured system should be looked at. Some Brigadesmen are using prompt card to test their suits. Use station professionals or advanced trainees to do this more proficiently.

- Teams put all equipment out on the roadway, blocking it and opening the equipment to the elements. Had to move once so that a vehicle could get through and again when it started to rain.

- No suitable rescue plans were in the rescue room until 4.00 am when a Brigadesmen from Southern went and obtained them.

- Team briefing to be arranged better. It was done outside in the dark with no plans. Use and arrange the room better **OR** have a briefing room allocated.

- A number of emergency activation calls got answering machines – even at Rescue Station and active mines – this needs looking at.

- There appears to be no foolproof method of determining which Brigadesmen are medically and BA current.

- Four Brigadesmen had beards and three had heavy facial growth. There is a "NO BEARD" policy whilst under BA? This was not addressed.

- White boards in rescue room were not used. Information should include basic mine environment, incident data, on-going data, team names and membership, additional equipment, time and action of critical events i.e.. GAG activated …….. – ETA

- Mines Rescue guidelines did not appear or were being discussed. Aren't they being used yet?

- Mines Rescue key staff didn't have colour identification jackets on. This is important as things go on – people change roles.

- Mines Rescue and team captains should attend witnesses de-briefing or read their reports.

- No appropriate food and drink supplied – health food and water

OPERATIONS BASE IN GENERAL

Room and Facilities

- Operations base location was too open to everybody – everyone could see what was happening.
- Security needs to be looked at – people coming and going as they pleased.
- Operational base membership should be pre-planned and have identification vests on.
- White boards should be present and used for:
  - Data gathered to date – names / times / reports etc
  - Gas monitoring information
  - Goals in a prioritised order
  - Tasks allocated → time – who, what-when etc
    → rescue team actions
- Actions → primary action → contingencies → limits (if any)

Functions

- Need to have somebody designated to record all information – time, what, who etc and to collect and file all data / reports as they arrive.
- Once actions are determined, Operations Base Team can split up to activate / organise **BUT** must have a pre-designated time that they will reconvene i.e.. Action at 6.10 am → reconvene at 6.30 am.
- Mine Surface Controller function – person who liaises with Operations Base and organises the things they require. Also, this person co-ordinates and allocates persons to …….. tasks → security / lamproom / portal / etc.

SUMMARY

12.05	Event
12.55	Station opened up – 3 calls
1.50	Arrived on site
2.15	First team ready
2.45	Second team ready
3.10	First briefing
4.07	Second briefing
4.15	Team's frustration building
4.18	Team briefing

Assessment Tool

				COMMENT
❖ **Station** *(Initiate emergency call out procedure)*	**Dysart** ❖ A call for assistance is received. √ ❖ Validity of call for assistance is verified. ½ ❖ Details of the call are recorded. ***Rough*** ❖ Telephone calls to initiate call out are made. ❖ Availability of sufficient rescue personnel is verified ***(14 persons confirmed MAX). 9 and still getting*** ❖ Mutual response call-out is extended if required. √ ❖ Station duty card procedures are implemented. ***No card used or checked*** ❖ Any required equipment is loaded for transport. ***Yes? But?*** ❖ Person in charge proceeds to Southern Colliery. √	❖ Required call out documents are located. ❖ Procedures are followed and information recorded. ❖ Contingency arrangements are made in the event of failure of prepared procedures to deliver expected outcomes. ❖ Delivery of information via the telephone is concise and clear. ❖ Delegation is authoritative. ❖ Time management is efficient and effective.		

				COMMENT
	Southern ❖ Official in charge at Southern is identified. ***Yes*** ❖ Current information is obtained. ***No*** ❖ Blackwater Station is advised of situation. ***Spoken to*** ❖ Location of rescue team preparation area is verified. ***Yes*** ❖ Relevant duty card authority for this area is delegated. ***No*** ❖ Incident Management Team personnel are identified and liaised with. ***Yes*** ❖ Control strategies are developed. ❖ Briefing for rescue teams is prepared and recorded. ❖ Rescue teams are briefed. ❖ Active team operations are monitored. ❖ Rescue teams are debriefed.	❖ Required call out documents are located. ❖ Procedures are followed and information recorded. ❖ Contingency arrangements are made in the event of failure of prepared procedures to deliver expected outcomes. ❖ Delivery of information via the telephone is concise and clear. ❖ Delegation is authoritative. ❖ Time management is efficient and effective.		

				COMMENT
❖ **Central Sub-station** *(Load and transport required equipment to Southern)*	❖ Access to building is available. ❖ BG-174's, RZ-25 test instruments, team minimum equipment and spare operational equipment is located. ❖ Above equipment is loaded for transport to Southern. ❖ Substation is prepared for on-going operations.	❖ Identification of rescue personnel to Central Gatehouse. ❖ Utilisation of available vehicles for equipment transport. ❖ Knowledge of equipment location. ❖ All required equipment is taken. ❖ Due care in relation to equipment handling is exercised. ❖ Time management is efficient and effective. ❖ In the absence of a Rescue Station Official, control and authority is exercised. ❖ Communication with Southern is made to advise ETA of teams and equipment.		

				COMMENT
❖ **Southern Minesite** *(Prepare for active team deployment)*	❖ Official in charge is identified. ❖ Rescue team preparation area is identified. ❖ Equipment is unloaded at designated area. ❖ Prescribed checks and tests on equipment are carried out and results recorded. ❖ Teams of required numbers are formed. ❖ Team captains and vice captains are appointed. ❖ Team briefings are received and understood. ❖ Extra equipment, if required, is identified and prepared for use.	❖ Positive and timely identification of official in charge (may be QMRS or Company) and designated operating areas. ❖ Due care of equipment when unloading. ❖ Prescribed checks and tests are competently and confidently carried out and recorded. ❖ In the absence of a Rescue Station Official control and authority is exercised. ❖ Team Procedures are demonstrated competently. ❖ Input and receipt of information at the team briefing is relevant and positive. ❖ Time management is efficient.		

Qld Mines Rescue Service : Performance Criteria

Assessment Summary

All aspects of the mandatory Performance Criteria were completed satisfactorily, however a number of issues require attention.

- the call out response times were outside the one hour limit stated in the mutual assistance standard : 1st team ready after 1hrs 20mins
  2nd team ready after 1hrs 50mins

- the turn out time for the GAG engine was acceptable, however the time delay for arrival of the fuel tanker (> 5 hours from Emerald) is totally unacceptable

- some aspects of maintenance on the GAG were poor. Fuel leaks around the afterburner injectors and a requirement to clean the spark plug should not have to be performed at deployment. It is recognised that the fuel leak in the main fuel intake line was the result of poor workmanship by a contractor, however, this should have been tested prior to the unit being stored ready for deployment

- there is an urgent need to improve the water collecting/dividing manifold. It is not acceptable to have this vital component so difficult and cumbersome to handle

- the GAG operators and supervisors were well trained, professional and performed admirably under trying circumstances. A satisfactory program of relief operators and supervisors was established.

Of particular importance is that there was only just enough water pressure available to safely operate the unit AND that after only 26mins of operation, it was reported that there was no water in the main reticulation line at the supply road tunnel mouth.

Assessment Tool

				COMMENT
QMRS **Performance Criteria**	Written Mines Rescue Agreement	Existence	Under Draft	
	Did corporation meet its obligations under the Agreement	Mutual Assistance Superintendent 14 Team Members 3 GAG Operators Equipment Duty Cards Station Action Sheets / Time Logs Southern Colliery Assessment	 Yes – Dysart Station Yes – 3 Southern 11 Central Yes Yes Dysart Station Duty Cards not used None Recorded Satisfactory	

				COMMENT
QMRS **Performance Criteria (cont.)**	Annual Exercise	Participation Emergency Exercise Committee Assessment	Not enough information passed to QMRS Poor briefings Teams becoming frustrated around 4.00am	
	Appropriate Training	Did Trainees and GAG operators demonstrate ability to use BA / GAG demonstrate ability to use rescue equip demonstrate familiarity with rescue procedures and protocols demonstrate confidence in ability to render aid demonstrate professional conduct	 Yes Yes Yes Yes Yes	
	Equipment	Maintained Available Tested Certified	Yes Yes Yes Yes	
	Mutual Assistance	MR Call Out Procedure Effective Deployment of personnel	OK Yes First team ready 1hrs 20mins after call out Second team ready 1hrs 50mins. **QMRS guidelines specifies two teams ready to go in 1 hour.**	All personnel were being called out instead of some being placed on "Standby"

				COMMENT
Operational Efficiency	Operational Mine Inertisation	Arrival of GAG Arrival of support vehicles / services Fabrication of GAG Hook up of GAG	Called 3.25am Arrived 8.55am Fuel Truck Arrived 11.10am Complete at 10.50am Water Line Manifold of poor design and function	Far Too Great a delay Should be readily adaptable and functional off the ground
		Operation of emergency seals Control / Monitoring of Atmospheres Predictive analysis Control of Fans / Vent Quantities / Velocity	N/A N/A N/A N/A	
		Operation of GAG	Fuel Leaks required to be fixed Spark Plug required cleaning	Maintenance work by external providers should be checked prior to storage
		On-going continuous operation operators support services	Fuel Pressures held OK 1st run = 11min (15 min total) 2nd run = 7 min (11 min total)	350 litres fuel 250-300 litres fuel
			Only just sufficient water pressure and quantity	Water for GAG drained lines to underground supply and after 26 mins
			4 teams available - 8hr shifts 3 supervisors – 12 hr shifts	
			Fuel to be sourced thru Shell	Formal contract to be arranged and signed Not enough care taken to protect area were GAG was operating : not roped off, no warning signs erected etc..

Accounting for Personnel and Security

Assessment Summary

Accounting for personnel and site security was generally handled very well. Many of the actions taken were as a result of personnel using their own experience of what should be done – not necessarily by following the ubiquitous Duty Cards.

There still exists an urgent need for a reliable personnel location system for underground mines.

Assessment Tool

				COMMENT
❖ Emergency Initiation	❖ Lamp-room attendant contacted.	❖ Record of phone call ❖ Knowledge of emergency Procedures ❖ Request for duty card and instructions		
	❖ Duty Card designated and issued to Lamp-room attendant	❖ Record of issue – time and name ❖ Duty card procedure compliance		
	❖ Check records of personnel underground	❖ Cap lamp and self rescuer register: ❖ Permanent employees ❖ Non-permanent employees ❖ Contractors ❖ Visitors, sales reps, etc ❖ Spare lamp and self rescuer issue ❖ Board records ❖ Out-of-service cap lamp ❖ Self rescuer records		
	❖ Advise Control Room ESO of personnel underground – numbers and location (if known)	❖ Record of phone call / contact ❖ Record of personnel underground and location (if known)		
	❖ Maintain required records (as per the duty card and emergency procedures)	❖ Record of all communication made, actions taken and instructions received		

				COMMENT
❖ Area Security	❖ Lamp-room boundaries marked / designated	❖ Plan of area ❖ Signs, boundary marking etc ❖ Recognition of area by mine and other personnel		
	❖ Surface muster / marshalling area boundaries marked / designated	❖ Plan of area ❖ Signs, boundary markings etc ❖ Recognition of area by mine and other personnel		
	❖ Lamp-room area secured to prevent unauthorised access	❖ Person appointed as security / control check point at each entry ❖ Security door / barricade / fencing erected ❖ Recognition of area by mine and other personnel		
	❖ Person(s) designated / appointed to secure muster / marshalling area – no unauthorised access	❖ Persons appointed as security / control check point around area ❖ Recognition of area by mine and other personnel		
	❖ Person(s) designated / appointed to record details of personnel evacuating from the mine on arrival at the lamp-room and muster area	❖ Record of appointment		

				COMMENT
❖ Emergency Control	❖ Lamp-room attendant	❖ Confirmation of emergency ❖ Duty card received ❖ Duty card procedure compliance ❖ Verify missing persons ❖ Confirmation to Control ESO of persons evacuated from mine – continually update records as people arrive at the lamp-room		
	❖ Lamp-room security	❖ Check persons who wish to enter the lamp-room are authorised to do so ❖ Stop unauthorised people from entering lamp-room ❖ Records maintained of personnel entering and leaving the lamp-room		
	❖ Surface muster / marshalling area security	❖ Query all personnel entering area – area for use only by those personnel evacuating the mine ❖ Direct personnel not evacuated from the mine to alternative muster / marshalling areas ❖ Records maintained of personnel entering and leaving the area		

De-Briefing of Personnel

Assessment Summary

There appeared to be no formal de-briefing procedure in place and as a result the de-briefing of personnel generated all the classical mistakes of lost information, wrong conclusions and poor recording.

There was a myriad of information available that was not collected. The deputies MiniGas instruments should have been quarantined and its data downloaded (yes, we did have data ready for presentation had this been done).

Diverting of incoming underground phone calls to an established Incident Control Room, would have provided the Control Team with direct links to the person with the most information to offer.

Further, it is at odds with the principals of information attainment for the Incident Controller not to have communicated directly with the people underground when the opportunities were presented.

The lack of a formal recording system would be seen as a major discrepancy in the Wardens Inquiry process of determining true nature and cause. Vital information can be lost, and other first impressions impinged by bias and unfocussed discussions, even in the short term.

Assessors Comments

ASSESSOR : GREG HUNT

DE-BRIEFING OF 700 CREW

- A lot of the elements which were in the audit were not asked, therefore, a lot of information could have been used but did not get passed on to the control team.

Crew arrived on surface:	2.55 am
Started de-briefing:	3.00 am
Completed de-briefing:	3.06 am
Total time of de-briefing:	6 minutes

RECOMMENDATIONS

- De-brief crew members separately.
- Record de-briefing notes
- Person on door of de-briefing room to control person entering or exiting.
- One person asking questions only
- People being de-briefed to be made to feel more comfortable
- Questioning format should be followed to cover all areas
- Person to record all information

DE-BRIEFING OF 704 CREW

Time Deputy arrived on surface:	4.40 am
Time de-briefing commenced:	4.45 am
Time of completion of de-briefing:	4.53 am
Total time of de-briefing:	8 minutes

RECOMMENDATIONS

- Selected people involved in de-briefing only
- De-brief all crew members
- Question format to follow to cover all questions
- Shut door and have somebody placed on the door to control who enters and exits the room

N.B.

The LW 703 crew did not survive the blast and hence were obviously not available for de-briefing.

They took part in the emergency evacuation to fully assess the evacuation plan from all parts of the mine.

Assessment Tool

				COMMENT
❖ How notified of incident	❖ RadioPhone DAC not notified.	❖ Contact with control ❖ What time were you notified?		
❖ How was incident detected?	❖ Environment damage ❖ Change in circumstances	❖ Smoke, dust increase in smoke		
❖ Did you assemble crew at place of safety?	❖ Place of safety	❖ Crib Room, ERS Station		
❖ Account for crew or personnel including contractors in section of pit		❖ How did you account for personnel?		
❖ Call control to confirm that personnel are accounted for		❖ Did you make contact with control?		
❖ Decide intended route		❖ What route was used?		
❖ Location of closest ERS		❖ Easy to find?		

Debriefing of Personnel

				COMMENT
❖ Where all rescuers taken?		❖ What was taken?		
❖ When changed over, to long duration self rescuers		❖ Time of change over?		
❖ Problems encountered on escape route?		❖ Visibility / condition of roadway?		
❖ What was seen on evacuation route?	❖ Environmental	❖ What were the changes?		
❖ Time taken to reach the surface		❖ Was it recorded?		
❖ Were names checked off		❖ By whom?		
❖ Who approached the crew or personnel on the surface?		❖ Senior Mines Official		
❖ What information was given on the surface?				
❖ How long before de-briefing took place		❖ Too long – Time on Surface Time of De-briefing		
❖ Location of de-briefing room?		❖ Was the room allocated an emergency plan?		

Debriefing of Personnel

				COMMENT
❖ Personnel involved		❖ Who was involved?		
❖ How was de-briefing recorded?		❖ Tape recorded / notes / videos		
❖ Was there a format followed for questions?				
❖ Type of questions asked?	❖ List of questions	❖ Relevant to questions		
❖ Person leading the de-briefing		❖ Senior Mines Official		
❖ Was the person / persons made comfortable?	❖ Re-hydrate ❖ Medical aid			
❖ Time of de-briefing?		❖ Length of de-briefing?		
❖ Was all information gathered?				
❖ Were all possible questions asked?				

External Agencies

Assessment Summary

Police

Advised of Incident	12.55am	
Arrived on Site	1.15am	

Excellent response and detailed knowledge of Police Procedures and requirements for disaster scenes. Provided professional and timely advice. Established necessary support and infrastructure locations.

Department Mines and Energy

Mines Inspector Notified	1.10am	District Inspector Barrie Biggam
Link Communications Advised	1.30am	
Brisbane Duty Officer Notified	1.40am	Senior Inspector Wal English
Inspector Arrived on Site	6.05am	

Information passed from mine to Inspector to Link to Duty Officer appears consistent. Callout times and notification times were satisfactory. An Inspector on site may have provided the Incident Control Team with guidance on "Process Control" and given instruction to produce atmosphere interpretation.

SIMTARS

Notified On Standby	2.40am	
Notified Please Attend	3.05am	ETA 8.00am
Mobile Gas Lab Arrived	7.55am	
Set Up at Fan Shaft	8.55am	Mine-site caused delay
Producing GC Gas Analysis	9.20am	

Excellent response and set up times. Professional and accurate advice and results. Overcame difficulties as they occurred.

The provision of a PHONE in the gas monitoring room at the fan shaft would appear essential.

District Union Check Inspector

Notified	1.26am	ETA	6.00am
Advised	DO NOT ATTEND		

Ambulance

Notified	12.38am	ETA	1.15am
Advised	DO NOT ATTEND		

Hospitals/Doctors

Notified	12.38am	ETA	1.28am
Advised	DO NOT ATTEND		

Challenge Points for General Discussion

Self Escape

One of the most challenging points to emerge from this exercise, is the issue of Self-Escape itself.

Does Self-Escape mean "self only" and "self at all costs"? Does it imply the first person to an oxygen cache can morally take all of them? Does it infer the first person to reach the section vehicle should, or must, drive themselves to safety?

Or do we have expectations that at least some effort will be made to gather and account for crew members, establish an escape strategy and lead crews from the mine?

If the latter is the case, then provision of resources and training MUST be provided to allow and prepare for it. It is NOT acceptable that we place such high "expectations" on persons and NOT provide the appropriate breathing apparatus to do the job OR an appropriate safe haven for personnel to gather and wait while it is performed.

We all have stories of "rescuers" becoming "victims" while the "victims" survive. These are invaluable lessons, and lessons hard learned. They also provide poignant reinforcement that if we hold such expectations of our personnel, we cannot and must not, expect them to consume their own Self-Escape oxygen supply in the rendering of assistance to others.

This test of the self-escape philosophy has a number of other demonstrated issues that **must now be urgently addressed**-

- It appears almost impossible for a changeover of self-rescuers to be done under duress *without the protection of a safe haven*
- *audible signals* may be the best method to guide personnel back to face-area safe havens
- safe havens can be equipped with *accurate plans* of the area to be traversed, *lighting, drinking water* to re-hydrate, *link-lines, first-aid equipment* and *communications*
- safe havens can be used as *"hubs" from which guidelines can extend*, at a reachable height, to a number of escapeways
- contain *suitable compressed air breathing apparatus* that may be utilised to provide *"search capability" or "first-aid fire fighting"*
- ***explore the feasibility of night vision glasses or infra-red imaging devices to aid escape in poor visibility***
- explosion proof communication systems such as *buried telephone lines*
- signage, escapeway delineation, doors, directional arrows and the like must be *located at eye level : preferably with raised or embossed writing*

Incident Control

It can only be reinforced again-

- Emergency Duty Cards systems must be reviewed with a view to achieving *Objectives* using realistic numbers of personnel to operate
- there must be established a central, clearly identifiable, decision making process, based on risk assessment principals. **It was particularly unnerving that the Incident Control Team had abandoned the chances of survival of an entire crew within 4 hours of the incident** (all were equipped with 8 hour duration oxygen self rescuers)
- there must be a central, clearly defined Incident Control Team
- an adequately resourced Incident Control Room from which to exert central control is absolutely essential
- *all underground communications should be capable of being call-forwarded directly to the incident control room with automatic recording devices attached*
- recording and logging of events is essential, and must be maintained throughout the emergency
- provision must be made for impounding and securing evidence i.e. deputy MiniGas instruments
- gather experts to provide specialist advice – proximate cause, predictive analysis, options and choices, Process Control Experts specifically to ensure essential processes occur/flow
- have an evacuation Trigger Point Flow Chart on the control room wall, similar to the call-out procedure flow chart

Shift De-Briefing

A number of essential issues were raised during the de-briefing of the affected crews-

- not enough real-life training has been done
- persons should not rely on someone else to organise a crew to walk itself out
- the use of the *"smoked glasses*" was an invaluable training aid
- self rescuer training to focus on entrapped procedure i.e. walking with the O_2 turned off – resulted in extra 20 minutes of O_2 time
- *self rescuer manufacturers to investigate modifying units to have "fluro" mouth pieces and breathing tubes – are worn over-shoulder – have harder mouth pieces – 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* ladders traversing overcasts should be lined up, or have guide lines joining them
- walkways over overcasts should have handrails to prevent falling off, and NOT have raised steps or trip hazards
- markers, signs etc that you cannot see are absolutely useless
- changeover stations are too far apart when walking under extreme duress
- provide water-proof (hence sweat-proof) notebooks for recording information underground

GAG

The time has come for the development of equipment to allow the GAG inertisation device to exhaust through boreholes into underground workings. It is an idea whose time has come.

The concept is generally accepted, the science is relatively simple and the need is apparent.

Task Group 4

There are a number of the recommendations contained in the Draft report by Task Group 4, that must be fully addressed prior to Task Group 4 finalising its deliberations. Particularly those dealing with

- generic industry training package for self escape and aided rescue
- escape to the surface or alternative place of safety
- advancements in the capability to alert, communicate with and assess the status of underground personnel during an emergency
- develop robust telemetric sensors OVER THE RANGES EXISTING POST INCIDENT
- emergency reconnaissance vehicle
- use of boreholes
- ventilation modeling
- guidelines common to both Qld and NSW for integrated emergency preparedness
- develop effective computer-based emergency decision support system for incident management and training
- emergency rescue vehicles

Conclusion

Several key issues have emerged through the conduct of this exercise.

The first and foremost of these is that mines must conduct thorough AND regular simulated emergency evacuations of all crews and all shifts.

There is simply no better method of determining emergency preparedness. Genuine simulations of expected conditions, *particularly poor visibility*, will dramatically demonstrate the adequacy of the escape mechanisms in place at the mine.

This has been a legislative requirement since December of 1996 and to think, or even to genuinely believe, that everything is in place without validation through simulation, is to court ethical, moral and financial disaster.

To quote from the Task Group 4 Draft Report, Chairman Mr. Mitch Jakeman stated

> ***"The potential risks in mining like, mother nature, are unforgiving and severely punish those that become neglectful"***

Let none of us become complacent.

Acknowledgements

This exercise could not have been conducted within the extremely short time frames allocated (7 weeks from initial direction to the conduct of the exercise) without significant contributions by a number of organisations and people.

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- the members of the Emergency Exercise Management Committee[2] and their respective organisations

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Greg Dalliston	District Check Inspector	CFMEU
Murray Wood	Mine Manager	Oaky No 1
Ian McDonell	Mine Manager	Cook Colliery
David Kerr	Assistant State Manager	Qld Mines Rescue Service
Shane Shepherd	Mines Rescue Coordinator	Central Colliery
Greg Hunt	Mines Rescue Coordinator	Newlands
Murray Bird	Chief Executive Officer NSW	Mines Rescue Service

- the underground assessors and their respective organisations

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Dennis Slattery	Lahelam
Glen Coppo	Oaky No 1
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Brendan Newham	Oaky No 1
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- Jenny Hurley - Community Liaison Officer Southern Colliery
- the media, who held their prior warning notifications under embargo as requested

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

[2] *Task Group 2 was reconvened at a meeting in Emerald on 8th August 1998 to modify the Exercise Types and Schedules contained in the "Approved Standard for the Conduct of Emergency Procedures Exercises " and to change the make up of the exercise management committee to reflect the changes which have occurred in the QMRS, associated legislation and the provision of GAG inertisation.*