Department of **Employment, Economic Development and Innovation**

2010 Level 1
Mine Emergency Exercise

Carborough Downs Coal – Tuesday 19 October 2010

Queensland Government

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Recognised Standard 08, Conduct of Mine Emergency Exercises, calls for the outcomes and learnings of these exercises to be shared with industry. Accordingly, this report is a record of the Level 1 (State) Emergency Exercise conducted at Carborough Downs Coal on 19 October 2010.

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Acknowledgments

This report has been compiled by the Level 1 Organising Committee comprising:

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Associate Professor David Cliff (who, along with Greg Dalliston, has been involved in each of the 12 Level 1 exercises) and Darren Brady from SIMTARS confirmed the validity of the assumptions made for the scenario.

The committee would like to thank Carborough Downs Coal management and mine workers for their assistance, commitment and cooperation during the exercise, and acknowledge the cooperation and assistance of all those involved in the exercise including the following five specialists:

- Martin Tsai, Computer Systems Engineer, SIMTARS, who modelled the effect of the scenario on the mine's gas-monitoring system and prepared a model to provide information as the scenario progressed
- Geoff Chick, Ventilation Officer, Broadmeadow Mine who modelled the ventilation changes in conjunction with Martin Tsai
- Hsin Wei Wu, consultant, Gillies Wu Mining Technology, who modelled the effect of natural ventilation and a fire in the workings so that realistic assumptions could be made about the likely extent of smoke in the workings
- Tony Bennett, Senior Mining Research and Design Technician, SIMTARS, who developed physical representations and models to support the scenario
- Dr David Smith, Occupational Physician, Queensland Mines – Safety and Health, who provided advice on the treatment of casualties and was available at the site to provide expert advice to the mine officials as needed.

A number of mines allowed senior staff to take on the role of assessor, which required several days away from the mine. We thank the companies for their support and recognise the contribution of the assessors.

In addition to the committee members and the specialists, the assessors were:

- Andy Binnersley, Oaky North
- Brad Watson, Broadmeadow
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Finally, we thank Hamish Sinclair-Ross, a mining engineer from Carborough Downs Coal, who sought answers to the committee's many questions in the lead-up to the exercise without raising suspicion. He was able to provide the committee with copies of plans, procedures, employee lists and planning schedules.

Summary and recommendations

The Warden's Inquiry into the coal mine explosion at the Moura No. 2 Underground Mine on 7 August 1994 recommended that every mine test its emergency systems at least annually.

This year's annual Level 1 Mine Emergency Exercise was held on Tuesday 19 October, between midnight and 5.30 am, at Carborough Downs Coal, an underground coal mine located 30 km south of Moranbah, or 180 km west of Mackay, in Central Queensland. Severe storms are frequently experienced in this region.

Objectives of the exercise

The exercise set out to:

- safely test the facilities and strategies in place at a mine to manage emergency events in all circumstances
- test the competency of mineworkers in using those facilities and implementing the strategies
- enhance the confidence and ability of mineworkers to respond in an emergency
- identify opportunities for improvement
- share the learning outcomes with industry
- test the mine's emergency response system
- test the ability of external services to administer assistance
- provide a focal point for emergency preparedness in the state.

Based on the learnings from previous exercises and the individual characteristics of Carborough Downs Coal, it also sought to:

- observe the donning and changeover of self-rescuers
- observe the preparation for evacuation following a fan failure
- observe evacuation from the mine through the belt drift
- test dealing with an injured person
- test the fire-fighting response
- evaluate the effect of the gate system on emergency responders, including mines rescue teams
- observe the use of the duty cards
- observe the Incident Control Team's decision-making and use of resources
- monitor the effectiveness of people-tracking systems
- monitor fatigue management
- examine the response to severe weather conditions.

Exercise scenario

A scenario was designed, within the objectives of the exercise, to test the systems and features at Carborough Downs Coal in an emergency and to verify the effect of recommendations of the previous year's emergency exercise.

The scope of the exercise included:

- mine response to the scenario presented, testing self-escape/aided escape and in-seam response as required
- mobilisation of Queensland Mines Rescue Service (QMRS) and other external services, including Mines Inspectorate, Industry Safety and Health Representative(s), SIMTARS, Police, Ambulance to the extent required by the exercise scenario.

The QMRS was expected to:

- provide the rescue team response as defined in the Mines Rescue Agreement with the mine
- deploy rescue teams underground including the establishment of a Fresh Air Base (if required) in response to the scenario.

The scenario was based on what could happen at the mine if a runaway vehicle underground caused a fire and injured the operator, a severe storm caused the main ventilation fans to stop, and a mines official inspecting the mine during the emergency is reported missing.

Evacuating mineworkers were expected to:

- shut the mine down safely before leaving their workplace
- don their self-rescuers when they found smoke in the roadways on their way out
- look for the source of the smoke
- fight the fire if they located it
- treat the casualty if they found him and search for a missing person
- find an alternative route from the mine.

When the miners found smoke, however, most abandoned their vehicles and walked out through a secondary escapeway. Only one crew remained in their vehicles after they decided to wear self -rescuers. For the others, it seemed that the decision to wear a self-rescuer was associated with walking out the secondary escapeway. The crew that stayed in their vehicle was the only one that found the fire and the casualty. Some members of the crew treated the casualty while others fought the fire; however, their first-aid knowledge and fire-fighting equipment were not suitable for the situation that they encountered.

The requirements of Recognised Standard 08 were met with respect to testing self-escape, aided escape and in-seam response. The requirement for mobilisation of the QMRS was not met.

Recommendations to industry

The assessors have made 18 recommendations based on the exercise — see below. They relate to training, allocation of tasks in the early stages of an emergency, fatigue management, and risk assessment.

1. That Communications Room Operators learn to delegate their many functions to available people once an emergency response is activated.

2. That critical functions that can best be carried out in the Communications Room be identified, and alternative locations be designated for other activities.

3. That making outgoing calls be delegated to one of the first available people, and done away from the Communications Room.

4. That a single set of duty cards be readily available and distributed as soon as an emergency procedure is activated.

5. That mines investigate the features that are available on the DAC, including provision to override automatic calls in an emergency or once they have been acknowledged.

6. That the Queensland Mines and Rescue Service examine how it will respond when a mine indicates that 'there may be a problem'.

7. That the amount of effort required to release a CSE SCSR be included in refresher training and inductions.

8. That evacuation training include a preference for using a vehicle wherever this is possible.

9. That, where evacuation is through a portal away from the main entrance to the mine, systems be in place to:

- record details of those who evacuate successfully
- control entry to the mine
- transport evacuated mineworkers to a suitable location for debriefing and other activities.

10. That a review of a mine's emergency management risks include the need for low expansion foam at high fire-risk points underground and for the training of mineworkers in fire-fighting technique.

11. That a review of a mine's emergency management risks include training in first aid and the location of emergency equipment.

12. That a relief plan be in place so that a blend of first and reserve members are available for the Incident Control Team.

13. That the Incident Control Team's objectives and priorities be clearly stated and posted so that they remain the focus of team activities, adjusted as they are achieved or as the situation changes.

14. That once an Incident Control Team is established all activities at the mine be brought under its control.

15. That mines examine the recording systems used for identifying who is at the mine and the underlying reasons for the systems. Where multiple purposes can be achieved in a single system, a single system should be preferred.

16. That mines review whether there are barriers to emergency response in their access system and identify ways of eliminating these without using people who could be used more effectively elsewhere.

17. That mines keep an up-to-date simulation of their ventilation system so that it can be used when circumstances change. A person familiar with the simulation must be available to the Incident Control team.

18. That the system for minute taking at Incident Control Team meetings be similar to the one used in operational meetings at the mine so that a new system does not have to be learned during an emergency.

Introduction

Background

The Warden's Inquiry into the coal mine explosion at the Moura No. 2 Underground Mine on 7 August 1994 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 al. 1996, p. 64)

This recommendation has been enshrined in the *Coal Mining Safety and Health Act 1999*, and the process is defined in Recognised Standard 08 Conduct of Mine Emergency Exercises at four levels:

- Level 1 – State Level Exercise
- Level 2 – Major Mine Site Exercise
- Level 3 – Minor Mine Site Exercises
- Level 4 – Supporting Exercises

The standard also calls for the learnings to be shared with industry.

The 2010 Level 1 exercise was held at Carborough Downs Coal, an underground coal mine located 30 km south of Moranbah, or 180 km west of Mackay, in Central Queensland. The exercise was held on the night shift of Tuesday 19 October, between midnight and 5.30 am.

Exercise scenario

The exercise scenario was developed to test the implementation of recommendations from previous exercises, recent incidents that could have occurred at the host mine, and particular features of the host mine.

The recent incidents included:

- severe weather conditions in the area
- loss of power to mine fans, followed by failure of the back-up ventilation system
- reduction in the approved duration of CSE self-rescuers from 50 to 40 minutes.

The features of the host mine that were incorporated included:

- a portal that was remote from the pit top
- the dip of the seam, which can lead to potential runaway vehicles
- the seam thickness and the height of excavation, leaving a 2-metre coal floor or roof — which has the potential to create a ventilation furnace. This can reverse the ventilation, as happened in a fire at Appin Colliery in 1976.

An underground inspection by members of the organising committee identified the Big Harry transformer in 11 to 12 cut-throughs, C Heading as a possible location. A fire there would make it necessary to evacuate through the belt drift — leading people to a remote location on the surface. The belt portal had limited shelter from a storm. Transport arrangements would add to the tasks requiring attention from the Communications Room Officer (CRO) and the Incident Control Team (ICT).

The effect of natural ventilation and a fire in the workings was modelled so that realistic assumptions could be made about the likely extent of smoke in the workings. This information was used to develop gas-monitoring screens that were provided to the CRO as the exercise developed.

The scenario

The scenario was designed to test:

- **Activation** — informing relevant people of the situation
- **Evacuation** — arranging for those at risk to move to safe place
- **Response** — taking remedial action
- **Incident management** — the processes and systems used to deal with the event.

It ran as follows:

- A large diesel-powered load-haul-dump vehicle rolls out of control down a steep grade underground, hitting a high-voltage electrical transformer and causing a fire. The operator is also seriously injured with severe burns and a broken leg.
- The fire causes harmful carbon monoxide and smoke to enter the mine's ventilation system. The distribution of these products is interrupted, however, by a subsequent failure of the main ventilation fans (caused by a severe storm).
- A severe storm characterised by torrential rain and strong winds hits the mine site. The storm interrupts electrical power to the mine and causes the main ventilation fans to stop. Torrents of water enter the box cuts and the underground workings.

- In the absence of a controlled ventilation system, the fire rapidly causes a reversal of the mine ventilation, rendering the main drift and other parts of the primary escapeway impassable due to thick smoke. The only fresh-air escapeway is the belt conveyor roadway.
- After two hours, the fire damages the gas-monitoring system, as well as the telephone and other communication systems. Communications between the underground and surface of the mine are severely impaired. There are about 50 people evacuating the mine at the time.
- An ERZ Controller carrying out outbye inspections during the emergency is reported missing when he fails to return from an inspection in a remote area of the mine.

Evacuating mineworkers were expected to:

- shut the mine down safely before leaving their workplace
- don their self-rescuers when they found smoke in the roadways on their way out
- look for the source of the smoke
- fight the fire if they located it
- treat the casualty if they found him and search for the missing person
- find an alternative route from the mine.

The exercise would also test the effectiveness of the arrangements at the mine to deal with the various matters as they arose. A central person in this exercise would be the Communications Room Operator, who would take emergency reports, mobilise an initial response, and monitor progress.

The assessors did not expect that resources beyond the mine would be called upon just for the fan failure, but they did expect such resources would be mobilised when smoke was found underground. They expected that the mineworkers would attempt to leave the mine in their transport vehicles and only travel on foot in the belt road when it became clear that the transport roads were inaccessible.

Observations

The observations are set out under the three phases of the exercise: Activation, Evacuation and Response. Comments on the systems and processes used are dealt with under Incident Management.

Activation

An emergency response begins when a person becomes aware that normal systems are not adequate

Communications Room, Carborough Downs Coal

to deal with a particular situation. This exercise was designed to test how:

- out-of-the-ordinary situations were identified
- assistance was called for.

Communications Room

A Communications Room was set up at Carborough Downs Coal to:

- display information from machinery, ventilation and gas monitoring
- observe a number of critical points through Closed Circuit TV
- provide a CRO to answer phone calls
- record the location of people underground
- make available contact lists for various support services.

In the initial stages, the CRO was the Incident Controller. He held this role until someone more qualified was available. (The Incident Controller is a quite different role from that of the CRO.)

The CRO alone monitors video cameras, gas-monitoring points and other monitoring screens, and answers calls on various communications systems — radio, DAC, 555, internal and external telephones — making adjustments to the tag board (which records the location of people underground). While a single person may be able to cope with this workload under normal conditions, it requires several people during the early stages of an emergency. Because of familiarity with all the facilities, the CRO is the ideal person to be the initial Incident Controller.

Recommendation 1: That Communications Room Operators learn to delegate their many functions to available people once an emergency response is activated.

Duty cards are a valuable tool for this delegation because they allow tasks to be set out so that anyone familiar with the mine can carry them out.

To ensure that CRO duties are carried out effectively, a person and a duty card may be needed for:

- each telephone, radio channel and other communication system
- each monitoring screen
- making outgoing calls
- managing each of the people-tracking systems (see table 1 on page 12)
- arranging escorts/transport from the security gate.

Duty cards

More than one duty card may be delegated to a single person, but the workload needs to be monitored. On several occasions in the exercise, the overworked CRO had to pick up a phone and say,'Hold the line, please' because of other responsibilities that were seen as more urgent. The potential for information to be lost is a major concern. The call could be from a person with information about the fire or details of obstacles to evacuation, or from an injured person. In a real emergency a delay could have tragic consequences.

Recommendation 2: That critical functions best carried out in the Communications Room be identified and alternative locations designated for other activities.

Many CRO functions could also be moved from the Communications Room during an emergency, as soon as people become available. Phones could be diverted, radios handled elsewhere and the gas-monitoring system could be accessed remotely. At one stage during the exercise there were eight people in the Communications Room, each one giving or getting important information.

Gas monitoring could easily be moved to the Ventilation Officer's office. Telephones could be diverted to any available office. The radio could be handled at any terminal, and the receiver in the Communications Room muted.

The start of the exercise was delayed because the CRO did not have access to resources that were locked away in offices. One of the items was a gas detector with 0.5 per cent low alarm for methane. (Gas detectors are required whenever any uncertified portable electrical equipment, such as a camera, is taken underground.) In a real emergency, doors could have been broken to retrieve the equipment; however, this could have day-to-day operational consequences for the mine.

The use of the duty cards

Duty cards list the critical tasks that must be done in most emergencies. They are allocated to people as the people become available; hence they remove the need for on-the-spot decision-making and reduce the requirement for experience and knowledge. The duty cards at Carborough Downs Coal list tasks for available people who can act as:

- Communications Room Operator (CRO)
- Debrief Officer
- Incident Controller
- Lamp Room Coordinator
- Logistics Coordinator
- Mines Rescue Coordinator
- Operations Coordinator
- Planning Coordinator
- Portal Security Officer
- Road Security Officer

The CRO issued only one duty card. This was given to a warehouse employee to log the return of cap lamps and tags. The CRO then continued as normal, instead of taking on the responsibilities of the Incident Controller and assigning someone else to deal with the phones. The CRO also attempted to make all outgoing calls as well as answer all incoming ones.

Recommendation 3: That making outgoing calls be delegated to one of the first available people, and done away from the Communications Room.

The remaining duty cards were issued after the establishment of the ICT. These cards were taken from a set in an ICT resources container, not from the Communications Room wall. This may be justified on the basis that the 'live' ones were kept in case a real need developed; however, in normal circumstances it is not acceptable to have two sets available as this could lead to two people carrying out the same task, or people not being assigned to a task because of an assumption that it has been done by others.

Recommendation 4: That a single set of duty cards be readily available and distributed as soon as an emergency procedure is activated.

The Portal Security Officer role was taken on by an evacuating mineworker. When he reached the surface he decided to record the names of all others who arrived. He may also have been the person who prevented people re-entering the mine to rescue the casualty left at the bottom of the drift. Neither of these actions appeared to have been under the control of the ICT.

See page 9 for a more detailed analysis of the ICT's role.

Response to severe weather conditions

Mines in the Bowen Basin are in a tropical zone, so are subject to severe weather conditions. Carborough

Downs Coal has TARPs (Targeted Action Response Plans) to deal with:

- storms within 20 km of the mine – TAR 010: Severe Weather Event
- water in the box cut due to rain – TAR 019: Rain Event
- the effect of rain on strata stability in the Box Cut – TAR 022: Box Cut Monitoring
- water over roads at or near the mine – TAR 023 Inclement Weather Causing Blocked Roads

When the first assessors arrived at the mine they declared trigger levels for each of the rain-related TARPs. They provided photos of points monitored by the mine's video camera system. These showed very heavy rain conditions. They also provided a Bureau of Meteorology (BOM) weather radar picture (see below). The mines TARPs advise the CRO to consult the BOM website when there is a storm forecast. The BOM pictures were actual ones, obtained during an investigation of a serious accident at a nearby mine. As the exercise progressed, the BOM maps and monitor views were updated.

Photo: Bureau of Meteorology.

PA systems
The mine has a surface PA system that can be heard throughout the office complex. This was used very effectively to call the ICT sub-groups to meetings and to gather all employees in a meeting room.

There is also a PA system on the underground DAC system, set up automatically to announce the point at which the belt system is switched off. This message, which is repeated regularly, made the DAC system virtually useless for making calls as people evacuated.

Recommendation 5: That mines investigate the features that are available on the DAC, including provision to override automatic calls in an emergency or once they have been acknowledged.

Mine Rescue Mobilisation
The objectives of the exercise as set out in Recognised Standard 08 include:

Mobilisation of Queensland Mines Rescue Service (QMRS) and other external services, including mines inspectorate, Industry Safety and Health Representative(s), SIMTARS, police, ambulance to the extent required by the exercise scenario.

Queensland Mines Rescue Service will be required to:

- provide the rescue team response as defined in the Mines Rescue Agreement with the mine
- deploy rescue teams underground including the establishment of a Fresh Air Base (if required) in response to the scenario.

One of the objectives of this year's exercise was to monitor the effect of the security gate on emergency responses. To enable this, it was planned that rescue teams from the Mutual Assistance Group would respond to the call. To make their trip worthwhile, they would then be engaged in a routine training exercise that continued after the exercise was completed.

When the responding Inspector of Mines arrived, he indicated that he would observe the decision-making process that the rescue team followed before the team proceeded underground. This would provide valuable information for understanding the risks associated with mine re-entry.

The ICT records indicate that a decision was made to call the QMRS, and put them 'on standby' at 0225 hrs. A decision was made at 0321 hrs to call them to site. At 0400 hrs, four Carborough Downs team members were on site, and another three at the camp. The QMRS Operations Managers arrived at the gate at 0445 hrs. They were in the office complex at 0514 hrs.

There were six BG4 rescue suits ready to go at 0419 hrs, and twelve at 0427 hrs. The exercise coordinator and the QMRS Operations Managers decided to limit the response to the minimum number necessary to go active. This meant that the furthest team, from Newlands Northern, could be turned around. It appears that this decision was misinterpreted by others as an instruction for all teams to turn around.

It is not clear who made the decision to turn the teams around. Mines Rescue said that it was decided by the mine. There is no record of this in the mine's logs or from discussions with those most likely to have been involved. Mines Rescue team members from other mines have expressed disappointment that they were not mobilised.

Opportunities were lost to observe the process and time taken for team members to pass through the gate. It was also unfortunate that the decision-making process for rescue teams to enter the mine to deal with a large fire and a missing person could not be monitored.

In future years, steps should be taken to prevent a repeat of this year's shortcomings:

A rescue training exercise at the host mine could be scheduled and set up for an unspecified time and date within the exercise window. Trainees would know that they would be called out to an exercise sometime in the next month, at a known mine but on an unknown date. The mine's rescue coordinator could set up a training run that would suit the number of people called out by a mutual assistance request. The training exercise should be based on the Level 1 scenario, but could continue after mine operations have resumed.

The Level 1 scenario would cover:

- monitoring of time taken to call out and respond
- application of mines rescue protocols to the scenario.

The training exercise would make the responding teams' time and trip worthwhile. It is essential that the rescue teams be assessed and debriefed and that findings be included in the report of the exercise.

The log references refer to rescue being 'on standby'. It is not clear what this would mean. If the rescue

team members are not being called out, their sleep should not be disturbed with a request to get ready. In a 24/7 roster, a call at any time of day might disturb someone's sleep.

Recommendation 6: That the Queensland Mines Rescue Service examines how it would respond if the mine indicates that 'there may be a problem'.

Even though the mine may request that rescue resources be placed on standby only, the QMRS, based on its greater knowledge and experience, may choose to bring resources closer to the mine. It is always easier to call off an emergency response when it is not needed than to make up lost time when the call comes too late.

Evacuation

Preparation for evacuation following a fan failure

When mineworkers leave their workplace, they should leave it in a condition that will allow safe re-entry and minimise the development of hazardous situations during their absence. These controls include supporting exposed strata, minimising the effect of any release of gas, and placing machinery in a safe location. The initial scenario — the loss of power to the belt system — did not justify an evacuation but should have led the mineworkers to secure their workplace, extend the ventilation tubes to the face, and carry out other minor maintenance tasks while production was halted. The assessors found evidence that such hazard controls appeared to be normal behaviour at Carborough Downs Coal on this shift.

When the fans failed, and it was evident that ventilation would not be restored quickly, a decision was made to evacuate the mine. Before leaving the mine, an attempt was made in each of the development panels to 'bag up the fan'. When the ventilation is restored, this has the effect of ventilating the face area with pressure from the main fans until it is possible to return to the section and restore power to the auxiliary ventilation fan. This was done in two of the three production panels. The crew suggested that it be done in the third section, but there was no brattice readily available. The section where this happened has recently been moved from where it shared resources with another panel. It was still near the other panel, but too far away to bring in shared resources under these circumstances.

Some members of one crew suggested taking Compressed Air Breathing Apparatus (CABA) from the section's emergency supplies. As this would not normally be done in an evacuation of this type, this was eventually decided against.

In general the shutting down of the panels was done in a controlled manner, consistent with good practice.

Donning and changeover of self-rescuers

In each of the recent annual exercises the assessors have commented on the lack of familiarity of mineworkers with the self-rescuers in use at the mine. This year the assessors were complimentary, and so clearly this has been the subject of effective training at the mine. Five people from the longwall area were asked to wear a self-rescuer during the evacuation. Initially they were given a training self -rescuer to put on, and when that had been done effectively they were asked to change from that dummy model to a real self-rescuer unit. They then wore the real unit until it expired.

The assessors, who included an experienced mines inspector from NSW and an experienced Site Safety and Health representative from a nearby mine, commented positively on the way that the donning and changeover were handled. However, a third assessor, who is less experienced in underground coal mines, found the process concerning. He felt that for one person in particular the experience was unnerving. He noted that a mine worker had discarded his first self-rescuer before having the next unit ready. It would seem that the less experienced assessor recognised a potential problem that we should pay more attention to. Shortly after the exercise, an alert was issued by NIOSH in the United States, drawing attention to difficulties experienced when opening CSE self-rescuers.

The three assessors observed that two of the five units were stuck in their canisters and required forceful removal by hitting them on the ground and using screwdrivers to pry them free. Difficulty taking units out of the canister is mentioned in the training videos for the CSE 100 self-rescuer. This is not surprising, considering the need for an airtight seal in a belt worn unit with a shelf life of 10 years.

Recommendation 7: That the amount of effort required to release a CSE self-rescuer be included in refresher training and inductions.

It was unfortunate that the activity could not be videoed, but arrangements that had been made to do so could not be followed through when the mine was unable to supply a suitably configured gas detector to accompany the camera. This shortcoming and another

similar one are discussed later in this report. In view of the difficulty in releasing the units from their case, it would improve mineworkers' understanding and confidence if any training done with live units was videoed.

The self-rescuers worn during this part of the exercise were CSE 100 units, which are approved as a 40-minute duration self-escape unit. In the exercise the conditions were arduous due to the grades involved. The actual times before the units expired ranged from 40 to 48 minutes. This appears to be consistent with the mine's spacing between caches of 1000 metres, which was established by walk out tests earlier this year.

An assessor with another crew was told that there had been regular training on self-rescuers use, but wear and tear had meant that some parts were missing on the training units.

This part of the exercise was in line with the objectives for emergency exercises generally under recognised Standard 08:

- safely test the facilities and strategies in place at a mine to manage emergency events in all circumstances
- test the competency of mineworkers in using those facilities and implementing the strategies
- enhance the confidence and ability of mineworkers to respond in an emergency.

The changeover was also highlighted as a training need in previous exercise reports.

In this year's exercise, the problem did not appear to be with lack of training, but rather with a unit that is difficult to open.

After the exercise a Safety Alert was issued by NIOSH, the United States regulator, which drew attention to the difficulty of opening CSE self-rescuers.

More work needs to be done to develop a self-rescuer that is fit for purpose, or other strategies must be adopted to control this risk.

Evacuate from the mine through the belt drift

It was expected that all evacuating mineworkers would continue to evacuate in their transport vehicles even after they had found the roadways to be polluted. The initial indication was that there were low levels of carbon monoxide and no smoke. This should have been enough for the evacuating mineworkers to put on their self-rescuers. It should not, however, have caused them to leave the vehicle and travel further out on foot. Yet this was what all teams did immediately when confronted with the low alarm CO levels. One team returned to the vehicle after a discussion, but the remainder travelled on foot at least 800 metres further than was necessary.

Almost all involved in the exercise appeared to associate using a self-rescuer with walking out.

Recommendation 8: That evacuation training include a preference for using a vehicle wherever this is possible.

The belt drift is not the signposted primary escapeway, required under section 298 of the Coal Mining Safety and Health Regulation 2001, although it could meet most of the requirements of that legislation. The mine has chosen to signpost another roadway as a secondary escapeway. While this is not specifically required under the legislation, it is good practice. The belt drift is neither the primary escapeway nor the signposted secondary escapeway, but does provide an alternative means of escape to the surface.

The belt drift reaches the surface at a different location to the normal travelling road (and primary escapeway) and the signposted secondary escapeway. This has advantages when, as in the scenario, the roadways between the fire (12 cut-through) and the box cut portals were blocked by fire, smoke, water and falls. There is no shelter at the belt drift portal. During a severe storm this would be a major disadvantage. There is also a need for transport to be arranged to bring people back to the pit top for debriefing.

The relative locations of the belt drift, offices and box cut portals are shown on the aerial photo on page 13.

Recommendation 9: That where evacuation is through a portal away from the main entrance to the mine, systems be in place to:

- treat and transport casualties
- record details of those who evacuate successfully
- control entry to the mine
- transport evacuated mineworkers to a suitable location for debriefing and other activities.

Response

Fire-fighting response

Only one of the evacuating crews looked for the fire. The others chose to evacuate on foot through the belt drift as soon as they found smoke. The assessors

found this disappointing because in the early stages it might have been possible to extinguish the fire.

The crew that fought the fire did so from the intake side without any breathing apparatus. They used water and fire hoses from a standard depot.

The mine is currently rolling out first response CABA pods. They have been installed in some production panels. Two sets and re-charge stations will be located outbye. They will be fitted with Eimco Quick Attach fittings so that they can be readily transported anywhere in the mine. Training in first response will also be conducted at the mine during the equipment roll out.

The only fire-fighting equipment near the transformer was a standard fire depot, with extinguishers, hoses and fittings. There was no foam stored underground.

The fire-fighting technique of the crew that attempted to extinguish the fire was adequate, but their equipment was not suitable.

Recommendation 10: That a review of a mine's emergency management risks include the need for low expansion foam at high fire-risk points underground and for the training of mineworkers in fire-fighting technique.

Dealing with an injured person

There was a lack of skill and a shortage of equipment to treat an injured person. Only one crew found the casualty, who was suffering from a broken leg and burns. There was no stretcher nearby and the casualty was dragged initially, then left alone underground while additional resources were found.

Recommendation 11: That a review of a mine's emergency management risks include training in first aid and the location of emergency equipment.

Provision for fatigue management of the ICT

The exercise began at midnight. The night shift had started their shift at 10 pm. The afternoon shift had returned to camp before the exercise commenced. The day shift management team left the mine at least five hours earlier.

It is difficult to make prescriptive rules for fatigue management that apply equally to any emergency. However, the effects of fatigue on the quality of decision-making cannot be ignored. Fatigue management for an ICT should include:

- arranging for half of the ICT to go home to bed as soon as it is known that the problem will take longer than a full shift to solve
- identifying a back-up person for each key person on the ICT
- members of the ICT admitting that they are tired and arranging a replacement.

Concern was raised that two people had been at the mine since the day shift when the assessors arrived. They remained at the mine and filled roles in the ICT. They were spoken to by at least two assessors, but seemed unaware of the implications.

If the exercise had continued until the missing mineworker was found and the fire was extinguished there would have been no ICT members available.

Recommendation 12: That a relief plan be in place so that a blend of first and reserve members are available for the Incident Control Team.

In a typical mine the Site Senior Executive (SSE) would be on one team, the Underground Mine Manager on the other. The Chief Mechanical Engineer would be on the same team as the Second Electrical Engineer to blend seniority and subject-matter knowledge. The actual team composition will be based on the mix of experience, expertise and functions at a particular mine, but should be planned in advance.

Incident Management

The role of the Incident Control Team

The ICT was formed when evacuating teams reported smoke. It was not necessary for the team to be formed because of the storm, the loss of power or the fan stoppage, but, once formed, it took control of those matters too.

The role of the ICT is shown in the mine's Principal Hazard Management Plan for Emergency Response:

> The ICT formed at 0230. The three sub-groups were formed at 0250.

The team's initial objectives were to:

- manage the evacuation of the people from underground
- fight the fire
- manage the restoration of power to the mine
- manage the restoration of ventilation
- act on any further information as it became available
- in time manage the resumption of operations.

Information later became available that:

- a miner was missing, believed to be underground
- another miner was injured and was still underground.

There was little evidence that the ICT set objectives or priorities.

Recommendation 13: That the Incident Control Team's objectives and priorities be clearly stated and posted so that they remain the focus of team activities, adjusted as they are achieved or as the situation changes.

The restoration of power commenced before the emergency was recognised. The restoration might have continued independently of the exercise, but fortunately those involved placed themselves under ICT control. If they had not, fans could have been restarted without planning for the effect of the fire and the fumes. All activity at the mine must be reported to and controlled through the ICT process.

Recommendation 14: That, once an Incident Control Team is established, all activities at the mine be brought under the control of the ICT.

This was done very effectively during the exercise by those involved in the restoration of power and the mine is to be complimented on this.

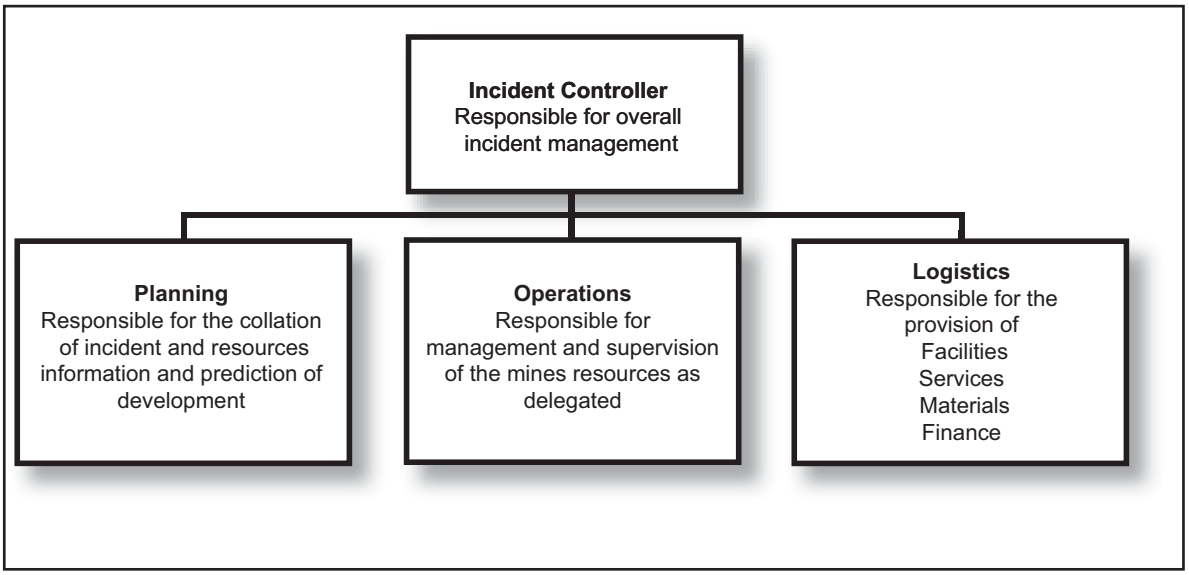
People-tracking systems

There are five systems in use at the mine for tracking people on site and in the mine.

1. **Record of the issue and return of cap lamps and self-rescuers**
   Permanent employees and long-term contractors are normally assigned a cap lamp and take the associated self-rescuer. If their lamp is faulty or not charged, they may take another lamp (and the associated rescuer) but are asked to record the details in a log book in the lamp cabin. Visitors and short-term contractors record the number of the lamp they are given in the same book. They may be assigned a permanent employee's lamp, if that employee is off roster or on leave. People are usually expected to take their lamp immediately before going underground and to return it as soon as they reach the surface. This shows who is underground at any time. In an emergency this self-managed lamp issue and return system is suspended and lamps are only available to approved people after issue by a Duty Card holder. Returned lamps are also checked in by the same duty card holder. (Duty Card 2.1)

2. **Tag board, located near the Communications Room** (see page 11)
   Permanent employees and long-term contractors have two printed, numbered, photo ID cards which they take from the general storage area when they enter the mine. They place one on a board which is divided into sections, representing zones at the mine. They take the second with them, and place it when they pass a board at the entrance to an underground zone. The purpose of this tagging system is to ensure that there are no more people in a zone than there are cached self-rescuers to be used in an escape. Most employees would

Figure 1: Incident Control Team relationships



spend their full shift in a single zone. Those who move between zones contact the CRO and ask that their tag on the surface board be moved. The CRO moves the tag. For this reason the surface tag board is adjacent to the Communications Room. Comments are made later in the report about the congestion caused by this location.

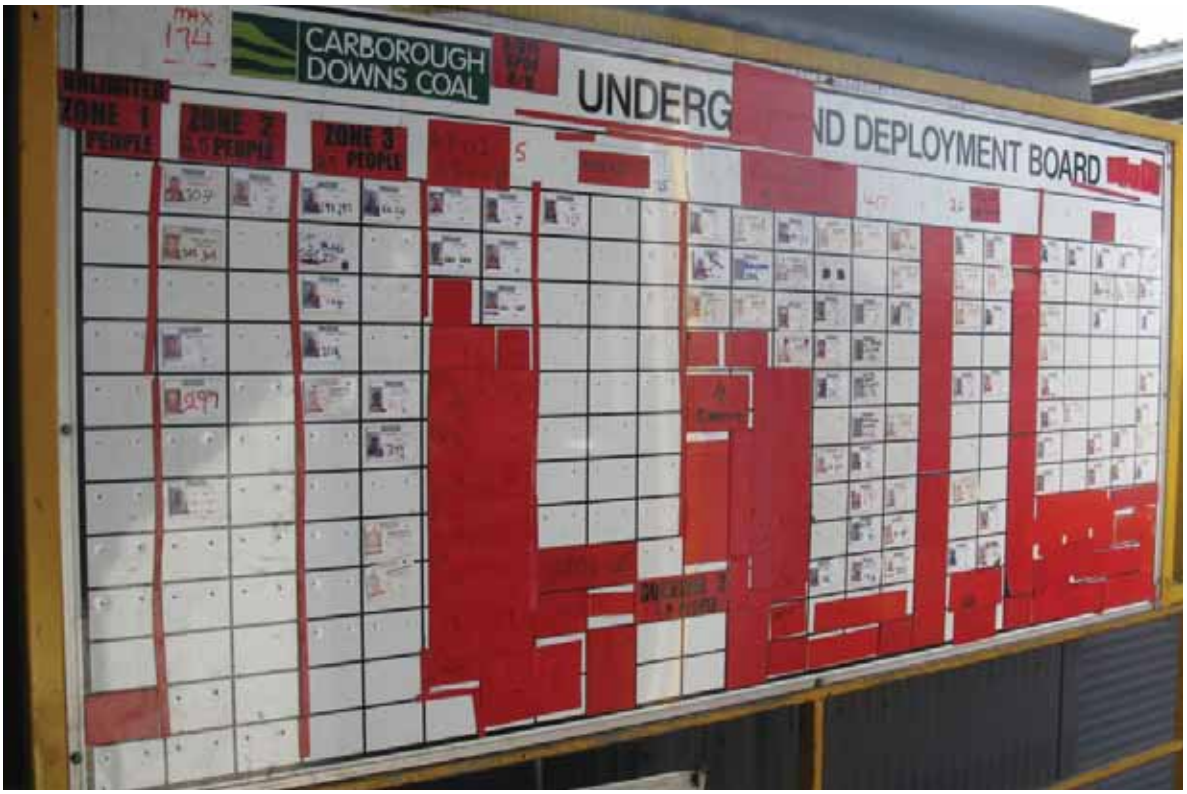
3. **CRO logs**
   On receiving a request to move a tag, the CRO logs this in the same way as all other calls to the Communications Room are logged This gives the CRO a written report of where key people are at the mine, providing a third system for locating people.

4. **Northern Lights Technology (NLT)**
   At the time of the exercise this electronic system was only partly installed. Each cap lamp is fitted with a unique Radio Frequency Identification unit (RFID). As the unit passes a sensor at a zone boundary, the location is adjusted in a database, which is displayed in the Communications Room. The results displayed in the Communications Room were significantly different from the numbers displayed on the tag board at the surface. At one time, there were 49 people underground according to the tag board, while only 32 had passed the NLT sensors. This disparity can be explained (a) because the system is not fully implemented yet and so there are still parts of the mine where coverage does not reach and (b) people who have placed their tag on the tag board have not yet passed the first sensor at the portal. Even so, the difference between the numbers recorded on the manual tag board and the electronic system warrants further investigation.

5. **Trigger Action Response Plan (TARP) for the location of missing people.** (see page 12)
   TAR 005, Emergency Response – Lost – Unaccounted Personnel defines a normal state as 'All personnel accounted for. Recording time in and out on Entry Access sign in register'. Trigger states include 'Failing to sign out' and 'Unable to locate'. When the assessors visited the mine they were asked to sign in and sign out at the main gate.

While each of these systems has a justifiable reason for existence, the risk of inconsistency seems to be very high.

Recommendation 15: That mines examine the recording systems used for identifying who is at the mine and the underlying reasons for the systems. Where multiple purposes can be achieved in a single system, a single system should be preferred.



Tag board

A further difficulty with the tag board at Carborough Downs Coal is its location outside the Communications Room. This caused congestion during the evacuation.

The manual tag board system relies on the CRO moving tags as people phone in to say that they have moved from one section to another. In normal times it is very convenient to have the tag board just outside the Communications Room. The CRO can make the moves for those few people who don't stay in the one zone for their full shift. The Communications Room location is on a walkway normally used by anyone going into and leaving the mine. This provides a reminder to people to place their tag before they enter and to remove it when they leave.

The remote access gate system

All people entering the mine pass through a security gate near the highway (see site layout next page). Only authorised vehicles can pass beyond this point. The road between the security gate and the mine buildings was once a coal haulage road.

The security gate records the identity of people entering and leaving the mine. It also can limit access to those who have a good reason to be on site.

In an emergency, a response could be delayed at the gate. The QMRS Operations Managers were delayed for about 15 minutes.

The Chief Inspector and Inspectors chose not to exercise their powers of entry and were also delayed while transport was arranged. The limited available resources were used escorting and transporting people from the mine to the gate.

Recommendation 16: That mines review whether there are barriers to emergency response in their access system and identify ways of eliminating these without using people who could be used more effectively elsewhere.

During a delay at the gatehouse, a responding Inspector noticed that there was no emergency power supply available, nor were there any torches. Under scenario conditions, the gatehouse would have been unable to function.

Ventilation modelling

The mine uses Ventsim to predict the effect of changes in conditions on the ventilation system. This system was used at each stage of the exercise by the mine's Ventilation Officer, reporting to the Incident Control Team. The activity was monitored by an assessor who is the Ventilation Officer at an adjacent mine.

An accurate simulation is invaluable in an emergency. To be effective, however, it must be up to date and people who can use it must be available. In this exercise both were true. The mine is to be complimented.

Persons(s) Actions	Normal State	Level 1 Response	Level 2 Response	Level 3 Response
Triggers		**Person(s) not returning as indicated on Register.** • **Failing to sign out.** • **Equipment breakdown.** • **Disorientated.**	**Person(s) not returning as indicated on Register.** • **Failing to sign out.** • **Injury.**	**Person(s) not returning as indicated on Register.** • **Failing to sign out.** • **Unable to locate.**
All Personnel	• All personnel accounted for. • Recording time in and out on "Entry Access Sign In Register"			
Supervisor		1. Call on radio or mobile phone. 2. Clarify location and reason e.g. breakdown, late return, etc. 3. Give direction and assistance. 4. Record and Report. 5. Notify Senior Position.	1. Call on radio or mobile phone. 2. Clarify location and reason e.g. breakdown, late return, etc. 3. Give direction and assistance. 4. Determine safest route of travel to First Aid Facility. 5. Transported to appropriate closest First Aid facilities 6. Record and Report. 7. Notify Senior Position. 8. Contact external response if required.	1. Call on radio mobile phone. 2. Notify Senior Position. 3. Notify other site personnel. 4. Secure the area site.
Senior Position (CDCM Representative)		1. Follow up incident analysis.	1. Monitor situation and maintain contact with reporting person. 2. Contact external response. 3. Notify SSE.	1. Contact external services for immediate response. 2. Notify SSE.
Site Senior Executive			1. Report occurrence to relevant authorities.	1. Notify Corporate Management 2. Prepare Media Statement as required.

Carborough Downs Emergency Response – Lost – Unaccounted Personnel TARP

Recommendation 17: That mines keep an up-to-date simulation of their ventilation system so that it can be used when circumstances change. A person familiar with the simulation must be available to the Incident Control team.

Logging activity

The mine's form for recording activities was only used by two of the eight people who took notes. The form had provision for the scribe's name, the time of the note, and a subject area. It did not have a page number prompt. The notes taken on the form were easier to follow than those taken on plain paper. There was a limited, informal use of whiteboards to display information. The use of the mine's PA system to provide updates was very effective.

Recommendation 18: That the system for minute taking at ICT meetings be similar to the one used in operational meetings at the mine so that a new system does not have to be learned during an emergency.

Before the exercise, a proposal was received to trial a logging system being developed in association with the QMRS Mine Emergency Management System. This request was refused on the grounds that the system was not in place at the mine, and the purpose of the exercise was to test the mine's systems. It may be appropriate to trial the system in Level 3 or Level 4 exercises. For Level 1 and Level 2 exercises the systems that should be used are those that would be available in a real emergency.

Site layout, security gate access

Communications Room, Carborough Downs Coal

Appendix 1: Information given to mineworkers

The assessors visited the mine two weeks before the event. The following short messages were included in pre-shift briefings:

- The Level 1 exercise is a chance to find out what we don't know about how to act in an emergency. By treating it seriously we can become that much better if we are ever unfortunate enough to be underground when a real emergency happens.
- Let your friends and family know that the exercise is planned in the next couple of weeks. That way if they hear a news report about emergency teams being called to Carborough Downs Coal they will not be unduly worried.
- The assessors are not trying to trap you or trick you. They are looking to see what everyday coal miners would do and what the whole industry can learn from our experience. Your mistake may save many other people's lives in a real emergency. Don't cover it up. Be proud of it so we can all learn from it.
- Remember to put a signed information tag on your crib bag, marked 'OK to take out in exercise' so that it can be brought to the surface if the exercise is today. We won't move any bag that is not tagged, so you may not get your crib.
- Do not use your belt worn or cache self-rescuers during the Level 1 exercise. A few people will be asked to wear a self-rescuer, but these will be supplied by the assessors. Keep your own rescuer ready for use in case of a real emergency, just as you do every other day.
- Do not take any extra risks during the level 1 exercise. Do not travel in a vehicle unless you have a seat. Do not do anything that you would not do under normal working conditions.
- During the exercise, all PED messages and telephone or DAC communications that are about the exercise should start with the words 'Exercise Only'. If there is a real emergency start your message with 'Emergency, Emergency, Emergency'. The exercise will stop if a real emergency occurs.

The assessors gave the following information to the mineworkers before the exercise commenced:

When they reached the crew

- The exercise is being held tonight, but not yet. You should continue operating as normal, but not leave the section, even if you normally work elsewhere or if your job involves moving around the mine.

When the power dropped off Big Harry

- Set up the panel as you would if there was no-one coming in next shift and you were leaving.
- When the power dropped off the fans
- You should now set the section up as you would if the power and fan are off, and then evacuate in a safe manner.

Travelling out

- If transport is available, use it. Assessors are to travel out by transport if any is available. This is to assess how the crew responds and to provide instructions at key points.
- If there is not enough transport, assessors are to travel out by transport. The number of people in a transport is limited to the number of seats in the vehicle. No overcrowding. How they handle extra people is a test of the exercise. Overloaded vehicles are not an option.

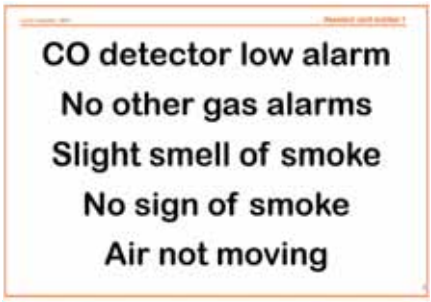
At 38 cut-through

- At the bend in the travel road, passing the transformer — tell anyone carrying a gas detector that it is showing a low alarm for CO. If they don't know the alarm level for their detector, tell them it is the actual reading plus 5 ppm.

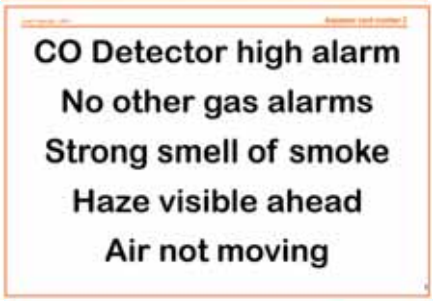
Signs were displayed at key points in the exercise (see following pages).

Signs given to workers

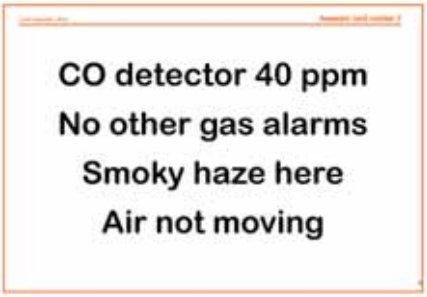
At 38 cut-through



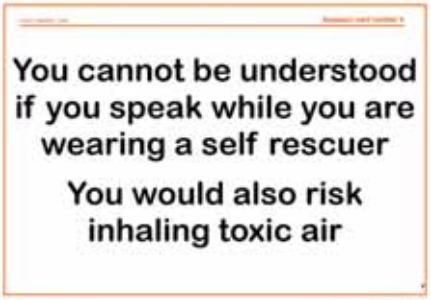
If people did not indicate they would put on their self-rescuer on CO low alarm



If people still did not indicate they would put on their self-rescuer at the high alarm



If people spoke after saying they would put on their self-rescuer



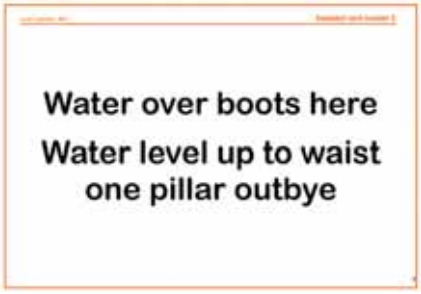
As people approached 13 cut-through in C Heading

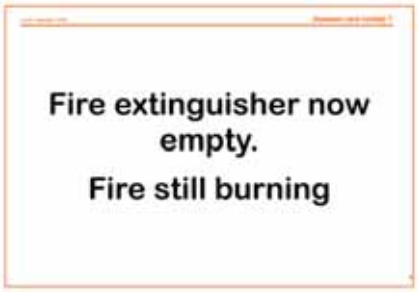
If they continued past 13 cut-through

Signs given to workers

As they approached the transformer in C Heading 12 — 11 cut-through.

If it was necessary to slow down or redirect crews, these assessors carried these signs:





Appendix 2: Exercise timeline

Time	Observation
0000	Exercise Controller issued second photo of sump and second BOM diagram – indicating water had reached level 2 on TARP and there was imminent storm.
0002	CRO rang fitter to go to check box cut pump due to rising sump — activating level 1 TARP for rain water at yellow level.
0005	Fitter requested by CRO to start box cut pump as yellow level had been reached on TARP.
0023	Fitter informed CRO that pumps in the box cut were ready to run.
0036	Radio Call – Both box cut pumps now running.
0052	Exercise Controller instructed CRO that he had lost power to 'Big Harry Transformer'.
0052	PED message sent to all underground that power was lost at Big Harry transformer.
0054	Phone call to electrician — 'Big Harry Transformer has lost power'.
0100	Tube 17 alarm — CO.
0102	Fan failure
0102 to 0119	Evacuations commenced due to fan failure.
0103	Real-time system multiple alarms. Box cut water level in red zone.
0110	First report of smoke by ERZ Controller.
0119	CRO issued Lamp Room Coordinator Duty Card.
0122	Backup generator going.
0134	CRO contacted warehouse and requested warehouse staff to come to Communications Room to assist.
0140	Ventilation Officer arrived at Communications Room.
0140	SSE called mine. Others on management team arriving.
0142	Casualty found by evacuating crew.
0145	Evacuating crew set up to fight the fire.
0150	First people arrived at belt drift portal.
0200	Underground phones no longer working.
0204	SSE arrived in Communications Room — took IC duty card.
0207	Other duty cards assigned. ICT established by SSE.
0209	Assistant CRO appointed.
0211	Ambulance called for underground casualty.
0212	Control advised that Fan 2 ready to go.
0213	SSE arranged risk assessment to send people underground to fight fire.
0224	Portal sentry arrived and placed barrier tape and witches hats at the portal.
0225	QMRS and GAG notified but not activated.
0231	First ICT meeting.
0233	First bus arrives to pick up evacuated people at belt portal.
0236	Call for ambulance made (simulated) ETA of ambulance 0300hrs.
0237	Tag board check — Outbye Deputy still not accounted for.
0305	Ambulance arrived at gate. Escorted to secret drift portal.
0310	Debrief started.
0318	Ambulance arrived at secret drift to pick up causality.

Time	Observation
0321	IC told planning to call out QMRS to support team going to fight fire.
0323	Last crew arrived at belt drift portal.
0330	Seven people still underground, two unaccounted for, injured person still underground.
0330	Electricians sent to start portal fan #2.
0336	Casualty arrived at surface.
0337	Inspectors at gate.
0338	Outbye Deputy still not accounted for.
0345	Fan restart checklist completed and given OK by VO.
0348	Fan No 2 restarted.
0350	Mains power now available.
0400	Mine Rescue Service called and they are responding.
0400	Main fans #3 & 4 able to be restarted.
0404	IMT decision made to not restart as ventilation modelling still being performed.
0514	QMRS personnel arrived. Total of nine mines-rescue trained people on site.
0515	Exercise complete.

Appendix 3: Considerations for future exercises

These comments are provided for future exercise committees, at both the Level 1 (State) and Level 2 (Major Mine Site) exercises.

Timing

The mines rescue competition calendar should be considered when setting the time. This may mean avoiding periods when rescue competitions are being held to limit the strain on resources or to deliberately schedule at the time of a competition to test flexibility. It could be at many stages in between.

The mine's roster and shift times should be tested. How would an exercise on the day between one roster leaving and the next roster arriving affect a response? What would be the effect of calling an emergency soon after the end of night shift with most of day shift trapped underground?

NSW Mine Design Guidelines

Since the exercise, the NSW inspectorate has reissued MDG 1020 Guidelines for underground emergency escape systems and the provision of self-rescuers, MDG 1022 Guidelines for determining withdrawal conditions from underground coal mines and the NSW Mines Rescue has published Guidelines for in–seam response using CABA for events where life is at risk. These are available from the NSW Government website at http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0013/204142/MDG-1020-emergency-escape-Oct-2010.pdf

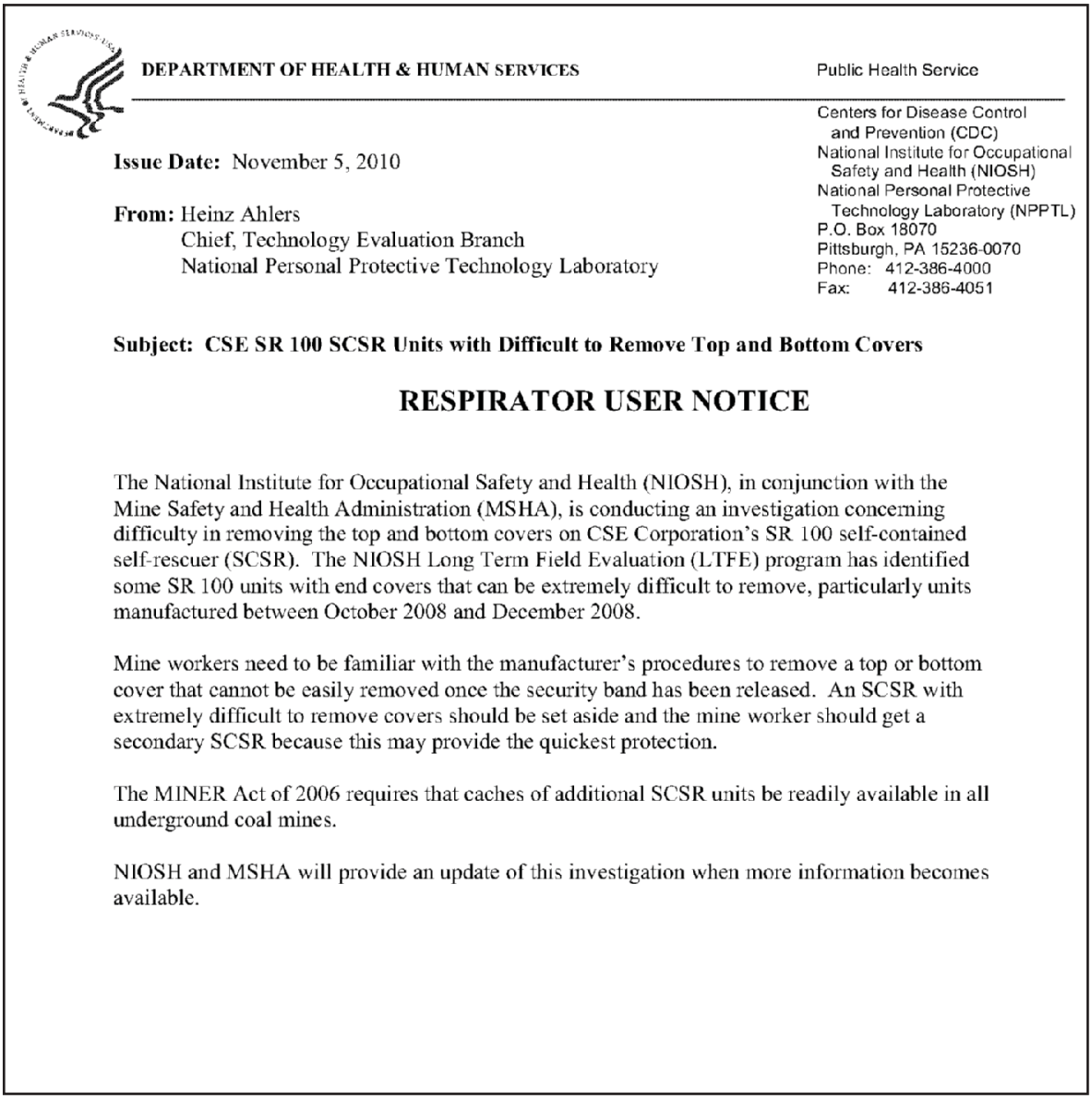
Pike River Mine

The findings from the Pike River Mine explosion on 19 November 2010, where 29 miners tragically lost their lives, provide lessons on emergency management for coal miners everywhere.

CSE 100 self-rescuers

Since the exercise, the United States Mine Safety Health Administration (MSHA) issued an alert about the difficulty of opening CSE 100 self-rescuers, in particular those manufactured between 2008 and 2010. (See Appendix 4.)

Appendix 4: Notice from MSHA re CSE 100 self-rescuers



DEPARTMENT OF HEALTH & HUMAN SERVICES Public Health Service

Centers for Disease Control and Prevention (CDC)
National Institute for Occupational Safety and Health (NIOSH)
National Personal Protective Technology Laboratory (NPPTL)
P.O. Box 18070
Pittsburgh, PA 15236-0070
Phone: 412-386-4000
Fax: 412-386-4051

Issue Date: November 5, 2010

From: Heinz Ahlers
Chief, Technology Evaluation Branch
National Personal Protective Technology Laboratory

Subject: CSE SR 100 SCSR Units with Difficult to Remove Top and Bottom Covers

RESPIRATOR USER NOTICE

The National Institute for Occupational Safety and Health (NIOSH), in conjunction with the Mine Safety and Health Administration (MSHA), is conducting an investigation concerning difficulty in removing the top and bottom covers on CSE Corporation's SR 100 self-contained self-rescuer (SCSR). The NIOSH Long Term Field Evaluation (LTFE) program has identified some SR 100 units with end covers that can be extremely difficult to remove, particularly units manufactured between October 2008 and December 2008.

Mine workers need to be familiar with the manufacturer's procedures to remove a top or bottom cover that cannot be easily removed once the security band has been released. An SCSR with extremely difficult to remove covers should be set aside and the mine worker should get a secondary SCSR because this may provide the quickest protection.

The MINER Act of 2006 requires that caches of additional SCSR units be readily available in all underground coal mines.

NIOSH and MSHA will provide an update of this investigation when more information becomes available.

Appendix 5: Response to 2009 recommendations

2009 recommendation	Relevance to this year's exercise
1. All mines should consider establishing first aid stations including stretchers at key locations underground including secondary egress locations.	In place at Carborough Downs; however, the key locations need to be reviewed. This is dealt with in the report of the exercise, in particular in the sections dealing with fire fighting and first aid.
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.	The actual escape route was not the primary or signposted secondary escapeway. It was a belt road, so signage may not have been necessary. There did not appear to be any problem with people finding their way out of the mine.
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.	Exercise to include changeover. The difficulty in opening a serviceable CSE self-rescuer was surprising to many of those involved. Where serviceable units are used, the act of opening them should be videoed and the video used in training and awareness sessions.
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.	Walk-out trials have been conducted at Carborough Downs Coal. The spacing between caches has been set at 1 km for CSE 100 units. The actual times to expiry for the five self-rescuers used in the exercise ranged from 40 to 48 minutes.
5. All coal mines to review the callout list for Inspectorate and Industry Check Inspectors and update their internal records and pro-formas where necessary.	The call-out of the inspectorate using the statewide emergency number worked satisfactorily. Two of the three ISHRs were at the exercise as assessors. The message went to the third ISHR's message bank.
6. Maintain 'oxygen time' on members of the mines rescue teams.	A plan to call out rescue teams from adjacent mines was called off. Confusion led to this decision — neither the SSE, QMRS nor the exercise committee called off the rescue response. This was a disappointing outcome.
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.	No external assistance was sought because the VO from an adjacent mine was an assessor for the exercise — he monitored the VO from Carborough Downs Coal.
8. All mines to communicate effectively all Level 1 exercise outcomes and recommendations to all coal mine workers.	Prepare a separate report containing the cumulative recommendations from this year's exercise.
9. All coal mines to respond to Queensland Mines Inspectorate (QMI) indicating the individual mines response and actions towards Level 1 exercise recommendations.	A mine record entry is being prepared for issue with the final report.
10. All mines to develop, communicate and implement minimum standards for nonverbal communication including a code of signals. These should be displayed in critical locations e.g. at caches, change over stations and refill stations.	These were used during the exercise.
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.	All mineworkers chose to don self-rescuers when low alarm levels of CO were indicated.
12. All mines to review their principal potential emergency situations and ensure risk assessments have been developed and are available in case of emergency.	These were not in evidence at the exercise.

2009 recommendation	Relevance to this year's exercise
14. Industry to engage with SCSR manufactures to develop a more effective SCSR design and develop a reliable and 'fit for purpose' escape system.	This has been reinforced this year by the difficulty experienced in opening CSE units.
15. All mines to review and maintain their signposting throughout the mine to assist mine workers and rescuers in case of evacuation.	The evacuation was not through the signposted primary or secondary escapeways.
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.	Lifelines were not used in the exercise.
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.	This was included in the minutes of ICT deliberations.
18. All mines should initiate the initial Mines Inspectorate callout via the standardised emergency callout number (07 3237 1696).	This number was used effectively. Normally it would divert to the Chief Inspector's phone, but because he was travelling in an area with poor mobile phone coverage, it diverted to the second person on the list.
19. The Queensland Mines Rescue Service (QMRS) should ensure that all mine sites are provided with detailed requirements for the deployment of GAG mine inertisation system, ancillary equipment and rescue teams.	This is included in the department's annual audit of the QMRS.
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.	This had not been done at Carborough Downs Coal.
21. All mines to consider the use of a 'mass callout system' for contacting mine personnel in an emergency situation.	Call out relied on a single person with other major duties — the CRO.
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.	The telephone and real time monitoring cables passed a high fire-risk route.
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 Communications Room in an emergency. All information required can be brought back to the Communications Room.	The CRO only issued one duty card — to the lamp room attendant to monitor and control recording of the evacuation. A duplicate set of duty cards was in the ICT supplies. The CRO used his own copy instead of the set in the Communications Room.
24. All mines to ensure that critical ventilation control activities are captured in a duty card.	There was no duty card for the VO.
25. All mines to consider backup for statutory ventilation officer (VO).	No backup arrangement was made.
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.	To be included in a statewide gas-management audit, currently being planned by SIMTARS and the department.

2009 recommendation	Relevance to this year's exercise
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.	QMRS were put 'on standby' when smoke was reported. They were later called out by the ICT, but the response was cancelled before brigade members from other mines arrived at Carborough Downs Coal.
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.	Not tested in exercise.
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	Not tested in exercise.
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.	Not tested in exercise.
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.	This is part of a software trial requested by QMRS. The committee felt that the trial in parallel with the Level 1 exercise would dilute the effectiveness of both exercise and trial. Information from the exercise can be provided for the software trial after the exercise.
33. All mines, in consultation with the QMRS, to ensure standardised fittings are available to connect GAG to mine water outlets etc.	To be included in the department's annual audit of the QMRS.
34. All mines to ensure that area lighting is sufficient around any GAG connection point.	To be included in the department's annual audit of the QMRS.
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.	The department's annual audit of the QMRS to be reviewed to evaluate the effectiveness of this recommendation.
36. MRE to all mines on recommendations and actions required to be taken.	To make publications more 'user friendly', separate report of exercise from cumulative recommendations.

Glossary

CABA	Short-term compressed air breathing apparatus used for self-escape, fire-fighting and rescue
CRO	Communications Room Operator — the person in the Communications Room at all times while the mine is operating. A CRO would normally take the first report of an emergency and initiate a call for extra resources. The gas-monitoring display, video monitors showing strategic points and the emergency phone are all in the Communications Room
CSE	Brand name for self-rescuers
DAC	Brand name for an underground communication system
ERZ Controller	ERZ controllers carry out regular periodic safety inspections; they are often referred to as deputies
GAG	A device that uses a jet engine to produce high volumes of inert gas
IMT or ICT	The Incident Management Team or Incident Control Team. Under the MEMS system the Incident Control Team is made up of representatives from Planning, Operations and Logistics groups
ISHR	Industry Safety and Health Representative (statutory position elected by the mineworkers under the Coal Mining Safety and Health Act)
MEMS	Mine Emergency Management System, developed by QMRS for managing emergency incidents at coal mines in Queensland
MISHC	Minerals Industry Safety and Health Centre (centre dealing with mining industry risk management at The University of Queensland)
MSHA	Mine Safety and Health Administration (part of NIOSCH) — United States organisation set up to prevent death, disease and injury from mining and to promote safe and healthy workplaces for US miners
NIOSH	National Institute for Occupational Safety and Health — the United States health and safety regulator
PED	A type of miner's cap lamp that includes a paging system
QMRS	Queensland Mines Rescue Service
Self-rescuer	A device worn by mineworkers on their belt at all times to provide a source of oxygen when passing through a contaminated atmosphere (sometimes referred to as a SCSR)
SIMTARS	Testing and research facility operated by the Queensland Government for the mining industry
SSE	Site Senior Executive — the most senior officer located at a coal mine with responsibility for the operations of the mine
TARP	Targeted Action Response Plan

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