Metalliferous level 1 mine emergency exercise 2016

George Fisher Mine

Queensland Government

CS6325 12/16

Cover photo: George Fisher Mine, L72 shaft

Contents

Preface

This report has been compiled by the 2016 Level 1 George Fisher Organising Committee, with input provided by each of the assessors involved in the exercise (assessors provided an account of their part in the exercise for this report).

This exercise is a new initiative by the Department of Natural Resources and Mines (DNRM) Metalliferous Inspectorate to help improve mine safety across Queensland. Similar exercises have been conducted each year at underground coal mines since 1998.

The organising committee would like to thank the assessors for their input and acknowledge the cooperation and assistance of all those involved in the 2016 metalliferous level 1 mine emergency exercise.

The organising committee would also like to thank George Fisher Mine for agreeing to be the first Queensland underground metalliferous mine to conduct such an exercise

Summary

This report is for the 2016 metalliferous level 1 mine emergency exercise held at the George Fisher underground mine between 10.00 am and 2.00 pm on Tuesday 30 August 2016.

The 2016 exercise at George Fisher Mine was the first simulated emergency exercise to be run by the DNRM Metalliferous Inspectorate in an underground metal mine.

George Fisher Mine is an underground metalliferous lead–zinc mine owned and operated by Glencore plc, and located 20 km north of Mount Isa.

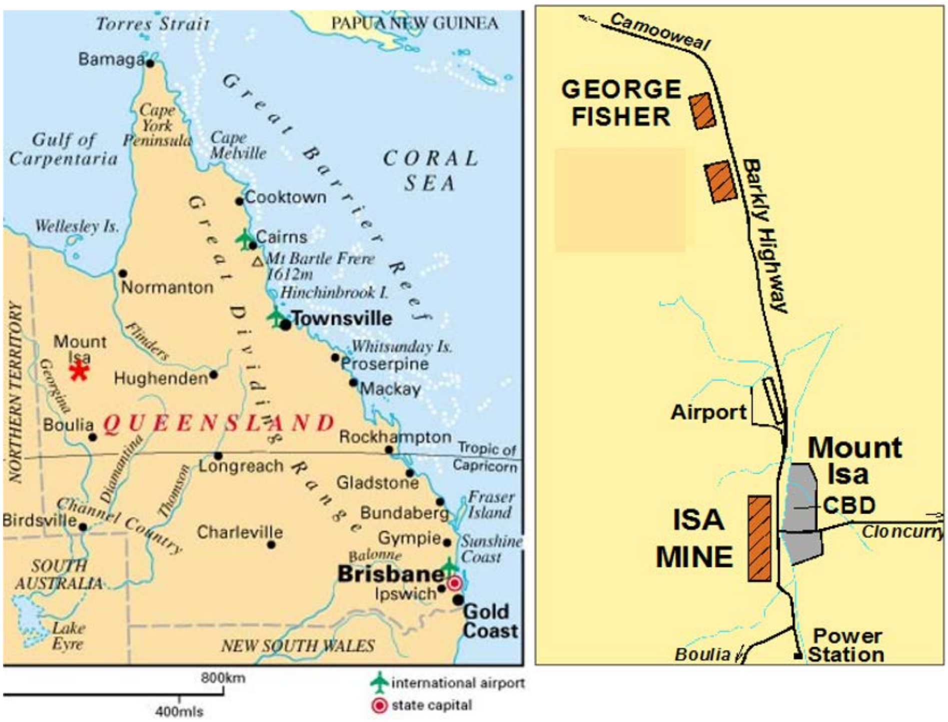

Figure 1: Location of George Fisher Mine

Objectives

The objectives of the exercise were to test the:

1. ability of personnel to don and wear a self-contained self-rescuer (SCSR) and walk to the nearest emergency refuge bay (ERB) wearing smoke goggles
2. activation of some ERBs to stand alone (no mine services)
3. capability of a crib room ERB to keep out contaminants
4. mine’s evacuation processes and ability to account for personnel
5. activation of the L72 winder for insertion of mines rescue to an area below a simulated fire
6. emergency management team (EMT) response.

Scenario

The scenario for the exercise was a fire on a loader located on the decline above 18C sub-level access on the L72 (north) end of the mine.

The site was barricaded with chains, and ‘no travelling unless authorised’ signs were posted at the site and at 15 level breakthrough to simulate the area of the mine that could not be accessed due to smoke from the loader fire. No actual loader was positioned here so as not to block the decline.

The loader driver was ‘injured’ trying to fight the fire and had made his way uphill to an ERB at 17 level HG to raise the alarm (HG is a reference from the mine plan).

Conclusions

The following major conclusions were made after reviewing all 14 assessors’ observations:

1. Level 1–type emergency exercises will lead to safety improvements in Queensland metal mines and should be run annually at underground metal mines.
2. Mine control quickly dealt with the ‘incident’ in a professional and controlled manner.
3. Mines rescue was quickly deployed to George Fisher Mine.
4. Personnel managed to activate the crib room ERBs, albeit with some difficultly.
5. Personnel successfully evacuated using SCSRs and smoke goggles.
6. Not all personnel followed the emergency response procedures.
7. The EMT was formed quickly; however, some issues were noted with the process.
8. The L72 shaft was converted to man-riding capability.

For the full list, see the 'Conclusions’ section (p. 23).

Recommendations

The following major recommendations were made by the assessors, with the aim of providing continuous improvement to the emergency response capabilities of the mine, the industry and the state:

- Review the effectiveness of SCSR training and assessment for workers.
- Ensure a robust change management process is followed when modifying or retrofitting safety-critical life support equipment.
- Provide all site personnel—who as part of their roles would be expected to be an EMT member—with industry standard emergency management/critical incident training.
- Ensure contingency planning for the situation where some EMT process-critical personnel are not onsite or available at the time of the emergency.
- Standardised training for emergency response team (ERT) members in metal mines and quarries, taking into account site-specific, reasonably foreseeable emergency scenarios.
- Fire simulation modelling software is now available. Modelling should be carried out on credible fire situations within the underground mine ventilation circuits.
- One underground metal mine should host a level 1 exercise on an annual basis, with an increased number of industry assessors.

For the full list, see the 'Recommendations’ section (p. 24).

Introduction

The Queensland Mining Warden's inquiry into the explosion at the Moura No. 2 Mine in August 1994 made the following recommendation:

> 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)

This recommendation applies to all underground coal mines in Queensland (level 1 exercises have been run annually since 1998 in coal mines).

While metalliferous mines are required to test their emergency response capability on an annual basis, during a meeting in Mount Isa with all underground mine managers in March 2016, the DNRM Metalliferous Inspectorate canvassed running a level 1–type exercise in an underground metal mine.

The 2016 exercise at George Fisher Mine was the first simulated emergency exercise run by the Metalliferous Inspectorate in an underground metal mine as a way improving industry cooperation and capability in emergency response.

The requirements for conducting emergency exercises at coal mines are set out in *Recognised standard 8: conduct of mine emergency exercises,* available on the DRNM website at www.dnrm.qld.gov.au. Recent level 1 mine emergency exercise reports are available on the Queensland Government website at www.qld.gov.au.

Objectives

The objectives of the exercise were to test the:

1. ability of personnel to don and wear an SCSR and walk to an ERB wearing smoke goggles
2. activation of some ERBs to stand alone with no mine services, electricity or compressed air, including
    - an ERB in the orebody
    - a crib room ERB
3. capability of a crib room ERB to keep out contaminants
4. mine's evacuation processes and ability to account for personnel, with one 'injured' worker above the fire requiring urgent medical attention
5. activation of the L72 winder for insertion of mines rescue to an area below a simulated fire to recover the 'injured' worker
6. EMT response and the use of the Australasian Inter-Service Incident Management System (AIIMS).

Being the inaugural exercise, it was not designed to test outside agency responses and was a site response check only. At no time were emergency services contacted.

George Fisher Mine

The George Fisher lead–zinc–silver ore bodies, located 20 km north of Mount Isa, were discovered in 1947. The mine was originally named Hilton Mine in honour of Charlie Hilton, the general manager of Mount Isa Mines at the time of discovery; however, it would be many years before this discovery would be realised.

A permanent headframe over the P49 shaft was completed in December 1975, with a depth of 1040 m. In 1981, mineralisation was located 2 km further north, known as Hilton North and later to be renamed George Fisher Mine after the former chairman of Mount Isa Mines.

Hilton began production in 1989, but by 1998 (once the most accessible ore had been mined) production was slowed in favour of development at George Fisher Mine.

George Fisher Mine was officially opened in 2000 and has continued to expand, with the L72 expansion project starting in 2012 and the hoisting system commissioned in early 2015.

See Figure 2 for the underground layout of George Fisher Mine, and Figure 3 for a diagram of the ore handling flow.

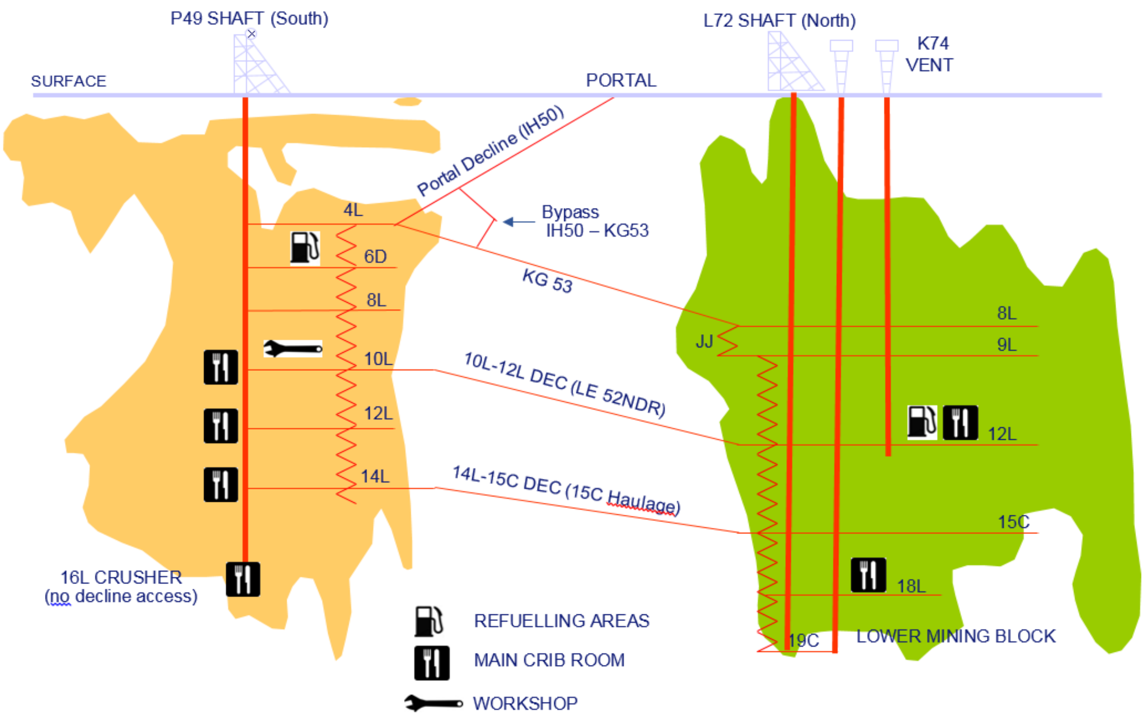

Figure 2: George Fisher underground mine plan

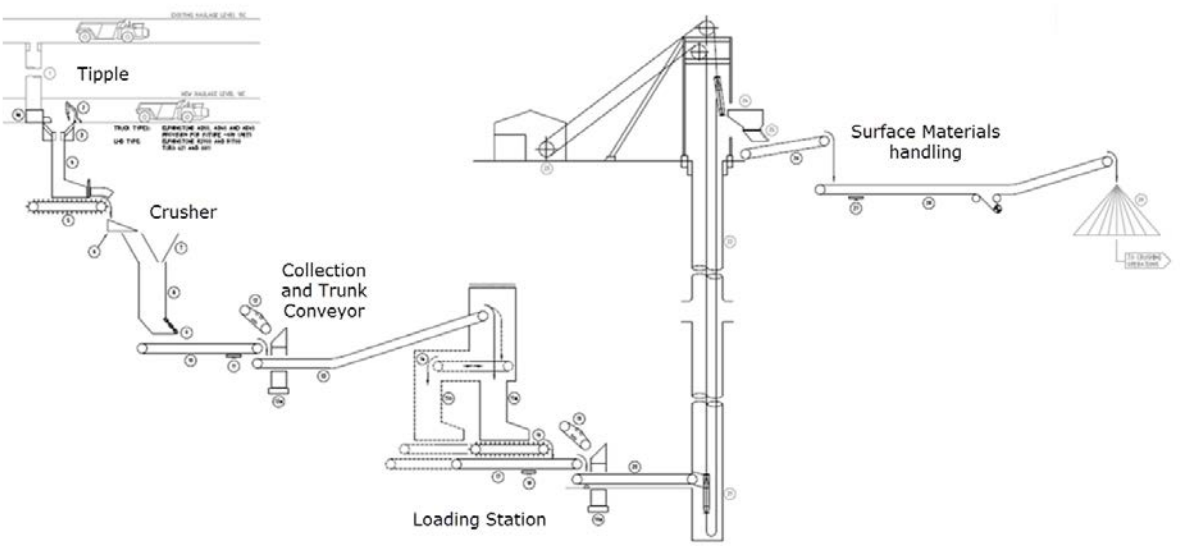

Figure 3: George Fisher Mine ore handling flow (L72 shaft)

Scenario

The scenario for the exercise was a fire on a loader located on the decline just above 18C sub-level access on the L72 (north) end of the mine.

The site and the decline up to 15 level breakthrough was barricaded with chains and 'no travelling unless authorised' signs. No actual loader was positioned here so as not to block the decline.

The loader driver was 'injured' trying to fight the fire and made his way up up to an ERB at 17 level HG to raise the alarm.

An assessor was always with the driver, who was provided a script to inform mine control of the situation.

Ventilation modelling of a vehicle fire at this location showed that areas of the mine would quickly become contaminated with smoke and carbon monoxide. The pollutants would slowly travel up the decline with the ventilation current.

This scenario allowed the desired objectives to be tested.

Assessors

A total of 14 assessors were on site, with representatives from the:

- Metalliferous Inspectorate
- Coal Mines Inspectorate
- Safety in Mines Testing and Research Station (Simtars)
- Queensland Mines Rescue Service
- Minerals Industry Safety and Health Centre
- South 32 Cannington Mine and Minerals and Metals Group Dugald River Mine.

See Appendix 2 for details of the assessors.

All assessors were provided with notes to brief mine personnel before activation of the exercise.

Surface observers:

- This is an emergency exercise that you have already been informed about.
- Please treat this exercise as a real event.
- I am the observer for this group.
- **Start communication with level 1 exercise communication.**
- **Do not ring 000 or any external services.**
- You are free to make your own decisions.
- You are not to endanger your own or any other person's safety in this exercise.
- As I am an observer, I am not allowed to assist you by answering questions.

Underground observers:

- This is an emergency exercise that you have already been informed about.
- Please treat this exercise as a real event.
- I am the observer for this event.
- **Do not put your self-rescuer on.**
- **Start communication with level 1 exercise communication.**
- You are free to make your own decisions.
- You are not to endanger your own or any other person's safety in this exercise.
- I will give instructions with regard to the underground environment.
- I may ask you to perform activities as part of the exercise test.
- As I am an observer, I am not allowed to assist you by answering questions.

Underground assessments

17 level HG ERB ('injured' worker)

Assessor: Asok Sur

The scenario was a loader fire on the decline above 18C sub-level access at the L72 end of the mine. The loader operator suffered 'severe burns', and made his way up the decline and called mine control from the 17 level HG ERB.

The loader driver called the emergency number 2222 at 10.00 am to report the status of the fire and his injuries—he was badly burnt and could not control the fire. The first emergency broadcast from mine control was received at 10.05 am, informing all mine personnel to report to a crib room/ERB/fresh air base (FAB) and 'tag safe'.

Throughout the exercise, numerous calls were made to the ERB from the surface to check the status and condition of the casualty. Some of the discussions provided advice on how to treat the wounds. The mines rescue ERT arrived at the ERB at 1.02 pm, tended the casualty's wounds and evacuated him through the L72 winder system.

The EMT decided to deploy the ERT down the decline from the portal to recover the injured worker. This was not successful due to the smoke that would have been in the decline. A second ERT was then deployed down the L72 shaft to check on personnel in the 18 level crib room. This team was subsequently deployed to recover the injured worker. The change in task given to the second team created an issue, as they did not have a stretcher.

What worked well

- Clear communication was given to the Isa Mines Control Centre (IMCC) operator in Mount Isa, and George Fisher mine control was patched into the call early.
- Mine control appeared to ask all pertinent questions (phone number, location, injury status, location of fire etc.).
- The EMT regularly communicated with the injured worker at almost 10-minute intervals, mainly enquiring about the status of his physical and mental condition.
- A mine paramedic called the 17 level HG ERB and provided treatment advice.

Areas for improvement

- Very little information was provided about the status of the recovery operation within the mine or the plan for the ERT to evacuate the casualty.
- An 'on/off' symbol for the compressed air valve in the ERB should be available to demonstrate if the valve is on or off.
- It was difficult to know the phone number for the ERB phone. The phone number displayed was not the actual phone number.
- Drinking water was not easy to locate.

Recommendations

Mine

- An 'on/off' symbol for the compressed air valve in the ERB should be fitted to indicate the status.
- The phone number should be clearly written somewhere near the phone in the ERB.
- The drinking water location in the ERB should be clearly indicated.

Industry

- While enquiring about the status/condition of a casualty or trapped worker, information should be provided on the status of the recovery operation to reassure the individual that an ERT is on its way.

L72 18 level crib room

Assessors: Martin Filar and Trevor Brown

The 18 level crib room is below the level where the vehicle fire occurred and is ventilated ascensionally; therefore, the atmosphere outside the crib room was not polluted. The crib room was activated for the purposes of the exercise to determine any issues with the activation process (see Figure 4).

The assessors were positioned in the crib room waiting for activation of the exercise. Personnel emergency device (PED) notification on cap lamps was received at 10.10 am, requiring all personnel to go to an ERB. At 10.12 am, a radio call was noted, informing personnel of the level 1 exercise and the need for everyone to go to an ERB.

Personnel started to enter the crib room from 10.15 am until the last person entered at 10.30 am. At this point, there was a total of eight personnel in the crib room.

One worker informed the assessors that he was operating on channel 9 and did not receive the broadcast from mine control. He was informed of the emergency by other personnel.

At one stage, four personnel exited the crib room to ‘tag safe’ as they had forgotten to do so.

The eucalyptus ‘stench gas’ was detected outside the crib room at 10.25 am.

Figure 4: The 18 level crib room being sealed

Crib room personnel were advised at 10.56 am that the atmosphere outside was contaminated and smoke was coming into the crib room. The crib room was successfully sealed and the MineARC systems activated so as to form an FAB. There were some difficulties following the process; however, the team persevered and succeeded. Issues were identified about where the charger for the gas monitor in the crib room had been relocated. This interfered with the activation of the MineARC system. Foam expansion canisters could not be activated to seal the crib room door. Paper towel was used instead,

What worked well

- The group in the crib room all worked well together to set up the room into an ERB. Key personnel took lead roles to activate systems.
- It took the group 15 minutes, from start to finish, to set up the room as an ERB.
- The group in the crib room improvised well when they could not get the expansion foam to work, using paper towel to seal the door.
- The group in the crib room were very calm while setting up the ERB.

Areas for improvement

- The knowledge of personnel about how to set up the crib room into an ERB should be improved. Some of the mistakes included not turning on the compressed air when shutting the doors, turning on the oxygen cylinders prior to starting the scrubbers and not filling the drain hole gaps early enough.
- If retrofitting devices to critical equipment, the fitting must not interfere with its function. A gas monitor fitted to MineARC rendered one of the units unserviceable.

Recommendations

Mine

- Put more canisters of expansion foam adjacent to the crib room door.
- Advise crib rooms when everyone has been accounted for so they know it is okay to seal the access doors if necessary.
- Improved instructions should be available on the wall, with a step-by-step process of how to convert the crib room into an ERB.
- Ensure a change management process is followed when modifying or retrofitting critical safety equipment.
- Remove the gas detector charging unit from the scrubber unit, as the chemical products could not fit in the scrubber unit. Check all other locations in the mine for the same issue.
- The electronic tagging for safe zone/blast zone should be relocated inside the crib room.
- Review the use, operator training, documentation, scheduled maintenance and electronic management system of crib rooms.
- During the incident, the EMT could use underground personnel to provide feedback on conditions in the mine (e.g. is there smoke outside the crib room?).

Industry

- Ensure a change management process is followed when modifying or retrofitting critical safety equipment.

Exercise team

- There needs to be better communication between the assessors when there are changes in the anticipated response.
- Implement greater realism for areas that have smoke or other types of atmosphere (e.g. use fog machines).
- If possible, use sentries to prevent access to areas that are classed as inaccessible.
- Assign a central person to handle communication between assessors.

12 level crib room

Assessors: Stan Slagmolen and David Carey

The 12 level crib room is located above the fire site. The assessors went to the crib room with the day shift mine captain. This meant he was underground when the incident occurred and would have to coordinate activities from the crib room.

This first workers entered the crib room at 10.12 am and started to prepare the room for sealing. It was noted that a drain from a wash basin had been installed in the crib room box drain and this interfered with the installation of the bottom sealing rail. The crew used their innovation and successfully sealed the area using self-expanding gas bags (see Figure 5).

Figure 5: The 12 level crib room wash basin drainpipe

The mine captain and shift supervisor made good use of the whiteboard in the crib room to track personnel and the incident response.

At 10.36 am, the decision was made to activate the crib room as all personnel were accounted for. At this point, 4 of the 12 people in the crib room had to exit the crib room and retrieve their SCSRs and cap lamps, which had been left outside.

The crib room was successfully sealed, but personnel again experienced difficulty in achieving the seal and activation.

Some of the cabinets containing the equipment had jammed doors, and the location of the gas monitor charger again caused problems with the activation.

Later in the exercise, six volunteers from the crib room wore SCSRs and evacuated to an ERB approximately 820 m above 12 level crib room (details of the evacuation are included in the next section of this report, ‘SCSR walk’, p. 11).

What worked well

- Improvised notes were used well by the mine captain and shift supervisor.
- The crews showed tenacity when searching through manuals for instructions on how to:
    - get the scrubber going
    - set up the crib room
    - use foam cans (sealant) to seal doors
    - use gas bags to seal the box drain in association with foam
    - check gas monitors.
- The crews showed good teamwork and leadership.
- Crews knew how to activate compressed air in the room and the rate for setting up compressed oxygen cylinders.

Areas for improvement

- Housekeeping around the scrubber needs to be improved. Some items were stacked on chests and cupboards of spare equipment could not be opened without damaging the doors (see Figure 6).
- Improvements need to be made to the general layout of the crib room with regards to the use of the scrubber, sealant and gas monitors, and the prompts for using this equipment (e.g. instructions were not placed with the equipment, requiring people to walk to and from the area).
- A standard procedure should be provided at the scrubbers for setting up rather than in the area outside the scrubber bay. This should include photographs of a correctly set-up unit and items such as buttons or switches that are referred to in the procedure.
- Training to use scrubbers had not been provided. This was the first time any of the people involved in setting up the scrubbers had done the task.
- Blank papers were used to account for personnel.
- There were no mine plans available in the crib room, particularly with reference to refuge chambers and crib room locations.
- The chain of command was a bit vague and there were some double calls (ERBs required to call shift supervisors and mine control).
- Installation of a washbasin drain line through the box drain prevented fitting a designed steel plate to seal the box drain.
- When personnel enter a crib room, the common practice is to take off their cap lamps and SCSRs and leave them outside. In an emergency, this separates personnel from their critical safety equipment.

Figure 6: Equipment stored above cabinets

Recommendations

Mine

- Provide checklists for supervisors (or personnel who have to account for staff).
- Provide easy manuals for the scrubber—a work instruction using photos as prompts would significantly improve the set-up process.
- Colour code or number carbon monoxide and carbon dioxide boxes with the location on the scrubber.
- Provide a mock model scrubber to practice dry runs.
- Conduct workplace area inspections to ensure crib rooms remain to standard and no undetected changes are made to critical safety equipment (e.g. stacking gear in scrubber area, unwanted modifications to drain).
- Provide maps in the crib rooms with all current locations and capacities of ERBs and crib rooms (e.g. distance to next location, FABs, other ERBs, shaft).
- Provide an area within crib rooms for people to place cap lamps and SCSRs when they are taken off so they remain accessible.

Exercise team

- Potentially align all team members with collecting data and relevant equipment (e.g. GoPros, cameras).
- Involve more industry participants. This was invaluable and provided some definite learnings.
- Possibly use suppliers in the team to understand how their equipment is actually used.
- Conduct mock and simulation runs with equipment (e.g. a dummy scrubber, use of expired SCSRs).
- Improve SCSR training and use the actual equipment.

SCSR walk

Assessors: Levi Laurie and Phillip Casey (Stan Slagmolen and David Carey)

Both assessors played an integral part in setting up the exercise scenario—Levi is a Mine Captain at George Fisher Mine and Phillip is the District Inspector of Mines based in Mount Isa. They set up the crash site at 18 level and the emergency initiation from 17 level HG, observed the 18 level crib room ERB activation, and set up and observed the SCSR walk.

The SCSRs used for the exercise were Dräeger OxyBoks K, which have a nominated duration of 25 minutes. The units used for the exercise had been withdrawn from service but were still operational.

Six volunteers from the L72 12 level crib room were informed that the room was no longer life sustainable and they would have to transfer to the nearest ERB, 820 m uphill towards 10 level. They were told that the air was irrespirable and they would need to wear their SCSRs. They were given a short description of how to initiate their SCSRs prior to beginning the exercise. Halfway through the walk, simulated smoke goggles were issued to all the volunteers. David Carey and Stan Slagmolen also acted as observers for this trial walk out. The walk out was conducted after all personnel had been accounted for and rescue operations had commenced.

Personnel took 20 minutes to reach the ERB, from the time they first opened the SCSRs and fitted them. At the ERB, they went inside and were able to relay the instructions to the assessors as to how they would activate it.

What worked well

- Mine personnel evacuated to the nearest ERB. It was expected that personnel would opt to go to the crib rooms, causing a lot of traffic and congestion of vehicles around the crib rooms.
- Six personnel volunteered and successfully completed the SCSR test of walking 820 m up the incline from 12 level to the nearest ERB—15 minute total travel time for a 1 in 7 decline.
- SCSRs were tested, including under smoke goggles and validated previous guidelines for spacing of ERB units.
- All personnel were able to don SCSRs in a reasonable amount of time without damaging the equipment.
- Smoke goggles provided visual impairment but did not seem to slow their rate of travel.
- After the exercise, all personnel reported a positive experience and learnings they could communicate to the rest of the workforce.

Areas for improvement

- Additional information and training to use SCSRs should be provided.
- Personnel attempted to talk while wearing SCSRs.

Recommendations

Mine

- Additional information and training to use SCSRs should be provided—out-of-date units were used for training.
- Reinforce with personnel that non-verbal communication is essential when using SCSRs.
- Educate personnel about the inability to assist others when using an SCSR and that, while walking together and reassuring each other is valuable, their focus must be on managing their own progress.
- There is potential to introduce mobility canes (used by blind or visually impaired people) for use with SCSRs in a smoky environment. This may not be practical due to the distributed nature of the workforce.
- Use 'practice' SCSRs during the mine induction process.

Industry

- The Metalliferous Inspectorate should develop a safety bulletin to communicate the learnings about the use of SCSRs.
- Continue an annual level 1 exercise for underground mines.

Exercise team

- It is important to have an efficient and dedicated site liaison officer to ensure the success of the exercise.
- There should be a dedicated and centralised communication officer set up to relay messages between the surface and underground. They could also coordinate the escalation of events.
- Station personnel at critical sites important to the exercise (e.g. the crash site, beginning of toxic atmosphere) to record who comes by and direct personnel as required. Bold signage could also be erected.

L72 winder

Assessor: Lionel Smith

The L72 winder control had been handed over earlier in the shift to allow the weekly inspections to be completed. As part of the maintenance, the skips were cleaned to permit examination of the conveyances.

Within the crew carrying out maintenance activities on the winder were two appointed winder drivers and a number of trainees.

When the winder was switched to emergency egress mode, the winder driver and skip attendant knew that the skip had a load rating of 800 kg and were able to explain the origins of this safe working load—this being when the winder is operated by the pony drive. Neither were able to clarify how they ensured that this load rating is not exceeded.

As part of the exercise, the L72 winder was to be set up for ERT personnel to access the mine and to recover an injured worker from the mine. To complete this, a skip was to be set up for man riding. This involved docking a skip at various levels to allow the floor to be lowered, rear guard to be installed and remote communications (ECAM) to be set up. The process for the changeover is documented in a site task analysis (George Fisher Mine L72 skip emergency egress).

During the conversion of the skip and after the floor was lowered, the linkages were detected from the anchor point in the floor. These plates are a trip hazard and if a worker was required to lie on the floor, these plates may impact on them (see Figure 7).

Figure 7: Floor of man riding in the skip

The linkage was then placed behind the door, which impacted on the door opening. As a result, the door only opened approximately halfway, which also impeded people accessing and leaving the skip. This was particularly evident when the ERT tried to get the injured worker out of the skip, to the point where the injured worker (who was supposed to be unconscious) was asked to stand up and get himself out of the skip (see Figure 8).

Figure 8: Skip door issue

At the shaft, there is an automatic system to deploy stench gas into the mine. This system, and the system at KJ76, did not activate and had to be manually activated.

When the supervisor received the call to start to prepare the skip for a possible emergency egress situation, the supervisor and one of his workers set up the skip by lowering the floor, installing the open area barrier and setting up the ECAM communications device. All devices and components required to convert the skip for man riding were located within the shaft area and readily accessible.

Throughout the exercise, there was regular and clear communication between the winder driver and skip attendant.

What worked well

- Personnel in and around the shaft setting up the skip for emergency egress were connected to fall arrest equipment at all times.
- Until all hand rails were installed, personnel near the shaft attached themselves to the fall restraint device.
- The set-up crew did not obtain a copy of the task analysis to review the steps, but did demonstrate through their actions that they have a working knowledge of the steps involved to convert the skip from material haulage to emergency egress and use the winder for emergency egress.
- There was good communication between all personnel involved at the L72 shaft.
- All components required to make the skip suitable for emergency egress fitted with no modifications required.

Areas for improvement

- Investigate why the remote release of the stench gas failed at the L72 and KJ76 shafts.
- The task analysis discusses people falling from heights but does not consider materials/ equipment falling from height onto personnel.
- The task analysis/risk assessment needs to be reviewed to ensure all steps are included for work at the collar and the platen.

Recommendations

Mine

- Review the door design to give a larger floor area to fit more people in the skip and allow access for a stretcher (see Figure 8).
- Review the height in the skip to allow personnel to stand under the protective cover (see Figure 8).
- Make a section of the kick rail in front of the door removable to allow personnel to access and egress the skip without considering the trip hazard.
- Install a hood over the open area to prevent any potential falling objects from striking personnel in the skip.
- Review and document how the safe working load may be easily calculated. This may be calculated by the number of personnel in the skip (if an ERT is present, additional calculation of known additional equipment to be carried such as BG4s, Oxy viva etc).
- Section 4.3 of the skip set-up procedure refers to the fabricated platform being returned to its position. There is no mention of this platform in other parts of the procedure. A review of the procedure is recommended to ensure the platform is installed by the skip attendant when arriving at the platen, or remove the reference in 4.3.
- Review the design of the linkage and attachment points for lowering the floor so that:
    - there is no trip hazards or protrusions on the floor
    - the linkage can be removed for the skip
    - the rope can be rolled up out of the way.

Industry

- Ensure that access to a skip for emergency egress has doors that are large enough for a stretcher to fit through.
- Have all access doors designed so they do not reduce the floor space, thereby reducing the number of personnel that can be conveyed in a skip.
- If a materials winder is to be used for personnel, have a simple quantifiable way to calculate or measure the load that is on the skip to ensure the overload rating in all drive modes is not compromised.
- Ensure that access and egress from a skip is not impeded by a trip hazard.

Exercise team

- Review the two-way radio communications—sounded to be on the fringe of range and not easily understood.

Surface assessments

Mine control

Assessors: Martin Watkinson and Carissa Crozier

Mine control is situated next to the Pitram control centre and across a walkway from the EMT room. There was one control room operator (CRO 1) who was assisted by a Pitram operator (CRO 2) during the exercise to facilitate communication and account for the location of personnel as they checked in from the crib rooms and ERBs.

There is an electronic tagging system that locates personnel in the crib room—'tag safe'. There is no such function in the ERBs and FABs, and personnel are expected to phone mine control and confirm their whereabouts and status.

There was an issue with one worker who entered an ERB and did not follow the site procedures to call mine control. This worker was a contractor and was located at 11.13 am when he called mine control.

General discussion was held about the signage in ERBs and the instruction for phoning mine control.

What worked well

- Mine control personnel remained calm at all times and seemed to have a good understanding of which processes to use.
- All communications were concise and clear, and personnel focused on appropriate matters at the appropriate times.
- Distractions or matters that did not concern the emergency were managed effectively.
- CRO 2 worked in well with CRO 1 and provided backup and assistance as necessary.

Areas for improvement

- ERB signage created issues when CRO 1 was determining the actual location of the missing worker.
- Some personnel did not 'tag safe' at crib rooms.
- Duty cards were not fully utilised.
- Red emergency phones cannot transfer calls.

Recommendations

Mine

- Install clear signage in the ERB that includes the identification number location and the telephone number.
- Provide refresher training for personnel on the procedure to follow in an emergency (e.g. 'tag safe' and telephone control when in an ERB or FAB). Ensure all contractors are included.
- Review the duty card for the CRO to reflect the detail that is needed.
- Investigate an option for transferring calls on the red emergency telephones.

Emergency management team

Assessors: David Cliff and Kevin Poynter

The EMT assembled in the EMT room at 10.15 am

The room is well proportioned, with three whiteboards with prepared formats for managing an emergency. Page 1 of one of the forms was not fully utilised (see Figure 9). This form would have clearly set the objectives, the location of the incident and the description of the incident. Discussions were observed later in the exercise, during which the actual location of the incident was being questioned.

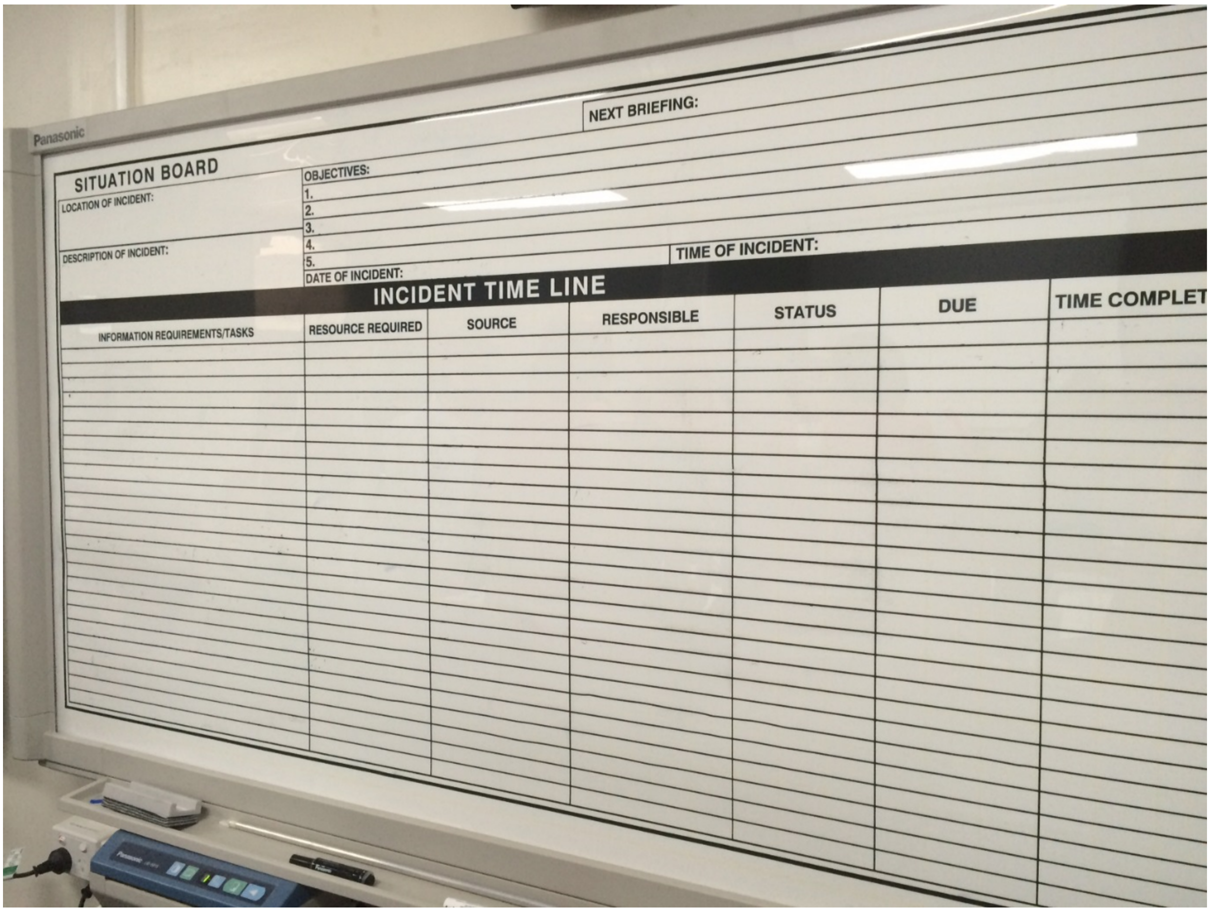

Figure 9: Situation board (not used)

There are several communication systems within the room, all of which created issues, with personnel talking on telephones and intercoms while meetings were being held. All of this led to an informal process being observed.

The whole ERT came into the EMT room for a briefing, which caused congestion in the room and delayed the EMT process.

What worked well

- In general, the emergency management process worked well.
- The ERTs were deployed quickly.
- Personnel underground evacuated to places of safety and were accounted for quickly (except one worker).
- The injured worker was recovered.
- The use of whiteboards to record information and actions was generally good, although the situation report board was not used to its full design (see Figure 9).
- The delegation of communication off site and to personnel was handled externally to the EMT.
- The missing worker was identified and located (not part of the exercise).
- The ERTs were on site within one hour.

Figure 10: General layout of EMT room

Areas for improvement

- Communication needs to be separated from the EMT room. On a number of occasions, there were multiple conversations occurring as well as the use of telephones and radio.
- Functionality of the EMT process would be improved by reducing the number of personnel in the EMT room and establishing separate rooms for specific purposes in line with the AIIMS approach.
- The EMT room could benefit from separating other functions from the room (e.g. planning, operations and logistics).
- The official emergency management plan (as stored in the EMT room) was not fully followed and the majority of duty cards were not issued. This is not to say that the actual process was inefficient, just that it was not as per the documented plan. The plan should reflect reality.
- The roles were not clear for the majority of personnel in the EMT.
- Resources in the EMT room should be checked regularly for ease of use, and personnel should be familiar with their operation, as:
    - the printer in the EMT room could not be accessed
    - the underground video cameras were not displayed in the EMT room until near the end of the exercise
    - page 1 of the situation report form was not accessed
    - there was no paper in one of the printers associated with a whiteboard.
- The incident management process was very informal and relied on individual memories (e.g. ventilation analysis was undertaken verbally with no reference to the ventilation model).
- The rescue process could have been better documented and formalised.

- A more formal decision-making process should be implemented.
- Better visibility of the status of the underground environment—gases, smoke, location of personnel—would improve focus on priorities and the urgency of the response.
- Control is required for EMT room access, in particular whole ERTs entering the room.

Recommendations

Mine

- Review the EMT process, including official duty cards and roles in light of experiences during the exercise, and the separation of functions to allow focus on key issues.
- Review the adequacy of the level of training of EMT members.
- Consider the practicality of the current EMT process if the incident had been triggered on a night shift or weekend.
- When deploying ERTs, they should be formally assigned a plan and objective from the EMT, as is recommended within the AIIMS process.
- Only the ERT captain should enter the EMT room to receive the task assignment, and then brief the ERT elsewhere.
- Review the current room layout and consider:
    - separating communications from the actual room
    - breakout rooms for operations planning and logistics for a protracted incident.

Industry

- Review the EMT process being used and ensure it aligns with the system proposed.
- Train mine personnel in the emergency response system.

Exercise team

- Improve surface combinations between surface team members.
- There is a need to get full documentation prior to the event so the 'planned' process can be compared to the actual process.
- Incorporate contingency planning in case the rescue operation does not go as the exercise planner intended.

Ventilation officer

Assessor: Deon Esterhuizen

The ventilation officer (VO) responded to the initiation of the exercise and reported to the EMT room, where he participated in EMT discussions. He identified early in the process (10.35 am) that the skip could be used as a safe extraction strategy for the injured worker.

This information was not acted upon by the EMT due to an apparent 'urgency' for deploying ERTs.

The VO remained in the EMT room, providing ventilation advice on recovery/rescue options as they were suggested. The site ventilation model was not referred to at any time during the process.

What worked well

- Generally, the situation was managed well by EMT members.

Areas for improvement

- Fire simulation software is not available at the mine.
- Fire simulation modelling has not been done.
- The VO requires training to use the fire simulation software.

Recommendations

Mine

- New fire simulation software has recently been made available commercially and the mine should ensure that it is available to the VO.
- The VO and other technical staff should be trained in the use of the fire simulation software.
- Modelling is required well in advance of emergency situations to identify sensitivities, as the primary ventilation circuit could be reversed in certain areas of the mine depending on the location and intensity of the fire.

Industry

- There is an over-reliance on the site-specific knowledge of VOs at mines and a contingency is required if an experienced VO is not on site. This same issue is being faced in coal mines and some of them have two VOs (one on each tour).
- Ventilation fire simulation should be undertaken at all underground metalliferous mines.
- Level 1 emergency exercises should be carried out by all metalliferous mines.
- The decisions made by the VO should be supported with modelling in an emergency situation.

Exercise team

- Improve the planning process to ensure the team is well prepared and coordinated with clear expectations to ensure that maximum value is added for the benefit of the mine.

Mines rescue response

Assessor: Darren Prince

Observations were made of the initial activation of the incident—the 2222 call and the call answered by the IMCC at the Mount Isa Mines site at 10.00 am. The mobilisation of the mines rescue response was observed, including the deployment to George Fisher Mine and the subsequent deployment of an ERT down the decline to recover the injured worker.

The response at the IMCC was professionally conducted, with all the relevant information received as well as patching George Fisher mine control into the emergency call to keep them up to speed with the underground events.

The first ERT was dispatched to George Fisher Mine at 10.40 am and the second team left at 10.49 am. The mines rescue station is located at the Mount Isa Mines surface operations. When ERTs are activated, the process is for the team to report to the rescue station to collect their equipment and then deploy to the required location. This ensures that a suitable rescue response is activated.

At George Fisher Mine, the first ERT was deployed down the decline to recover the injured worker. This ERT initially established an FAB at 10 level at the P49 end of the mine. They were informed of smoke in the decline when they approached the 12 level L72 crib room. The ERT went under oxygen and slowly worked their way down to 14 level. With increasing ‘smoke’ and the information that the second ERT had now been deployed to recover the injured worker, the first ERT retreated to the FAB, at which stage it was noted the vice-captain had 54 bar pressure in his BG4 breathing suit.

In a real event, smoke would have been seen in the decline and at other locations within the mine, as well as on some of the video cameras placed underground. It is difficult to maintain realism when there is no actual smoke to be seen. It had also been presumed by the planning group that ventilation analysis would have indicated the presence of smoke in the decline and the only way to extract the injured worker would be via the L72 shaft. This change of response from what had been expected caused some confusion within the assessment team.

The second ERT deployed down the L72 shaft were monitored by the 18 level crib room assessors. Their initial deployment was to evacuate personnel from the 18 level crib room. This was requested by the exercise team to achieve the exercise objective of testing the use of the L72 skip as a man-riding facility and the ability of ERT personnel to deploy in the skip. The ERT deployed achieved this task and reached L72 18 level at 12.36 pm.

Once underground, the second EMT realised that the first ERT had encountered smoke and could not get to the injured worker. Discussions in the EMT room identified the alternate route to the 17 level HG ERB without going through smoke or past the fire site. The second ERT was then deployed to retrieve the injured worker via the new alternate route. This ERT searched 18 level for mine plans but could not locate any. They ascended the decline rather than the alternate route identified. They drove into a blind end and then travelled through the ‘no travelling unless authorised’ barricade that indicated the site of the vehicle fire. Again, as there was no actual fire, it is difficult to maintain realism within the exercise.

The injured worker was treated and recovered in the ERB. However, because of the change to the plan, the second ERT did not have a stretcher with them, which complicated the handling of the injured worker who sometimes had to walk. It was also noticed that there is a large gap between the skip and the plat at L72 18 level that requires attention.

What worked well

- The response by IMCC was professional.
- Incident details were recorded.
- Information was relayed successfully.
- The handover to the rescue supervisor was well handled.
- The rescue station response was professional.
- In the absence of the supervisor, ERT members started updating the emergency board and preparing equipment.
- Underground activities of the rescue team were observed.
- Good teamwork was shown by the responders.

Areas for improvement

- Utilise an esky to store ice for BG4s if deployment is delayed.
- The ERT should take a second XAM for team use when checking atmosphere while active. The ERT had one, but as per procedure this had to be left at the FAB.
- A mine plan of the deployment area should be given to active ERTs (e.g. searches).
- ERT captains should update the ERT regularly while travelling in separate vehicles.
- ERTs should always have access to a stretcher or take one with them on deployment.

Recommendations

Mine

- ERTs should stay out of the EMT room. Only the ERT captain should be present and receive the briefing.
- Maintain one point only for communications for active ERTs during active duty.
- ERTs are briefed on clear objectives and carry suitable information and equipment to achieve those objectives.
- Assess the acceptance of risk for the size of the gap at the 18 level between the rescue skip and the platform.
- Place critical ERT gear at each of the main plats or cribrooms for escape (i.e. at the 18 level have oxygen, stretchers, guide ropes and first aid kits ready for ERTs to use when they go underground).
- Ensure maps/plans are available in the crib room and provided to ERTs.

Exercise team

- Determine if there is more than one solution for the scenario and have several options if the EMT identifies another solution.

Conclusions

The following conclusions were made after reviewing all 14 assessors' observations.

Glencore and George Fisher Mine have demonstrated the benefit of running such simulated exercises, with the mine and industry representatives identifying many opportunities for improvement. Many of these improvements are simple and easy to adopt.

1. Level 1–type emergency exercises will lead to safety improvements in Queensland metal mines and should be run annually at underground metal mines.
2. Mine control quickly dealt with the 'incident' in a professional and controlled manner.
3. Mines rescue was quickly deployed to George Fisher Mine.
4. Personnel managed to activate the crib room ERBs, albeit with some difficultly.
5. Personnel successfully evacuated from one ERB to another using SCSRs and smoke goggles, showing that the spacing between ERBs are adequate when using OxyBoks K SCSRs.
6. Not all personnel followed the emergency response procedures:
    a. not 'tagging safe' in crib rooms
    b. not calling in from ERBs.
7. Leaving mine belts with cap lamps and SCSRs outside cribrooms means they are not immediately available in an emergency.
8. The EMT was formed quickly; however, some issues were noted with the process:
    a. the EMT room needs to be reorganised, possibly with an adjacent communications facility—as the room is being moved closer to mine control, mine control could possibly fulfil the communication duties
    b. the duty cards need to be reviewed
    c. more practice is needed in AIIMs
    d. formal instructions are required for mines rescue deployment and other decisions by the EMT
    e. no breakout rooms or space for logistics, operations and planning.
9. Issues were noted regarding the L72 shaft conversion to man-riding capability:
    a. bracket in the middle of the floor
    b. top cover not fitted and would not have been high enough for tall ERT members
    c. door not wide enough to allow passage of stretcher
    d. gap between the cage and the platen at 18 level L72.

Recommendations

These recommendations have been made by the assessors with the aim of providing continuous improvement to the emergency response capabilities of the mine, the industry and the state.

They should be reviewed by the mine, the metalliferous industry and Inspectorate as applicable.

The exercise team will review the options for conducting future exercises. The recommendations for the exercise team have been provided to help industry and others plan and coordinate emergency exercises at underground mines.

Mine

Remote/orebody ERBs

- Review the layout of ERB's to ensure that:
    - compressed air valves are clearly labelled to identify the on/off position
    - the ERB phone number and location is clearly posted adjacent to the ERB phone
    - the location of drinking water in the ERB is clearly labelled and indicated
    - each ERB has the location of the next nearest available ERBs clearly identified.

Cribroom ERBs

- Ensure a robust change management process is followed when modifying or retrofitting original equipment manufacturer–designed, safety-critical life support equipment:
    - The gas detector charging unit in one cribroom did not allow the chemical products to be fitted into the scrubber unit. Check all cribroom ERBs in the mine for the same issue.
    - Consider a 'permit to work' system to authorise changes or modifications to an ERB cribroom and associated critical safety equipment.
- Ensure an appropriate number of expansion foam canisters are provided and located near the cribroom door. The positon of these should be clearly labelled and identified as critical safety equipment.
- Ensure personnel are able to operate expansion foam canisters in an emergency. The operation of these should be demonstrated as part of regular toolbox talks.
- Establish a suitable method to enable personnel can access and egress the cribroom ERB without compromising the airtight seal of the swing doors.
- Ensure the instructions for converting a cribroom into an ERB are:
    - cribroom specific
    - laid out in a step-by-step order (assisted by photographs and labelling/numbering, diagrams)
- Ensure all corresponding critical safety equipment referred to in the instructions for converting a cribroom are clearly identified and labelled with the function and operational positions (e.g. colour-coding or numbering carbon dioxide and carbon monoxide boxes with location on scrubber).
- Relocate electronic tagging for safe zone/blast zone inside the crib room.
- Provide a location within the cribroom ERBs for personnel to place their cap lamps and SCSRs so they remain accessible.
- Provide a mock model scrubber to practice dry runs.
- Establish routine inspections to ensure ERB cribrooms remain to standard and that no undetected changes are made.

- Ensure that each all cribrooms have a set of current mine fire plans, which include the location and capacity of all ERBs in the mine.
- Provide standardised checklists and instructions for accounting for personnel in the event of a mine evacuation.

SCSRs

- Ensure that SCSR training and assessment includes:
    - reinforcing that non-verbal communication is essential with use of SCSRs
    - that SCSRs are for self-rescue and personnel should not stop to help or assist others while wearing a SCSR
    - the need to retain and use the foil heat protector.
- Consider using out-of-date SCSR units for training and/or exercise purposes (use practice SCSRs during the mine induction process).
- Consider the introduction of mobility canes (used by blind or visually impaired people) for use with SCSRs in a limited visibility environment.

Skip man riding

- Review the skip man-riding arrangement with respect to:
    - the door design—to give a larger floor area to allow access for a stretcher
    - the height in the skip—to allow persons to stand under the protective cover
    - options for the kick rail in front of the door—to allow people to access and egress the skip without the trip hazard
    - a hood over the open area—to prevent any potential falling objects from striking a person in the skip
    - calculating the potential load (people and equipment) of the skip—to ensure the safe working load is not exceeded
    - the skip man-riding procedure—to ensure that it adequately covers the installation and removal of the fabricated man-riding platform
    - the design of the linkage and attachment points for lowering the floor so that
        - there are no trip hazards or protrusions on the floor
        - the linkage can be removed for the skip
    - the acceptability of the size of the gap between the skip and the platform on 18 level.

EMT process

- Review the EMT process, including:
    - the official duty cards and roles of EMT personnel in light of experience during the exercise
    - mapping the current EMT process against AIIMS process and decide if AIIMS is to be followed or not
    - controlling and limiting access to the EMT and the EMT control room during an emergency
    - options for transferring calls on the red emergency telephones
    - the adequacy of the level of training of EMT members
    - the effectiveness of the current EMT process if the incident had been triggered on a night shift or weekend
    - consideration of how underground personnel could be used to provide feedback and advice on conditions in the mine
    - providing ERTs with a plan and clear objectives when they are deployed to enable them to assess what personnel and equipment are necessary to respond
    - only allowing the ERT captain to enter the EMT room to be briefed on the task assignment (briefing of the remainder of the team should occur elsewhere

    - a single point communication between the ERT and active emergency squads
    - considering deploying/storing critical emergency equipment at strategic locations in the mine
    - the current EMT room layout
        - having communications separate from the actual room
        - providing breakout rooms for operations planning and logistics for a protracted incident
    - EMT access to and use of up-to-date ventilation modelling (e.g. VentSim to assist with decision-making and planning)
    - ventilation modelling in emergency situations to identify sensitivities in the primary ventilation circuit depending on the location and intensity of the fire.

Industry

Some of the following comments are general in nature and do not necessarily reflect any deficiency identified during the exercise.

- Ensure that annual emergency exercises are structured to test for the effectiveness of the site emergency response systems, procedures and processes based on a site-specific, reasonably foreseeable emergency scenario.
- Provide all site personnel—who as part of their roles would be expected to be an EMT member—with industry standard emergency management/critical incident training.
- Site emergency procedures should consider:
    - ensuring the EMT process being used aligns with the site systems and procedures
    - contingency planning for a situation in which some EMT process-critical personnel are not onsite or available at the time of the emergency
    - EMT access to and use of up-to-date ventilation modelling (e.g. VentSim to assist with decision-making and planning)
    - utilising ventilation modelling to identify sensitivities in the primary ventilation circuit depending on the location and intensity of the fire
    - how the EMT communicates with any underground casualties/affected personnel, as well as providing them with factual information on the status of recovery operations.
- Review the effectiveness of SCSR training and assessment for personnel.
- A standardised mines and quarry training system/standard for ERT members should be considered and include:
    - training necessary for various credible scenarios (e.g. height rescue, swift water rescue, road accident rescue)
    - critical ERT requirements based on scenario/situation
        - minimum number of members to form a team
        - minimum number of teams needed before first team can deploy
        - minimum number of ERT members required at each mine.
- Where auxiliary winding equipment is to be utilised:
    - ensure that access is of sufficient size to allow transport of a stretcher
    - have all access doors designed so they do not reduce the floor space, thereby reducing the number of people that can be conveyed
    - review and document how to calculate the potential load (people and equipment) of the skip to ensure the safe working load is not exceeded
    - ensure that access and egress from a conveyance is not impeded by a trip or gap hazard.
- Ensure a change management process is followed when modifying or retrofitting critical safety equipment.
- Support the continuation an annual level 1 exercise for underground metalliferous mines.
- Communicate the learnings of the Mines Inspectorate safety bulletin on the use of SCSRs.

Exercise team

- Information on this level 1 exercise should be shared with industry through published papers and presentations at relevant industry forums.
- Provide a dedicated and centralised communication officer to relay messages between the surface and underground.
- Consider creation of greater realism during exercises by the use of smoke generators.
- Utilise personnel or bold signage at critical sites/locations during the exercise to indicate or denote the significance of the site/location (e.g. the crash site, beginning of toxic atmosphere etc.).
- Where possible, standardise the methods and equipment used to record and capture data and key events during the exercise.
- Consider utilising the services of people with video experience to record the relevant parts of the exercise.
- Actively seek and encourage industry participants to be involved in the planning, conduct and assessment of exercises.
- Where possible, include original equipment manufacturers (suppliers) in the team to understand how their equipment is used and performs.
- Where possible, ensure that team members have undertaken or performed a particular activity that will occur during the exercise (e.g. donning an SCSR and self-escaping or operating an ERB).
- Ensure that each level 1 site has a dedicated site liaison officer to ensure the effective planning of the exercise.
- Ensure that necessary documentation on systems, procedures and applicable equipment is obtained prior to the event.
- Be mindful that there could be more than one reaction to an emergency scenario by the EMT and be prepared to address this if necessary.
- Ensure that the exercise team has a clear understanding of the aims and objectives of the exercise, and that each team member understands their specific role and function.
- Following a level 1 exercise, conduct a review and identify potential improvements and learnings.

Appendix 1: Exercise time line

The following table is a time line showing the major points within the exercise.

Table 1: Summary of the level 1 exercise time line

Surface location	Surface observation	Time	Underground observation	Underground location
		9.49 am	Barricade and flicker lights erected	Just above 18C on decline
Mine control	CRO 1 received call on emergency phone (2222)	10.00 am	Loader operator activated emergency by dialling 2222 Said he crashed the loader, which caught fire He could not control the fire and was badly burnt	17 level HG ERB
IMCC	Emergency call received and information recorded about loader fire at George Fisher Mine Call party lined to George Fisher mine control Mines rescue activated		Fire reported on 18C by mine worker—burns suffered Emergency evacuation called and escalated to mine control Source of fire not known	12 level crib room
Mine control	First general page to evacuate to ERB and FAB ‘tag safe’	10.08 am	Emergency broadcast on all channels	17 level HG ERB, L72 12 level crib room
Mine control	Concern that the stench gas eucalyptus had not all released	10.10 am	Received PED message about the emergency and to go to ERB	18 level crib room
		10.12 am	First 4 personnel from work areas entered crib room	L72 12 level crib room
Mine control	Broadcast put out on channel 9 by CRO 1 CRO 2 put out another emergency announcement to mine	10.13 am	Crew started to prepare crib room door for sealing Bottom rail put in place Water drain unable to be sealed Drain area sealed by self-expanding gas bags	L72 12 level crib room

Surface location	Surface observation	Time	Underground observation	Underground location
EMT room	Incident briefing/duty cards allocated Incident controller and deputy wearing identifiable vests VO requested to attend	10.15 am	First mine worker entered crib room—indicated the radio channel he was on (channel 9) did not broadcast and he only knew of the emergency from others	18 level crib room
EMT room	Injured worker confirmed as being in 17 level HG ERB Phone number recorded (6223)	10.16 am		
Mine control	Worker phoned in safe and provided ERB number	10.17 am	2 additional workers entered the room (now 4 in room)	18 level crib room
		10.18 am	2 more workers entered the room (now 6 in room)	18 level crib room
Mine control	Third general page to evacuate to ERB and FAB pit	10.19 am		
EMT room	Emergency duty officer asked VO to determine contamination spread		Additional worker entered the room (now 7 in room) 4 exited the room to swipe electronically into the safe zone	18 level crib room
Mine control	Worker phoned in safe and provided ERB number			
EMT room	VO requested confirmation of fire location—someone confirmed 18C level	10.20 am	One of the worker's exited the room to swipe into the safe zone	18 level crib room
EMT room	EMT controller asked if everyone had been told to go to the ERB (didn't hear answer as there was a lot of noise in the room)	10.21 am		
Mine control	Worker called CRO 1 to advise he was at ERB69 16C		7 in crib room Manual tag board to update—all names not yet recorded	18 level crib room

Surface location	Surface observation	Time	Underground observation	Underground location
EMT room	Fire on 18 level confirmed and injured worker identified	10.23 am		
Mine control	CRO 1 received call to advise worker at ERB49 11C			
Mine control	L72 skip operating and available	10.25 am	Stench gas could be easily smelt outside	18 level crib room
Mine control	CRO 1 received call from worker—safe at Bay 8 and advised who was with him			
EMT room	Asked if they could drive down and recover injured worker Advised there are no restrictions—'just a fire', need to check for gas as you go	10.27 am		
Mine control	Emergency phone rings Worker on line wanted to speak to the EMT room Advised him to call 6170 as they can't transfer from emergency phone	10.29 am		
Mount Isa Mines rescue station	10 members on site 1 set of minimum equipment ready	10.30 am	Last worker entered the room (now 8 in room)	18 level crib room
EMT room	Asked if we could get the computer screen on the wall running	10.31 am		
L72 shaft	Worker released the stench gas manually	10.32 am		
Mine control	EMT runner wanted to know when the first emergency call went out and what was said	10.33 am	Faint smell of stench gas	15C breakthrough

Surface location	Surface observation	Time	Underground observation	Underground location
		10.34 am	Started to shut the ERB door	18 level crib room
Mine control	CRO 1 noted 2 personnel not accounted for		Sealed door—installed incorrectly at first attempt but fixed and closed	18 level crib room
EMT room	Discussion about rescue access—set FAB up at 13 level? Still a lot of noise and difficult to hear VO advised that skip could be used for evacuation of injured worker	10.35 am	Increasing smell of stench gas	Decline
Mine control	1 worker found 1 still missing			
		10.36 am	All accounted for	L72 12 level crib room
Mine control	Worker phoned from ERB36—advised 2 others were with him	10.37 am	Door closed	18 level crib room
Mine control	CRO 1 received call advising ERT 1 on their way via the haul road	10.38 am	Door closed 4 out of 12 in crib room realised they left their SCSRs and cap lamps outside the sealed area and went to get them	L72 12 level crib room
Mine control	CRO 1 advised CRO 2 that ERT 1 requested a map of the area of concern	10.39 am		
EMT room	Mine manager called DNRM to provide primary information and update on situation	10.40 am	Sealing of doors with foam doesn't work Personnel don't know how to operate the cans and start reading manual on cans	L72 12 level crib room
Mine control	Couldn’t account for last missing worker (contractor) CRO 2 called EMT room to advise	10.43 am	A worker figured out that a seal on the foam canisters needed to be removed Once this was done doors were sealed	L72 12 level crib room

Surface location	Surface observation	Time	Underground observation	Underground location
Mount Isa Mines rescue station	ERT 2 and rescue supervisor left for George Fisher Mine	10.49 am	Started on scrubber activation (no. 2 and no. 3)—there was a fair bit of confusion Used a manual located in area to help with set up—manual related to transportable ERB	L72 12 level crib room
		10.52 am	Expander foam not working	18 level crib room
L72 shaft	Platform lowered for man riding Handrails installed	10.56 am	Scrubber no. 2 seemed to be up and running Lack of knowledge about units	L72 12 level crib room
EMT room	Possible access routes for ERT access discussed—final decision to be made when more information became available	10.58 am		
EMT room	ERT 1 arrived and were debriefed by EMT Mine captain recommended use of L72 shaft	10.59 am		
Mine control	CRO 1 advised there was no cap lamp for missing worker (he was not registered) They could not send him a PED message	11.02 am		
L72 shaft	Skip raised to allow access for personnel if required	11.10 am	Notification came through that there was still 1 person unaccounted for	L72 12 level crib room
		11.12 am	All scrubbers and oxygen operational	L72 12 level crib room
		11.15 am	Carbon dioxide scrubbers wouldn’t fire due to retrofitted gas monitor mounting	18 level crib room
EMT room	Patient contacted—pain increasing and feeling light headed	11.16 am		

Surface location	Surface observation	Time	Underground observation	Underground location
Mine control	Missing worker called from ERB (he could not find information on which ERB)—used phone 6626, advised he was on B7 level			
		11.18 am	A second scrubber unit was set up and started	18 level crib room
L72 shaft	Winder was ready for man riding	11.20 am		
EMT room	Agreed route with ERT 1	11.20 am		
EMT room	Injured worker location confirmed in ERB above loader fire—ERT 1 to access him via the decline			
EMT room	ERT 1 mobilised to 10 level	11.26 am	Expander foam worked Door sealed	18 level crib room
EMT room	ERT 1 told to get moving, and that communications could continue from underground	11.32 am		
EMT room	EMT discussed needing to go down the shaft to fight the fire	11.43 am		
		11.50 am	ERT 1 entered via portal	
EMT room	ERT 1 told to go to L72 and access the crib room—asked to confirm 800 kg weight limit	11.55 am	Comms from surface to ERT 1—ERT 1 to establish FAB at 10 level	
		11.57 am	ERT 1 established FAB at 10 level	
		12.03 pm	ERT 1 started coupling up ready for deployment	
		12.10 pm	A worker not sure if they had to wear respirator or SCSR when in smoke	18 level crib room
		12.12 pm	ERT 1 deployed in 2 vehicles from FAB	

Surface location	Surface observation	Time	Underground observation	Underground location
L72 shaft	ERT 2 entered the skip and closed the door	12.18 pm		
		12.24 pm	ERT 1 arrive at 12 Level under BG4s	12 level crib room
		12.25 pm	ERT 1—‘smoke’ at 12 level crib room	12 level crib room
		12.30 pm	6 volunteers selected and started donning SCSRs Discussion about donning process before commencing as none of the volunteers had previously worn an SCSR	L72 12 level crib room
L72 winder house	Confirmation that all personnel had exited the skip	12.34 pm	ERT 2 reached the 18 level conveyor through the skip	18 level conveyor
		12.35 pm	All 6 successfully donned SCSRs Minor problems with 1 unit sticking in canister but worked in pairs to resolve fitting of units Commenced walk up decline towards ERB	L72 12 level crib room
			ERT 1 left 12 level and proceeded to 15 level	12 level crib room
		12.36 pm	ERT 2 arrived at plat at L72 18 level—4 ERT members and a platman/guide Tag line, medical equipment, oxygen therapy—all in BG4 (not platman/guide) No stretcher	L72 plat 18 level

Surface location	Surface observation	Time	Underground observation	Underground location
EMT room	ERT 2 requested to check and confirm loader fire exact location	12.40 pm	ERT 2 at 18 level crib room with platman/guide Plan changed—now told to get eyes on fire Decided to use available vehicles Searched for plans in 18 level crib room—none obtained Plan changed—proceed to injured worker On route got lost and went through incident scene to reach injured worker	18 level crib room
		12.42 pm	Smoke goggles donned approximately halfway through walk Walked together in 2 groups—1 group of 4 and 1 group of 2 1 attempt to talk wearing SCSR	SCSR walk out—decline
		12.50 pm	Personnel arrived at ERB 820 m uphill from 12 level crib room Discussion about experience with SCSRs and how to activate an ERB	ERB above 12 level
		12.55 pm	ERT 2 spent 5 minutes (were lost) trying to get to 17HG ERB	Drives and decline
EMT room	Discussed using haulage level between 18C and 17 level in fresh air Medic still on 10 level	12.57 pm		
EMT room	ERT 2 instructed to make way to ERB and see if injured worker could be extracted through L72 shaft	12.59 pm		

Surface location	Surface observation	Time	Underground observation	Underground location
		1.17 pm	ERT 2 arrived at L72 Injured worker now unconscious, shallow breathing and weak rapid pulse Injured worker removed from vehicle, oxygen applied, then carried to plat area	L72 plat 18 level
EMT room	EMT couldn't hear anything clearly—radio comms breaking up	1.29 pm	Injured worker loaded on to skip—also 4 ERT members and platman/guide	L72 plat 18 level
		1.40 pm	ERT 1 arrived at FAB Vice-captain had 54 bar pressure in BG4 FAB checked for fresh air	FAB
L72 shaft	Skip arrived on surface and stopped approx. 750 mm lower than the platform Winder driver made 6 attempts to land the skip in the correct position The skip ended up 250 mm lower than the surrounding walkway	1.41 pm		
EMT room	Level 1 exercise officially closed by exercise coordinator	1.50 pm		

Appendix 2: Assessors

Trevor Brown—District Inspector of Mines (Townsville)

Trevor has worked in the mining industry for the past 32 years and is currently the District Inspector of Mines based in Townsville. Prior to this, Trevor worked as an underground Safety and Training Coordinator for a major underground metalliferous mine in north-west Queensland.

While working in the industry, Trevor was an active emergency response member and squad captain. He also trained and assessed other emergency response members and was a certified St John's instructor. In 2001, Trevor was a member of the winning team at the 2001 Australian road accident rescue titles in Perth, and later that year he was also part of the Australia emergency response team that competed at the world titles in Johannesburg, South Africa. Trevor was part of the organising committee and judge for the annual Queensland Mines Rescue Challenge, which was widely regarded as the premier mines rescue competition in Australia at the time. As a mine control officer for a major underground mine, Trevor coordinated a number of significant incidents involving underground and surface emergencies, and was publicly recognised and praised for his actions.

In 1997, Trevor completed training and assessment studies at the University of Southern Queensland, where he developed training packages for mining incident management and control personnel. This package was successfully implemented at the mine that won the 1998 Australian Minex award for safety and health. As an Inspector of Mines, he assisted with the training and coaching of the first quarry emergency response team to be formed in Queensland.

Since 2002, Trevor has worked as an Inspector of Mines with the Queensland Mines Inspectorate, specialising in safety and health management systems, training management systems and emergency response. He has investigated numerous high-potential incidents and fatalities, and prepared reports on his finding for the state coroner. Trevor was also a member of the technical adviser team for the development of emergency response codes of practice for the National Mining Legislation Harmonisation Program.

David Carey—CEO, Queensland Mines Rescue Service

David commenced as CEO for the Queensland Mines Rescue Service in December 2014. A mining engineer with 38 years' experience in underground and open-cut coal mining, he has held roles in general management, mine planning and mine management in New South Wales, Queensland and Indonesia.

David's qualifications include a BE (Min) Hon; GAICD statutory qualifications as a mine deputy, undermanager, coal mine manager and Queensland site senior executive; and an MBA in Technology Management.

He spent six years as an active mines rescue team member and gained operational and technical experience in most forms of underground coal mining both in New South Wales and Queensland, as well as technical and management roles in open-cut coal mines in New South Wales, Queensland and Indonesia.

David spent five years with the New South Wales government as a coal mines Inspector, Senior Inspector and Area Manager, leading the Extractive Industries Safety Advisory Committee and participating as a member of the Coal Mines Undermanager's Qualifications Assessor's Panel.

Philip Casey—District Inspector of Mines (Mount Isa)

Philip is the District Inspector of Mines in Mount Isa and has been with the Mines Inspectorate since 2004, starting as an Inspection Officer. Prior to that, Phil worked in operational roles at the Mount Isa Mines Lead, Enterprise, George Fisher Mine and X41 Mines.

Phil has a Graduate Diploma of Mining, a Diploma of Workplace Inspection (Mining, Explosives, Petroleum and Gas) and a Diploma of Surface Operations Management, and holds a First Class Certificate of Competency for an underground metalliferous mine.

David Cliff—Professor of Occupational Health and Safety in Mining, and Director of the Minerals Industry Safety and Health Centre

David was appointed Professor of Occupational Health and Safety in Mining and Director of the Minerals Industry Safety and Health Centre at The University of Queensland in 2011. His primary role is providing education, applied research and consulting in health and safety for the mining and minerals processing industry. He has been at the centre for over 15 years.

Prior to that, he worked for over 10 years at the Safety in Mines Testing and Research Station (Simtars). He has been a member of the organising committee for the level 1 emergency exercises in Queensland underground coal mines since their inception in 1998, and has attended or provided assistance in over 30 fire and explosion incidents at mines. David also has extensive experience in providing advice on mining occupational health and safety in many countries.

Carissa Crozier—Regional Explosives Licensing Officer

Carissa spent nine years working in the Mines Inspectorate in both the central and northern regions of Queensland, and has recently transferred to the DNRM Explosives Inspectorate. During her time in the Mines Inspectorate, she was involved in several statewide committees (including the Health Improvement and Awareness Committee), auditing and investigations.

Carissa has been involved in several statewide emergency exercises and has coordinated logistics for level 1 emergency exercises in coal mines from 2008 to 2011, and again for metalliferous mines in 2016.

Deon Esterhuizen—Inspector of Mines

Deon is currently an Inspector of Mines. He audits, inspects and investigates compliance with mining legislation and prepares investigation reports into accidents and incidents. He is also involved in auditing metalliferous mine ventilation circuits throughout Queensland and previously worked as a senior mine ventilation engineer in underground metalliferous mines and tunnelling.

Deon has experience across the various mining engineering disciplines, including mine geomechanics, and was a mine planning engineer prior to becoming an Inspector of Mines. He has 15 years' experience in mining and quarrying, and holds a certified practicing quarry manager certification with the IQA.

Deon has a National Diploma in Metalliferous Mining, a Master of Engineering Science, a Graduate Diploma in Mine Ventilation and a Master of Mining Engineering.

Martin Filar—Superintendent Operations Engineering

Martin, a mining engineer and member of AusIMM, has been involved in the mining industry for the past eight years. During this time, he has held a variety of technical and operational positions while working at mines in both Western Australia and Queensland. He also has experience in emergency response, attending a number of competitions in Western Australia, while also being the captain of the mines rescue team at his site. During his time as captain, he was the Geotechnical Engineer at a seismically active mine, which led to him and his team often being mobilised for response and rescue.

Levi Laurie—Mine Captain, George Fisher Mine

Levi has worked in metalliferous mining for over six years in technical services and operations. He had been employed as a Mine Geologist, Mine Rescue Squadman and Mine Foreman at George Fisher Mine before taking up the newly created role of Mine Captain.

Levi has a Bachelor of Applied Science in Geology. He acted as the site liaison for this level 1 exercise and as an underground observer.

Kevin Poynter—Acting District Inspector of Mines (Rockhampton)

With a First Class Mine Managers Certificate and a member of the Mine Managers Association of Australia, Kevin has assisted in two previous level 1 emergencies and has over 30 years' experience in coal mining operations. He has worked as an Inspector of Mines in Queensland since 2011, undertaking three annual audits of the Queensland Mines Rescue Service, and is currently acting in the position of District Inspector of Mines

Darren Prince—Training Officer

Darren is a Training Officer with the Queensland Mines Rescue Service, and has extensive knowledge of rescue procedures and protocols. He has trained underground rescue teams that have been successful at local and national levels of competition. He has been involved in the underground coal industry in the Bowen Basin for over 30 years, and has been involved in mines rescue for 22 years. During this time, he has been involved in various mines rescue competitions, level 1 exercises, re-entering sealed areas, mine emergencies and sealing operations.

Stanley Slagmolen—Mining Engineer

Stan—a qualified engineer and member of the Australian Institute of Mining and Metallurgy and the Dutch Royal Institute of Engineers—has been involved in the mining industry for more than 10 years, with over five years in underground mining and four years in mines rescue. He has been involved in operations management, explosives supply management, production planning and scheduling, and mine design in Queensland, the Northern Territory and overseas.

Stan is a senior member of the emergency response team at Dugald River Mine, where he has trained and led the emergency response team. He also participates in the generation and optimisation of the emergency response framework and statutory compliance at Dugald River Mine.

Lionel Smith—Acting Regional Inspector of Mines

Lionel is an electrician by trade and continued with studies in electrical engineering, maintenance engineering and maintenance management. He has worked in the underground coal industry in New South Wales and Queensland. While in Queensland, he held duty cards associated with emergency response at two mines and actively participated in a coal level 1 exercise at Crinum Mine. Lionel's current role is Acting Regional Inspector of Mines for the south region, leading a team dedicated to improving safety and health across the mining sector.

Asok Sur—Inspector of Mines

Asok Sur currently works as an Inspector of Mines with DNRM based in Mount Isa. His role is to undertake inspections and audits of mines and quarries, and to investigate accidents, incidents and complaints about the operation of mines and quarries.

His has a Bachelor of Mining Engineering and a Masters of Mining Engineering (with a specialisation in mine geomechanics).

Asok has more than 36 years' experience in metalliferous and coal mines as a mining engineer, mine manager and mines inspector in Australia and overseas.

Martin Watkinson—Executive Mining Engineer, Safety in Mines Testing and Research Station (Simtars)

Martin is the Executive Mining Engineer based at Simtars, providing technical assistance to the Australian mining industry in the fields of ventilation, gas monitoring, emergency response, risk management and development of safety management plans.

Martin has been involved in all of the coal mining level 1 mine emergency exercises between 2001 and 2008, and was the chair of the committees for the 2006, 2007 and 2013–2016 exercises.

Between 2007 and 2013, Martin worked for Vale and Adani in senior management roles. He has provided emergency response advice and coordinated emergency exercises in Queensland, New South Wales and New Zealand.

Glossary and acronyms

Australasian Inter-Service Incident Management System (AIIMS)	Response system for managing major accidents and incidents
BG4	Closed-circuit breathing apparatus
Crib room	Location where personnel eat, and office accommodation for mine supervisors
CRO	Control room operator
DNRM	Department of Natural Resources and Mines
Electronic Consulting and Manufacturing (ECAM)	Company specialising in mine shaft communication systems
Emergency management team (EMT)	Team established to manage incidents using AIIMS
Emergency response bay (ERB)	A safe haven where personnel can go when there is a fire in the mine—compressed air is normally supplied and the ERB has a stand-alone supply of air, including carbon dioxide scrubbers to last for 36 hours
Emergency response team (ERT)	Mines rescue
Esky	Australian name for an insulated cool box (also a trade name)
Fresh air base (FAB)	A continuously monitored station for dispatch or return of ERTs in close proximity to irrespirable zones
HG	Reference on the George Fisher mine plan
Isa Mines Control Centre (IMCC)	Central control room at Mount Isa Mines, at which all emergency responses are coordinated—this is the location where the 2222 call is answered
Level 1 mine emergency exercise	State level mine emergency exercise to test the mine's emergency response system, test the ability of external services to administer assistance and provide a focal point for emergency preparedness in the state
L72	L72 shaft at the George Fisher mine
MineARC	MineARC systems are a manufacturer and supplier of emergency refuge chambers and ancillary safety equipment (in this report, the reference is to the carbon dioxide scrubber system)
Mine captain	Senior supervisor in charge of a shift
Mine control	The surface control room where underground operations are coordinated

Mines Inspector	Government official employed to examine and report on mines and surface plants' compliance with mining laws, rules and regulations, and safety methods
Mines Inspectorate	The government agency that employs Mines Inspectors
Non-verbal communication	Method of communicating using beeps on a telephone or DAC (a clear call communication system), similar to morse code
Personal emergency device (PED)	Ultra-low frequency, through-the-earth communication system used for paging—originally developed to provide a fast and reliable method of informing underground miners of emergency situations (due to system enhancements and the ability to readily contact personnel wherever they are underground, PED is also sometimes referred to as a productivity enhancement device)
Pitram	Production scheduling tool used in metalliferous mines
Pony drive	Small motor designed to drive a skip or cage through a shaft at slow speeds suitable for man riding
Recognised standard	A standard made for safety and health under the *Coal Mining Safety and Health Act 1999,* which states ways to achieve an acceptable level of risk to persons arising from coal mining operations
Self-contained self-rescuer (SCSR)	A respiratory device used by miners for the purpose of escape during mine fires and explosions—it provides the wearer a closed-circuit supply of oxygen for periods of time, usually less than 1 hour
Simtars	Safety in Mines Testing and Research Station
Skip	Permanent container that is hoisted in and out of the mine to transport ore to the surface in a shaft
Stench gas	Aromatic gas released into the ventilation current to alert mine workers that there is an incident at the mine and that they should go to a place of safety—eucalyptus is used at George Fisher Mine
Sub-level access	The entrance to each level
Tag safe	Use of an electronic tagging system to indicate that a worker is in a place of safety
Ventilation officer (VO)	Person responsible for coordinating all ventilation-related activities at the mine, including running a computer-based ventilation modelling system
XAM	XAM-7000 multi-gas monitor supplied by Dräeger—often used by mines rescue organisations

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