Fight or Flight Sub Committee 2 Position Paper
First Response
Presented by Geoff Nugent and Ken Singer

Authors:

Geoff Nugent Operations Manager QMRS
Ken Singer Compliance Manager Anglo Coal Capcoal Underground

On behalf of Sub Committee No.2. Ken Singer, Geoff Nugent, Paul Cuddihy, Greg Dalliston, Ron Mckenna, Kylie Ah Wong, Doug White, Ian Tyson, Andy Mifflin, Tim Watson

Context and Purpose

The matter of *First Response* is an issue for all Queensland Underground Coal Mine Workers. There is a view that our industry has lost its *Fight* mentality, and has reverted to *Flight* as a first response. It is also apparent that some emergency preparedness and response processes have not been reviewed to incorporate recommendations of the past 10 years; Level 1 Emergency Exercises, and recent mining disasters, both domestic and international.

In October 2006 an emergency response seminar was held in Emerald. This seminar was titled *Fight or Flight (the first 5 Hours).* This seminar was organised by the Chief Inspector of Coal Mines (CICM) Queensland in response to ongoing recommendations and issues raised from the Queensland Level 1 Emergency Exercises, as well as two explosions at underground coal mines in the USA namely Sago January 2006 and Darby Mine May 2006. There appeared to be issues relating to emergency evacuation, and first response in all of the cases. The intent of the seminar was to identify all of the issues which were perceived to be relevant and formulate a methodology to address and resolve the issues aiming at standardisation across the mining industry when ever possible.

Industry professionals from Queensland, NSW and New Zealand attended this seminar. There were guest speakers from the USA. Full details of the proceedings of the seminar are available from the CICM Queensland. The issues raised at the seminar were documented and fell in to three groups;

1. Self Escape
2. First Response
3. Support and Research

Volunteers were sought from industry to take part in each of the groups. This paper is the status report from Group 2 “First Response”.

The Charter of Sub-Committee No. 2 (First Response) is;

- *Recommend best practice in providing a first response by workers at the mine in the event of an emergency situation that may involve*
  - *Assisted escape of persons*
  - *Fire control*
  - *Medical assistance to persons*
  - *Repairs to ventilation and/or communications system*
  - *Strata control*
  - *Others as determined by the mine SMS such as chemical spills*

- *Outcomes should be based on risk management principles and include short and long term options suitable for implementation into industry*
- *Identify where legislative change is required*

The Scope of Committee No.2 is;

- *Review world wide practice and equipment in emergency response*
- *Must address the following from the Emerald workshop outcomes*
    - *How to ensure emergency response trained personnel get priority in use of CABA*
    - *Options for breathing apparatus for emergency first response*
    - *Limitations and risks of each option*
    - *Recommend operational requirements for Fit for Purpose apparel for emergency response-* ***refer to SC 3***
    - *Training competencies, divided into components relevant to mine needs*
    - *Recommend communication options/protocols –****to SC 3***
    - *Tracking training and location of emergency staff*
    - *Identify parameters where equipment can be used (low height mines)-* ***refer to SC 3***
    - *Maintenance management of CABA*
    - *Refill stations location and transportability*
    - *Identify the interface options between first response and mines rescue support*
    - *How to establish culture of confidence in first response*
    - *Training in giving first aid whilst using CABA*
    - *Identify decision making and leadership skills required for emergency response*
    - *Pre-developed risk assessments for common mine emergencies (belt fires, diesel fires, spon com etc)*

- *Must consider the following documents*
    - *Moura Warden's report and associated Task group reports*
    - *Improving Mine Safety Technology and training report- USA September 2006*
    - *Level 1 exercise reports*
    - *Consider practical constraints in implementing recommendations*

The purpose of this paper is to update the Mining Industry on progress of Sub-Committee No.2.

Definitions of First Response

The Sub Committee agreed on the following definition;

First Response *is the initial actions taken by the personnel on hand, with the equipment available to them, to control or contain an unwanted event. The unwanted event is or has the potential to cause a condition of danger. It can not be defined to a time period nor an entry level (eg. small fire/large fire).*

First response can be enacted at any level providing personnel are confident to assess the situation, recognize hazards, have suitable equipment on hand, know their limitations, plan and communicate remedial action, conduct remedial action and recognize evolving risk and the need to withdraw.

Why is effective First Response important?

Some actual recent events in Queensland Underground Coal Mines have demonstrated that effective *First Response* can save lives. There have however been several repeat recommendations in the Level 1Exercises that demonstrate that *First Response* had not been as effective as it should be. Fatalities may have occurred if a real situation existed.

- Theory has it that 80% of outcomes (eg. Costs) are a result of those decisions made in the initial or planning stages of a project. The *S-Curve* is testimony of that. Likewise, the *First Response* actions of those at the scene, and on shift at the time, will establish the outcomes, paradigm, result,

or the thrust and direction of an emergency response. The decisions by those responding and "calling the shots" can be the difference between life and death, or mine closure or mine recovery-particularly during the initial stages of an incident.

Recommendations of Level 1 Emergency Exercises (the story so far)

The 2006 Level 1 Emergency Exercise Report, contained in part, the following recommendations. These recommendations are consistent with other annual Level 1 Exercises:

1. First response

Industry needs to seriously address the issue of first response by clearly identifying what a first response team is expected to do i.e. fight a fire plus any other identified duties and what equipment they require. This will also mean that intensive fire fighting training and other associated training will be required. This should be undertaken as soon as possible, particularly as many mine sites (Broadmeadow included) do not permit the lighting of fires on site.

2. Change over protocols and training in the use of SCSRs

Training in donning and use of SCSRs needs to be addressed as indicated by previous level 1 exercises, and highlighted in recent forums in the USA. It is recommended to industry that a similar competency based training regime to that proposed by the USA mining industry (at refresher intervals of 3 monthly) is implemented as well as ensuring that all mineworkers have used a real SCSR or a training rescuer that has simulated heat and resistance capabilities.

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

3. Incident management process

In recent years the mining industry has started to adopt the Incident Control System (ICS) Training provided by the Queensland Fire and Rescue Service or the mining version called Mine Emergency Management System (MEMS). Mine sites need to clearly evaluate which system they are going to utilize to cope with emergency response (including the conventional systems already in place). Each mine must then ensure that their staff are trained, practiced and competent to fulfil their roles and responsibilities as identified in their own system. The draft recognized standard for the conduct of emergency exercises will be available for comment in August 2006.

Legislation

The following Sections of the Coal Mining Safety and Health Act 1999 (the Act) are applicable to these discussions;

- Section 273 of the Act requires that if a coal mine worker is competent and able to eliminate the danger from a hazard, the worker must take the action necessary to eliminate the danger.
  (3) If the coal mine worker is not competent or able to eliminate the danger, the worker must—
  (a) take measures to prevent immediate danger to other coal mine workers that the worker is able reasonably to take; and competent persons Withdrawal of persons in case of danger
  (1) If a coal mine is dangerous, all persons exposed to the danger must withdraw to a place of safety.
  (2) (b) immediately report the situation to the coal mine worker's supervisor.

Comment; The Act requires mineworkers to take action, to mitigate a hazard

- Section 273 of the Act requires that if a coal mine worker (the *original worker*) believes that there is immediate personal danger, the worker has the right—
  (a) to remove himself or herself to a position of safety; and
  (b) to refuse to undertake a task allocated to the worker that may place the worker in immediate personal danger.

  Comment; The reality is that a person must believe that they are capable of taking any action other than "to remove himself or herself". The required performance measure, or desired outcome in relation to training is therefore;

  - *To train mineworkers to the point that they believe they are capable, and they will continue to take action to mitigate and contain the hazard.*

  Comment; First Response Action Plans must not only identify situations that must be contained, they must clearly document when it becomes dangerous and it is no longer acceptable to take action to mitigate and contain, but to withdraw to a place of safety. In 1987 for example, Brady and McKenna[1] in their provisions described a dangerous situation;

  - *"if smoke is dark and dense.. no ventilation control over the fire zone is possible… the fire is intense and well established…smoke back up is observed…. there is evidence of a fuel rich fire starting to recirculate, then all personnel should be withdrawn urgently from the underground". Mine Officials at Cook Colliery were trained in these rules.*

- Section 35 of the Act requires a coal mine's safety and health management system must provide for managing emergencies at the mine. The system must include provision for the following— (a) identifying, by risk assessment, potential emergency situations; (b) minimising risks associated with potential emergency situations; (c) carrying out aided rescue and self-escape of persons from the mine in an emergency;……..

  Comment; We must understand the difference between Aided Rescue and self-escape, when developing First Response Strategies. There is a belief that self-escape can not, and should not incorporate provisions for a mineworker to assist another. This belief is inconsistent with what we observe people doing during emergency exercises and real events that potentially saves lives. There is a natural desire to help others, and to stay together in groups. This is generally seen as a good thing and a behaviour that we should encourage if it is safe to do so.

[1] CRQ Mine Emergency Procedures

The Process adopted by Sub Committee 2.

1. Scoping exercise to establish context and purpose, outcomes and role clarity with other Sub Committees (excel spreadhsheet).
2. Define what is meant by *First Response*
3. Review the most recent and relevant documentation (within the scope).
4. Collate recommendations for level 1 exercises and other relevant recommendations (eg. *where is the "library" of relevant information in respect to the recommendations of Moura Inquiry?*)
5. Construct First Response Action Plans (FRAPs). Ensure they are relevant and meaningful to front line personnel, and that they address the recommendations , and provide guidance to sites as they implement a first response strategy.
6. Review existing training and competency processes aimed at achieving effective implementation and the objective of FRAPs. Make recommendations regarding amendments to the relevant competency standards:
7. Review application of equipment (eg. SCSR and CABA) and FRAPs, understand limitations ie. What constitutes a dangerous situation, understand "acceptable limits", potential of reacting without all of the information, how to train people in decision making processes when they are not necessarily trained to the level of fire brigades etc)
8. Recommend legislative changes to assist in achieving the objectives (eg. Changes to the Act, Regulations and/or Develop a Recognised Standard)

We have made the following spreadsheet available to interested parties- Qld Level 1 Ex Recs_98 to 06.xls

First Action Response Plans (FRAPs)

It is acknowledged by the sub committee that there has been some proactive and well developed response strategies and systems, for the response of fire and medical assistance. Strata entrapment has been a less focused area within the Underground Coal industry. The Committee was supplied with resources from various mine sites to assist in the development of First Response Action Plans.

The Sub committee agreed that the category requiring the most development and resource would be aided escape (CMSHR 2001 S170)- based on the current Industry control being a QMRS Mutual Assistance Agreement.

Based on that, a small working group formed to develop ideas to present to the Sub Committee for review and a platform to commence the Risk Management process of Assisted Escape and Aided Rescue.

As part of the Sub committee scope equipment and apparatus for first Response (along with there benefits and limitations) were to be sourced and reviewed.

The First Response categories (listed in the above sub committee charter) were divided amongst the members of the Sub Committee to review and research the appropriate number of levels for each category- with their definitions and the primary elements which affect each category (ie. People, Equipment, Environment, systems and engineering controls). The group developed a standard document (not a Risk analysis tool) to capture subjects within each element that needed to be assessed for relevance as controls for each category.

An example of such an approach is shown for a typical fire event;

An Example of a First Response Action Plan developed by the Sub Committee

Fire Fighting First Response

	Level 1	Level 2	Level 3
Description	**Small fire, electrical component fire or smoldering material, in confined area not spreading.**	**Open fire, frictional ignition, gas or combustible material, contained to small area, normal ventilation.**	**Large open fire potential to spread quickly, dense black smoke , possibility of smoke and noxious gasses backing up against ventilation.**
People	One to Two people Confident - competent Investigate, quantify, execute, communicate.	Two or more Confident - competent Investigate, quantify, execute, communicate.	Fire Team Confident - competent Investigate, quantify, execute, communicate.
People Training	Regular periodic training in the use of limited fire fighting equipment, for a level one response, fire recognition and evaluation. (Generic Induction) Respond to local emergencies. MNCG1004A	Regular periodic training in the use of limited fire fighting equipment, for a level two response, fire recognition and evaluation. Respond to local emergencies. MNCG1004A	Regular periodic training in the use of advanced fire fighting equipment, for a level three response, fire recognition and evaluation. Self contained breathing apparatus, turbex, foam etc. MNCG1005A
Equipment **Equipment** **1. LOCATION**	Fire extinguisher, dry powder, CO2, Stone dust, one inch fire hose Equipment located in line with the mines safety and health management system and subject to mine lay out and specific equipment.	Fire extinguisher, dry powder, CO2, Stone dust, one inch fire hose, fire hose(65mm) branch, fog, divider, foam low and high expansion, Equipment located in line with the mines safety and health management system and subject to mine lay out and specific equipment. Recognition of areas of heightened risk and control measures to mitigate risk.	Fire extinguisher, dry powder, CO2, Stone dust, fire hose(65mm) branch, fog, divider, foam low and high expansion, turbex, breathing apparatus, provisions for changing equipment. Change over stations or structure available near IRA where changing breathing apparatus or recharging breathing apparatus can be achieved Equipment located in line with the mines safety and health management system and subject to mine lay out and specific equipment. Recognition of areas of heightened risk and control measures to mitigate risk.
Equipment Location Suggestions	Fire Fighting trailers - fire fighting zones – traditional approach. Alternative - identify IRA's (increased risk areas) have equipment available suitable to control hazards in areas such as drive heads, pony drives, Mg Drives		

System	Fire recognition Identification of correct fire fighting equipment Confidence level in operation of equipment and processes Recognition of potential to escalate Understanding of escalation process	Fire recognition Identification of correct fire fighting equipment Confidence level in operation of equipment and processes Recognition of potential to escalate Understanding of escalation process	Fire recognition Identification of correct fire fighting equipment Confidence level in operation of equipment and processes Recognition of potential to escalate Understanding of escalation process
Environment	Surface buildings, workshops, underground fuel bays, electrical switching rooms (surface and below ground) Underground traveling roads, panels or belt roads.	Workshops, underground fuel bays, electrical switching rooms (below ground) Underground-traveling roads, panels or belt roads. Hot, humid, dust. Smoke	Workshops, underground fuel bays, electrical switching rooms (below ground) Underground-traveling roads, panels or belt roads. Hot, humid, dust. Smoke

Engineering Controls Identified	CO Monitors, heat activated deluge systems, hand held heat seeking devices, automatic air dumping system	CO Monitors, heat activated deluge systems, hand held heat seeking devices, automatic air dumping system	CO Monitors, heat activated deluge systems, hand held heat seeking devices, automatic air dumping system Gag docking ability

Equipment Research and Development:

Smokehood:

Potential advantages – no breathing resistance, no nose piece, no impediment to the voice, no heat.

CO2 builds up to 5%, this is something that we would need to look at with a longer duration unit, and however the principle is sound. Brian tabled this unit at Sub Committee 1 at their next meeting.

Existing and proposed tecnology to improve communications, and tracking

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Long Duration Breathing Apparatus:

Qld Breathing Systems (QBS) are in the process of developing breathing apparatus that is similar to that in use with the armed services and underwater deep-sea divers. Existing units are capable of up to 2 hours duration. This organization is seeking an ACARP grant to explore modification of this unit for underground use. QBS are presently looking at the development of a longer duration unit.

This was referred to group 3 for further involvement/investigation.

PED System

A generic presentation relating to the existing PED system that is generally well known in industry. Future developments in relation to two way communications were discussed and are in development stages for approval.

Northern Lights

The NLT is a new system to Queensland that has the potential to assist in early warning, communication and assisted escape. This system is also awaiting certification. Points of interest relevant to aided/assisted escape were;

- Super light weight cap lamps with comms on board (two way messaging).
- First I.S. two way messaging system.
- Works on fibre optics and wireless Ethernet.
- Double acknowledgement – sends message back when lamp receives it, sends another message when he reads it, sends another message when he acknowledges it.
- Software will hold message when lamp is not online/out of range.
- Everything is time stamped.
- Can initiate emergency from lamp – toggle moved back and forward 6 times, will count down from 10 before sending message to surface.
- Readers can be placed at each cut through, powered by lithium battery (good for 5 years). Message sent to surface by Wifi.

The committee recognises that one of the main hurdles to significant step change in the industry (eg. Technology) is the time taken and cost of certifying equipment.

Self Escape, Assisted Escape and Aided Rescue

There is currently inconsistency in what level of support a Coal Mine Worker should be able to provide to another, when engaged in self-escape. The objective should be for a coal mine worker to respond to an incident, to self-escape, and to be provide assistance to another coal mine worker. The definition of self escape should recognize this (as opposed to rescue). The facts are that this is a natural response from our people, as demonstrated by real situations and exercises. We should acknowledge this.

The sub committee recognized that Aided/assisted escape would require further development and direction due to the Industry broad acknowledgment that re-entry in irrespirable atmospheres from a place of safety is currently the role of QMRS. The definitions of Aided Escape, Self Escape and Aided Rescue may require further analysis and defining.

The following table explains the Subcommittees consensus recognized levels and definitions for Assisted Escape and Aided Rescue.

Level	**Level 1 Inseam Assisted Escape**	**Level 2 Inseam Aided Rescue**	**Level 3 Surface Aided Rescue**	**Level 4 External Aided Rescue**
Definition	Assisting another Coal Mine Worker to a place of safety from an area which has become dangerous	Providing assistance from a place of safety (inseam) to an endangered Coal Mine Worker.	Providing assistance from Surface to an endangered Coal Mine Worker	**Providing assistance from an external agency to an endangered Coal Mine Worker**

Example Level 1 –An evacuation of a Longwall face has been triggered due to smoke and contaminants entering the panel. During the evacuation a crew member becomes distressed and is having difficulty donning their SCSR. Another crew member (also evacuating) Assists the distressed person to don their SCSR and remains with them during the evacuation to assist them to a place of safety outbye the source of smoke and contaminants.

Example Level 2 – An ignition of flammable gas (causing an explosion) has occurred at the face of a 90m long development roadway while 2 Coal Mine Workers were conducting roof support operations at the face. The explosion disrupted power and ventilation in the development roadway. The 2 Coal Mine Workers are alive but unable to escape due to their injuries. The panel Deputy and 2 outbye crew members can observe the lights of the injured coal mine workers from the last line of cut through which is positively ventilated and deemed a place of safety.
The panel Deputy and 2 outbye workers (Rescuers) make a conscious decision to enter the development roadway to provide assistance to the injured and endangered Coal Mine Workers. The Rescuers each use a Respiratory Protective Breathing Apparatus and apply controls based on their skills and knowledge in aided rescue.

In the above table you may note a distinct change of word between definitions of level 1 and levels 2 & 3. The subcommittee noted that the legislation uses the terminology aided escape (Reg 170). The committee members agreed on Aided Rescue as it reflects a more accurate description of what the objective is. This terminology will be requested to be changed in legislation, along with the definition of self escape, and assisted escape.

Where to from here?

Committee annotations on respective levels

Level 1

- What are the limitations on both SCSR and CABA to provide assistance to endangered Coal Mine Worker when escaping?
- When does it become dangerous for the person providing assistance?
- Could further controls be established for the use of SCSR as an assisted escape tool?

Level 2 - as per level 1 as well as-

What competence does a person need to make a decision to enter an irrespirable &/or visibly restricted are to provide assisted rescue?

The following aspects are being considered;

What is the minimum equipment for the rescuers and guidelines to be applied?

Level 3 - as per level 2 & 3 as well as

When people are accounted for on the surface and safe who has the authority and competence to determine "what is dangerous" (or not) for on site rescuers to re enter the mine?

Level 4
This is outside the scope of the committee and was not reviewed but allowed to remain as part of the table to demonstrate the interface between on site aided rescue and external assistance.

As discussed previously there are primary elements that may impact on each Level with subjects that may need to be addressed through Risk Analysis.

For Assisted /aided escape the subjects in each element were generic as listed in the below table.

Based on the above review and discussion the committee determined a risk assessment would be required to develop a guideline for Assisted Escape and Aided Rescue. Provisos agreed for the risk assessment by the committee were as follows;

The Risk Assessment would be conducted by the committee with limited invited industry representatives where gaps in representation were identified. Outcomes are to be documented in Guideline.

Risk Assessment Method: The determination of the type of risk assessment method is at the determination of the consultants, as recognized content experts. (David Reece and Mark Parcell, "The Safety Managers").

Outcome: To develop a guideline that addresses the provision of Assisted Escape and/or Aided Rescue to endangered coal mine workers in irrespirable atmosphere.

Objective: To analyse potential hazards and develop guidelines for coal mine workers providing assisted escape or aided rescue to other coal mine workers within an irrespirable atmosphere.

Scope: The risk assessment is to include: Breathing apparatus and types (inc SCSR)

- Noxious and toxic atmosphere
- Thermal environment
- Grades and walking conditions (assumed travel rates)
- Hazard awareness of persons providing assistance of aid
- Activities (Physical stress and air consultation rates)
- Availability of communications (internal and external)
- Fitness of persons responding

- Identify when assistance or aid is abandoned and return to place of safety (due to unacceptable level of risk)
- Limited or reduced visibility
- Permission to go, decision making and availability of information (e.g. critical information)
- Number of persons required to respond (including backup)
- Explosibility atmosphere (consideration required for potential ignition sources)

Note. The above list is in order (as determined by the sub committee) of difficulty to resolve with controls.

It is agreed that the outcomes of the risk assessment and guideline is not to quote or dictate distance or time, more to provide a formula for application with all equipment and situations.

The risk assessment team will undergo an appropriate literature search of relevant material (ie Industry database, NSW MRS Guidelines, Level 1 Emergency Exercises, etc…

Training and Black Coal Competencies

There is a range of related competencies currently available to Industry. The committee plans to approach RIISC to review competencies 37,38,and 39;

Endorsed Components of the National Training Scheme as follows:

- MNCU1037A Escape from hazardous situation unaided
- MNCU1038A Provide aided rescue to endangered personnel
- MNCU1039A Respond to in-seam incident

There is a need to establish if Industry wants to develop training resources for these three areas. The objective would be to ensure competency theory and practical assessment are common across the Industry. Mines could then recognize training delivered at other mines, and when accepting training and assessment by RTO's could ensure common quality of assessment.

Conclusion

Based on collated and historical evidence and documentation collected by this committee it is recognized that there is and has been some well developed first response strategies throughout industry. Although some of these strategies have been long standing the dissemination through industry has been limited for various reasons.

The committee also recognizes that there are a number of developed competency standards available which have seen mixed use within industry.

The committee intend to provide recommendations to industry to develop a framework for minimum base standards which can be adopted for any operator. Structured around the following;

- Legislative change for both First Respond terminology and Parameters
- Review the adequacy of relevant MNCU competency standard; do they achieve what we require?
- Training package standard (generic training package for site specific package to be built from)
- Training delivery standard (outcome based)
- Training package relevant to Guideline/recognized standard
- Testing of skill and knowledge (standard for conducting emergency exercises QMD967393)
- Definition of testing and training to the statutory standard.
- MNCU Training package referenced in recognized standard

The committee is scheduled to meet again in August 2007, after the conference, to incorporate feedback received at the conference.