International Mines Rescue Conference

Russia 2017

Training to Manage Emergencies in Coal Mines

Carey, David

Chief Executive Officer,
Queensland Mines Rescue Service,
Dysart, Qld, 4745, Australia

dcarey@qmrs.com.au

ABSTRACT

A coal mine emergency requires vast amounts of data to be managed, scenarios to be evaluated and decisions to be made to safely recover the situation. This must be achieved whilst managing employee, community and legal obligations with differing priorities to those necessary to control the event. A structured and well understood process and the utilisation of appropriate technological support to aid decision making from data is essential to achieving the best possible result in such a situation.

Queensland Mines Rescue Service (QMRS) conducts mine emergency management systems (MEMS) training for coal mine operators. This system provides a central decision making authority, a process to conduct necessary planning and scenario evaluation, and management of resources for action implementation.

From 2011 QMRS has made available to industry a decision making assistance program called MRAS (Mine re-entry assessment system) that can give the person tasked with incident management confidence that hazards can be controlled based on available information.

MEMS develops actions during an event by setting objectives at each stage to focus on 'What is Important Now'. As planning evaluates a response and operations implement the required actions each objective is met and the event moves forward. MRAS allows actions to be tracked and hazard status to be reviewed on an ongoing basis as well as the generation of automated reports and status updates as required. This capability reduces the demands and distractions on the incident controller. The MEMS process has recently been adapted to the control of surface mine incidents and would readily integrate to non-coal emergency management.

Australian legislation and operating practice leaves the control of an emergency event with the mine personnel. The people who will be called upon to take on critical roles within an emergency management system, such as MEMS, must become familiar with and comfortable in working within that system. Whilst the initial training course provides a familiarity with the process, quality lower level event simulations that utilise the same systematic approaches must be utilised to reinforce the learning of that initial training.

INTRODUCTION

Underground coal mine emergencies can be complex events that are difficult to analyse and respond to in a timely manner due to the isolated environment in which they may occur, their potentially violent nature that may result in damage to mine infrastructure and installed monitoring systems and the resultant impact on people in the vicinity.

The logistical and emotional challenges of dealing with potentially lost colleagues, conflicting demands for information from company representatives, government officials, media and family members will challenge the most experienced and practiced of managers, let alone those who may find themselves thrust into such a situation. The greater the level of familiarity with an event management process of those who may fill the role of incident controllers and their level of awareness of the non-technical issues that inhibit the effective implementation of the control system, the more successful will be the management of an event.

Control of an emergency requires a strong and directive approach. Decisions need to be made to allow an event to progress to resolution often based on partial information. Hazards that exist must be recognised and information obtained to determine if an acceptable level of control exists to deploy recovery resources. Objectives set to progress the event must keep in mind the limitations of information and the safety of the emergency response resources. A structured process of control for the event that has been trained and is adequately resourced will rapidly become essential in maintaining an effective event response.

MINE EMERGENCY MANAGEMENT SYSTEM (MEMS)

Emergency simulation events in during 2000 to 2003 highlighted a need to establish a clear organisational structure for the management of a mine emergency, including information gathering techniques, decision making processes and communication mechanisms.

Queensland Mines Rescue Service (QMRS) has conducted mine emergency management systems (MEMS) training for coal mine operators since 2005. MEMS was developed from the Australasian Inter-agency Incident Management System - Incident Control System (AIIMS-ICS) with adaptation to reflect mining legislation, the complications of an underground mine environment and mining personnel. This system provides a central decision making authority, a process to conduct necessary planning and scenario evaluation, and management of resources for action implementation. To improve decision making, several other factors need consideration such as communication, situational awareness, leadership and teamwork, stress and fatigue management. In addition to setting a structure for the management of the emergency the training also touches on the psychology of decision making, provides guides to communicating internally to those involved in the event and family, planning for the resourcing of extended duration events and dealing with the media. The course is delivered via scenario based hands on teaching methods over a 4 day residential course. See figure 1.

A coal mine emergency requires vast amounts of data to be managed, scenarios to be evaluated and decisions to be made to safely recover the situation and minimise the consequences of the event. This must be achieved whilst managing employee, community and legal obligations all of whom may have differing priorities to those necessary to control the event. A structured and well understood process to the management of the incident and the utilisation of appropriate technological support to aid decision making from data that has been practiced to a level of familiarity is essential to achieving the best possible result in such a situation. The successful transfer of information and communications between the control room, the planning and operations groups and the incident management team has often been noted as an issue during simulation events as noted in the Level 1 report (2015).

The essential component of MEMS is the one person who is in control and who is responsible for managing the entire incident, the Incident Controller. In the initial stages of an emergency this person may be the site supervisor at the immediate location of the emergency. That person will determine the response to the event (planning), organise the actions to be undertaken to bring the event under control or the removal of persons to a place of safety (operations) and coordinate the gathering of required resources to deal with the event (logistics). As the size and complexity of an event grows the Incident Controller may need to delegate a number of these functions to others to allow adequate focus and ensure leadership in each area, as shown in Figure 2. Similarly the role of Incident Controller may be subsequently assumed by more senior mine officials as the scale of the event grows. Formal delegation of leadership to the three functional areas identified above to more senior personnel will also occur. Each of these areas will need to be adequately resourced with people possessing the appropriate skills to analyse data, develop plans, implement action plans and obtain required resources if the Incident Controller is to be successful.

As such the MEMS is fully scalable to the event at hand, expanding as additional resources are required to cope with the increasing scale of an event and similarly resourcing can be reduced as an event is brought under control and the objective becomes returning the mine to operation.

Moving an event forward requires the setting of objectives to achieve 'what is important now'. Initial objectives may relate to understanding the nature and scale of the event. As the event progresses the objective will change as what is important to achieve now changes. This may involve aiding the escape to a place of safety of the persons effected or taking steps necessary in bringing the event under control. Once the incident control team have set an objective then strategies to achieve the objective will need to be developed. This is the role of the planning team as multiple options may exist that will need evaluation to determine the most appropriate option.

Strategies are the how an objective will be achieved. They are a broad plan of action to achieve the objective. Tactics are the application of resources to implement the strategy plan and achieve the current objective. To capture and track the progress of controlling the event MEMS requires the documenting of the current objective along with the strategies to be implemented and the required resources into an incident action plan (IAP) which must be approved by the incident controller prior to implementation. This is a critical part of the MEMS process. Monitoring the progress of implementation of the actions contained within the plans tracks the development and control of the event. As the incident develops the current objective will change as will the required strategies leading to a new IAP. Actions that remain incomplete need to be tracked and their ongoing relevance assessed as the event progresses. Recording event information and actions builds up an event record, an event timeline and a status report that becomes a useful communication tool for those requesting information, such as government officials and media, as well as becoming a historical record of the event for subsequent investigations.

Once an incident action plan is approved the leaders of the planning, operations and logistics groups take the plan to guide the activities of their group to develop the tactical plans required to progress the IAP. Each group interacts to determine what each requires from or to do for the other groups. Having a single plan to guide the immediate activities creates a unity of purpose that moves everyone towards the common goal. It also provides the means of communication as roles are handed over under a succession plan to those coming into roles for an extended emergency event.

Knowledge of the conditions existing in a mine after an incident are essential in deciding what strategies are appropriate, such as whether or not to deploy mines rescue teams, as part of the incident recovery process. Applying this knowledge in a structured manner to the assessment and the acceptability of the risks likely to be faced by those teams during rescue activities before authorising their deployment is an onerous task incumbent upon the person controlling the incident response.

In 2011, as a result of an industry funded ACARP research project, the prototype information management software, MRAS (Mine Re-entry Assessment System), that supports the decision making process to deploy rescue resources in accordance with operational guidelines was made available to industry.

MRAS assists decision makers to make considered decisions; it does not make decisions for you. When fully set up it allows the information that already exists within a mine's Safety Management System that is relevant to the incident to be accessed and considered rapidly within the pressured environment of an emergency. Secondly the incident specific questions contained within MRAS focus the incident control team on gathering and assessing information relevant to the incident as it progresses.

At any time during the event the control team can generate reports to assess what information is currently known and what still needs to be gathered. They can generate a running log of the status of the incident as shown in figure 3 and can provide situation update emails to selected people from within the program. As gas data is obtained and analysed by appropriate computer systems this information can be imported to MRAS for the assessment of the explosibility risk.

MRAS provides a process to consider the adequacy of the information available upon which decisions have to be made, to consider and acknowledge the explosibility hazards of the environments within which a mines rescue team will need to work and to acknowledge and formally authorise the entry of teams into or for teams to remain within a mine either during or post an incident occurring. This same process should be worked through in deciding if mine personnel should remain underground as part of a response strategy in dealing with a developing emergency.

In 2016 QMRS has modified its MEMS training course to deliver a unified approach to mine emergency management that is suitable to either underground or surface coal mine operations. The experience gained from this activity would indicate that with very little modification to the training scenarios utilised the MEMS process could be readily delivered to non-coal mining operations that are either surface or underground mines.

CONCLUSION

The application of the MEMS is just as likely to encounter the same general problems as other incident management systems. Research on ICS and AIIMS, upon which MEMS is based, as discussed by Fuller (2014) suggests that without comprehensive training and development of interpersonal and inter-agency relationships these systems are likely to fail. In a coal mine environment there is a lesser need for inter-agency interactions due to the unique nature of coal mining however there is still a need to deal with mines rescue, mines inspectorate and workforce representatives as well as manage family and media requirements.

Whilst the initial training course provides a familiarity with the process the absence of routine effective simulation practice and adequate refresher training allows this familiarity to decline and has often led to the process breaking down whether in a real event or in a major simulation event. In addition there is a need for the development of the interpersonal skills necessary to coordinate a group process and deal with the conflicting needs of external agencies. As commuting based rosters increase the probability that experienced staff may not be readily available to manage a developing emergency and the presence of social media increases the communications challenges of keeping control of such a situation the need for a structured approach to be applied to the management of an emergency situation grows. Only through repeated training in the process prior to the need to apply such skills in reality will the system be able to be successfully applied to emergency management.

Utilisation of the MEMS processes for all levels of emergency simulation will grow confidence in the system processes and trust in the people who will be managing an event, improve communication skills and processes and improve decision making capabilities through a trained awareness of the steps an emergency will progress through. Opportunities to integrate the processes of emergency management into operational activities and to recognise the commonalities that exist with other major activities that occur on a more routine basis such as major maintenance shutdowns or equipment relocations can provide an increasing level of confidence should it be necessary to manage an emergency event. Developing plans, scoping and sourcing resources and implementation of agreed plans are common to project and emergency management. On many occasions it has appeared to be a lack of familiarity with and confidence in the process that has triggered delays in the resolution of an event rather than a defect in the process.

Whilst QMRS continues to improve the quality and applicability of the training by the integration of non-technical skills awareness into the course, opportunities to increase familiarity with the process appear to offer the greatest benefit in the short term.

REFERENCES

Fuller R; 2014, Exploring non-technical issues that impact on incident management team decision-making at underground coal mining incidents; and the development of a non-technical issues taxonomy. PhD Thesis UQ

Queensland Government Mine Emergency Level 1 Event Reports; 2003, 2015

FIGURES

Figure 1 MEMS Training Course

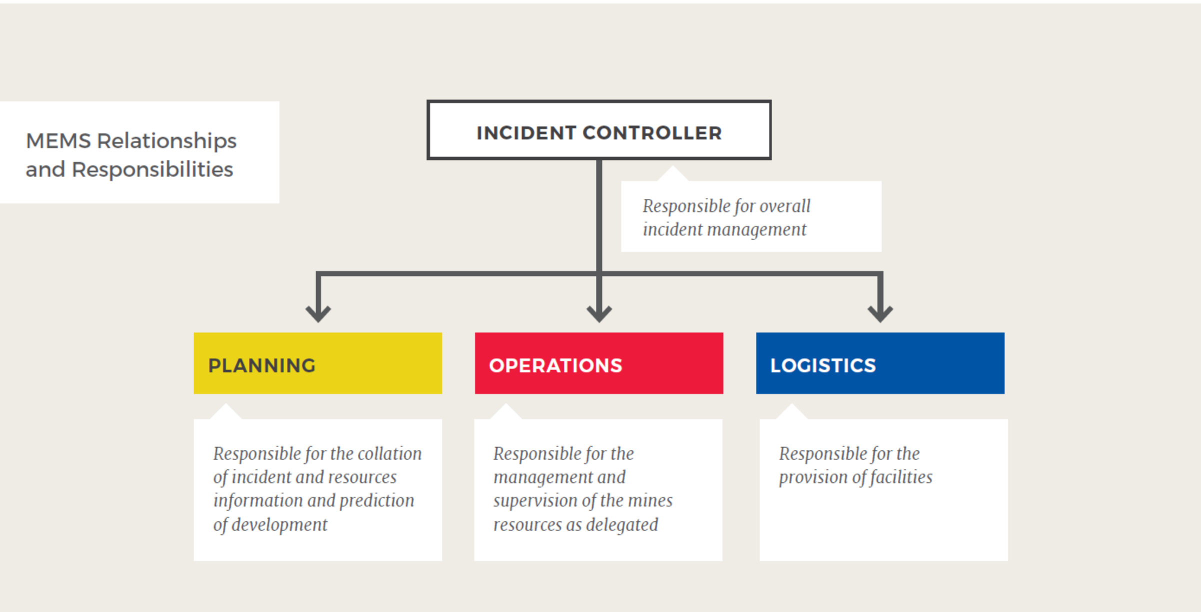

Figure 2 MEMS Functional Roles

Current Situation Report

Incident Date: 19/11/2010
Incident Time: 15:30
Incident Type: Fire

Incident Description: Explosions and subsequent fire at Pike River Mine. Mine has been sealed and fire brought under control.

Date	Time	Current Situation
3/07/2011	18:00	Hebel block wall completed 1715hrs. Drift effectivley sealed @170m All atmospheric conditions stable throughout mine. O2 2.26% @ potal mointor (Inbye Seal). Objective achieved, IMT dissolved 1800hrs.
3/07/2011	9:38	IMT convened 0845hrs. Concurred to complete seal with Hebel blocks and moratr. Will require approx 80 blocks. Team 1 to establish base for for wall on top of grout. Small iincrease in 02 at PRDH45 (Expected.) O2 falling at Portal 1.9%..
2/07/2011	19:34	Last team out 1929hrs. Remaining distance to roof 1.9m RH side 1.6m Lh side..Pumping slowand strata binder setting slwalso pushing seal out. Proposal to finish seal with Hebel blocks to roof with mortar.
2/07/2011	15:04	Team entered 1100hrs, pumping recommenced 1200hrs. Product quality poor for the first hour. Team 1 exite 1300hrs. Team 2 entered 1315hrs pumped to 2.2m exited 1515. Grout flow slow. Team 2 enterd 1530 due out 1730.
2/07/2011	10:19	IMT resumed 09:00; Atmospheric readings stable all TARPS remain stable. TB pressure slight increase due to frost. Lines continully monitored for failure. Seal fill tactics agreed and confirmed as per decision precious IMT 2 teams to portal 10:00hrs.
1/07/2011	19:00	IMT concurred to fill remainder of seal with 6m3 Hebel Bloccks and 6m3 Strata Binder. Pump with " Blue Heeler" and Clarke M150 pumps. Contingency to use Pitcrete spray and Picolla pump. All to start normal time tomorrow.
1/07/2011	17:30	Pumping continued for 5 hrs seal fill to 1.6m . IMT informed at 1700hrs not enough grout to complete job only 1m left. IMT reconvenned 17:15. All atmospheric conditions stable. Team 2 exited 18:20hrs.
1/07/2011	11:00	IMT resumed 800hrs All gas readings and trends within acceptale limits. Permit to Enter issued fo 0900 - 2000hrs. Team 1 entered @ 1015hrs. Pumping commenced 2 lines blocked. 1 line left and new line ordered from town.

Figure 3 MEMS/MRAS Incident Situation Report