Emergency Preparedness- The Crinum Model

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FOREWORD

Crinum was a developing new BHP mine when the explosion occurred at their Moura No 2 mine on 7 August 1994. The lessons learned from that tragedy were acted upon at Crinum in an urgent, vigorous and totally committed manner. Thirty of the surviving Moura No.2 workforce moved to Crinum bringing with them their experience and their passionate commitment towards ensuring that there would be no repetition.

However Crinum also acknowledged its obligation to be prepared should the unthinkable occur.

At the outset a fundamental philosophy was identified:-

"Every individual at the mine, regardless of mining experience, employer or familiarity with the mine, must be empowered to declare an emergency, through the Control Room, based on their perception of the situation"

Definitions: refer page 21.

PRINCIPLE ELEMENTS OF EMERGENCY PREPAREDNESS

A holistic approach to emergency preparedness is taken based on the following principle elements that form the framework of this document:-

1. ***Safety Management System***
2. ***Monitoring & Inspection***
3. ***Emergency Response/Incident Management***
4. ***Fire Fighting Facilities/Strategies***
5. ***Self Escape Facilities/Strategies***
6. ***Aided Rescue Facilities/Strategies***
7. ***Communications***
8. ***Training & Education***
9. ***Ventilation Control Devices***
10. ***Explosion Mitigation***
11. ***Re-entry***
12. ***Audit, Review & Continuous Improvement***

1. SAFETY MANAGEMENT SYSTEM

1.1 Crinum Mine Health & Safety Management Plan

The overarching plan from which the mines 23 Management Standards and 10 Hazard Management Plans emanate. Collectively they are the fundamental foundation to Emergency Preparedness.

1.1.1 **The Management Standards** are:-

- ❑ *Leadership and Commitment*
- ❑ *Responsibility and Authority*
- ❑ *Planning and Objectives*
- ❑ *Performance Measurement and Reporting*
- ❑ *Hazard and Risk Management*
- ❑ *Plant and Equipment Integrity*
- ❑ *Design and Construction*
- ❑ *Training and Competency*
- ❑ *Safe Working Behaviour and Employee Participation*
- ❑ *Communication*
- ❑ *Accident / Incident Management*
- ❑ *Safe Work Procedures*
- ❑ *Occupational Health and Hygiene*
- ❑ *Legal Compliance*
- ❑ *Contractors / Suppliers and Visitors*
- ❑ *Reviews, Audits and Inspections*
- ❑ *Emergency Preparedness and Response*
- ❑ *Product Stewardship*
- ❑ *Management of Change*
- ❑ *Research*
- ❑ *Acquisitions and Divestments*
- ❑ *Hazardous Materials Management*
- ❑ *Critical Safety Management*

2. MONITORING & INSPECTION

In order to be prepared for anything, quality status information must be provided in a timely manner by a monitoring and inspection system. It is all about ***measuring and comparing against established norms.***

With respect to emergency preparedness the Monitoring and Inspection System is applied to three principal areas:-

- ❑ ***The Underground Environment***
- ❑ ***The Location And Control Of Personnel***
- ❑ ***The Equipment & Facilities Provided To Assist Management Of An Emergency***

2.1 MONITORING & INSPECTION OF THE UNDERGROUND ENVIRONMENT

The scope includes:-

- ❑ ***quantity and quality of the mine ventilating atmosphere***
- ❑ ***condition and movement of strata***
- ❑ ***water quantity and quality***
- ❑ ***status of sealed area atmospheres***

2.1.1 Monitoring & Analysis Of The Mine Ventilating Atmosphere

2.1.1.1 Hand Held Gas Monitors: The Wardens report into the Moura No.2 disaster made reference to what was seen as a limited application of Carbon Monoxide detector tubes and urged the adoption of more modern, hand held gas detection instruments for this gas.
Four instruments were chosen for assessment at Crinum that met the criteria of having the ability to detect four gases including Hydrogen Sulphide. Assessment criteria included weight, size, reliability, serviceability and cost. Mine deputies had significant involvement in the trials and in the final choice of the **Mini-Gas 4**. This instrument detects methane, carbon monoxide, hydrogen sulphide and oxygen and has memory capability for down loading for record keeping and trending analysis.
Having proven reliable and easy to use, additional units have been purchased for use with underground diesel machinery (methane sensors only but can be upgraded).

All permanent employees are trained in their use and they are used routinely by:-

- ❑ Mine officials
- ❑ Miner operators (primarily for H_2S & CH_4)
- ❑ Shearer operators in H_2S prone areas
- ❑ LHD operators (CH_4)

2.1.1.2 Mine Automatic Monitoring Systems:

2.1.1.2.1 Electronic Real Time: From commencement Crinum has utilised an electronic real time monitoring system. It monitors the main ventilation system with respect to velocity, quantity and environmental monitoring of methane and carbon monoxide via sensors located at 35 key locations around the mine. CO litres make is automatically calculated. System features include:-

- ❑ Trolex sensors
- ❑ Primary signal carrier is Dupline based via 'A' Hdg.
- ❑ Secondary signal carrier is via Data Highway Plus (DH+) via 'B'Hdg.
- ❑ Gate roads are on an independent Dupline.
- ❑ Two Duplines from surface to furthermost extremity allowing faster communications.
- ❑ All GasMon (Gas Monitoring) boxes fitted with Dupline receiver.
- ❑ All data reports to the SafeGas program.
- ❑ Zoned tripping of power by methane detection:-
  - ❑ Auxiliary fan in production panel trips HT at panel transformer
  - ❑ NERZ / ERZ1 interface trips panel isolator.
  - ❑ Gate road sensor at 1 - 2 C/T trips all underground power.
- ❑ Mains are similarly set, but are on Dupline 1.
- ❑ Dupline Signal Generators located at mine centre to take advantage of maximum known Dupline cable length

1.1.2 Hazard Management Plans: are in place for:-

Emergency Procedures,** Mine Evacuation,** Fire,** Water,** Strata Control,** Gas, Spontaneous Combustion & Ventilation, Cables, Electrical, Technical Background To Management Plans.

**** These HMP's** have particular focus with respect to emergency preparedness and their content is summarised as:-

1.1.2.1 Emergency Procedures Management Plan (Y RMMU 008, issue 6, 28/5/01): Details the procedures and systems to be adopted in dealing with an emergency. It contains comprehensive phone contacts and the order in which key personnel and external organisations are to be contacted. Also included is the duty card system and the action plans to be followed.

1.1.2.2 Mine Evacuation Management Plan (Y RMMU 005 version 4, 16/1/01): The scope covers *Emergency Evacuation, Re-entry and Emergency Exercises.*

1.1.2.2.1 Identification Of Possible Emergency Events:

Potential events identified as requiring evacuation to a 'Place of Safety':-

- ❑ Fire underground
- ❑ Explosion
- ❑ Irrespirable atmosphere
- ❑ Ventilation failure
- ❑ Inrush of water
- ❑ Fall of ground
- ❑ Sealing part of the mine.
- ❑ Extended power failure
- ❑ Fire - surface facilities
- ❑ External threat(egbomb)
- ❑ Major equipment / vehicle accident

1.1.2.2.2 The strategy provides for the maintenance of:-

- ❑ Monitoring systems enabling early response.
- ❑ Action Response Plans.
- ❑ Defined 'Places of Safety'
- ❑ Clearly identifiable evacuation routes.
- ❑ Communication systems
- ❑ Surface control station
- ❑ Adequate evacuation equipment & facilities
- ❑ A high standard of Training

and the planning for the ***withdrawal of persons to a 'Place of Safety'*** which includes:-

- ❑ Scheduling of simulated emergency exercises
- ❑ Liaison with external support agencies
- ❑ Auditing of existing facilities
- ❑ Defined routes of travel
- ❑ Personnel resources
- ❑ Equipment resources
- ❑ Budget requirements

1.1.2.3 Fire Management Plan (Y RMMU 010, issue 2, 18/3/01): The strategy is based on the establishment of:-

- ❑ Systems for prevention, detection and suppression
- ❑ Action response plans addressing specific scenarios
- ❑ Equipment to manage fires
- ❑ Location and type of equipment appropriate to the location

1.1.2.4 Water Management Plan (Y RMMU 001, issue 8, 08/01/01): The strategy is based on:-

- ❑ Flow monitoring installations
- ❑ Sump level monitoring
- ❑ Hydro-geological studies
- ❑ Monitoring water containment levels

1.1.2.5 Strata Control Management Plan (Y RMMU 004, issue 5, 15/3/00): The strategy is based on:-

- ❑ Geotechnical & Geological Mapping
- ❑ Tell Tale/extensometer installations
- ❑ Instrumented roof bolt systems

2.1.1.2.2 Tube Bundle: A comprehensive system utilising 20 monitoring points at key locations evacuating samples through three infra red, one para magnetic and one electro chemical analysers. The latter provides low concentration monitoring of CO unaffected by cross sensitivity to other goaf gases (eg N_2O). The system caters principally for the monitoring of sealed areas with sampling points at key final seals and a minimum of four points along the active goaf. It also provides verification and redundancy sampling of the main ventilation system.

2.1.1.3 Bag sampling: Extensive routine sampling is conducted, under the Gas Management Plan, from final seals (in accordance with the 'Approved Standard For Monitoring Of Sealed Areas'), active goaf seals, surface boreholes, longwall Tail Gate and ventilation splits.

2.1.1.4 Gas Chromatograph: The Agilent Quad Micro instrument is used that has a stand alone PC for analysis and data storage. Personnel trained in the use of the GC are four Control Room Operators, two Relief Control Room Operators and the Ventilation Officer. Use is controlled by *"Operation of the Gas Chromatograph and Analysis of Bag Samples". S RMMU 024.*

2.1.2 Monitoring The Status Of Sealed Area Atmospheres:

2.1.2.1 Tube bundle: Sealing is done in two stages. Firstly substantial temporary seals of steel prop, mesh and grout construction are erected followed by the installation of the Final Seals (140 kpa) further outbye. Twin tube bundle sample points, to provide redundancy in the system, are installed inbye the temporary seals (5 tubes, 2 each for roof, floor and general body). Where appropriate a general body tube is connected to the auto tube bundle system.
Installation standard is controlled by procedure "Installation of a Goaf Seal" S RMMU 029. The intent of this is also captured in the contractors own job specific work instruction.

2.1.2.2 Bag Sampling From Surface boreholes: Via ex-refuge chamber holes in addition to the routine sampling referred to in 2.1.1.3 above.
As the longwall panels retreat and the refuge chambers are removed to new locations, a tube bundle sample point is installed in the surface connection borehole. Samples drawn from these locations initially provide data for the active longwall goaf and in the long term, data for the sealed area.

2.1.3 Monitoring Of The Condition And Movement Of Strata:

Guided by the Strata Control Management Plan and closely controlled by the Strata Control Committee. Meeting weekly the committee reviews all monitoring data, particularly any alarm levels reached and action taken and forward plan based on the geological and geotechnical data available. It comprises Underground Mine Manager, Geotechnical Engineer, Longwall, Development and Services Coordinators and the Shift Coordinator on the day.

2.1.3.1 Mechanical Tell-Tales: These are installed to the 8m and 1.8m horizons in all intersections during mine development. During longwall extraction through the area these are read each shift and daily for two weeks afterwards. Trigger levels are Level 1: Up to 25mm in any one horizon; Level 2: 25 - 50mm; Level 3: + 50mm.
Ongoing monitoring is to a schedule determined by the Committee based on the rate of movement.

2.1.3.2 Electrical "GEL" Extensometers: These are used in areas of anticipated strata movement eg. areas of soft strata, longwall installation road widening and Main Gate intersections where high forward abutment pressures are experienced.

2.1.3.3 Physical Inspection and Observations: Data gathering commences with the development crews and is recorded by the front line supervisors. The information is subsequently verified by geotechnical and geological personnel during the course of their inspections and is mapped.

2.1.4 Inspection: Generally the element of inspection is integrated into the relevant sections.

2.1.4.1 Mine zoning The inspection regime was established using risk assessment followed by practical trials to ensure practicability. Focus is placed on the four areas identified as presenting the highest risk:-

- ❑ Production areas
- ❑ Other areas where persons are working
- ❑ Conveyors
- ❑ Electrical equipment

2.1.4.2 Panel inspection Boards: The information is closely aligned to that contained on the statutory report including status of ventilation, roof and sides, pumps and travel road condition, inspection times, general comments, equipment location etc.

2.1.4.3 ERZ Controllers Statutory Report: This has been re-designed by the Controllers to align with the new legislation.

2.2 MONITORING AND CONTROL OF THE LOCATION OF PERSONNEL

Monitoring and control of the location of personnel has a high priority at the mine. The number of persons allowed into the mine and into any part of the mine, is strictly linked to the availability of self escape apparatus, that is, sixty minute oxygen self rescuer unit caches in and about the mine.
It is achieved by utilising the following systems and procedures: -

- ❑ ***Visitor Registration System***
- ❑ ***Lamp Room Tag Board System***
- ❑ ***SGS Swipe Card System***
- ❑ ***Surface locations***
- ❑ ***Underground locations***
- ❑ ***Contractor Location Board***
- ❑ ***Deputy Location Board***
- ❑ ***Spare Lamp and Self Rescuer Board***
- ❑ ***Underground Section Tag Boards***
- ❑ ***Communication Procedures***
- ❑ ***Communication Systems***

2.2.1 Visitor Registration System: All visitors to the mine are required to register at the main reception on a typical registration slip that captures name, date, affiliation, person being visited, time in and time out. The slip is inserted into a plastic clip-on holder to be worn by the visitor at all times while on the surface. Adjacent to the register is a receptacle containing "Safety Information" pamphlets that are issued to visitors. Visitors sign out and return the plastic holder on leaving the site.

2.2.2 Lamp Room Tag Board System: In the Lamp Room there are three large, wall-mounted tag boards that are designed to assist with the monitoring of the location of personnel on site. Personnel not employed by Crinum and working at surface locations use the ***"Surface Contractors and Visitors"*** board. All personnel going underground use the other two boards, the ***"Personal Security Tag Board"*** and the ***"Personal Security Underground Register"***. The tags are basic plastic key ring tags containing the person's name.

2.2.2.1 Surface Locations: The ***"Surface Contractors and Visitors"*** whiteboard is divided into two halves. The left half is further subdivided into two columns titled 'ON SITE" and "OFF SITE" containing a number of hooks on which to hang the tags. The right half is divided into eight large squares to cater for eight visitors. Each square makes provision for recording Name, Company and Crinum Contact. *(photo 1)*

2.2.2.2 Underground Locations: The underground tag system comprises two large boards, wall mounted in the lamp room, and two tags for each person requiring to go underground. They are colour coded Red, Blue, Green and Purple for the four production crews, ERZ Controllers are Yellow, staff Orange and visitors & contractors are White.

The larger of the two boards is the ***"Personal Security Tag Board"***. This is divided into five sections, one for each of the production crews and a visitors and contractors section. Each section is divided into a number of squares each containing a hook for the two tags and a name. It is the main repository for all the tags. *(photo 2)*

The second board is the ***"Personal Security Underground Register"***. This is divided into 96 squares with a hook in each square *(photo 3)*. One of the two tags is placed on an available hook on the underground board immediately before proceeding underground. The total hooks on the board are directly related to the oxygen self-rescuer capability underground. If all hooks are occupied no one else can go underground. The second tag is retained on the person for use on the underground section tag boards. This is described later.

On returning to surface individuals are required to remove their tag from the underground board and return both tags to the appropriate section on the Personal Security Tag Board.


Photo 1

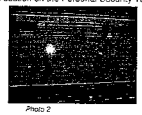


Photo 2


Photo 3

2.2.3 Contractor Location Board: This was introduced recognising that the movement of contractors around the mine was a particular issue to manage. It is simply a white board on the wall of the control room that is set up to capture the contractors, their location and any mobile equipment they may have. The board is updated as contractors report their location changes during the shift. This system is used in addition to the underground tag system and also the daily planning meeting that identifies all contractors on site, their proposed task and location. Contractors logbooks are retained in the control room.

2.2.4 SGS Swipe Card System: Installed in June 2001 the systems two main functions are with respect to contractors and are firstly to track and check their bona fide details and prerequisites for work at Crinum and secondly it solicits a declaration as to the fitness for work. It is located adjacent to the Tag Boards.

2.2.5 Deputy (ERZ Controller) Location Board: This is a plasticised plan of the underground inspection zones with the name of the Controller for each zone recorded using a whiteboard marker. It is located on the control room wall *(photo 5)*.

2.2.6 Spare Lamp and Self-Rescuer Board: This is the typical whiteboard contained on the lamp room wall. Everyone taking a spare lamp and rescuer underground is required to enter their name, date, lamp and rescuer number and proposed location and to delete the entry on returning the lamp and rescuer.


Photo 4

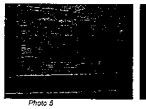


Photo 5


Photo 6

2.2.7 Underground Section Tag Boards: These tag boards are bracket mounted at the entrance to each section underground so as to be easily used by persons in vehicles without leaving the vehicle. Again the number of hooks on the board corresponds to the self-rescuer capability within that section. If a hook is not available the section cannot be entered. The second personal tag is placed on the board.
The boards are generally in close proximity to the Section Inspection Boards that provide a detailed description of the inspection and safety status of the section and to DAC communicators. Large reflective signs hung from the roof in the centre of the roadway alert to the boards *(photos 6, 7, 7A)*

2.2.8 Communication Procedures:

2.2.8.1 Call-up Procedure on Entering and Leaving the Mine:

DAC communication is provided at the top and bottom of both the Conveyor Drift and the Men and Materials Drift. Procedure requires all persons entering the mine to communicate to the control room giving their intended destination. The Controller maintains a log of these events. *(photo 8)*
On leaving the mine communication is required to the Controller from the drift bottom DAC.

2.2.8.2 Call-up Procedure on Entering and Leaving sections of the Mine: Before entering a section of the mine all persons are required to communicate their intention to the surface controller who will log the information. Also to notify the section deputy which the surface controller will generally facilitate via the PED system *(photo 7)*.


Photo 7


Photo 7A


Photo 8

2.2.9 Communication Systems

2.2.9.1 Surface Control Room - Refer to 7. Communications, page 14.

2.2.9.2 Electronic equipment: Electronic communication systems at the mine, in order of importance, are:-

1. *Telephone*
2. *DAC System (Tannoy type)*
3. *PED System*
4. *Two-way radio*

2.2.9.2.1 Telephone: The underground telephone system is Austdac. It has the "Caller Location" feature in the Control Room and uses the standard 555 emergency number. *(photo 9)*

2.2.9.2.2 DAC's: The system has the "Caller Location" in the control room. Locations include all belt road intersections, panel entries, longwall feceline, top and bottom of surface "drop holes" and many others.

2.2.9.2.3 PED System: All cap lamps at the mine are fitted with the PED System. The standard cap lamp battery is fitted with a special top that provides an LED display panel that will display digital messages in the same way as a standard pager. The wearer is alerted to a message being received by the cap lamp commencing to flash. The transmitter/controller is located in the surface control room.
The principle function of the PED system is to communicate emergency instructions to all persons underground.

2.2.9.2.4 Two-way radio: Two-way radio has proven to be relatively unreliable in use underground. Generally they are carried only by persons with a "roaming commission" underground.

2.3 MONITORING & INSPECTION OF EQUIPMENT AND FACILITIES PROVIDED TO ASSIST THE MANAGEMENT OF AN EMERGENCY

The objective of this element of Inspection and Monitoring is to ensure that emergency equipment and facilities are where they should be and are fit for purpose ie. maintaining the standard. Equipment and facilities include fire fighting equipment, oxygen breathing apparatus, escapeways, the monitoring equipment itself etc. The regime typically includes:-

- ❑ Fire officer - monthly inspections, coordination of equipment maintenance & change out, annual audit

- ERZ Controllers - inspection of fire fighting equipment, lifelines, first aid kits etc
- Fire Depot boxes are tag sealed with extinguishers outside
- Lamp Room Attendant - monthly audit if first aid kits, 12 hourly start up of ambufance, weekly calibration of hand held gas detectors
- Fenzy vaccuum tests monthly
- Monthly - mine monitoring systems
- Weekly emergency siren on DAC - 7pm each Sunday
- Weekly test of 555 emergency number
- Fenzies annual NATA test

3. EMERGENCY RESPONSE & INCIDENT MANAGEMENT

3.1 Incident Control Rooms: Emergency exercises have identified a conflict of interest between the accepted philosophy of the single Incident Control Room and the immediate needs of an emergency response. Consequently the system has been modified to incorporate two facilities:-

- The ***Immediate Response Room*** and
- The ***Incident Management Room***

3.1.1 Immediate Response Room: Exercises have shown that immediately following the declaration of an emergency the focal point for information, telephonic communication and direct communication with personnel is in and around the Control and Lamp Rooms. Therefor the person in charge at that time needs to be in that area to:-

- Gain first hand information from monitoring equipment and personnel
- Oversee implementation of the Duty Card system
- Interview any direct witnesses

For this purpose, the ERZ Controllers Room, which is adjacent to the Lamp Room, is designated the ***Immediate Response Room.*** Facilities include computer, phone, whiteboard, mine plans and an open view of the lamp room.

3.1.2 Incident Management Room: The Main Conference Room is retained as the *Incident Management Room.* This is sufficiently isolated from the main operations area to provide the Incident Management Team the necessary environment in which to work effectively.
Facilities include computer (SafeGas too!), phone, electronic whiteboard, mine plans (the Newlands plan system is to be introduced)

3.1.3 Incident Management Team: The team comprises the Underground Mine Manager, Ventilation Officer, a Site Safety & Health Representative, Inspector, an Industry Safety & Health Representative, Mines Rescue Superintendent and specialists as required.

4. FIRE FIGHTING FACILITIES & STRATEGIES

4.1 Fire Management Plan: Summarised in section 1, page 2.

4.2 Main Water Reticulation System:

4.2.1 Surface Supply: The mine has a dam of 5 mega-litre capacity providing direct feed underground. It is supplied from the Selma Weir and is recharged at 70% capacity. In addition 4 x diesel electric pumps provide backup and are tested monthly.

4.2.2 Underground Reticulation: This is a ring main design comprising a 120mm main feed located in the main transport road ('B' Hdg) to the panel entries and a 100mm feed in the conveyor road. Gate road supply is aligned to the homotropal layout standard and is described on page 10.
The drift bottom supply pressure is regulated to 1750 kpa max. and is monitored in the control room. Flow gauges are provided at line end in all panels.

During longwall production, unlike many longwall ventilation arrangements, the coffin seal is left in place. This facilitates four major functions:-

1. ***Retention of a partial homotropal ventilation system***
2. ***Controlled low flow ventilation to optimise monitoring for products of combustion***
3. ***Isolation of the Drive head & Loop Take-up area in the event of fire***
4. ***Optimising the effectiveness of the Fire Suppression System***

4.6.1.1. Retention of a partial homotropal ventilation system: Intake air entering along the Main Gate travel road is segregated from the conveyor road up to the Tripper Drive location (about 8 cth). At this point the air splits to enter the conveyor road. At the conveyor road the air splits again, the majority continuing inbye to the longwall face and about 20% travelling outbye over the Tripper Drive and conveyor ie. Homotropal. This is to remove the heat generated by the tipper drive directly to the main return.

4.6.1.2. Controlled low flow ventilation to optimise monitoring for products of combustion:

Ventilation over the drive-head is limited to approx 8 m^3/s which enhances the opportunity for products of combustion to be detected. Sensors for methane and carbon monoxide are provided at the three locations shown viz.-

- Directly over the drive-head transformer
- On the conveyor side of the inbye isolation doors
- In the dogleg return connection road

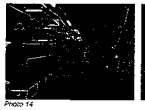


Photo 14

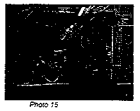


Photo 15

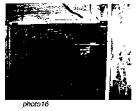


photo16

4.6.1.3. Isolation of the Drive-head & Loop Take-up area in the event of fire: Crinum is unique in its ability to effectively isolate the Main Gate Drive-head area from air intaking to the longwall in the event of a fire at this location. General views of the area are shown in *photos 14, 15 & Diag.1*
A regulated duct is installed in the coffin seal allowing a controlled flow direct to return *(photos 20 & 21).*
During the development phase, in conjunction with the coffin seal, isolation is achieved by closing the three sets of pneumatically operated doors located in the roads that access the drive-head and loop take-up *(photos 16, 17).* These are closed by manually operating the control valve shown in *photos 18 & 19.* It is intended to enable the Surface Control to activate the doors.
During the longwall phase the double machine doors in 'D' heading are normally closed and have a regulated ducting through them to give controlled ventilation over the transformer direct to the main return. *(Diagram 1)*

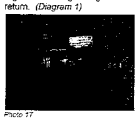


Photo 17


Photo 18


photo 19

4.3 Emergency Sealing Facilities

4.3.1 Underground: Panel Emergency Isolation Doors are the steel frame, steel door, hinge down type in two sections for easier handling. *(photos 10 & 11)*

4.3.2 Surface:

4.3.2.1 M&M Drift: The portal mouth is a steel framed, iron sheeted structure that incorporates two sets of doors that form the re-entry airlock arrangement. The doors are manually operated using levers external to the structure. A roll down tarp membrane is also provided *(photo 12.)* The structure also incorporates the GAG Inertisation docking port.


Photo 10

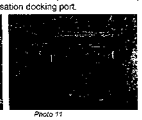


Photo 11


Photo 12

4.3.2.2 Conveyor Drift: The sealing system involves the pumping of a special grout into the drift via three boreholes.

4.3.2.3 Fans: Immediate sealing on stoppage of the fan is by the self-closing doors. Following destruction or removal of the fans, sealing is achieved by the placement of an 8m diameter concrete lid.

4.4 Mobile Equipment: All plant is fitted with 2 x 9kg 60 BE extinguishers.

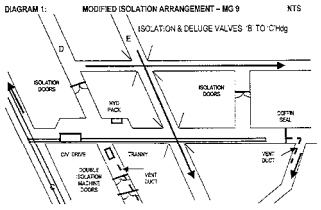
4.5 Electrical Plant: All plant is equipped to the standard set out in the old legislation.

4.6 Underground Innovations in Fire fighting:

4.6.1 Conveyor Drive head/Loop Take-Up – Isolation and Fire Suppression System:

During development of the longwall gate roads a typical homotropal system of ventilation is used. This involves the construction of a "Coffin" type seal, immediately behind the loop take-up, to segregate the intake air entering over the drive head from the air returning from the face along the conveyor roadway and into the dogleg connection to the main return. *(Diagram 1)*

DIAGRAM 1: MODIFIED ISOLATION ARRANGEMENT – MG 9 NTS



4.6.1.4 Fire Suppression System: In conjunction with the isolation capability the drive-head/Loop is fitted with a water deluge system throughout its length. The initiating valve is located beside the door operating valve. The deluge system can also be triggered from the surface control room *(photos 18 & 22).*

All permanent personnel are trained in the operation of the doors and deluge system at least once per year and prior to panel commencement for the relevant crews. This is generally incorporated into emergency exercises. The system is described in the site specific induction for non permanent employees.
Should a drive head/loop take-up fire occur there is a high degree of confidence that it will be effectively managed.

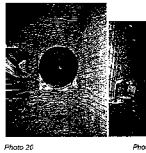


Photo 20

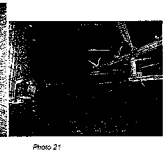


Photo 21


Photo 22

4.6.2 Facilities Associated with Homotropal Ventilation Layouts:

Crinum utilises a typical homotropal ventilation layout for longwall gate road development. Also typically, the main fire fighting water reticulation system is contained in the road adjacent to the conveyor road (the travel road) rather than in the conveyor road itself.

The means by which Crinum manages delivery of water from the travel road to all points along the conveyor system is not typical and constitutes a high standard. The standard layout is shown in ***Diagram 2***

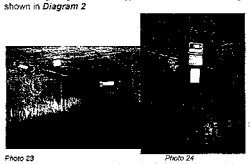


Photo 23

Photo 24

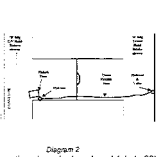


Diagram 2

A T-piece, hydrant and isolation valve is installed at each intersection along the travel road *(photo 23).* A 75mm flexible armoured hose (petroleum spec) runs from the isolation valve along the out-through, through the ventilation stopping and terminates with a hydrant and a 25mm outlet at the inbye corner of the conveyor road intersection. The hydrant and 25mm outlet are mounted on a bracket that is securely bolted to the coal rib. 120m of fire hose is cradle mounted (flaked) at the hydrant *(photo 24).* Initially the system also featured a large hose reel of 130m capacity permanently connected to the 25mm outlet and positioned so as to facilitate a straight pull of the hose along the conveyor.

This has been discontinued as in practice the reel, even in this 'ideal' situation, proved to be unreliable (oversaln due to the significant inertia of the reel causing jams) and cumbersome (heavy and difficult to start spinning initially).
The installation standard is inspected and audited regularly, (ERZC, fire officer, civ deputy)

4.6.3 Underground Workshop: This is located at 17 cth in the Mains, between 'A' & 'B' Headings. The area is well lit and has concrete floor and grouted ribs, an office, store room, inspection pit, welding fume extraction system and a foam fire suppression system. The refuelling bay section has a ventilation system direct to the return. The workshop is not yet commissioned.

4.6.4 Oil Filled Transformer Installations *(diagram 3)*:

Key features include:-

- Ventilated directly to return
- CO monitoring over transformer – activates power trip & VCD
- Fire suppression over transformer operated by a pyro tube.
- Ribs sprayed prior to installation
- Floor ballasted prior to installation

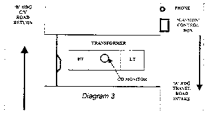


Diagram 3

4.7 Training:

4.7.1 Fire Ground Training Area: This is a specialised surface training facility. It is a level, road base surfaced, area with fire hydrants and other equipment installed. Underground roadways are simulated by the erection of framework and suitable cladding. Sections of conveyor and belting are used in fire scenarios. The standard oil fire vats are provided *(photo 25).* The Fire Ground is routinely used for:-

- Emergency Exercises
- Crew Exercises
- Induction
- Contractors

(It has been recognised that contractors employees are not participating in fire fighting training to an adequate degree and this is currently under review.)

4.8 Inertisation Capability:

4.8.1 GAG Jet Engine Facility: The docking port is at the M&M Drift Portal. A team of four operators is maintained, one member being the Area Coordinator for QMRS.

4.8.2 Tomlinson Boiler or other: The capability exists to pump inert gas into sealed areas via the refuge chamber surface boreholes.

4.9 Future

4.9.1 Compressed Air Breathing Apparatus (CABA Units): Fire fighting facilities in underground coal mines have been prescribed by legislation for many years. Historically the need for a high standard has been recognised and respected. However, in recent times a significant inadequacy has been identified. Unlike our States Fire and Rescue Service the industry has not had breathing apparatus in the fire fighting armoury (other than Mines Rescue mobilisation). Without such apparatus fire fighting capability is significantly handicapped in the confined space of underground. The units also permit verbal communication (denied by the SCSR units) a potentially vital feature in an emergency.
A feasibility study has been completed into the use of CABA units and these will be incorporate into the Fire Fighting & Self Escape Strategies in a similar manner to the system at Newlands Mine.

4.9.2 Turn Out Gear: "Turn Out Gear" is the term used for the specialised protective clothing worn by fire fighters. Again it is planned to include this in the fire fighting facilities at the mine.

5.3 Visual Aids: The Primary Escapeway is equipped with a high standard of visual aids *(photos 26, 27, 28 & 29)* including -

- Reflective Signs and reflective Egress Droppers (Strip Hangers) (18m spacing)
- White cementitious grout lagging/support of intersection rib corners in the Mains
- High standard of stone dusting (including Wet stone dusting).

5.4 Lifelines: A lifeline is located in the "Last Egress" (returns). It is a 6mm, plastic coated wire and is hung from the roof by a light chain at waist height. The chains and cones are wrapped with reflective tape to improve visibility. Cones are attached to the line at 20m intervals to indicate the direction of travel by feel. In addition, groupings of cones indicate approach to a hazard, eg. an overcast (2 cones) and a change of direction (3 cones). Installation is per Work Instruction I DEVP047 "Lifeline Extension and Installation" *(photo 32).*
All crews do a Last Egress walk out of the mine twice yearly minimum to maintain familiarisation with the lifeline, overcasts, doors and fenzy caches.

5.5 Walking Sticks: 24 walking sticks are provided in each crib room and six at all other cache locations. These are for escapees to use in poor visibility conditions in a similar manner to the visually impaired. For example, when walking an effective strategy might be to tap along a pipeline while in a vehicle they could be used to gauge proximity to the rib line.

5.6 Vehicles: All transport vehicles carry a basic first aid kit. The underground ambulance, located beside the surface first aid room, also has oxy viva, entonox, inferno vacuum mattress and splints and air splints. Emergency transport vehicles are maintained in all coal producing sections and must be authorised by the ERZ Controller to leave the section.

5.7 Plans: Emergency Evacuation plans are located at crib rooms, refuge chambers and surface.

5.8 Roadway Construction: To a high standard using medium and fine ballast and are regularly graded and rolled. Extensive use is made of "Bill Holes" & drains to control water and principal intersections are concreted. (Work Instruction I D670 400 "Road works - Construction of Roads". The Last Egress is regularly graded and kept spotless.

5.9 Oxygen Self-Rescuers:

5.9.1 Fenzy Biocell 1 units are worn by all personnel entering the mine (30 minutes). All personnel undergo refresher training at least annually including the changeover process.

5.9.2 Oxygen Self-Rescuer Caches:

These are the Fenzy 60 units rated at 60 minutes. They are housed in steel cabinets, bright yellow in colour and having the distinguishing triangular reflective decal *(photos 30, 31,32,33).*


Photo 30


Photo 31


Photo 32

Caches are located along the Last Egress route, at crib rooms, refuge chambers and at the return side of the coffin seals of the homotropal layout. Locations were determined by risk assessment considering data from trials by the Southern Mines Rescue Station, the Joint Coal Board and SIMTARS, that used information provided by the mins on consumption rates of a cross section of the workforce.

5. SELF ESCAPE FACILITIES & STRATEGIES:

Should an emergency event occur, the chances of survival of persons underground are greatly increased if they have the ability to make their own way to a place of safety without undue delay, that is, the ability to ***Self Escape.*** Indeed it may well be the only chance of survival. This is without doubt the most important aspect of emergency management. It requires a very substantial commitment by management to planning, resourcing and training. This section describes the facilities and strategies that have evolved at Crinum to assist personnel to make their own way to safety.

5.1 Mine Design:

5.1.1 Surface Connections: There are three main connections between underground workings and surface. Two are the normal means of ingress and egress from the mine, the Men & Materials Drift (970m at 1 in 10) and the Conveyor Drift (840m at 1 in 8). These are main intake airways and can be travelled by rubber tyred vehicles. The third is the Upcast shaft that is 64m deep and has no travel facilities.

5.1.2 Main Entries: There are five Main Entries comprising two return airways (headings D & E) on the southern flank, and three intake airways (headings A, B, & C). The conveyor system is located in C Heading and is totally segregated from other roads. A major control in the management of risk associated with underground transport is the mines one way travel system. A heading is for travel inbye and 'B' heading for travel outbye. This also has some obvious advantages for emergency escape.

5.2 Escapeways & Facilities: Escapeways were established prior to the new legislation and are in compliance with it. The strategy set out in the Emergency Evacuation Management Plan is based on three principal escapeways which, in order of priority, are:-

Photo 26

- **Primary Egress** - 'A' & 'B' Heading travel roads (combined intakes).
- **Secondary Egress** - the Conveyor Road (segregated intake airway)
- **Last Egress** - the return airway.

Continuous improvement is facilitated by the audit and review process that is applied to all systems and procedures relating to all facets of the mines operations. The standard of the mines escapeways has evolved in accordance with this process.

5.2.1 The Objective of a Primary Escapeway (Primary Egress) is to provide a roadway in which the ability of persons to travel to safety in an emergency and in conditions of poor visibility is optimised. The strategy to achieve that objective involves:-

- Compliance with regulation 296 (segregated intake airway)
- A high standard of road construction to facilitate high speed traffic movements
- Good housekeeping (absence of obstacles)
- Extensive provision of visual aids
- Duplicate roadway (A & B Headings in the Mains)

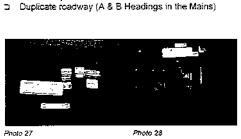


Photo 27


Photo 28

Photo 29

From the furthest working face (approx 4.5km) there are six changeover points not counting the belt work unit. There are 475 Fenzy 60 units stored in caches underground and this relates directly to the 95 person limit on the Underground Register Board. Fenzy caches can only be relocated after direct authorisation of the Underground Mine Manager.

5.10 Refuge Chambers.

Recommendation No.10 from the Moura No.2 Inquiry was for a working party ***"to examine and report on a range of issues relating to emergency escape facilities"*** and included ***"should fully investigate the potential for refuge chambers in underground coal mines as part of an overall escape strategy"***

Crinum acted on the findings of the working party and assigned BHP Engineering and CompAir the task of designing a chamber. Criteria to be considered included *size, maximum accommodation, air supply systems, food & water supply, resistance to damage, portability, communication systems and sanitary facilities.*
The final design accommodated twenty-four personnel inside a steel enclosure that was connected to services from the surface via a borehole *(photo 34).* The services are fresh air supply, telephonic communication, fresh water delivery from surface (and liquid food) and atmosphere monitoring both inside and outside the chamber. They are easily transported by a fork-lift Eimco.
The chamber is the first to incorporate the "flush air" system that, through a system of filters maintains uncontaminated ventilation within the chamber and therefor allows the occupants to move around freely without breathing apparatus *(photo 35).* A self-contained air supply is provided as a back-up in the event of interruption to the surface supply. A bank of 8 x 50lt medical standard compressed air cylinders at 300 bar, feeds a ring main to which 24 face masks are connected *(photo 36).*

Photo 34


Photo 35


Photo 36

Food & water supply comprises high protein, canned, liquid food sufficient for three days. This is stored beneath the bench seats *(photo 35).* Other features include high standard ablutions, playing cards, high sugar content lollies.
Chambers are strategically located according to the risk assessment conducted for the Fenzy requirements and also serve as Fenzy SCSR caches providing a fresh air changeover environment.

A significant issue was the initial lack of confidence in the Rescue Chamber strategy by the workforce. This has gradually been reversed through the education and training program. All personnel undertake annual training in the refuge chamber systems which includes familiarisation with the surface facilities installed above the chambers.

5.11 CABA Units: Refer to Fire Fighting section 4. page 10

6. AIDED RESCUE FACILITIES & STRATEGIES:

6.1 Mines Rescue Capability

6.1.1 Objective: To ensure the immediate response of two competent mines rescue teams with the ability to conduct a search and rescue operation underground in the event that any personnel are unable to self-escape to the surface.

6.1.2 Strategy: The objective is achieved by:-

- Operations Management commitment to mines rescue
- Maintaining a minimum of 24 mine personnel as Members of the Qld Mines Rescue Service
- Providing and maintaining the facilities and equipment required (itemised below)
- An effective management structure (Manager & Mines Rescue Coordinator)
- Maintaining close liaison with QMRS
- Providing in-house training in addition to QMRS training
- Maintaining a high profile for mines rescue at the mine

6.1.3 Manning: Initially three teams of six were considered adequate. However, experience gained from emergency exercises has shown that twenty-four members are required. Early exercises in which the call-out procedure was activated demonstrated the inability to effectively assemble the minimum two teams of six members required to under-take a rescue attempt. At the last Level 2 Exercise held in November 2000, seventeen (17) members effectively responded from town and three were already on site and able to assist.
The Operations Management Team is highly committed to mines rescue and ensures a high profile is maintained. This in turn generates high morale among the members, a keen interest among the workforce generally and a healthy environment in which to recruit new members. It also contributes significantly to the general culture of safety awareness at the mine.

6.1.4 Facilities and Equipment: The mine has a dedicated Mines Rescue Room (6m x 6m) close to the Control Room and Lamp Room. Equipment housed includes:-

- 18 x BG174 suits with 10 exchange O_2 bottles
- 6 BA's with 7 exchange air bottles [alg capability]
- Oxygen decant system
- Generator set and vacuum pump for borehole sampling
- Washer & drier for cleaning suites
- Stretchers
- Various BG174 spares
- Required items for a team response in an emergency/training
- BA cylinder charging set [petrol powered]

6.1.5 Organisation And Control: The Underground Mine Manager and Mines Rescue Coordinator are responsible for the mines rescue capability. The Mines Rescue Coordinator is responsible for the day to day activities and delivery of training and this requires close liaison with the QMRS. He is also responsible for maintaining a register of available members. Each team has a Captain and a Vice-Captain and they are responsible for direct leadership and control of the teams.

6.1.6 Training: At the beginning of each year, the Q.M.R.S., in liaison with the mines, formulates a training program for each mine under its jurisdiction. The Mines Rescue Coordinator liaises with respect to:-

- ***Preferred training days***
- ***Special training needs***
- ***Member names and manning changes***
- ***Assistance with training***

Oxygen training with the BG 174 suites is conducted bi-monthly as required by QMRS and takes the form of structured incident scenarios of two to three hours duration. It is conducted at the mines in turn.

The agenda covers:-

- Safety issues and particularly those of the previous 24 hours
- Production issues of the previous 24 hours
- Production issues of the next 24 hours
- Departmental updates eg. Ventilation, Maintenance and Conveyor management.
- Contractors currently on site and in the next 24 hours.

Weekend activities are planned at the Friday meeting and are reviewed at the Monday meeting.
The communication value of the forum is recognised by inspectors who routinely attend.

7.3 Daily And Weekly Plans: The *Weekly Work Plan* is prepared by the Area Coordinators and issued every Sunday. Subjects covered include:-

- *Safety and Training*
- *Ventilation*
- *Geotechnical*
- *Development operations*
- *Longwall operations*
- *Services (Contractors, pipe work, stone dusting etc)*

Information includes, for example, relocation of self rescuer caches, roadway dust sample results, contractor tasks and locations, visitors, safety alerts, safety statistics and non-routine excavation requirements in development panels.
ERZ Controllers conduct tool box talks with their crews on their first roster shift and this includes discussion of the Weekly Plan.

The *Daily Plan* has a similar format but focuses on each 24 hours and contains the relevant information from the Daily Planning Meeting.
All personnel have access to the weekly and daily plans and these are seen as another vital tool in keeping the work force informed in a timely manner.

7.4 Shift Changeover & ERZ Controller Briefing: This process is recognised as critical in the communication chain. It is resourced appropriately to achieve a high standard as indicated by the five stages of the process:-

1. Two-way radio communication with personnel travelling to work covering safety, production, contractors and services. Highlights any particular issues that might impact on the coming shift.
2. On mine arrival changeover continues in ERZC Room where the radio conference is updated.
3. Telephone communication from the off-going deputy underground to his on-coming counterpart further updates the current and projected status of the panel.
4. Crew hand-over between the shifts takes place in the panel underground
5. Finally, before work commences, the ERZC conducts a briefing with his crew to summarise the status of the panel and focus on any special needs to work safely and productively during the shift.

7.5 Safety Contacts: It is the objective of BHP and Crinum Mine to ensure that:-

- all safety matters are adequately communicated to all personnel
- opportunities are regularly provided for effective two-way communication
- effective cross communication exists throughout the Company
- systems are in place for the communication of safety matters to and from external parties.

Safety Contact meetings are held on dayshift every Wednesday for Longwall crews and every Thursday for Development crews. Contractors and temporary employees attend one of these meetings or alternatively attend their own meeting with Crinum personnel. The agenda covers:-

- ***Safety performance [KPI, LTI, LTIFR]***
- ***Safety issues***
- ***Safe Act Observation reports***
- ***Refresher Training***

The **Organising Committee** comprises Safety & Training Manager, a Site Safety & Health Representative, a Section Coordinator (rescue trained) and the Assistant Superintendent of the Blackwater Mines Rescue Station. Level 2 & 3 exercises are planned and implemented according to the requirements summarised in Table 1 of the Approved standard.

With respect to the Level 2 Exercises, the "Approved Standard" requires ***"a report on the performance and outcomes of the exercise is to be provided to the District inspector who will ensure that pertinent issues are made available to industry"***. Reports are provided on the Inspectorate proforma report form that is to be incorporated into the new "Recognised Standard".

Level 4 exercises are organised, implemented and assessed by the ERZ Controllers. They generally take the form of either a desktop or practical exercise. A desktop exercise might typically be a crew discussion on how best to manage a given scenario while practical exercises typically involve evacuation in low visibility conditions (wearing fogged glasses) to locate the long duration rescuer cache(s) and egress to the surface. Exercises are conducted throughout the year by the Deputy and as with all of the exercises, whether it be a Level 2 or 4, an assessment and written report is done and feedback is passed on to all at the mine for comment.
Crews have found particular benefit in these exercises from the actual experience with low visibility problems that sharpens the "pit sense" and the team work bonding in solving the problems.

Since commencement in March 1995 exercises have identified many issues and flaws, both underground and surface, and have proven to be invaluable in maintaining and improving the evacuation process.

8. VENTILATION CONTROL DEVICES

Ventilation Control Devices are included in the context of Emergency Preparedness as they are required by legislation to meet specifications designed to withstand potential abnormal over-pressures. Devices employed at Crinum include:-

9.1 Stoppings:

9.1.1 Mains: Dry block construction of 5 psi rating. Spray grouted to seal. (installed in addition to pre-existing non-rated stoppings)

9.1.2 Panel: 2 psi. dry block with man-door and 100mm pipe for c/v mist trickle dusters.

9.1.3 Segregation: The Mains belt road is fully segregated using a range of VCD's including block and cementitious stoppings, segregation overcasts and non-rated machine doors at all belt and electrical installations. As "D" Hdg. progressively becomes the second main return. 5 psi stoppings are installed with the original block stoppings to form airlocks.

9.2 Seals:

9.2.1 Longwall Segregation: 20 psi "mattress" type protected on both sides by "Tin Cans".

9.2.2 Longwall Final Seals: 20 psi polyurethane core (Micron) type.

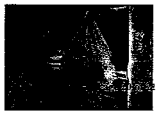
9.2.3 Overcasts: 5 psi rated

9.2.4 Machine Doors: Test rated machine doors are not available but Crinum has adopted a very substantial, air operated, structure *(photo 36)*

9.2.5 Emergency Sealing Facilities - See Firefighting Section 4.3, page 8.

9. EXPLOSION MITIGATION - (STONEDUSTING):

Stone dusting receives appropriate priority and is done systematically and in compliance with legislation. Of note in achieving and maintaining the standard are:-



During the alternate month training is conducted in-house and is structured around:-

- ***desk top exercises***
- ***fire fighting***
- ***first aid***
- ***mine gases***
- ***spontaneous combustion***
- ***team procedures***
- ***borehole sampling***
- ***instruments used by mines rescue***

The Mines Rescue Superintendent or his assistant attends this training.

6.1.7 Q.M.R.S: Crinum has a Mines Rescue Agreement with QMRS setting out the criteria for effective capability.

6.1.8 Mutual Assistance Arrangements: Crinum participates in the regional strategy being in Group 3 together with Cook, Kenmare, Kestrel and Oaky No.1.

6.1.9 Local doctor: The local doctor is familiarised with the mines operations and, importantly, is familiar with its personnel.

6.1.9 Future: Training needs identified include hazardous chemicals and the open cut fire truck.

6. COMMUNICATIONS:

Communication is the administrative heart of any system and its optimisation must be a goal of any enterprise. Crinum is proud of the standard it has achieved and continues to develop. Its success is founded in three principal areas:-

- The Surface Control Room that is the communications centre for the mine
- The systems and procedures that are in place
- The vigorous participation of personnel at every level of the organisation

7.1 Surface Control Room: Located adjacent to the Lamp Room and underground muster area, a focal point for all personnel entering the mine. It is manned at all times having a compliment of four operators and two relief operators. The principle function is that of Monitoring and Communication.

7.1.1 Scope of Monitoring includes:-

- *Main Mine Fans*
- *General body atmosphere quality & quantity (Electronic system)*
- *Active and sealed goaf atmosphere (Tube Bundle)*
- *Mine De-watering System*
- *Underground water supply*
- *Location of Personnel*
- *Inspection Status of the various sections of the mine*
- *Location of mobile equipment*
- *Conveyor status monitoring*
- *Longwall status*
- *Gas Chromatograph analysis*
- *Mine services eg compressors, fire pumps*

7.1.2 Scope of Communication includes:-

- *Phones*
- *DACs*
- *PED*
- *Two-way radio*
- *Tannoy (surface)*
- *Direct verbal*

7.1.3 Operator competencies: Preferred 3rd. class certificate (min), working knowledge of the mine systems, SafeGas operation, GC operation, computer literate, Occupational First Aid Certificate.

7.2 Daily Planning Meeting: The daily planning meeting is scheduled at 8am Monday to Friday and is attended by the Operations Management Team. It is the foundation of the communication and planning system with information cascading down to the work face.

Crews have an opportunity to discuss issues and possible solutions with Safety and Management personnel. All issues are logged and follow up is reported back directly to the parties concerned and also to all mine personnel via the weekly plan.

7. TRAINING & EDUCATION

The foundation of the training & education process is the Thirty Standards (Blue Machine) and ten HMP's referred to in the Safety Management Section, page 1. Complimenting legislation these set the minimum standards by which the mine will operate.

8.1 Induction Training: The objective is to inform visitors, vendors and contractors of the systems, hazards, rules, procedures and conduct to be aware of while on site.
The Generic and the BHP Coal General Induction are a prerequisite for Contractors. Site specific induction, surface and underground, is provided by the mine. Contractors can have a combination of surface and underground or either and can work accompanied or unaccompanied depending on the induction and experience. On completion, a card is allocated and is current for two years.
Both experienced and inexperienced, newly employed and permanent employees are required to complete the full induction process before working in and around the mine. Inexperienced employees remain under close personal supervision for three months and experienced employees for three weeks, while the systems and procedures are learned. In the latter case all previous authorisations (machine tickets etc) are challenge tested during this period.
All newly employed *statutory officials* undergo training covering the HMP's, Safety Systems, Inspection regime and Managers Rules and must be assessed as competent prior to being authorised and recorded in the mine record.

8.2 Challenge Testing: On-the-job challenge testing is widely and consistently used and its value cannot be overstated. It has particular value in assisting non-permanent personnel with their knowledge and understanding of their environment and particularly with respect to the communication systems and the self escape facilities and strategies. All staff and supervisors use the technique regularly and mine workers also take an active role on occasions.
Human nature being what it is makes personnel challenged initially feel somewhat threatened and nervous but as the value and integrity of the process is recognised a significant respect is developed for the process together with a sense of pride in the ability to pass the test.
All vehicles are regularly challenged for compliance with the 24-hour safety check. Again it is recognised that contractors work at a number of different mines and can become confused as to the systems and procedures in place at Crinum.
On going awareness of the rules, regulations, systems and procedures will lead to a more confident and competent workforce, permanent and contractor, which, in the first instance, will significantly assist in the management of risk and in the second instance, with the management of an emergency should it arise.

8.3 Training: Crinum Mine ensures that all personnel are appropriately trained and competent so as to be able to perform their work safely and skilfully. To achieve this a matrix of competency requirements was established to cover all roles and to identify safety and operational needs. Only personnel with the correct competencies and authorisations can perform designated tasks.
Sixteen sessions are held throughout the year on key subjects including Fire Fighting, Hydraulic Equipment, Cable Management, Hazard Identification and Risk Awareness, Isolation Procedures and Don/Wear oxygen self rescuer. In addition a program of annual refresher training has been developed to meet the five yearly legislative requirement.
Contractors are provided with the same training opportunities as the permanent workforce.

8.4 Emergency Exercises: Recommendation 5 from the Moura No.2 Inquiry included *"Emergency procedures should be exercised at each mine on a systematic basis, the minimum requirement being on an annual basis for each mine"*. This lead to the development of the "Approved Standard For The Conduct Of Emergency Procedures Exercises, QMD 98 7393" with which Crinum complies.

10.1 Longwall: Prior to commencement the Tail Gate is bulk dusted as the "Tin Can" secondary support is installed. Also 1000 kg bags of stone dust are suspended from the roof in the Tail Gate at 18m intervals (every 6 cans). These are the supply for the **Trickle Dusting system** that uses a compressed air venturi, fed from the wall, that is spiked into the stone dust bag *(photo 38)*.
Photo 38

10.2 Development: Faces are dusted per legislation and two pallets of dust are kept at the auxiliary fan trickle duster. In addition a trickle duster and two pallets of dust are installed at every other cut-through to trickle dust the conveyor road.

10. **RE-ENTRY:** Surface emergency seals facilitate mine re-entry and HMP governs protocol.

11. AUDIT, REVIEW & CONTINUOUS IMPROVEMENT:

The Strata HMP is reviewed weekly, others are reviewed monthly and updated annually.
Selected HMP's are subject to annual third party audit (eg ventilation - SIMTARS)

12.1 The Future?:

- Electronic scanning for personnel & equipment location
- Electronic display boards
- Dupline Systems - remote activation of doors and regulators etc
- Get Exto's data to surface via data highway

DEFINITIONS:

Emergency: An Emergency is a situation in which control of the risk has diminished to the point where urgent action is required to either regain control and/or remove personnel from the hazard and/or minimise financial loss.
Emergency Preparedness: The ***Facilities And Strategies*** that need to be in place to effectively manage all foreseeable potential Emergency Situations.
Emergency Evacuation: The planned orderly withdrawal of personnel from the risk associated with an Emergency Situation.
ERZ Controller: A person appointed by the Underground Mine Manager to conduct statutory inspection and supervision with respect to a defined Explosion Risk Zone.
Self Escape: The process of a person escaping from a mine in an emergency without direct assistance from surface personnel.
Aided Escape: Processes whereby surface personnel are directly involved in assisting persons underground to escape from a mine in an emergency.
Place of Safety: A designated place to which persons will evacuate without being in danger from the hazard that triggered the evacuation.
Incident Management team: A person or group of persons with authority defined by an "Emergency Procedures Plan" and an obligation relevant to it, to manage an emergency situation.
Coffin Seal: A seal designed to allow the passage of a conveyor through it while minimising ventilation leakage.
Homotropal: A ventilation layout whereby the ventilation flows in the same direction as the coal clearance system.
DAC: "Digital Analogue Converter" - a push button, tannoy type, fixed electronic communicator.
Egress Droppers: A visual aid comprising 1500mm x 100mm strips hung from the roadway roof at set intervals and having a highly reflective surface on the inbye side to provide guidance in evacuating the mine particularly in low visibility conditions.
Primary Escapeway: An intake roadway in which the ability of persons to travel to safety in an emergency and in conditions of poor visibility, is optimised.

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