Introduction of Battery Powered Coal Haulers into Board and Pillar Panel Production

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ABSTRACT

Powercoal Pty Ltd operates eight underground coal mines in New South Wales and produces coal for both domestic power stations and the export market. Approximately 40% of total production is from continuous miners. Over the past five years, place change mining methods have been introduced to improve productivity from continuous miners. This has involved utilising the existing coal clearance system from the continuous miner to the ratio feeder using trailing cable shuttle cars.

By late 1996 average productivity at Cooranbong Colliery using this system had plateaued at 800 tonnes per eight hour shift. A number of factors were identified to increase average productivity to 1500 tonnes per eight hour shift. An improved coal clearance system was one of the factors identified.

Battery powered coal haulers were selected to improve the rate of coal clearance from the continuous miner to the ratio feeder. This paper details the decision making process in arriving at this selection. Issues discussed include alternate systems considered, advantages and disadvantages of battery haul cars, compatibility with other mining processes, tendering and supply arrangements, and implementation issues including mining and equipment approvals.

The battery powered coal haulers commenced operation in November 1997. The paper details limited operating experience since that time.

INTRODUCTION

Background

Powercoal Pty Ltd operates eight underground coal mines in New South Wales. The company produces approximately eleven million tonnes of coal per annum for both the domestic thermal and export markets. Approximately 40% of Powercoal's production is from continuous miners, either from first workings or secondary extraction. Much of this coal is won from the Wallarah, Great Northern and Fassifern Seams of the Newcastle Coal Measures where either local geology and/or subsidence constraints preclude the use of longwall methods. Prior to place change mining (PCM), typical "whole of panel" productivity averaged 350 tonnes per seven hour shift or 7.3 tonnes per face man hour. (Note: This measure is calculated using hours at the face and face manning numbers employed in the process.)

In 1989, faced with increasing competition in the domestic thermal market, the PCM system was identified as a means to deliver competitive productivity within the geological and mining constraints commonly encountered at Powercoal's Lake Macquarie mines. The system was successfully introduced in 1992 at Myuna Colliery in the Fassifern Seam. Productivity increased to 800 tonnes per seven hour shift (12.1 tonnes per face man hour) with peaks of up to 1500 tonnes per seven hour shift (22.7 tonnes per face man hour). The system relied on a coal clearance system of three Joy 15SC shuttle cars of 9.5 tonnes capacity each.

The system was introduced at Cooranbong Colliery in 1994 and modified to suit local geology and mining constraints. Coal clearance typically utilised two Joy 15SC shuttle cars. As improvements to the system were made, average productivity in first workings increased during 1995/96 but has plateaued at 800 tonnes per eight hour shift (12.7 tonnes per face man hour). Peak performances of up to 2000 tonnes per eight hour shift (28.6 tonnes per face man hour) have been achieved.

Benchmarking with United States mines identified scope for considerable improvement. Average productivity from PCM operations in the United States is 20 tonnes per face man hour with peaks of up to 35. One factor for this difference was

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the rate of coal clearance from the continuous miner to the ratio feeder. Battery powered coal haulers (BPCHs) were highlighted as providing improved coal clearance rates in PCM units. The introduction of BPCHs combined with a review of pillar dimensions and the introduction of a roadway improvement programme will aim to improve coal clearance rates in PCM units. Target average productivity is 1500 tonnes per eight hour shift (20.0 tonnes per face man hour).

This paper details the selection and introduction of BPCHs at Cooranbong Colliery.

Cooranbong colliery

Cooranbong Colliery is located approximately 50 kilometers south of Newcastle on the south western edge of Lake Macquarie. The mine produces 1.7 million tonnes per annum from the Great Northern Seam at depths ranging from 60 to 140 m. Seam height varies from 2.4 to 3.0 m and the coal is extremely hard by national and international standards. The roof is a hard, undulating conglomerate with support requirements ranging from pattern bolting (1.8 m bolts, 2 m spacing) to more intensive bolting with W-straps (1.2m spacing) and mesh.

The floor (Awaba Tuff) ranges from claystone to siltstone and 300 mm of coal is left as a wheeling base. The seam is naturally damp and bogholes are commonplace. Regional seam dip is less than 1 in 40. Local seam rolls can be up to 1 in 8.

Five heading panels with pillar dimensions of 45.5 x 45.5 m centres are advanced using place changing techniques and are subsequently extracted using Voest Alpine Breaker Line Supports. Prior to battery haul cars the place changing unit consisted of:

1 x Joy 12CM12 Continuous Miner

2 or 3 Joy 15SC Shuttle Cars

1 x Mobile Roof Bolter

1 x 913 Eimco for roof scaling/floor cleanup

1 x Stamler Ratio Feeder

Manning consisted of one team leader, one engineering technician and seven production employees.

Implementation process

The implementation process for the BPCHs is summarised in Table

Table 1 - Battery Powered Coal Haulers Implementation Process 9NSW Govt 1984. The boat Mines Regulation (Electrical – Underground Mines) Regulation 1984. (Govt Printery: Sydney)

Process		Comments
1•	Identify productivity improvement factors.	• Coal clearance rate from miner to ratio feeder. • Other key factors identified.
2•	Identify alternatives and preliminary evaluation - advantages/disadvantages.	• Continuous haulage. • Battery Powered Haulers • Diesel Powered Hauler
3•	USA Benchmarking Tour	• Inspect high productivity PCM units using BPCHs.
4•	Invite tenders for the supply of a Coal Clearance System based on BPCHs.	• Six month trial followed by performance hire arrangement. • Performance criteria ■ haulage rate (tonnes/hr) ■ system availability (%)

	• A "total system" approach.
5• Evaluate tenders	• Safety, Performance Criteria, Financial Evaluation.
6• Review of Production Process	• Panel layout and design, wheeling routes, battery charge/change station, manning, infrastructure.
7• Training Programme	• Risk Review/HAZOP Study, • Safety Operations, Maintenance. • Safe Operating Procedures.
8• Construct/Install Infrastructure	• Battery Charge/Change Station. • Ratio Feeder
9• Six Month Trial	• Modifications to Process. • Audits and Review. • Detailed assessment of performance.
10• Decision to Proceed with Performance Hire.	• Safety. • Powercoal Investment Criteria.
11• Performance Hire	• Audits and Review of Performance.

PRELIMINARY EVALUATION

Shuttle cars - the existing system

The existing coal clearance system utilised Joy 15SC Shuttle Cars and clearly an option to be carefully considered was to seek incremental improvements in performance from the existing system

In considering this option the following factors were incorporated into a capital replacement financial model:

- The existing fleet was 16 years old;
- Overhaul costs;
- Maintenance costs and availability;
- The high cost of trailing cable repairs;
- Wheel unit costs;
- Average payload 9.5 tonnes; and
- Productivity plateau of 800 tonnes per shift average.

The financial model indicated that a quite modest productivity improvement would justify the capital cost of a new coal clearance system. Following detailed analysis, there was limited scope only for safety and productivity improvements with continued use of shuttle cars.

Alternate coal clearance systems

Alternate systems considered were:

- Continuous haulers - roof or floor mounted;
- Bridge conveyor systems;
- "Bendicar" system;

- Battery powered coal haulers; and
- Diesel powered coal haulers

Advantages and disadvantages

A preliminary evaluation of the alternatives was undertaken based on a simple ranking system. Battery haul cars were considered the most appropriate system for use at Cooranbong. The advantages and disadvantages of BPCHs compared to other alternatives is given in Table 2.

Table 2 - BPCHs Advantages and Disadvantages

Advantages	Disadvantages
Safety	
• Elimination of trailing cables - arcing in hazardous zone. • Manual handling - trailing cables. • Articulation - improved roadway conditions. • Ergonomics - driver compartment/seat. • Driver compartment canopies. • No diesel fumes.	• Physical size of the BPCHs. • Stored energy - potential to ignite CH_4 during ventilation failure • Chemical energy - burns, fires. • Driver visibility when loaded.
Productivity	
• 16 tonne payload. • Rapid coal discharge. • Flexible wheeling routes.	• Less capacity than continuous haulage. • Battery life - roadway conditions/grades. • Cycle time to achieve optimum battery performance.
Cost	
• No trailing cable/wheel unit repairs. • Less mechanical components. • Advantage gained from one or more units.	• Battery Charge/Change station. • Requires special ratio feeder.
Employee Morale	
• No diesel fumes. • No trailing cables. • Flexible wheeling routes. • Not radically different to shuttle cars/training.	• Battery life/changing.
Flexibility	
• Can handle variable seam conditions. • Flexible wheeling routes. • Materials transport. • Outbye maintenance.	• Requires battery charge station. • Requires special ratio feeder.
Other Advantages	
Proven technology - 20 years in USA.	

USA BENCHMARKING TOUR

In May 1997 the author undertook a study tour of high productivity United States mines using PCM systems and BPCHs. Particular emphasis was placed on visiting operations with "soft" or wet floor conditions and/or operations in dipping and undulating coal seams. Galatia Mine (Illinios) was also inspected. This mine uses diesel haul cars on a moderately soft floor in gateroad development. Productivity in gateroad development was 1000 tonnes per eight hour shift or 13 tonnes per face man hour.

Table 3 summarises productivity results and shows a comparison with Cooranbong using Joy 15SC shuttle cars

Table 3 - Productivity Comparisons - United States Study Tour

Mine	Tonnes	Face Hrs	Manning	Tonnes/ Man/Hr
Cooranbong - Best	2000	7	10	28.6
Grand Canyon - Avg.	2300	10	9	25.6
Unicorn - Avg.	1850	8	11	21.0
Darby Fork - Avg.	1300	8	10	16.2
Cooranbong - Avg.	800	7	9	12.7

Table 3, also shows that high productivity is achievable with BPCHs. All operators were enthusiastic about their particular brand of haulers. It should be noted that the author identified numerous factors that contributed to the productivity results in the United States mines and that the use of BPCHs was but one of these factors.
Two significant factors relating to the BPCHs observed in the mines visited were roadway conditions and the design and location of the battery charge/change stations.

Floor conditions were observed to be significantly better than typical Australian mines. This was in part due to geology, but, in this author's opinion, equally due to road maintenance procedures. In all PCM operations a designated roadway cleanup employee and scoop-tram were part of the production crew.

With regard to underground battery charge/change stations, all were designed to be simple and mobile. Charge/change stations were regularly advanced with the panel and kept within 500 m of the face line. As well as maximising battery life, operators stated that this system allowed better inspections and maintenance and, if a problem did occur, a quicker emergency response.

All charge/change stations were unmanned and no operators were aware of any significant incidence (e.g. fire) involving a charging station in recent years. This was confirmed by independent sources through the United States' Mines Safety and Health Administration (MSHA).

TENDER ISSUES

Tender specification

In may 1997 a tender was issued seeking the supply of a coal clearance system utilising BPCHs for use in PCM systems at Cooranbong Colliery. Features of the tender were:

1. The number of BPCHs was not specified. A coal haulage rate (tonnes per hour) was specified to match the cutting rate of the miner.

2. The performance criteria specified was:

- the system must be approved for use in NSW underground coal mines;
- System availability must exceed 97%;
- A coal haulage rate (tonnes per hour) from the continuous miner to the ratio feeder must be nominated and guaranteed under specified test conditions. This rate was to be verified once per month. A rate of 600 tonnes per hour would be necessary to match continuous miner performance; and
- The system must be compatible with conditions and the PCM process as practiced at Cooranbong Colliery

3. To submit a conforming tender, each tenderer had to spend at least 30 man hours underground to understand and be familiar with local conditions and mining processes.

4. Powercoal's preference was for a performance hire agreement based on tonnes hauled.

The tender was designed to ensure tenderers considered not only technology issues, but that they also consider how that technology would deliver performance as part of a total mining process. This caused tenderers to also consider issues such as wheeling routes, cycle times, charge station design and location, floor conditions and panel design.

It was Powercoal's intent to purchase performance rather than engineering potential.

Tender outcomes
After detailed evaluation, the tender was awarded to Long-Airdox Pty Ltd. Features of their offer included:

1. Detailed production cycle analysis including recommendations on pillar dimensions and wheeling routes to deliver superior productivity;
2. A battery management plan including charge station design and charging procedures;
3. The inclusion of a battery powered scoop-tram for roadway improvements and clean up;
4. Commitment to performance criteria - haulage rate and availability; and
5. Performance payments based on tonnes hauled.

Table 4 summarises technical aspects of the offer. Figs 1 and 2 show the Long-Airdox CHA818 Un-a-Hauler and Fig 3 shows the 488GLBC Un-a-Trac Scoop Tram.

The inclusion of the scoop tram was significant. Detailed modeling by Long-Airdox indicated a 1% improvement in roadway rolling resistance would deliver up to 20% improvement in unit productivity.

APPROVAL AND INFRASTRUCTURE ISSUES

Battery charge/change station

The Long-Airdox offer included a battery charge/changing station designed around a ground based turntable arrangement as shown in Fig 4. The turntable is powered by compressed air and allows discharged batteries to be uncoupled from the BPCH, the battery to be placed on charge and a fresh battery to be picked up. It is designed for single person operation. A single cut-through can accommodate two turntables that manages six batteries for two BPCHs.

The only disadvantage of the system is that the turntables are quite large and require some effort to erect. This renders the charge/change station less mobile and more difficult to construct. Battery charge/change stations observed in the United States often had the batteries simply sitting on the floor of a cleaned up roadway or hanging off chains from the roof. This made the charge/change stations simple and easy to move.

Table 4 - Technical description

Component	Specification
Battery Hauler	**Long-Airdox CHA818 Un-a-Hauler**
Number of Vehicles	3
Capacity	16.4 tonnes
Tram Speed	8 km/hr
Tram Height	1840 mm
Ground Clearance	310 mm
Mass - Empty (with battery)	28,530 kg
Max. Operating Grade	1:4
Batteries	3 per vehicle
Battery type	1375 Amp-hour lead acid
Scoop Tram	**Long-Airdox 488 GLBC Un-a-Trac**
Number of vehicles	1
Tram Speed	8 km/h
Tram Height	1575 mm
Ground Clearance	380 mm
Mass with battery	19,320 kg
Batteries	3 per vehicle
Battery Type	1000 Amp-hour lead acid
Load Capacity	9000 kg

To determine the best system, two charge stations were constructed - one turntable system and one ground based. For the ground based system, batteries are placed on the ground for charging and cooling and picked up using a jumper cable as shown in Fig 5. The jumper cable is managed by a lightweight monorail hung from the roof.

Both systems will be trialed for two months and a decision will be made on the preferred system.

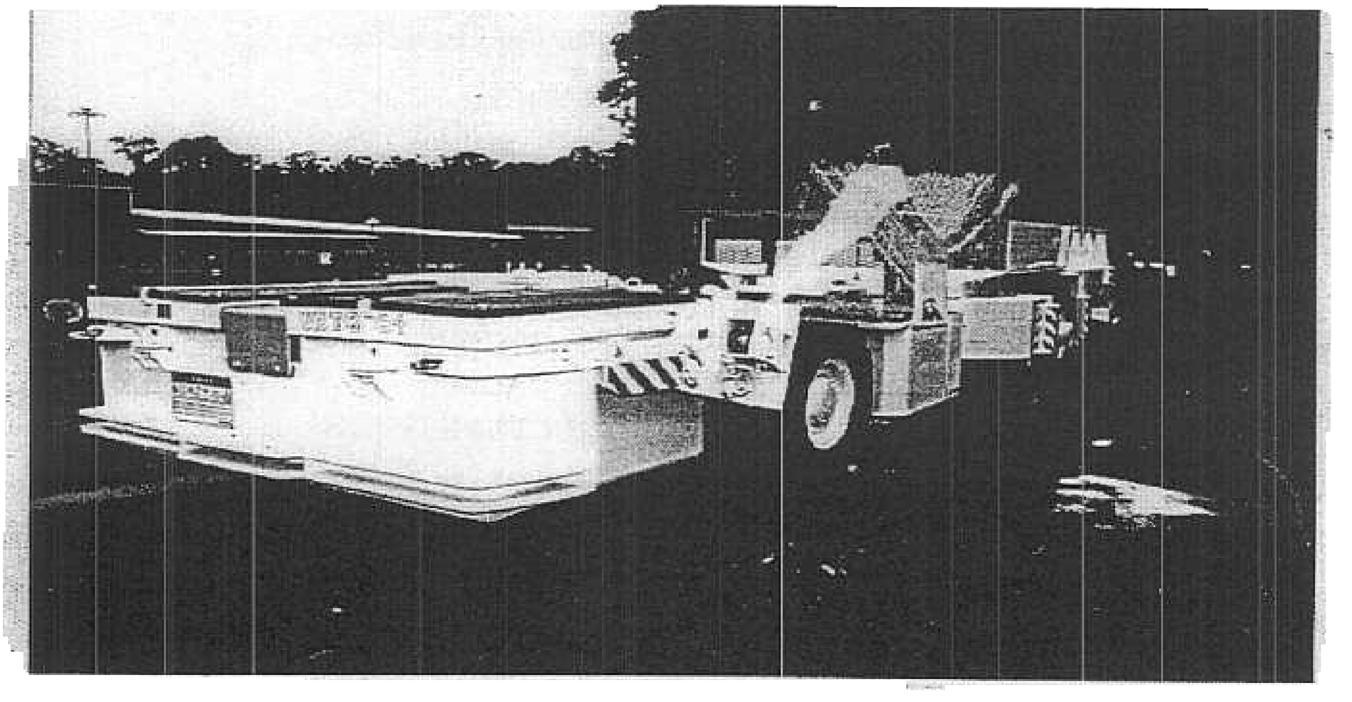

Fig. 1 - .Long-airdox CHA818 un-a-hauler - battery end

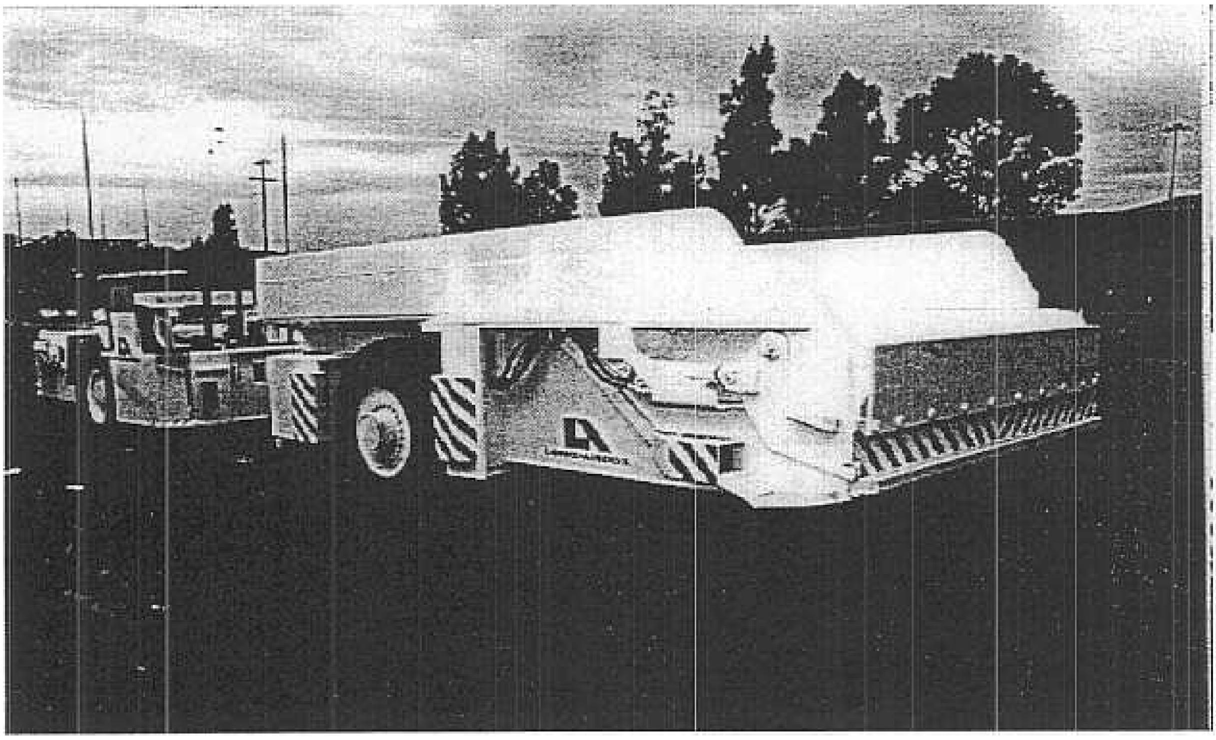

Fig. 2 - Long-airdox CHA818 un-a-hauler - coal discharge end

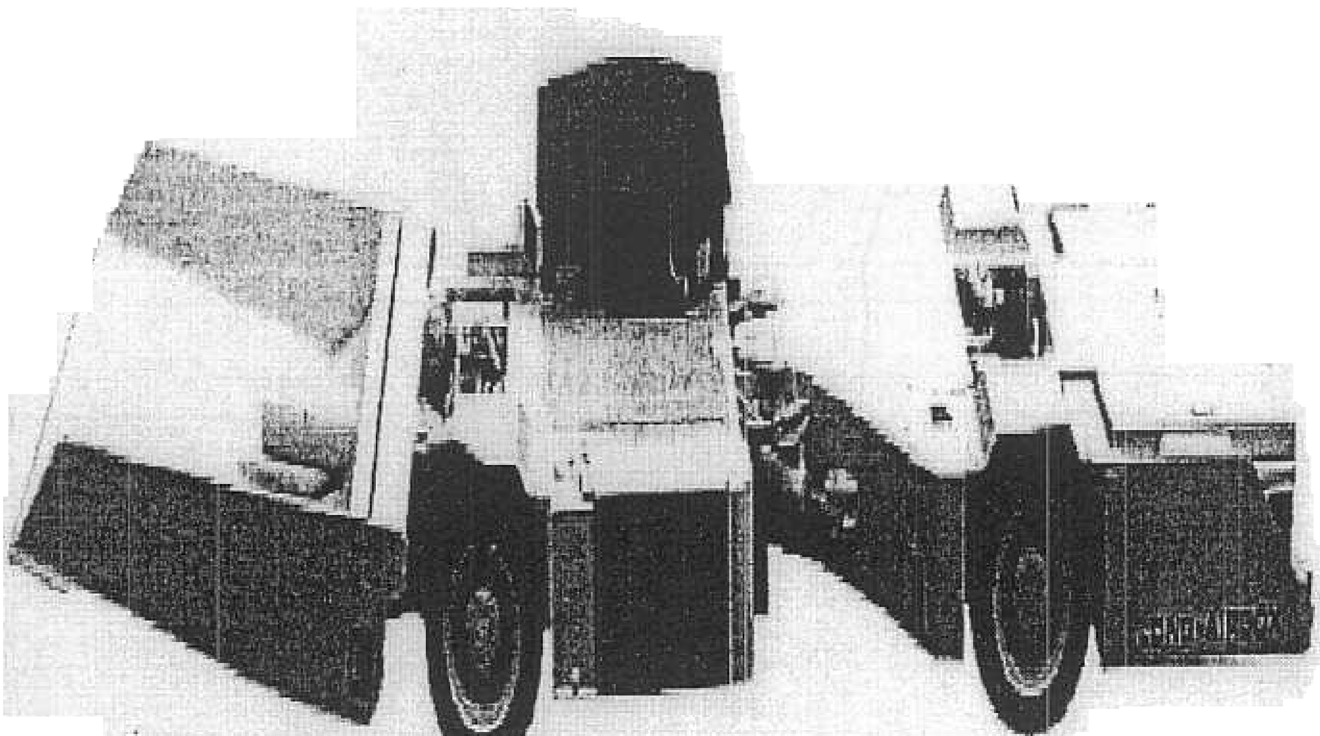

Fig. 3 - Long-airdox 488GLBC un-a-tram scoop tram

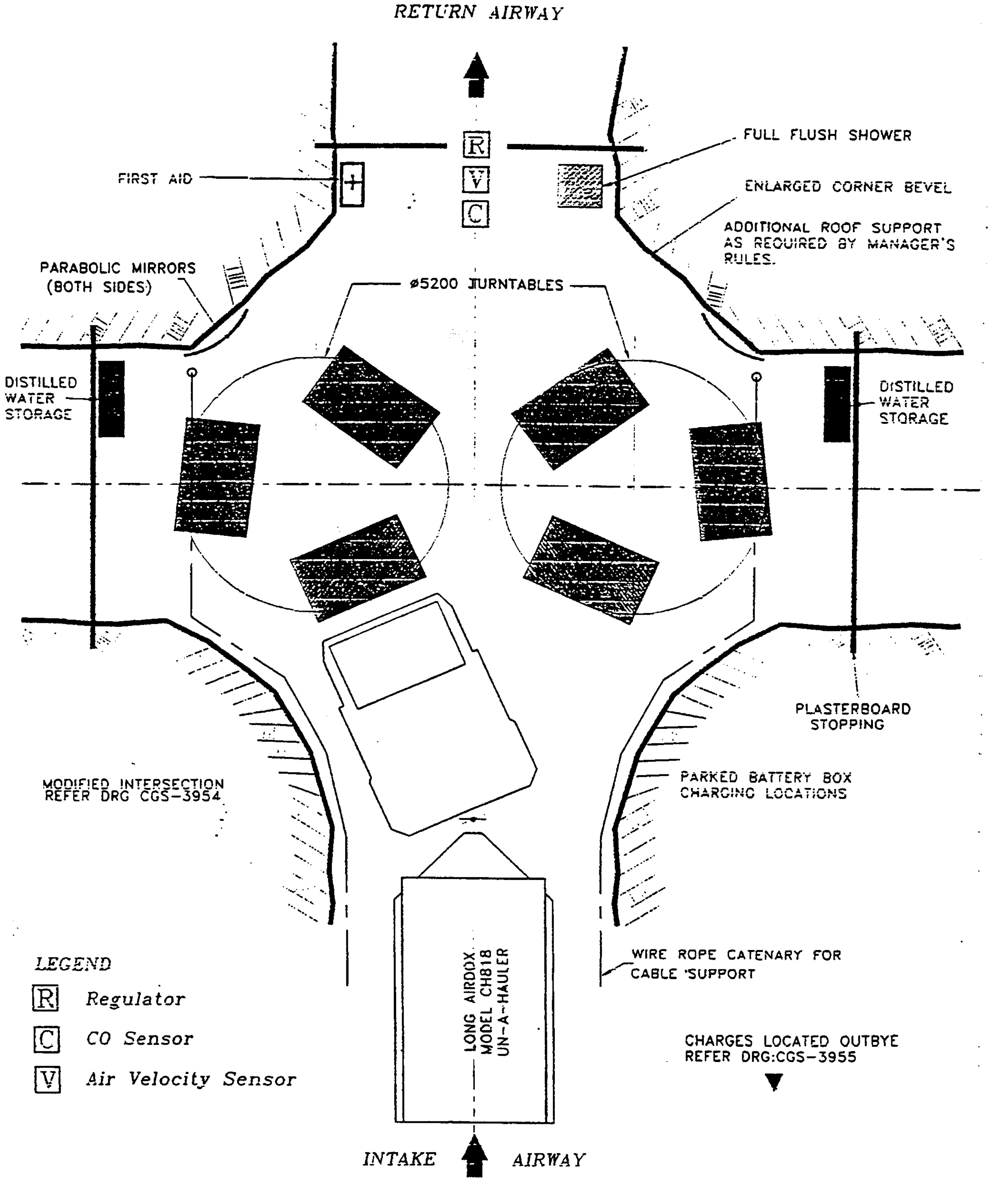

Fig. 4 - Battery charge/change station - turntable system

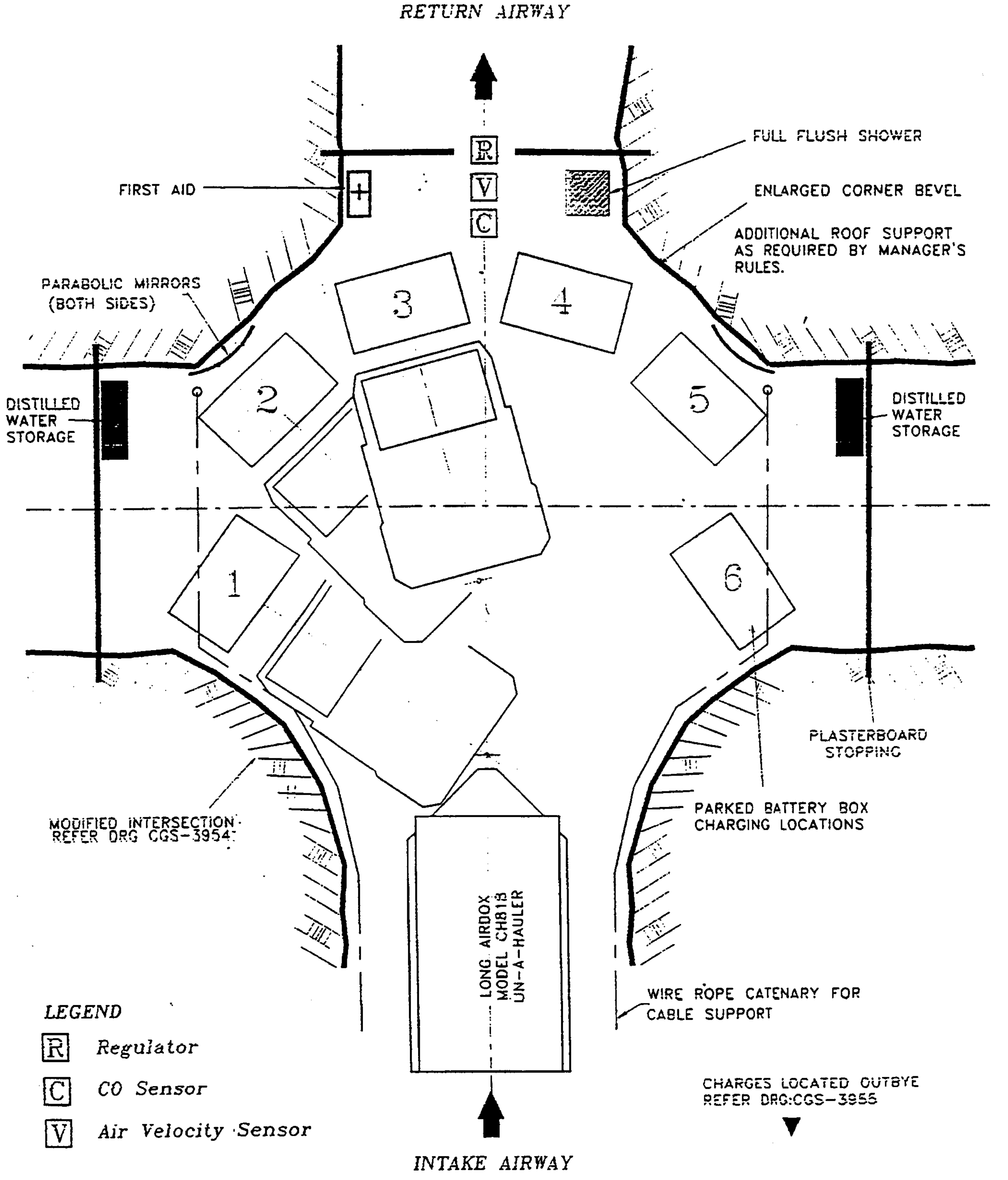

Fig. 5 - Battery charge/change station - ground based system

The Coal Mines Regulation (Electrical - Underground Mines) Regulation 1984, Clause 38 (b) (NSW Govt 1984) states:

"The manager of a mine shall ensure that every battery-charging station at the mine is –

1. *lined with non-flammable material;*
2. *provided with suitable and sufficient means for combating outbreaks of fire;*
3. *so designed and operated that the air from across the battery racks passes directly into return air, unless its situation is otherwised approved; and*
4. *continuously manned during the time that battery charging is in progress, unless a monitoring system approved for the purpose has been installed to enable battery charging to be performed unattended."*

Compliance with these provisions and other safety requirements is achieved by:

- The station is located outside the hazardous zone;
- Ribs stonedusted to a standard of not less than 90% incombustible content with stonedust wet applied;
- Floor thoroughly cleaned and stonedusted;
- Direct ventilation to return - 3 m^3/s - controlled by adjustable regulator; and
- Lighting, first aid equipment, telephone, signs, quick flush shower located at the charge station.

A Risk Review was undertaken and the following features are in place to gain approval for unmanned operation:

- CO monitoring with power trip and surface alarm;
- Air velocity monitor with power trip;
- Maintenance and inspection procedures;
- Safe Operating Procedures; and
- Provision to disconnect electricity from the surface.

Based on the above monitoring system, an application has been made to the Department of Mineral Resources (DMR) to have the station approved for unmanned operation. At the time of writing, approval for unmanned charging of short duration (up to two hours between shifts) has been granted.

Ratio feeder

Due to the coal discharge action of the BPCHs, a purpose-built ratio feeder is required incorporating an open, drive-in rear section. It was intended to use a Stamler BF-14B-9-7C Feeder Breaker with an open back and high sides. This type is commonly used in the United States. This design, however, could not be used in its standard form due to recent guidelines issued by the Department of Mineral Resources. The guidelines, titled MDG31 "Design Guidelines for Construction of Feeder Breakers", apply to all ratio feeders supplied after 1 January 1997. Clause 3.8.7 of MDG31 states:

"the inbye conveyor feed end shall be fitted with an end plate across the full width of the surge bin the height of which is equal to the lowest side plate for the remainder of the surge bin."

This clause does not permit the use of an open back feeder with high side walls. Officers from the DMR confirmed that the guidelines could only be satisfied by a "hard" barrier. "Soft" barriers such as warning lights and restricted access zones were not acceptable.

Stamler, after many "brainstorming" sessions with local and overseas engineers and involvement from colliery personnel, have designed a heavy duty plastic drive through barrier that is erected and hung from the roof. It must be dismantled, moved forward and re-hung from the roof with each belt move. The inclusion of the barrier also had some unintended consequences during the training programme. The barrier meant that shuttle cars and BPCHs could not use the same ratio feeder. A phased introduction of the BPCHs became difficult as detailed in a later section.

IMPLEMENTATION PROGRAMME

Risk reviews/HAZOP studies

Four formal risk reviews were carried out during the implementation process:

1. A risk review carried out by Long-Airdox to identify core risks as part of the Tender Conditions;
2. A risk review into the design, construction and management of an unmanned battery charge/change station;
3. A risk review into changing and charging of batteries at a charge/change station; and
4. A risk review into the operation of BPCHs in a PCM production unit including wheeling routes, discharge into the ratio feeder, battery management, ventilation requirements and roadway grades.

Each risk review team consisted of management, team leaders, operators and technicians from Long-Airdox. The risk review techniques used were based on DMR MDG 1010 "Risk Management Handbook for the Mining Industry". From each of the above, Safe Operating Procedures (SOPs) were developed for each process.

Some key risks identified during the risk review process were:

- Poor off-drivers side visibility while reversing a loaded BPCH;
- In the event of a ventilation failure, BPCH's must be immediately removed from the hazardous zone;
- The BPCH's operate with little noise and no trailing cable. There is increased risk of collision in a highly productive PCM unit; and
- Risk of crush injury of pedestrians while changing batteries in the battery charge/ change station.

Training

As part of their tender offer, Long-Airdox supplied a comprehensive training programme that incorporated:

- vehicle operation;
- battery management including charging/changing;
- engineering/103 Scheme inspections and maintenance; and
- troubleshooting procedures.

A trial area was set up on the surface with roadway/cut through dimensions painted on a paved area. A battery charge station was also constructed. Employees from all shifts were trained in the SOPs and appointed competent in writing by the Mine Manager.

Underground trials

Underground trials commenced on the 1 November 1997 in the Bay 1A panel. The battery charge/change station was located approximately 500 m from the face line. This location would allow a planned section move in December 1997.

It was originally intended to phase in the BPCHs by running one hauler with two Joy 15SC shuttle cars. As well as allowing improved operator training, there would be less risk to production results in the event of commissioning problems. The requirement for a hard barrier on the rear of the ratio feeder, however, meant that shuttle cars and BPCHs could not use the same ratio feeder.

As a compromise the open back ratio feeder was located as a side loading point one cut through behind the normal ratio feeder. Whilst allowing dual operation, the system was cumbersome (two feeder set ups per belt move including rear end barrier) and unproductive (the BPCHs had to travel an extra 200 m per cycle). Despite these inconveniences underground commissioning commenced in early November, 1997.

By allowing the BPCHs to run in parallel with the shuttle cars, focus has been on safe operation and operator familiarisation rather than productivity results. The parallel operation has also allowed battery charge/changing procedures to be reviewed and modified.

Battery management

From the outset, it has been emphasised to operators that battery changing is part of the production cycle. It must not left to maintenance teams or the "next shift". It is anticipated that each vehicle will require a battery change once per shift. To ensure hauler performance, it is essential the battery management procedure is rigorously applied. Each hauler is designated a turntable and a set of three batteries. In each eight hour production shift each of the three BPCHs must change their battery once.

The protocol developed is that on each production shift, hauler #1 will leave the face area for a battery change at the start of the first miner flit. It is anticipated that the battery changeout will take 15 minutes (excluding traveling time to the charging station). Haulers #2 and #3 will repeat this procedure at the start of miner flits two and three. Discipline in this area is critical to system performance.

Floor management

A key feature of high productivity PCM units in the United States is roadway management. A designated employee is permanently employed using a scoop tram for roadway cleanup and repairs. The advantages of this are:

- improved safety - slips, trips, falls;
- improved productivity - faster flits and wheeling;
- reduced machine maintenance and repair costs; and
- improved battery life.

A battery powered scoop tram is included as part of the coal clearance system and, as part of the supply contract with Long-Airdox, it has been designated to work solely in the vicinity of the BPCHs.

To further improve roadway conditions it is proposed to trial "dragging rails" beneath the BPCHs to systematically grade roadways during production. This technique has proven successful in a number of mining operations.

Manning and equipment

Equipment to be utilised in the PCM unit with BPCHs is:

- 1 x Joy 12CM12 Continuous Miner
- 3 x Long-Airdox BPCHs
- 1 x Long-Airdox Scoop Tram - roadway cleanup
- 1 x CRAM Mobile Roof Bolter

- 1 x 913 Eimco Roof Scaling machine
- 1 x Stamler Ratio Feeder

Manning will consist of one Team Leader, one Engineering Technician and nine Production Employees. Target productivity is 1500 tonnes per 8 hour shift or 19.5 tonnes per face man hour. This is consistent with United States' PCM results.

RESULTS TO DATE

A crucial aspect of the six month trial will be battery performance in the roadway conditions encountered at Cooranbong Colliery. At the time of writing, the battery powered scoop tram had not arrived. Systematic roadway cleanup as part of the production cycle, a key component of the system, will commence in January 1998.

Initial underground trials of the BPCHs has highlighted an issue that must be addressed by suppliers. Lead-acid batteries require "cycling" to reach maximum capacity. Advice is that to reach maximum capacity, a new battery will have to be cycled approximately 15 times. It has also been advised that optimum battery performance is achieved by loading the battery in a manner similar to its final use, that is, the cycling process is best carried out underground. For a single coal hauler with three batteries this requires approximately 15 days of operation to reach battery design capacity. From a production viewpoint this has a number of implications:

- if unit production is critical to the business, BPCHs must be used in conjunction with other coal clearance systems for a period of time;
- due to MDG31 guidelines, BPCHs and shuttle cars cannot share the same ratio feeder; and
- extra manning is required for little productive output during the cycling period.

Despite these commissioning issues the initial results are encouraging. Operator feedback is positive with drivers impressed with the ergonomic design of the operator's compartment. Driver comfort on rough roads is excellent due to the improved seating design. Operators also state that vehicle articulation delivers excellent manoeuvrability and less roadway degradation around corners. Discharge into the ratio feeder has so far been trouble free. The elimination of trailing cables is seen as a significant safety and operational improvement.

The vehicles have handled the roadway conditions well but battery performance has been difficult to evaluate due to battery "cycling" requirements during battery commissioning. No vehicles, however, have yet been bogged and four wheel drive assist has been used infrequently.

Battery charging/changing has been performed in both charge stations with operators stating a preference for the turntable system. When picking up a battery the hauler must be perfectly "square on" and level with the battery. The turntable system does this more easily than the ground based system. Some refinements to the ground based system are being considered.

The six month trial will continue until the end of June 1998. Periodic reviews of total system performance will be conducted during this time. A decision to extend the trial into a long term performance hire arrangement will be made at the conclusion of the trial.

CONCLUSION

Powercoal's Cooranbong Colliery has introduced battery powered coal haulers into the place changing process to improve safety and productivity. BPCHs have demonstrated high productivity and safe operation over many years in the United States' coal industry. The vehicles represent proven technology.

Powercoal's philosophy is to purchase performance rather than engineering potential. This is reflected in a partnering arrangement with the supplier, Long-Airdox, that incorporates:

- a six month trial period;
- performance based payments;
- guaranteed performance criteria - availability and haulage rate; and
- the option to extend the trial into a long term performance hire arrangement.

Limited operating experience to date clearly demonstrates safety improvements and improved flexibility compared to previous coal clearance systems.

Crucial to the success of the trial will be battery performance on the roadway conditions at Cooranbong Colliery. At present it is too early to draw any conclusions on this issue.