MYUNA
MULTI SEAM COLLIERY VENTILATION

By

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ABSTRACT

Myuna Colliery long term ventilation requirements were included as part of the overall planning of colliery construction and underground development.

Ventilation, during the simultaneous sinking of two drifts and the downcast shaft, was accomplished by established methods of ducted exhaust and blower fans. Drivages for the 3 seam interconnections of shaft and drifts were ventilated by extension and duplication of the exhaust systems.

Ventilation, for the below seam extension of the belt drift, construction of between seam and below seam bins, and the completion of a circular between seam drift, required a step by step changeover to a temporary main ventilation exhaust fan mounted adjacent to the top of the completed downcast shaft.

The second, permanent upcast, shaft was commenced and colliery production started one seam at a time, using the transport drift, while the underground bins, belt and between seam drifts were completed.

The upcast shaft was completed and a connection made in the upper seam, completing all contract mining and allowing the main fan to be erected.

The permenent twin centrifugal fan system was installed, commissioned and test run to full speed, while the mine continued to be ventilated by the temporary fan and while the initial colliery production connected the drifts to the upcast shaft.

The changeover was then made from the temporary to the new main fan system and full load, testing of fan flow, pressure, power and efficiency was carried out over two weekends.

INTRODUCTION

This paper deals with the broad aspect of ventilation methods for colliery development, some of the difficulties associated with ventilation of the colliery construction phases and the planning, specification, supply and testing of main ventilation system.

Concurrently with Myuna, a second colliery Cooranbong, was planned and developed. Cooranbong Colliery has basically a single level layout with a second seam to be worked in a separate area from the point where the first seam cuts out. Production requirements are the same as Myuna. Since Cooranbong reserves are under land, an additional upcast shaft could be planned later in the life of the colliery and on this basis, compromises were found to allow the specification of a common duty area for the ventilation fan systems for both mines.

MYUNA COLLIERY

Myuna Colliery was constructed for and is now operated by Newcom Collieries Pty. Limited to supply coal to the Electricity Commission of

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New South Wales, Eraring Power Station. The Colliery was designed to supply 1.2 million tonne of coal per year and for all main facilities to be suitable for expansion of output to 1.8 million tonne per year.

Evaluation of the coal seams in the Eraring area, for use in power generation, began in the late 1960's, detailed colliery planning started in 1977, and major construction contracts toward the end of 1978. Coal production started late 1981 and had reached 5,000 tonne by mid 1982, from 10 continuous miner unit shifts per day spread over 5 units installed in the 3 seams.

Colliery recoverable coal reserves are contained in the Wallarah, Great Northern and Fassifern seams with a maximum depth of about 140 m in the pit bottom area of the Fassifern seam and ranging upward to a 40 m minimum solid rock cover under Lake Macquarie.

The colliery underground development will extend from a pit bottom, under land on the western edge of the reserves and extend under the lake for distances up to 8 km and is expected to rely on the initial drifts for access and shafts for ventilation, for the life of the mine.

COLLIERY DEVELOPMENT CONCEPTS

The Myuna Colliery development concept was to provide separate cross measure drift access for men and materials and coal haulage and separate main intake and return ventilation systems.

The concept was also to develop, in the construction phase, so that at the end, each seam would have established man and material access, haulage by conveyor from an underground bin to the surface and established ventilation

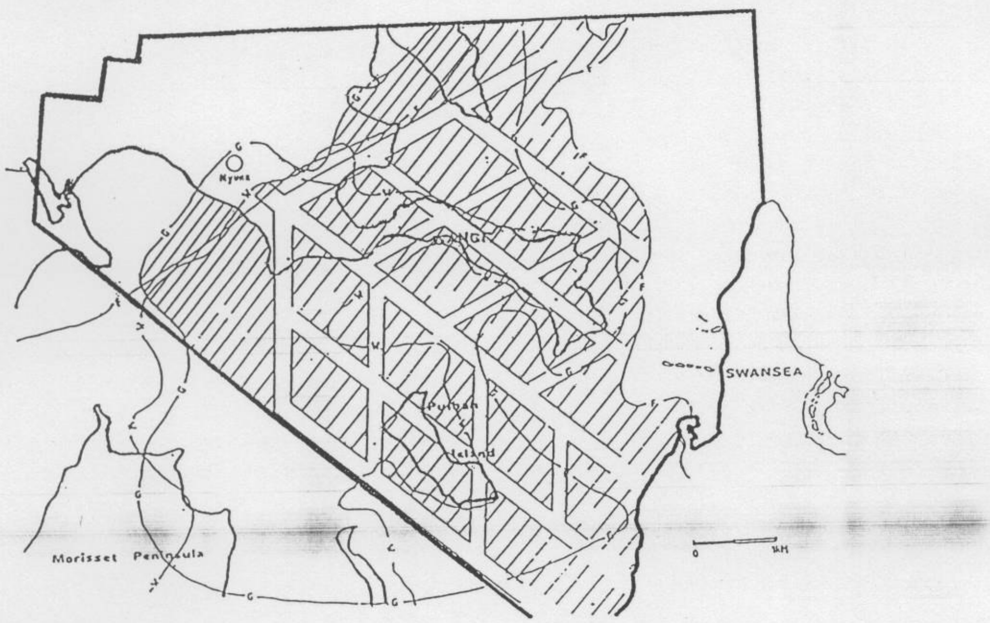

Fig. 1. Myuna - Limits of Colliery Development

circuits, to allow simultaneous start of colliery operations in all 3 seams, thus allowing rapid expansion to full production.

Separate contracts were let at about the same time, for shafts and drifts. The drift contract included the underground bins and some in seam drivage. The shaft contract included the majority of the in seam drivage and between seam circular drift.

The contracts were programmed to a common point for commencement of colliery coal production.

Fig. 2 indicates the extent of the colliery development by the shaft and drift contractors.

CONTRACT DEVELOPMENT

SHAFT CONTRACTOR

The 2 shafts were sunk sequentially, the first by full face drilling and second by bench drilling, all were mucked from a stage loader and concrete lined in a conventional cycle.

The downcast shaft was sunk first, with drivages in seam to the Great Northern and Fassifern seam bin positions, drivage of approximately 2/3 of the circular drift and subsequent connection of these workings to the belt drift.

The upcast shaft was then sunk to the Wallarah seam and drivage in this seam to the downcast shaft was completed before the sinking recommenced to the lower seams.

DRIFT CONTRACTOR

The 2 drifts were driven simultaneously with a conventional drill, blast, muck and roofbolt cycle.

The drifts were connected at the Wallarah seam, the Wallarah bin constructed and the connection extended to the downcast shaft.

The men and material drift was continued to the Great Northern Seam, where the pit both locomotive shunts were developed and connections made to the shaft contractors drivage.

The belt drift was continued on through the

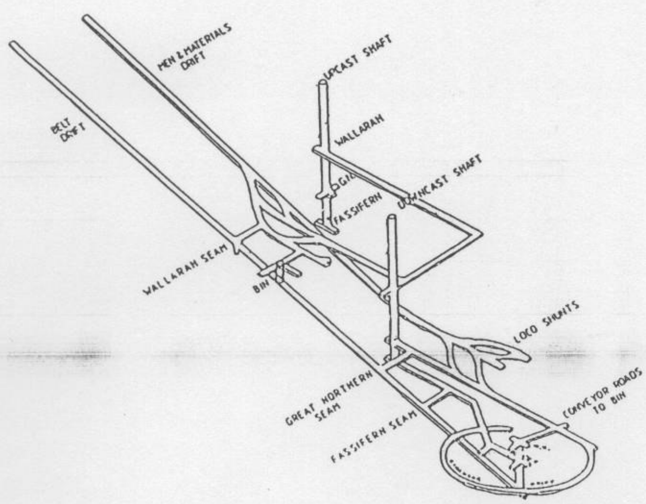

Fig. 2. Myuna Colliery - Contract Development

Great Northern and Fassifern seams to the below seam bin bottom position.

Using access provided in the Great Northern and Fassifern seams, the underground below seam bin and between seam coal pass were constructed and the circular drift was completed.

GENERAL

Other matters, related to construction methods, influenced construction ventilation.

The shaft contractors in seam drivage was mostly by road header miner, while that by the drift contractor was all by drilling and blasting.

Diesel powered load-haul-dump vehicles were used in the presink stage of the drift construction and for all in seam and between seam connections.

Methane gas was found to be present in the Great Northern and Fassifern seams.

Each drift and shaft with ventilation ductwork installed, was treated as a return airway for the purpose of the N.S.W. Coal Mines Regulations Act and all underground communication, electric control, motors and starters were either intrinsically safe or flameproof.

The significant quantity of carbon monoxide generated from blasting, was noted and this called for attention, particularly where new techniques were involved, before re-entry after blasting.

As the various interconnections were made, ventilation circuits changed and ventilation methods had to be modified, until at the end of construction, all interconnected roadways were ventilated by a single, temporary mine exhaust fan mounted at the top of the downcast shaft.

CONSTRUCTION VENTILATION

SHAFTS

A compressed air blower fan was used for ventilation, clearing shot firing fumes during the presink, and for collar construction.

The main shaft sinking ventilation system, comprised a surface mounted blower fan and steel duct, clamped to cables suspended from the surface.

The duct work was kept well above the floor of the shaft to minimise damage from blasting. Ventilation of the shaft bottom was achieved by a relatively high velocity of air leaving the duct.

The air quantity provided by this blowing method, was sufficient to maintain a reasonable time for clearing fumes from shot firing, before men re-entered this shaft.

DRIFTS

The drift ventilation was maintained by conventional surface mounted, electric powered, centrifugal fans exhausting from the face area through steel ducting laid on the floor at the side of the drift.

Compressed air powered axial flow blowers were used to push air through roof hung flexible ducting to the face of the drift, for initial ventilation of breakaways from the drift and for standing places.

Each exhaust system quantity was maintained in excess of the cumulative quantities of the blower fans installed.

DRIVAGE FROM THE SHAFT

For drivage from the shafts, the surface fans had been made to be turned on their foundations, to change from a blowing to an exhausting ventilation system and the vent tubes were extended from the shaft into the face area of the drivage.

The higher vent tube resistance of the shaft ventilation system eventually limited the use of diesel equipment and the length of efficient drivage possible with the shaft sinking ventilation equipment.

A second identical fan was then added in series, providing increased pressure to overcome duct resistance.

DRIVAGE FROM THE DRIFTS

From initial ventilation of breakaway with face blower fans, "T" junctions and regulators were installed in the drift duct to split the belt drift ventilation.

After a trial with a larger fan, and a check on tube resistance it was decided to install a second exhaust fan and large diameter tube system through the belt drift to separately ventilate the Wallarah seam drivage.

UNDERGROUND BINS

Long hole drilling and blasting was used for all underground bin construction and because this method involves shots being fired above inaccessible bin openings, it also requires careful attention, special inspection procedures and ventilation of bin cavities during the shot firing.

Positive ventilation of the bin cavity created by blasting from the bottom up was achieved by closing the door on the bin heading concerned and pulling air through the cavity and up through an open centre relief hole as indicated on Fig. 3.

CHANGEOVER FOR CONSTRUCTION

Following completion of the man and material drift the fan and duct were removed, to allow the permanent haulage to be completed and the drift was ventilated as a main intake.

The downcast shaft sinking equipment was transferred to the upcast shaft which was then started as a completely separate operation.

At that stage the remaining construction to be ventilated, involved completion of Wallarah seam drivage, construction of the portions of the

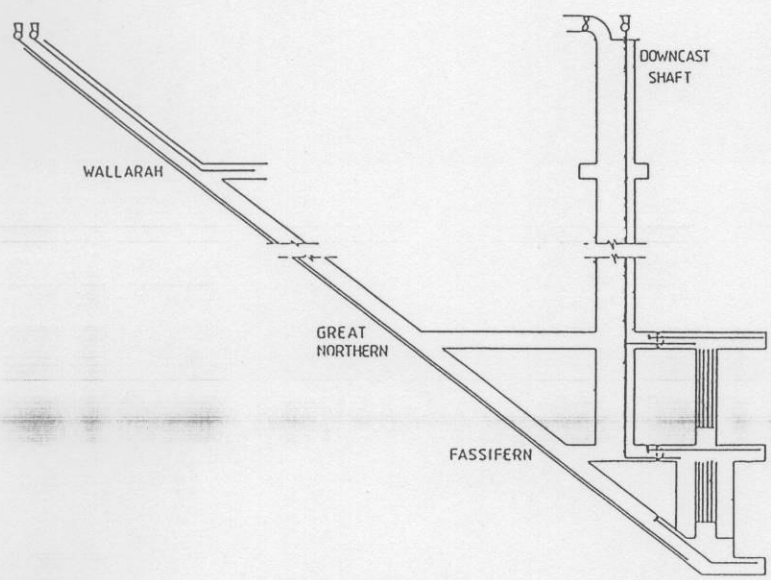

Fig. 3. Construction of Ventilation - Final Stage

lower seams bin, completion of the circular between seam drift, extension of the belt drift to form a sump and installing the drift conveyor system.

Fig. 3 shows a schematic arrangement of the final construction ventilation system used for the belt drift, bin construction and other drivages.

The downcast shaft vent tube was replaced by larger tube to reduce resistance and permit exhaust ventilation from multiple construction faces, still with a surface mounted auxiliary fan.

A Newcom owned 2.4m axial flow fan was installed to exhaust from the downcast shaft to provide initial ventilation from the start of colliery production and to provide a main ventilation circuit for the remainder of the construction.

The construction ventilation systems were progressively removed as the various interconnections were made and separate ventilation splits established down the drifts, around the faces in each seam and up the downcast shaft to the temporary main fan.

The permanent main fan system was installed after colliery operations reached the upcast shaft.

COLLIERY VENTILATION

Early Planning

Planning for the colliery permanent ventilation system commenced with consideration of various options for combinations of shafts, drifts and shaft diameters. The 2 shaft, 2 drift option was selected with consideration of capital cost versus operating benefits.

The 6.1 m shaft diameter was selected on the basis of capital cost versus net present value of future power costs.

Colliery Development Layout

The overall colliery development layout was decided as indicated on Fig. 1 generally based on the geological constraints of thinning of all 3 seams to the West and the limitation of 40 m solid rock cover requirements to the East.

The selected overall layout allowed the pit bottom plans to be developed for each seam and the extent of the contract drivages to be determined in a way that would fit in with the colliery development concept of rapid expansion to full production.

Fig. 4, showing the Great Northern Seam pit bottom layout, is included to indicate the system of separate centre main intake panels developing in 3 directions away from the downcast shaft and pit bottom area and main return panels for each main development direction, returning each side of the main intakes to the upcast shaft.

Ventilation Simulation

The colliery development plans were expanded to show detailed ventilation circuits on a predicted development over the 1st 5 years of operation in each seam with production building up 6,000 tonne per day from continuous miners operating in separate panel splits.

Development plans were extended to cover the predicted mine layout for a 10, 15 and 20 years, with ventilation for a maximum production rate of 9,000 tonne per day and used with test information for similar conditions to determine leakage and overall flow and pressure requirements to be included in the specification of the Myuna and Cooranbong permanent ventilation systems.

Figure 5 showing the Wallarah seam development is a revised 5 year plan of the type of layout used for estimates of ventilation requirements.

MAIN FANS

Specification for Tenders

A twin centrifugal fan system was specified and provision for a future increase in

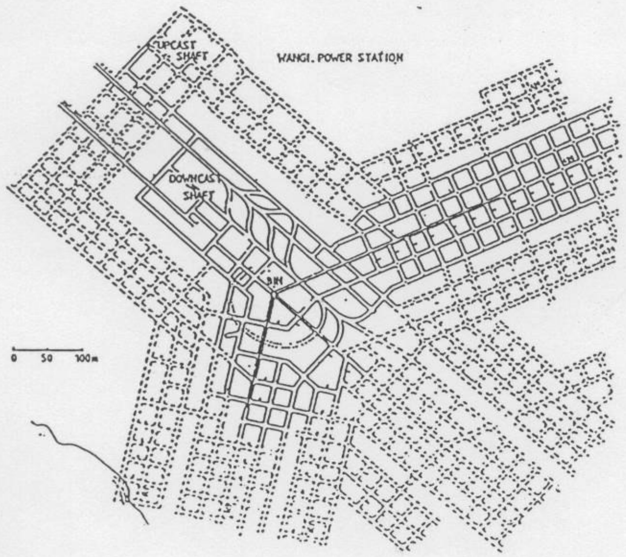

Fig. 4. Myuna Pit Bottom G.N. Seam

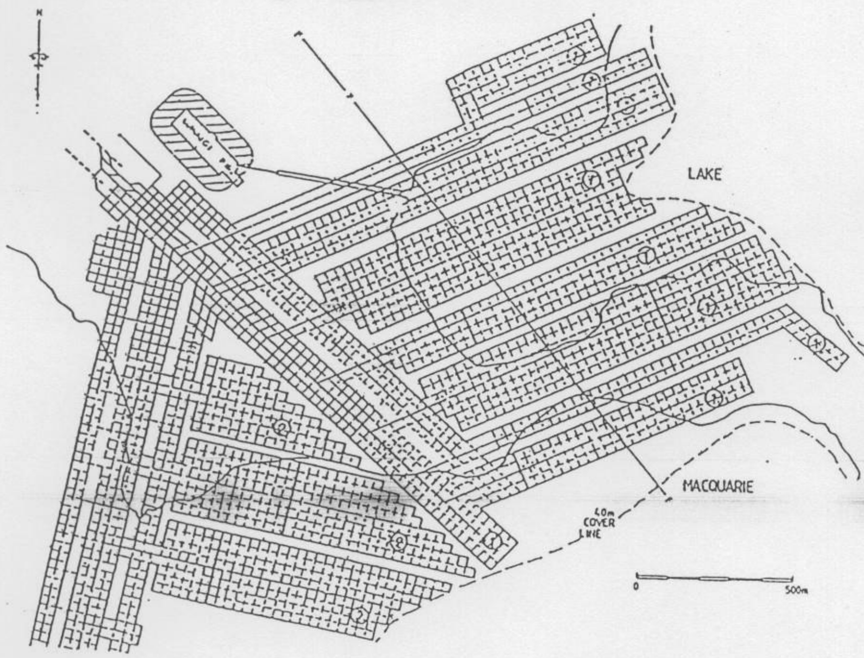

Fig. 5. Myuna - Wallarah Seam Development

performance was sought.

A detailed specification was drawn up indicating the progressive changes in the performance required to cover the predicted colliery life at maximum production rate and setting out the duty area for the fan system design.

The layout and scales of the tender graphs were specified to simplify comparison of quotations.

Guaranteed iso-efficiency lines were required on the tender graphs and penalties based on nett present value of future power costs resulting from inefficiency, were included in the specification.

Fan Arrangement

The main fan systems selected and now installed at Myuna and Cooranbong Collieries each comprise twin 3.8 m diameter centrifugal fans each driven by a 530 kW 375 RPM direct current motor with thyristor speed controllers.

The fan system includes shaft top turning elbow and "Y" shaped flow splitting duct, power operated, inlet dampers and outlet evasee.

The motor room includes individual fan speed controllers, a low tension electrical distribution, high voltage circuit breaker and an outside power supply transformer.

The fan room is pressure ventilated and the motors and speed controllers exhaust room air outside the building.

Figure 6 shows the general arrangement of the fan system and control room.

Damper Operation

The dampers on each fan duct are designed

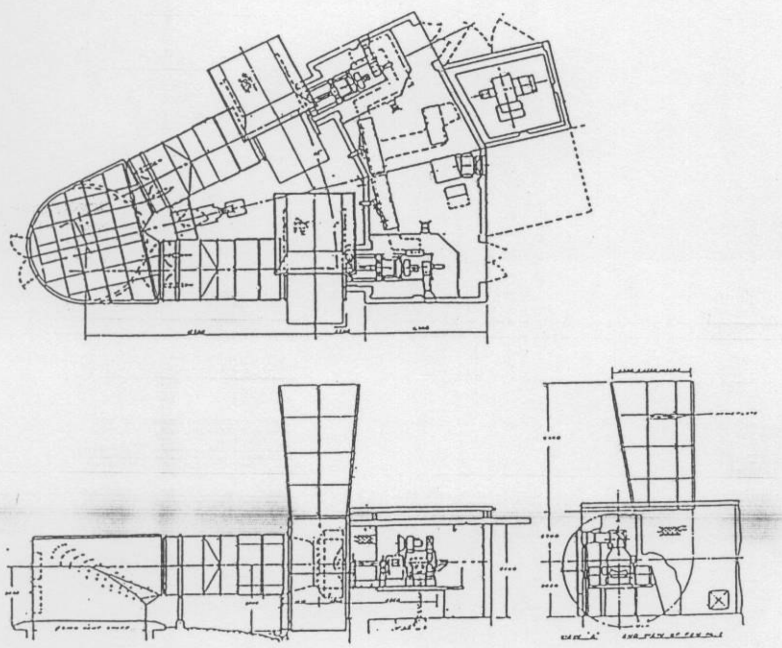

Fig. 6. Newcom - Twin Fan Arrangement

to automatically close when that fan is stopped or stops on fault, thus preventing short circuit of air through the fan that has stopped. Back up protection prevents run back on the fan that has stopped.

If power drops off both fans the dampers remain open allowing any natural ventilation to continue.

A pressure switch is installed with a transducer and control lines to cut off underground power supplies and raise alarms at the colliery or with an answering service when the mine is unattended.

Instrumentation and Alarms

A total head pressure probe is installed in this shaft 1 m below the collar.

Flow is measured by differential pressure on two piezometric rings mounted each end of the tapered inlet to the fan.

Direct reading pressure and flow (from differential pressure) gauges are mounted in the fan control room with transducers to provide remote indication and chart recordings. These, together with critical and non-critical alarms, are mounted outside the Undermanager's office.

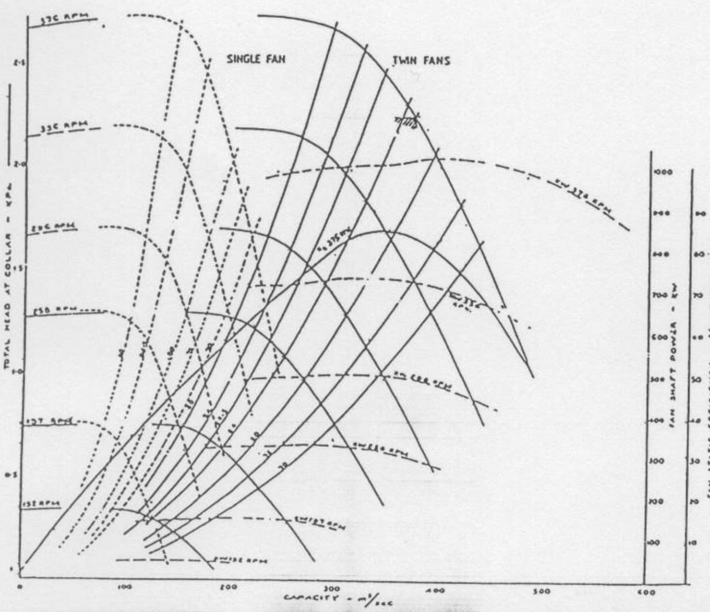

Fig. 7. Newcom - Ventilation System Performance

DISCUSSION

O. KREILIS (Southern Engineering Services): How much consideration was given to changing the method of mining. If a change was made from continuous miner operation to longwall operation and a longwall assembly was put in each seam which would mean three longwall faces, each capable of possibly producing 6,000 tonne a day, would the ventilation system be the stopping point? Because of manning and that, on the present planning for 9,000 tonne/day, it could quite easily be done on the number of people but could the system take say, an 18,000 tonne per day production rate? This seems to be quite possible out of that type of mine described and from personal inspection. But could the ventilation system take it and if not, how could this tonnage be attained if it was required?

R.J. THOMPSON (Newcom Collieries Pty. Ltd.): The ventilation system certainly would handle longwall comfortably, the problem is that the location of the coal seams under shallow cover under water does not permit conventional longwall production anyway. It would be nice to find a very short longwall that could be perhaps single heading development take a block of 50 metres and leave a block of 50 metres and do it in a better way than what is being done now with pillars left standing forever.

P. MITCHELL (BHP Steel Division Collieries): Has any provision or thought been given to either an alternate power supply or a secondary drive for the fans in case of a unit breakdown, especially when both fans are in operation?

R.J. THOMPSON: There was certainly some thought given to it. There is not a major gas problem. The twin fan system itself provides a secondary fan in the event of breakdown of any one part of the twin fan system. It was not considered, at this stage, necessary to provide diesel or some other form of power supply.