Improvement in ventilation in a fire affected mine

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Synopsis

Improvement in work place environment by conventional methods viz., installation of higher capacity fan, fans in parallel operation or booster fan is a risky proposition in many coal mines in India because of difficult geo-mining condition such as shallow depth, multi seam workings having thin parting and inter connected goaves one above the other. The situation is further worsened if the mines have fire affected sealed off area connected to different ventilation circuits. On many occasions circulation of more air quantity by increasing fan pressure have resulted in initiation of spontaneous heating.

To address these problems, authors have made some improvement in conventional Dynamic Balancing of Pressure Technique and worked out few ventilation schemes which are aimed for neutralization of pressure differential across sealed off area at the same time having improvement in ventilation in the mine. The excess pressure differential across sealed off area is mainly caused by introduction of higher capacity fan. Similar situation prevailed in one of the mines of Jharia Coalfield, India. The problem was solved by application of the above technique.

In this paper, brief description of the technique, the problem in the mine, results of investigation, computer simulation studies of various schemes and methodology adopted for implementation of the technique in the mine have been discussed in some detail.

Keywords: Dynamic Balancing of Pressure Technique, Spontaneous heating, Work place environment.

Introduction

The bord-and-pillar method of mining is most commonly adopted in Indian coal mines. Initially development and subsequently sectionalization of the panels is taken up to develop the entire mine. Finally, depillaring operation starts from the boundary either by adopting stowing or caving operations. The fan attains maximum pressure to ventilate far-off working districts. In this situation the possibility of imbalance of pressure across a sealed off area is maximum, particularly when the area lies between intake and return airways. If a sealed-off area is subjected to a pressure differential more than its critical value its pressure behaviour is likely to shift from normal to abnormal. Continuation for a longer period may lead to spontaneous heating. In many mines fire affected sealed-off areas are situated near pit bottoms connected to main intake and return airways providing ideal conditions for the onset of heating. At times such problems have resulted in permanent closure of the mines due to safety reasons.

Kacchi Balihari Colliery of Bharat Coking Coal Ltd. (BCCL), India, a mine having similar features, was facing acute ventilation problems[1]. The presence of a few fire affected isolated panels close to DC pits did not encourage the mine management to increase the air flow rate in the mine by enhancing fan pressure due to risk of reinitiation of heating in the sealed panels.

Comprehensive scientific studies were carried out by the authors for improvement in climatic conditions at workings, without endangering the safety of the mine. It revealed that an improvement in the climatic condition in the mine is possible with the implementation of dynamic balancing of pressure technique[2–4] around isolated panels so that the effect of an increase in fan pressure could be neutralized. The technique was implemented in the mine and has given encouraging results.

The technique

Fire in a sealed-off area can be controlled by reducing leakage of air. The leakage takes place into the sealed-off area when pressure difference across the sealed off area exceeds a critical value. This is indicated by pressure behaviour of the stoppings. The continuous leakage of air into sealed-off area does not occur when the pressure difference across it is below the critical value as indicated by the normal pressure behaviour of stoppings.

The critical value of the pressure difference across the sealed off area depends upon:

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© *The South African Institute of Mining and Metallurgy, 2003. SA ISSN 0038–223X/3.00 + 0.00. Paper received Mar. 2002; revised paper received Apr. 2003.*

- Cumulative pressure drop in the gallery around the sealed-off area
- Durinal change in barometric pressure
- Quality of sealing.

In this technique, to control/prevent fire in a sealed-off area, the pressure difference across them is brought below its critical value by maintaining the desired level of air pressure gradient in the ventilation circuit around the area. This is indicated by the shifting of abnormal pressure behaviour to normal. The basic requirements for implementation of this technique are:

- Ventilation survey data comprising a pressure and quantity survey to simulate the ventilation network on computer for deriving a suitable pressure gradient.
- Monitoring of the pressure behaviour of the stoppings round the clock.
- Conversion of the adjacent gallery connected to the stoppings into a pressure chamber with a regulator installed at the ends.

The main advantage of this technique is that once it is implemented around the sealed-off area, the pressure behaviour of stoppings can be further readjusted with the help of regulators provided in the system, if there is any change in fan pressure.

Particulars of the mines

Kachhi Balihari Colliery (10 and 12 Pit) under the Putki Area of BCCL is situated in the eastern part of India about 300 km from Kolkata. It has produced prime coking coal since 1901. It comprises workings in two seams: XV Seam (5.1 m thick) and XVI (5.8 to 6.55 m thick). The mine is served by 3 pits: pits No. 10, 11 and 12. The pit details are furnished in Table I.

The winning operation is now concentrated in XV seam as XVI seam is exhausted and sealed except a few galleries around the pits, which are opened for pumping water and inspection purposes.

Problem and brief history of fire in the mine

The climatic condition at the workings was rather oppressive, with temperatures exceeding the statutory limit (wet bulb temp. more than 30.5°C). The conditions could not be improved mainly due to the limitation in fan pressure to keep fire under control in panel-C, XV seam which occurred in early 70s. Subsequently, XV seam was drowned and workings were shifted to XVI seam. In 1987, XV seam was reopened after dewatering and fire recurred and subsequently the fire area was isolated from the rest of the mine by erecting 19 numbers isolation stoppings which could bring the fire under control.

In January 1997 the fire again burst through the roof near IS No. 9 after the operation of two fans in parallel mode to increase air quantity. The fire was again controlled by erecting two stoppings, 9A and 9B outbye of IS No. 9, stoppage of one of the parallel fans and short-circuiting some air around the pit bottom.

The measures, however, could control the fire to smoldering stage but the reduced amount of air circulation again deteriorated the environmental conditions at the workings.

Location of fire affected panel—C and ventilation circuit

Panel-C is situated in XV seam, below a caved panel of XVI seam, around 12 pit bottom isolated by 19 number of stoppings as shown in Figure 1. The stoppings are ventilated by two separate ventilation circuits. One circuit is to ventilate a set of stoppings from IS No. 9B to 1 connected with the main intake at 4L and main return at 0L in R_3 rise. The other one is to ventilate another set of stoppings from IS No. 10A to 19 connected to 12 pit (DC) bottom and 10 pit (UC) bottom. Regulators are installed in the gallery at entry points near IS No. 9B and 10A to regulate air quantity in these circuits. Sampling pipes are provided in stopping No. 5, 8C , 9B, 10A and 13.

Ventilation system

The mine is ventilated by an axial flow exhaust type fan No. 1 installed at the surface and connected to No. 10 Pit through a fandrift for ventilation of XV and XVI seams. Another axial flow fan of similar type No. 2 is connected to the same drift as standby. No. 10 pit acts as upcast for both the seams, whereas No. 12 and 11 pits act as downcast for XV and XVI seam respectively. In XVI seam, a regulator in main return near 10 pit bottom and a door near 11 pit bottom are installed to control the air flow rate. A schematic diagram of the ventilation network of the mine is shown in Figure 1. Details of the fan parameters are given in Table II.

Ventilation investigation

A ventilation investigation comprising pressure, air quantity and temperature survey, the study of performance of the main fan, study of the pressure behaviour of the stoppings and measurement of temperature inside Panel-C through stoppings was carried out in the mine while a single fan was operative. These investigations was aimed to collect data for computer simulation studies to identify suitable schemes, thereby designing and establishing dynamic balancing of pressure around panel-C to control fire as well as improve climatic conditions at the workings, PR 26 and Tippler section with two fans in parallel operation.

Pressure survey

For better a understanding the ventilation circuit may be divided into four circuits: Circuit I, II, and III in XV seam and circuit IV in XVI seam.

A pressure survey along the above circuits was carried out by 'hose and tailing' method. In fact, a 4-km length of airways was covered during, a pressure survey. Results of the pressure the survey carried out along circuit I, II, and III are graphically represented in Figures 2 and 3.

Circuit No.		
	I	Ventilation circuit from 12 pit bottom to the deepest level i.e. 15L, Tippler section in west side and PR-26 section in east side and 10 pit bottom via main return (R3 rise)
	II	Ventilation circuit for ventilation of a set of stoppings (IS No. 9B to 1) from 12 pit bottom to 4L and then to main return R3 at 0L
	III	Ventilation circuit for ventilation of a set of stoppings (IS No. 10A to 19) from 12 pit bottom to 10 pit bottom
	IV	Ventilation circuit in XVI seam from 11 pit bottom to 10 pit bottom via pump dip.

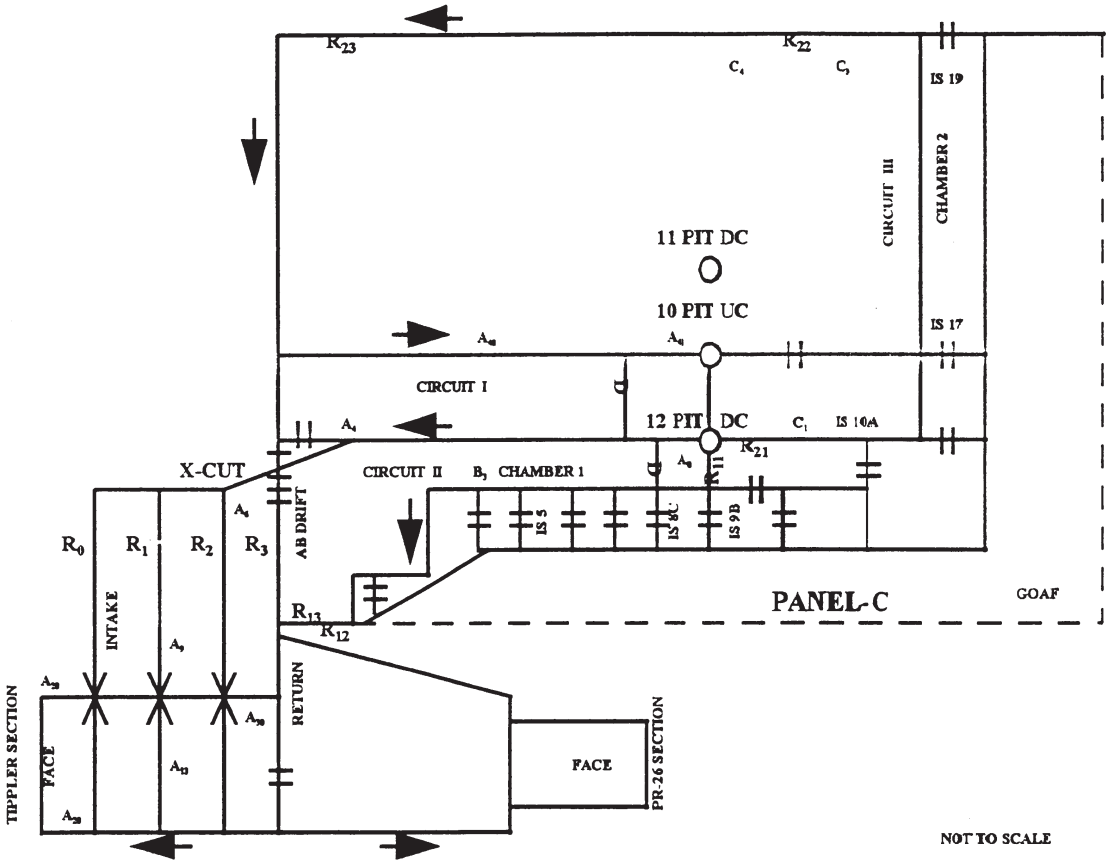

Figure 1—Schematic ventilation network of Kachhi Balihari colliery (BCCL)

From Figure 2 it is evident that the pressure loss in a few segments viz., cross-cut in main intake, AB drift and 10 pit shaft, a level was high which requires cleaning of debris and parallel path. Similarly from Figure 3 it can be seen that the pressure gradients in Circuits II and III are not identical because Circuit II is connected to circuit I at 4L whereas Circuit III is connected with 12 pit bottom. The pressure loss along 12 pit shaft level from 0L to 4L was creating pressure difference between IS No. 9B and 10A. It is worth while to mention here that this pressure loss was mainly due to the low height of the gallery and the presence of a fleet of tubs in the airways. A regulator in the gallery between IS 11 and 13 was absorbing 21 Pa pressure and creating a pressure imbalance between stoppings No. 11 and 13.

Table I

Details of the pits

Sl. no.	Pit no.	Depth (m)	Diameter (m)	Sunk up to	Purpose
1	10	213	5.5	XV Seam	UC
2	11	112	5.5	XVI Seam	DC
3	12	212	5.5	XV Seam	DC

Table II

Details of fan parameters

Parameters	Fan 1	Fan 2
Make	MMM	Voltas
Model	AF-80	PV-200
Diameter, mm	2000	2000
No. of blades	16	8
Motor, kW	115	110
No. of belts	8	7
RPM	657	960
Voltage,Volt	550	550
Current drawn, Amp	55	101
Fan pressure, Pa	150	200
Fan Quantity, m^3/sec	41.6	43.5

Circuit IV: In XVI seam a limited pressure survey was carried out in the circuit because the circuit was small and no appreciable pressure loss was measured in the gallery except across regulators.

- Pressure loss across door/regulator at 11 pit shaft level west side—10 Pa
- Pressure loss across door/regulator at 10 pit shaft level east side—118 Pa.

Air quantity survey

To assess the air quantity distribution in the mine, an air quantity survey was carried out at about 20 strategic locations using recently calibrated vane type anemometers. A summary of results is graphically represented in Figure 4.

The investigation revealed that there was recirculation of 1.2 m^3/s of air in the mine between the 4th level and the workings. The volumetric efficiency was about 28%.

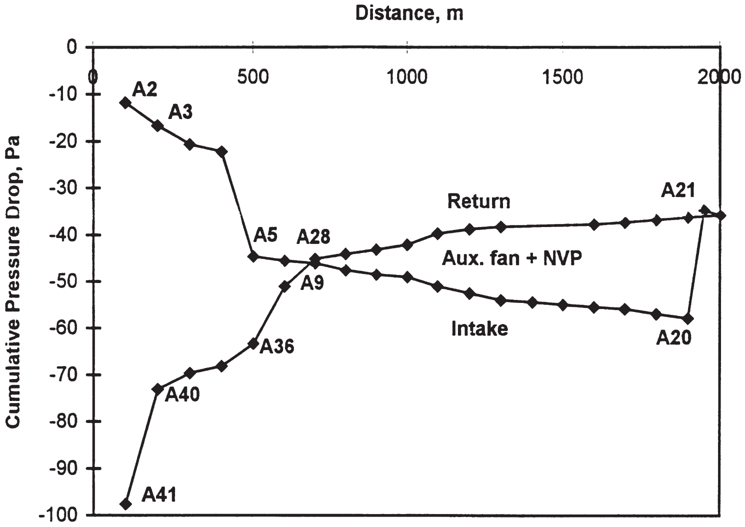

Figure 2—Pressure gradient along intake and return airways (Circuit I)

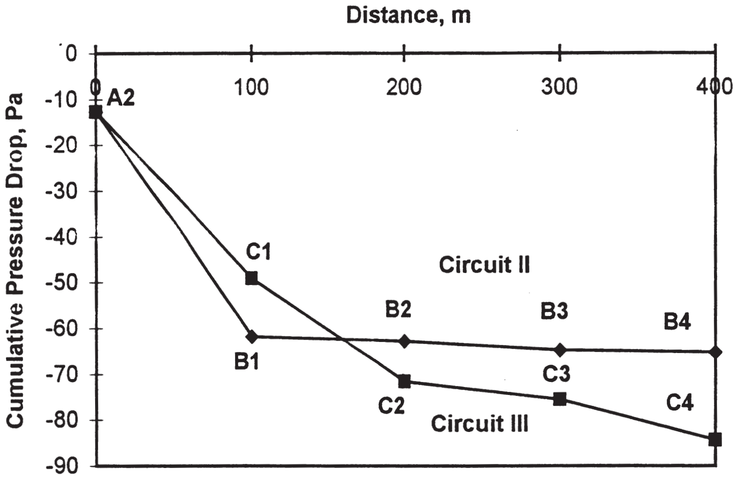

Figure 3—Pressure gradient along Circuits II and III

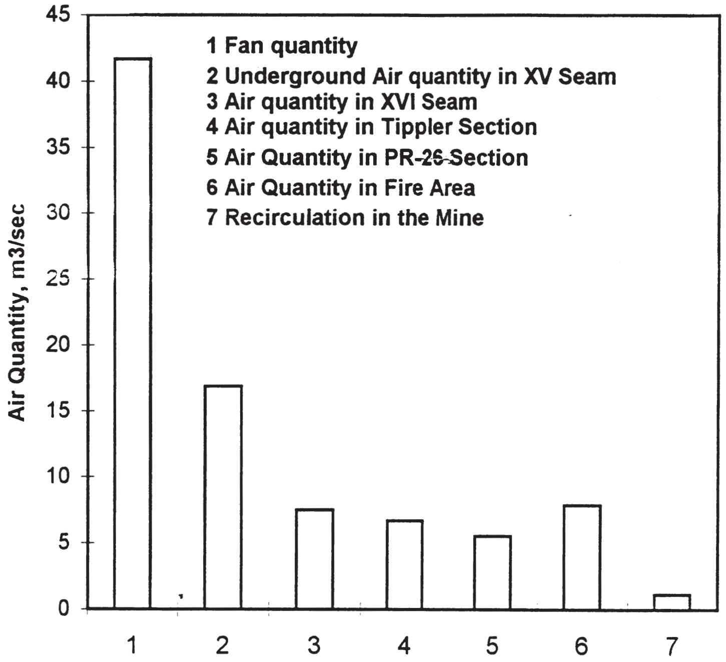

Figure 4—Summary of air quantity distribution in mine

Temperature survey

A temperature survey was carried out in the mine by whirling hygrometer to assess the climatic condition in the mine. Wet and dry bulb temperatures measured at different important locations are furnished in Table III.

From the Table it is evident that there is a sudden rise in wet bulb temperature from 28.5 to 30°C and humidity to 100% between 3L and 7L. This may be due to recirculation of air (about 1.2 m^3/sec) from return to intake at and below 3L.

Performance study of fans

Studies were conducted on both the fans installed in the mine by running them separately and subsequently in parallel operation. Three sets of measurements were taken by varying the resistance of the mine. Characteristic curves for fan 1 and 2 and their combined one running in parallel operation along with mine characteristics are depicted in Figure 5.

Study of pressure behaviour of stoppings

To study the pressure behaviour of stoppings of panel-C in XV, seam pressure across stoppings No. 5, 9B, 10A and 13 and barometric pressure with time were measured and are represented in Figures 6a, 6b, 6c and 6d. From Figures 6a to 6d, it is evident that the pressure behaviour of all the stoppings was almost normal when the fan was developing about 147.0 Pa pressure. In this case continuous leakage of air into the goaf is not possible. Results of the measurement of pressure of the stoppings and cumulative pressure drop in the gallery outbye of the stoppings are furnished in Table IV.

Measurement of temperature of the panel-C

The temperature of the sealed-off area (1.5 m inbye) was measured by a digital thermometer by inserting a probe through a sampling pipe provided in the stopping. Results are furnished in Table V.

From the Table it is evident that the temperature inside the sealed-off area was close to virgin rock temperature, indicating non-existence of fresh heating.

Arrangements proposed for effecting dynamic balancing of pressure technique

To neutralize the excess pressure differential across panel-C by the above technique, the following arrangements were proposed.

- ➤ The position of the gallery (circuit II) outbye of stopping No. 9B to 1 was treated as a chamber. Three regulators, one (R11) upstream of IS No. 9B and the other two (R12 and R13) downstream of IS No. 1 were proposed as shown in Figure 1

Table III

Results of temperature survey

Sl. no.	Location	Temperature°C wet/dry
1	12 pit bottom	26.5 / 27.0
2	Junction of R0/3rd level	28.5/29.0
3	Junction of R0/5th level	29.5/29.7
4	Junction of R1/7th level	30.0/30.0
5	Junction of 13 level/10 dip	30.5/ 31.0
6	Junction of 13 level/13 dip	31.3/31.5
7	Working at 14th level west/19 dip	34.0/34.0
8	Return, 18 rise/14th level	33.5/33.5

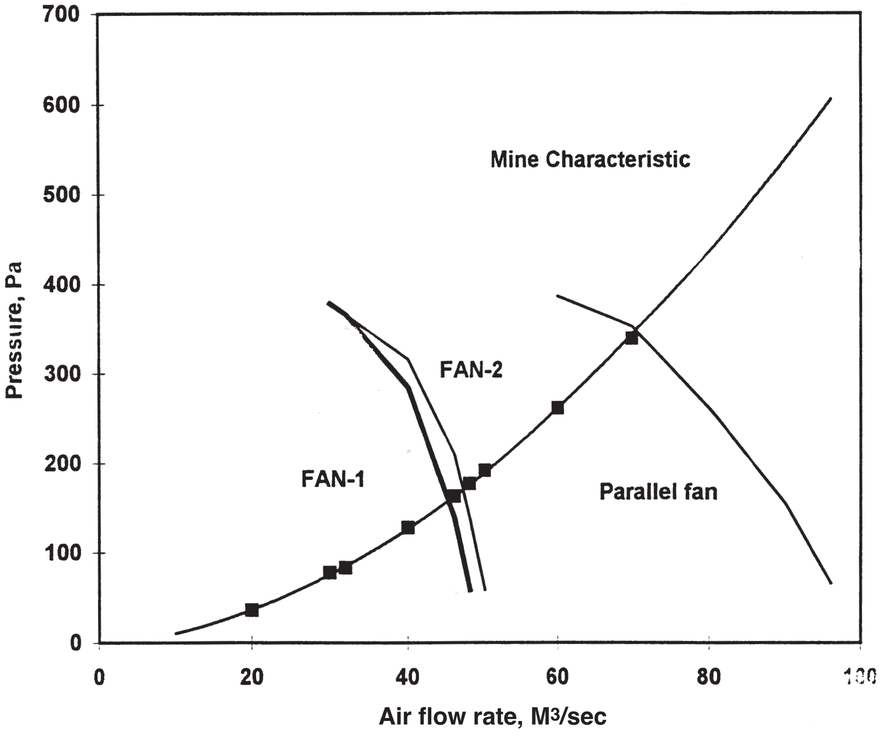

Figure 5—Characteristics curve of Fans 1 and 2

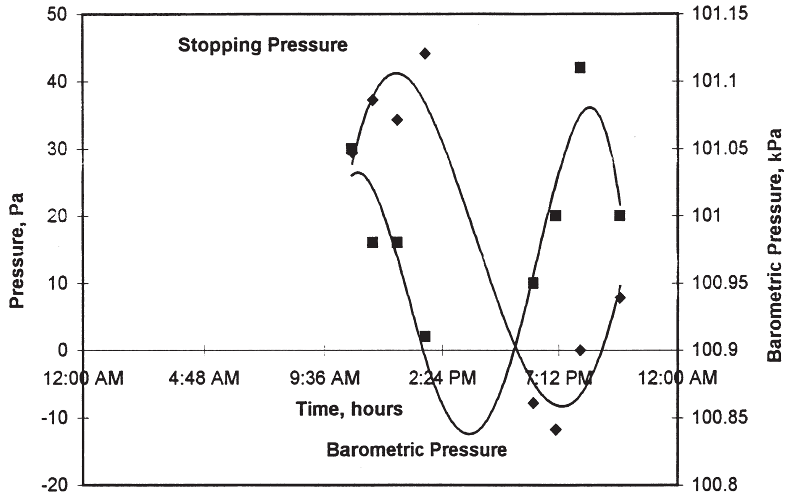

Figure 6a—Stopping pressure and barometric pressure with time of the IS no. 5

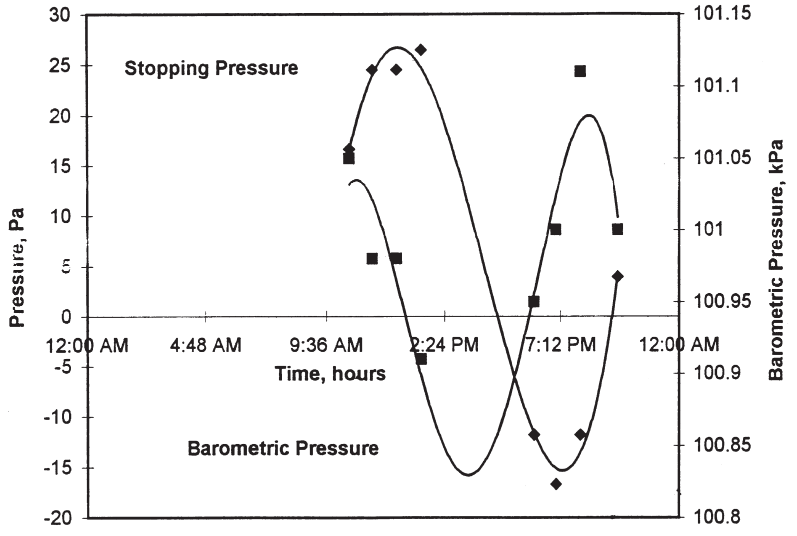

Figure 6b—Stopping pressure and barometric pressure with time of the IS no. 9B

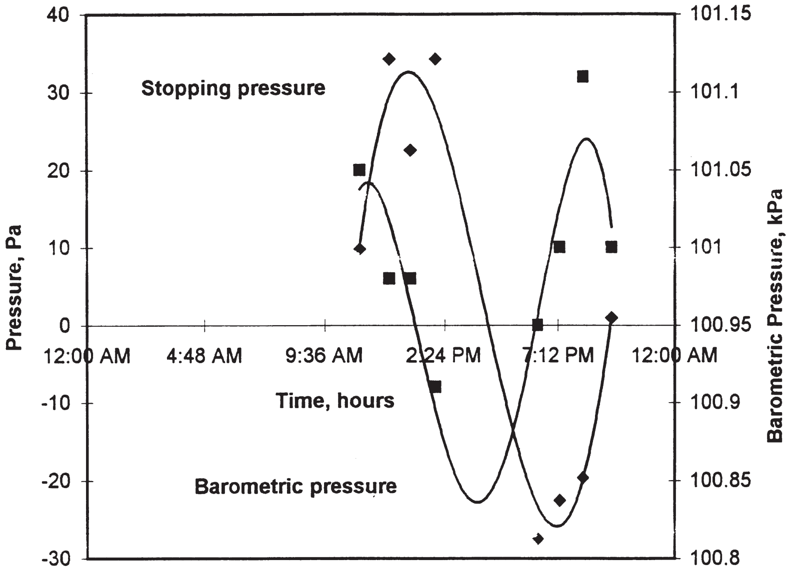

Figure 6c—Stopping pressure and barometric pressure with time of the IS no. 10A

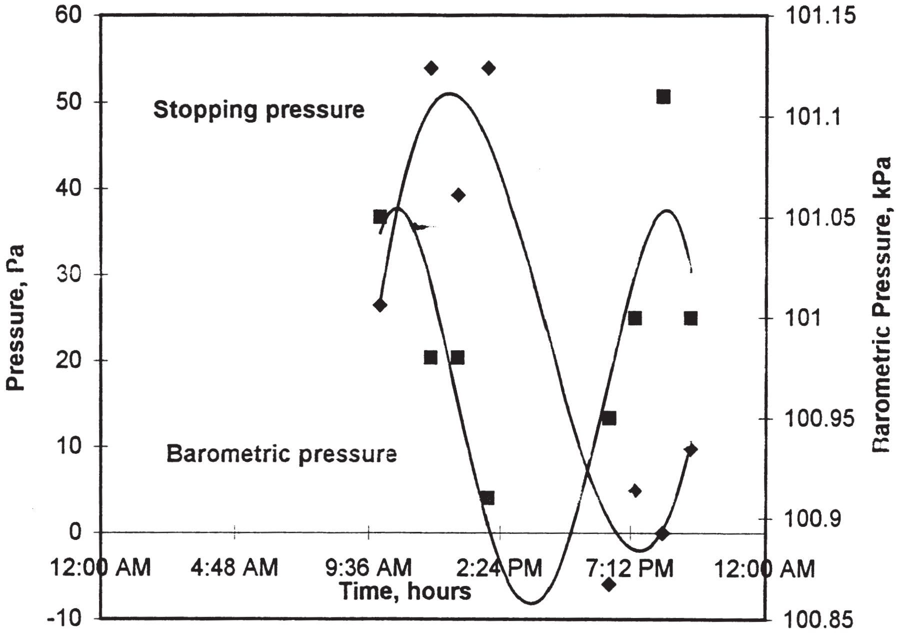

Figure 6d—Stopping pressure and barometric pressure with time of the IS no. 13

Table IV

Pressure of stoppings with cumulative pressure drop in the gallery outbye of the stoppings

Sl no.	Circuit no.	Stopping no.	Pressure of stopping, Pa	Cumulative pressure drop outbye of stopping, Pa
1	I	9B	+25	- 61
2	I	5	+ 29	- 62
3	I	1	*	- 67
4	II	10A	+ 15	- 50
5	II	13	+ 39	- 72
6	II	19	*	- 74

* indicates that no sampling pipe was provided

Table V

Temperature measurements inside Panel-C

Sl. no	Stopping no.	Temperature, °C
1	5	35
2	9B	34
3	10A	33
4	13	36

Table VI

Parameters for different schemes

S. no.	Scheme no.	Parameters number				
		1	2	3	4	5
1	1	✔	✔	✔		
2	2	✔	✔	✔		✔
3	3	✔	✔	✔	✔	
4	4	✔	✔	✔	✔	✔

- The segment of the gallery (circuit III) outbye of stopping No. 10A to 19 was treated as a chamber. Three regulators, one (R21) upstream of IS No. 10A and the other two (R22 and R23) downstream of IS No. 19 were proposed. Their locations are shown in Figure 1.

Further ventilation schemes with or without pressure balancing arrangements in the ventilation network of the mine were worked out. The main parameters considered for solutions are given below.

- Reduction in resistance of cross-cuts gallery in the main intake by about 40% by cleaning debris
- Provision of a parallel path in the main return i.e. along 10 pit shaft level from 4th level to 10 pit bottom via sump
- Regulation of air quantity in circuits II, III & IV
- Pressure balancing arrangements in circuits II and III
- Parallel mode of operation of two surface fans i.e. Fans 1 and 2.

Combining the above parameters into different combinations as given in Table VI, four ventilation schemes were worked out and their efficacy was ascertained by computer simulation studies of the ventilation network of the mine. Further, the design parameters of pressure balancing arrangements were also determined by computer simulation studies.

A summary of the results of computer simulation studies of four schemes are furnished in Tables VII and VIII.

The expected output as envisaged in scheme 2 are based on a network without a pressure balancing arrangement. From Table VII it is evident that in scheme 2 the increase in air quantity at the workings are in the range of 40–75%. From Table VIII change in pressure differential across panel-C is from 4 to about 68 Pa. The increase in the average cumulative pressure drop in chamber 1 and 2 from 56 to 204 Pa and 52 to 272 Pa respectively is expected. This may create

Table VII

Summary of results of computer simulation studies under various schemes

Sl. no.	Parameters	Existing	Scheme 1	Scheme 2	Scheme 3	Scheme 4
1.	Main Fan I. Pressure, Pa II. Air quantity, m³/s	 147 41.67	 167 41.0	 353 56.1	 167 41.0	 353 56.10
2.	Surface leakage, m³/s	6.88	7.42	10.77	7.40	10.77
3.	Intake to the seam, m³/s I. XVI seam II. XV seam	 7.42 26.47	 6.23 27.33	 9.88 35.43	 6.23 27.35	 9.88 35.43
4.	*XV seam* Intake, m³/s, to the I. Tippler section II.PR26 workings III.Fire area (IS 10A–19) IV. Fire area (IS 9B–1)	 6.70 5.55 4.38 3.52	 7.78 7.47 3.80 3.95	 9.62 9.72 3.48 5.18	 7.78 7.47 3.80 3.95	 9.62 9.72 3.48 5.18
5.	Recirculation of air in XV seam below 4Lm³/s	1.17	0.60	Nil	0.60	Nil
6.	Pressure drop across regulator of Chamber 1, Pa - at entry point (R11) - at exit point (R12 & R13)	 29 -	 51 -	 129 -	 26 27	 10 141
7.	Pressure drop across regulator of Chamber 2, Pa - at entry point (R21) - at exit point (R22 & R23)	 35 -	 100 -	 243 -	 55 44	 59 190
8.	*XVI seam* Presure drop across regulators near - 11 pit bottom - 10 pit bottom	 10 118	 7 146	 57 238	 10 146	 67 262

Table VIII

Cumulative pressure drop around panel-C and pressure drop across the panel and across the parting under different schemes

Parameters	Existing	Scheme 2	Scheme 4
XV seam Chamber 1 Cumulative pressure drop (Pa) outbye of stopping No.			
9B	53	199	81
1	59	208	88
Average	56	204	85
XV seam Chamber 2 Cumulative pressure drop (Pa) outbye of stopping No.			
10A	46	264	81
19	58	280	90
Average	52	272	86
Presure differential across panel-C between chambers 1 and 2	4	68	1
XVI seam Cumulative pressure drop in the outbye of sealed-off area of XVI seam	15	65	76
Pressure difference across parting between XVI seam to chamber 1, XV seam	41	139	9
Pressure difference across parting between XVI seam to chamber 2, XV seam	37	207	10

Table IX

Design parameters for dynamic balancing of pressure

Regulator no.	Location	Circuit no.	Pressure difference, Pa	Air quantity m³/sec	Size, m²
XV Seam					
R11	Entry point of Chamber 1	II	10	3.48	1.34
R12	Exit point of Chamber 1	II	88	3.48	0.45
R13	Exit point of Chamber 1	II	53	3.48	0.58
R21	Entry point of Chamber 2	III	59	5.18	0.82
R22	Exit point of Chamber 2	III	100	5.18	0.63
R23	Exit point of Chamber 2	III	90	5.18	0.66
XVI Seam					
Shaft level near 11 pit bottom	—	IV	68	9.88	1.30
Shaft level near 10 pit bottom	—	IV	235	9.88	0.70

a substantial pressure differential in panel-C across and along the seams. The increase in pressure differential across parting towards chamber 1 and 2 are 139 and 207 Pa respectively. This may lead to reinitiation of spontaneous heating in panel-C.

The expected output as envisaged in scheme 4 is based on a pressure balancing arrangement. The increase in air quantity at the workings is in the range of 40–75%. From Table VIII it is evident that the increase in average cumulative pressure drop between chamber 1 and 2 is from 56 Pa to 85 Pa and 52 Pa to 86 Pa i.e. an increase in cummulative pressure drop of 29 and 34 Pa respectively. Similarly the expected increase in cumulative pressure drop outbye of XVI seam would be 15 to 76 Pa. The pressure differential across the panel (the difference of average cumulative pressure drop between chambers 1 and 2) is about 1 Pa.

Thus it is expected that there would be only a marginal change in pressure drop along and across the seam around the panel. Therefore scheme 4 is found suitable for implementation.

The design parameters for dynamic balancing of pressure are calculated from Table VII and are furnished in Table IX.

Establishment of dynamic balancing of pressure

The measures envisaged in scheme 4 were implemented. In the scheme, six regulators, R11, R12 and R13 in circuit II and R21, R22 and R23 in circuit IIII were installed as per specifications given in Table IX. Locations of the regulators are shown in Figure 1. Two regulators, one in shaft level near 11 pit bottom and the other one in shaft level near 10 pit bottom were installed as per specification given in Table IX. Ventilation measurements for fan pressure, fan quantity, air quantity available at the workings and pressure drop across regulator were recorded. Details of the measurements are furnished in Table X. The pressure of the stoppings (namely 5, 9B, 10A and 13) and barometric pressure at the outbye of the stoppings were simultaneously recorded with time. Results are graphically represented in Figures 7a to 7d.

Table X

Measurements after implementation of scheme 4 and its comparision with the single fan operation

Sl. no.	Parameters	Single fan operation	Parallel fan operation
1.	Main Fan (Fan 1) I.Pressure, Pa II. Air quantity, m³/s.	 147 41.67	 Fan 1–323 Fan 2–320 Fan1–33 Fan 2–34.7
2.	Surface leakage, m³/s .	6.88	13.8
3.	Intake, m³/s, to the I. Tippler section II.PR26 workings	 6.70 5.55	 12.0 10.8
4.	Recirculation of air in XV seam below 4Lm³/s	1.17	0.0

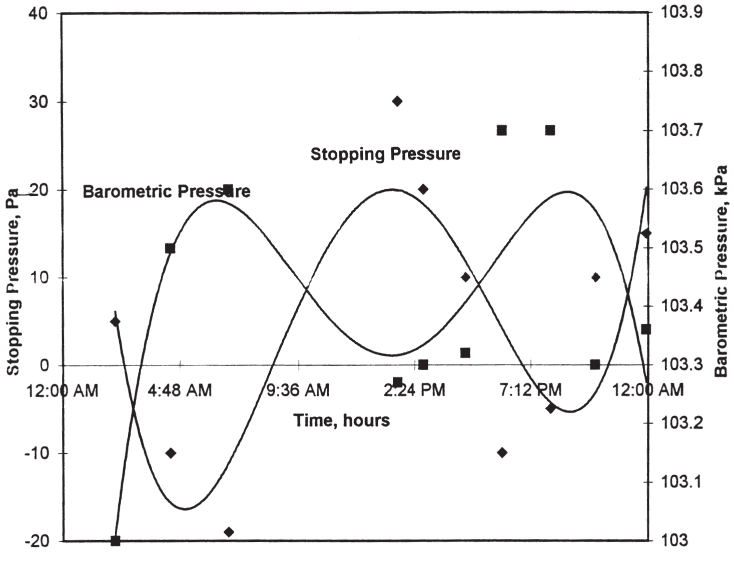

Figure 7a—Stopping pressure of IS no. 5 and barometric pressure with time after parallel operation of fans

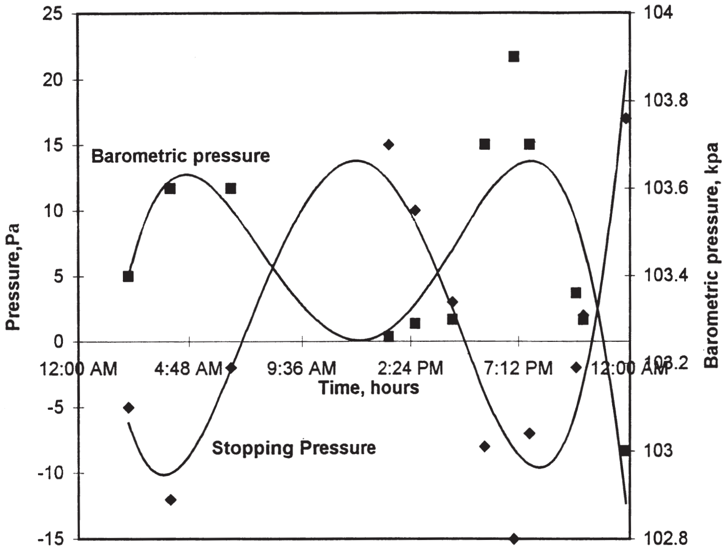

Figure 7b—Stopping pressure of IS no. 9B and barometric pressure with time after parallel operation of fans

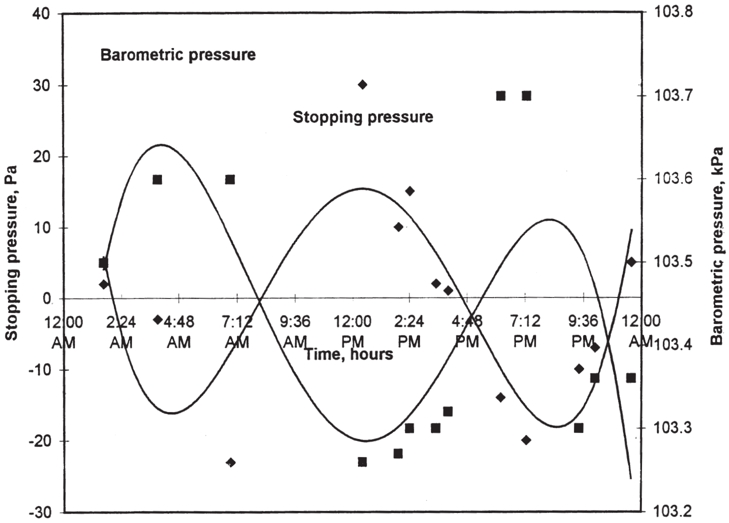

Figure 7c—Stopping pressure of IS no. 10A and barometric pressure with time after parallel operation of fans

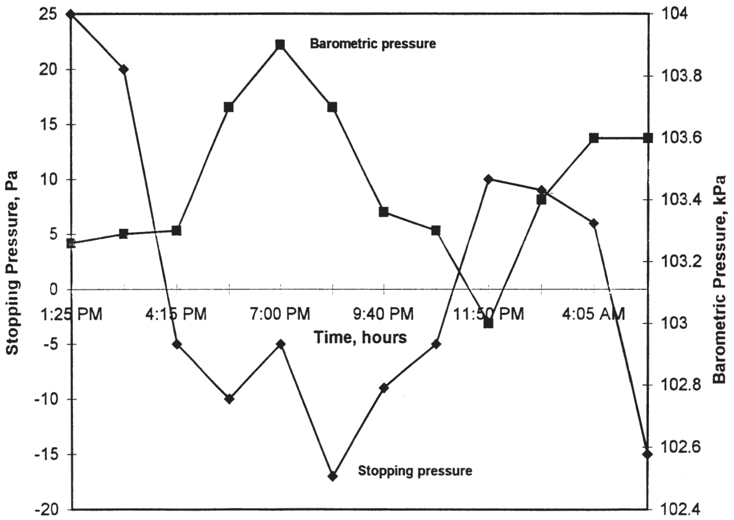

Figure 7d—Pressure of stopping and barometric pressure of the IS no. 13 with time after parallel operation of fans

It has been revealed from Table X and Figure 7A to 7D that in air quantity at the face was almost double of the existing value without any recirculation and pressure behaviour of all the stoppings of panel-C would be normal.

Conclusions

The detailed field investigations in the mine in stages covering ventilation survey, pressure behaviour of stopping, performance studies of fans under single and parallel mode of operation, in-depth computer simulation studies, pressure behaviour of stopping after parallel operation of fans led to the implementation of scheme 4.

Ventilation measurements recorded after implementation of the scheme 4 confirmed that two fans 1 and 2 may be operated in parallel for improvement in the climatic condition at the workings without enhancing the risk of heating in sealed panel-C provided the measures suggested in the scheme are carefully maintained.

Thus by application of this technique, fire in sealed panel can be controlled/prevented even after increase in fan pressure for circulation of an adequate air quantity in the mine. The technique is general enough for application in other mines under similar conditions.

Acknowledgements

The authors are thankful to the Director, Central Mining Research Institute, Dhanbad for his kind permission to publish the paper. The authors sincerely acknowledge the help rendered by mine management and Sri A. Ansari of CMRI during the field investigation and execution of the technique in the mine. The opinions expressed in this paper are those of authors and not necessarily of the organization to which they belong.

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Environmental Sustainability Award for Skorpion Zinc*

Skorpion Zinc was awarded the IAIAsa Premium Award at the International Association for Impact Assessment (SA Chapter) Annual Conference at the Wilderness on 2 September. This highly coveted award is presented in recognition of excellence for projects that are developed, planned and managed for the benefit of the sustainability of human society and the environment.

Environmental consulting firm WSP Walmsley was involved as part of the team at Skorpion Zinc, from the exploration phase in 1997 through a full Environmental Impact Assessment, compilation and implementation of an Environmental Management Plan during the construction phase, to the development and certification of an ISO 14001 Environmental Management System for operations.

The project is particularly noteworthy because of its location in the pristine Sperrgebiet in south-western Namibia, an area listed as one of the world's top biodiversity hotspots. The desert environment is so sensitive to disturbance that a set of tracks can endure for decades. For this reason, it was essential to enforce strict environmental management from day one.

The goal was achieved through the dedication of numerous people, particularly the effort of project manager, Norman Green and his team, environmental manager Michele Kilbourn Louw, on-site environmental co-ordinator Michelle Yates and her team, as well as the environmental consultants, WSP Walmsley.

Some of the highlights of the project include:

- A waste separation and recycling programme on site
- An Environmental Code of Conduct signed by all site personnel
- Strict track and litter control
- A full-time environmental co-ordinator on site
- A massive plant rescue and relocation programme
- Innovative designs to reduce water consumption
- Vegetation and air quality monitoring
- EIAs for all support infrastructure e.g. air strip, water pipeline and powerline.

Not many fast-track projects could live up to Skorpion's slogan of 'Get it right first time, every time', yet consensus is that the Skorpion Zinc Project has set the benchmark for profitable business ventures at minimum cost to the environment. When it is fully operational, Skorpion Zinc is expected to contribute 4% to Namibia's GDP. ◆

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Mining products win prestigious SABS design institute awards*

The Ekscalibur Water Cannon and Pump Control Valve, both from Hydropower Equipment, have won prestigious SABS Design Institute awards in the engineering category. The awards, which focus on industrial and engineering and design excellence, were announced at a gala event at Gallagher Estate in Johannesburg on 4 September 2003.

The designers and manufacturers of fifteen products that have already proven successful in the market-place received awards at this, the 34th annual event.

The Ekscalibur Water Cannon

The Ekscalibur Water Cannon is a water-jetting gun that releases a sizeable 100 kW of power to move broken rock in mines. This is approximately three times the power of a traditional hand-held jetting gun.

The reaction force of this powerful jet necessitates the need for the cannon to be clamped by means of a unique pressurized hydraulic prop. This dramatically reduces operator fatigue and enhances safety by placing the operator behind the cannon, well away from the jet and hose.

Cleaning performance is improved, eliminating the need for a face scraper. The Ekscalibur sweeps the rock between 5 m and 8 m, compared to the traditional 2 m to 4 m. Shorter cleaning times result in fewer blasts being lost due to ‘face not clean’ problems.

The Ekscalibur Water cannon is now standard equipment in the mine where it was developed and has proved its worth in blasts that would have otherwise been lost.

The Ekscalibur Water Cannon is a robust, compact piece of mining equipment whose small size belies its amazing power. It is also available as a 'mini-cannon,' which has an intermediate nozzle and consumes 4 litres of water per second.

Pump Control Valve

The Pump Control Valve is a valve designed to protect underground mine dewatering pumps against pressure surges associated with pump start-ups, controlled shut-downs, and starting with the pump column empty or only partially full.

Operating pumps without such protection is a common problem in South African mines and can lead to premature pump balance failure or wear and, at worst, seizing of the pump and possibly a burst column.

The Pump Control Valve incorporates a two-stage opening and closing process controlled by valves, which sense upstream and downstream pressure. The main valve and the control valves are all energized by the pressure in the pump column, obviating the need for an external power source—which can be troublesome in the event of a power failure.

Besides protecting the pump column from pressure surges, the valve can prolong the life of pump rotating components, especially balance discs which are most exposed to damage on start-up.

About the Design Institute Awards

The Design Institute Awards encourage local engineering and industrial design excellence and promote local product design and manufacture. The awards are adjudicated by a panel of judges who are experts in the field of industrial and engineering design.

The entrants were judged on product innovation, appearance and tactile aspects, safety and ergonomics, ease of maintenance, installation, and performance. The winning products will now use the prestigious SABS Design Institute Awards, logo on their packaging and advertising.

The winners also showcased their products at the Business Growth and Opportunities for Africa Exhibition held from 3–6 September at Gallagher Estate. ◆

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