FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

TECHNICAL MEMORANDUM NO. 14/1966.

REPORT ON A METHANE SURVEY CONDUCTED IN THE DURBAN NAVIGATION COLLIERY.

by

F.E. JOUBERT

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INTRODUCTION:

This report covers a survey of the methane content of seven sections of Durban Navigation Colliery. In conjunction with a methane survey conducted in New Schoongezicht Colliery this survey concludes the preliminary investigation into the methane conditions in mine air.

FIELD WORK.

The survey planned broadly by the sub-committee of the Steering Committee was finalised in co-operation with the mine management.* Four members of the Institute's staff, guided by employees of the mine, visited seven working sections of the mine and one of the main upcasts. The survey was done over three shifts. Of the seven sections, two were stoping sections (removal of pillars), one was a long-wall section, and four were development sections of which two were normal mechanized sections in a virgin area and one was preparing for long-wall operations. Since the New Schoongezicht survey had shown that the methane content of the air in return airways is reasonably constant, determinations of methane content were not done on a strict time basis in this survey. That type of survey can best be done by automatic recording equipment. It was rather endeavoured to gather as much information as possible as to maximum methane concentration at faces being worked and the distribution of methane in a working section.

M.S.A. General Purpose Methanometers were used to determine methane content of the air. Two reference gases of known methane content were stored under pressure in cylinders and the calibration of the methanometers were checked against these gases after every shift.

RESULTS.../

* It was also planned to install a recording methanometer in a ventilation shaft but this instrument was not yet available at the time that the survey was undertaken.

RESULTS

The results of the survey are given under headings (i) to (viii), with corresponding numbers on the mine plan indicating the areas of testing.

Broken line arrows in the sketches indicate intake air and solid line arrows indicate return air.

Results of methane concentrations are accurate to ± 0.05% of listed values.

(i) SECTION 50.

Mechanized development section in South-Eastern part of mine.

A survey of the section was done on the 29th March, by one officer.

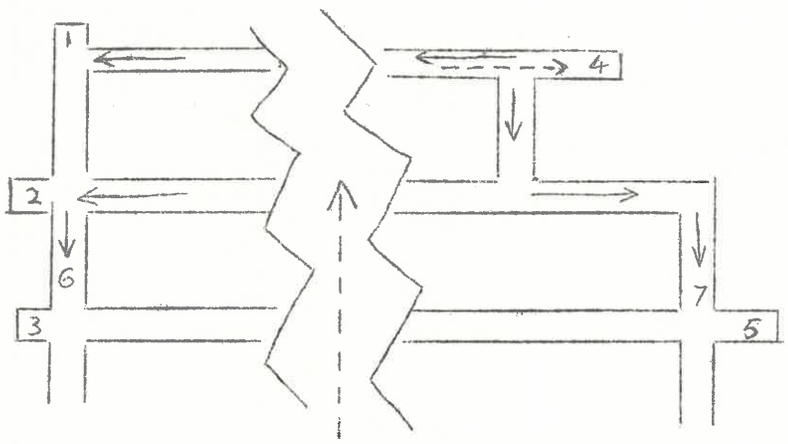

FIGURE 1

Figure 1 is a rough sketch of the section. Positions 1, 2, 3 and 5 are "box-holes", i.e. mining was discontinued here. Position 4 was worked at the time of the survey. At positions 6 and 7 the return air from the section was tested. Results obtained at these seven testing points are tabulated in Table 1.

Table 1...../

TABLE 1

RESULTS OBTAINED IN SECTION 50.

POSITION	ORIENTATION		% METHANE	NOTES
	HORIZONTAL	VERTICAL		
1	15' into box-hole	On floor(0')	0.6%	
1		3' up	0.8%	
1	from edge of	6' up	0.8%	
1		9' up	0.8%	
1	airway	12' up	1.2%	
1		14' up	>5%	This layer is about 6" thick
2		3' up	0.6%	
2		6' up	0.8%	
2	15' into box-hole	9' up	1.4%	
2		14' up	4.0%	
3		6' up	0.8%	
3	On edge of box-hole	14' up	1.5%	
3		6' up	0.8%	
3	7½' into box-hole	14' up	2.4%	
3		6' up	1.0%	
3	15' into box-hole	14' up	>5%	
4	20' from end of	On floor	0.5%	Cutting and
4	ventilation pipe,	6' up	0.4%	blasting done
4	near front	14' up	0.4%	the previous day
4	10' from end of	6' up	0.4%	
4	ventilation pipe	14' up	0.4%	
4		On floor	0.3%	
4	near front	6' up	0.3%	After cutting
4		14' up	0.3%	
4		On floor	0.4%	
4	near front	6' up	0.5%	After blasting
4		14' up	0.9%	
4		3' up	0.2%	
4	near front	6' up	0.5%	10 minutes after blasting
4		14' up	0.8%	
4	Readings in drill holes		0.4% + 0>5%	
5	Edge of box-hole	On floor	0.2%	Bad roof
5		14' up	0.3%	
6 *	See Figure 1	On floor	0.4%	
6 *		3' up	0.4%	
6 *		9' up	0.7%	
6 *		12' up	0.8%	
6 *		14' up	2.1%	
6 +		On floor	0.6%	
6 +		6' up	0.9%	
6 +		14' up	1.0%	
7	See Figure 1	On floor	0.2%	Before any operations took place in this part
7		3' up	0.2%	
7		6' up	0.2%	
7		9' up	0.2%	
7		14' up	0.2%	
7		3' up	0.2%	After cutting
7		14' up	0.2%	
7		On floor	0.2%	After blasting
7		6' up	0.2%	
7		14' up	0.5%	

* These readings were taken at 7.40 a.m.
\+ These readings were taken at 12.00 a.m.

During.../

During the eight hour shift in which the survey was undertaken 364 tons of coal was mined.

The volume of air flowing into the section during this shift was 63,300 x 8 x 60 = 30,384,000 cu ft.

The average methane content of the air flowing out of the section via returns No. 6 and No. 7 is about 0.45%.

The volume of methane produced per ton of coal mined during the shift is therefore about 380 cu ft.

Important features of these results are the high methane content in the upper layers of the air in the box-holes, and the occurrence of 2% of methane in one of the return airways.

(ii) SECTION 25

This is a mechanized development section in Southern part of mine.

A survey of this section was done on the 29th March, by one officer.

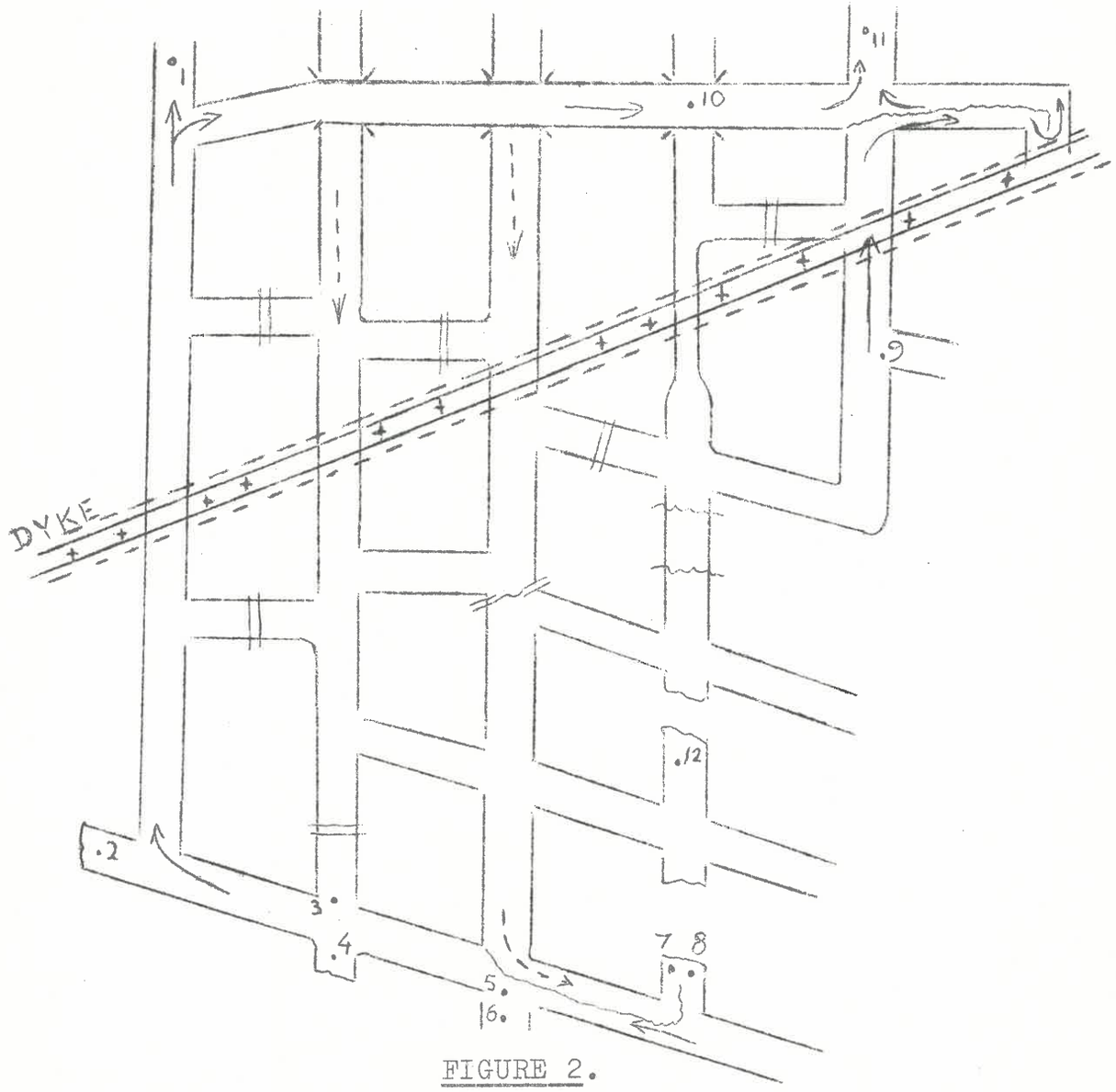

FIGURE 2.

Figure.../

Figure 2 is a rough sketch of the section. 1 and 11 represent points where the return air from the section was tested; 10, 3 and 5 other testing points in the returns; 2, 4 and 6 testing points in box-holes; 7, 8 and 12 testing points at working faces.

At point 9 a sample was taken of gas bubbling through water. This latter sample, taken in a glass container, was tested with a gas chromatograph in the laboratory.

Results obtained at these testing points are tabulated in Table II.

The volume of methane produced during the shift in this section per ton of coal mined is approximately 890 cu ft., based on the following figures:

Average methane content of return air	0.55%
Volume of air taken in per minute	56,700 cu ft.
Quantity of coal mined	167 tons.

TABLE II

RESULTS OBTAINED IN SECTION 25.

POSITION	ORIENTATION		% METHANE	NOTES
	HORIZONTAL	VERTICAL		
1		Middle of return	0.5%	
2		Middle of return	0.8%	
3		Middle of return	0.6%	
4		Middle of return	1.4%	
5		Middle of return	0.8%	
6		Near roof	1.2%	
7		Near roof	0.4%	Intake side of line brattice
8		Near roof	0.5%	Return side of line brattice
9		Floor	97%	Average of two samples
10		Middle of return	0.5%	
11*		Middle of return	0.6%	
11		Middle of return	0.6%	Immediately after blasting
12+	10' from face	Near floor	0.4%	(10 minute after blasting
		Near top	1.2%	
		Middle of layer	0.9%	
		Near floor	0.6%	
		Near top	1.1%	
		Near floor	0.5%	
		Near top	1.1%	
		Near floor	0.4%	
		Near top	0.8%	
		Near floor	0.4%	
		Near top	0.9%	

* The samples at position K were taken at about 10.20 a.m.
\+ The samples at position L were taken over a period of 25 minutes at about 9.00 a.m.

(iii).../

(iii) SECTION 86.

Development section in Eastern part of mine.

A survey of this section was done on the 29th March, by two officers.

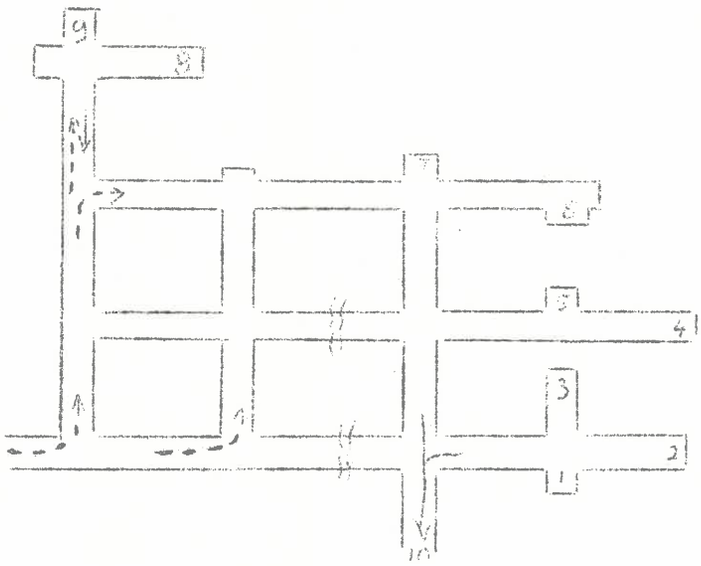

FIGURE 3.

Figure 3 is a rough sketch of the section with numbers 1 to 9 indicating working faces and 10 the total return from the section. Line brattices were used to get ventilation air to all the faces. The results are tabulated in Table III.

TABLE III.

RESULTS OBTAINED IN SECTION 86.

POSITION	TIME a.m.	PLACE OF SAMPLING	% METHANE	NOTES
1	7.25	Near top of roof	0.3%	Miner inspecting working sections before start of shift
1	7.25	Near floor	0.2%	
1	9.40	Middle	0.1%	No activities going on.
2*	7.20	Near roof	3.0%	Inspection before start
2	7.20	Near floor	1.2%	
2	8.10	Middle	0.2%	Before cutting
2	8.40	Middle	0.3%	After cutting
2	9.10	Middle	0.3%	After blasting
2	9.35	Middle	0.3%	While loading
3	7.28	Near roof	0.3%	Inspection before start
3	8.20	Middle	0.2%	Before cutting
3	9.30	Near roof	0.4%	After blasting
3	9.30	Near floor	0.1%	
4	10.10	Middle	0.3%	After cutting
4	10.10	Inside cut	0.7%	
5	10.15	Middle	0.1%	
5	10.45	Middle	0.1%	After drilling

TABLE.../

TABLE III (Continued).

POSITION	TIME a.m.	PLACE OF SAMPLING	% METHANE	NOTES
5	10.45	Inside drill hole	3.5%	
5	11.00	Near roof	0.3%	After blasting
5	11.00	Near floor	0.2%	
5	11.00	Far in against roof	0.6%	
6	10.20	Middle	0.1%	Mostly loading only at these points
7	10.25	Middle	0.1%	
8	10.30	Middle	0.1%	
9	10.35	Middle	0.1%	
10	7.45	Middle of drive	0.15%	
10	8.00	Middle of drive	0.15%	After first blasting.
10	8.15	Middle of drive	0.15%	
10	8.30	Middle of drive	0.1%	
10	8.45	Middle of drive	0.1%	
10	9.00	Middle of drive	0.15%	
10	9.15	Middle of drive	0.15%	
10	9.30	Middle of drive	0.15%	
10	9.45	Middle of drive	0.15%	
10	10.00	Middle of drive	0.15%	
10	10.30	Middle of drive	0.15%	
10	11.00	Middle of drive	0.15%	
10	11.30	Middle of drive	0.15%	

* Position 2 is near a dyke.

In section 86 approximately 100 cu ft. of methane were produced per ton of coal mined during the shift.

The calculation is based on the following data:-

Average methane content of return air	0.15%
Air intake	13,900 cu ft/min.
Quantity of coal mined	99 tons

(iv) SECTION 33

This is a stoping section in the Eastern part of the mine.

A survey of this section was done on the 30th March, by one officer.

No cutting, drilling or blasting was done during this shift and the production was nil. Some loading of coal took place.

Results are tabulated in Table IV.

TABLE .../

TABLE IV

RESULTS OBTAINED IN SECTION 33.

POSITION	% METHANE	NOTES
Left-hand side of return airway	0.2%	This value was constant at all heights sampled.
Right-hand side of return airway	0.2%	This value was also constant at all heights sampled.
On floor of working section	0.15%	)
1' from floor	0.2%	)
2' from floor	0.3%	) These readings were taken
3' from floor	0.4%	) where loading was just
4' from floor	0.9%	) completed.
5' from floor (near roof)	0.9%	)
In other working sections	0.2%	) Loading of coal taking
In other working sections	0.3%	) place.
Return airways	0.2%	Average methane content not
Near places where gas was emitted from floor	0.2%	influenced by gas emitted.

(v) SECTION 65.

This is a stoping section in North-Western part of mine.

A survey of this section was done on the 30th March, by one officer.

(a) Results for the left-hand side return airway are tabulated in Table V.

TABLE V.

RESULTS OBTAINED IN SECTION 65
RETURN AIRWAY

TIME a.m.	POSITION OF TESTING	% METHANE	NOTES
7.10	Near floor	0.2%	
7.10	Midway up	0.2%	
7.10	Near roof	0.4%	
7.25	Near floor	0.3%	At 7.20 blasting occurred
7.25	Midway up	0.3%	
7.25	Near roof	0.4%	
7.40	Near floor	0.3%	At 7.35 blasting occurred
7.40	Midway up	0.4%	
7.40	Near roof	0.5%	

TABLE.../

TABLE V (Continued)

RESULTS OBTAINED IN SECTION 65
RETURN AIRWAY

TIME a.m.	POSITION OF TESTING	% METHANE	NOTES
7.40	Against roof	1.0%	Maximum of different readings.
7.50	Near floor	0.2%	
7.50	Midway up	0.3%	
7.50	Near roof	0.4%	
10.00	Near floor	0.2%	
10.00	Midway up	0.3%	
10.00	Near roof	0.5%	

(b) Near the goaf.

At the edge of the goaf a reading of 2.0% methane was obtained at a height of about 4'.

20' away from the goaf edge the following readings were obtained:-

Near floor : 0.4%
Midway up : 1.8%
Near roof : 2.2%

(c) Normal work at face, both seams being developed. Results are tabulated in Table VI.

TABLE VI.

RESULTS OBTAINED IN SECTION 65 AT THE FACE WHERE BOTH SEAMS ARE WORKED.

TIME OF TESTING	POSITION OF TESTING	% METHANE
Before work commenced	Near floor	0.05%
Before work commenced	Midway up	0.1%
Before work commenced	Near roof	0.2%
After cutting	Near floor	0.1%
After cutting	Midway up	0.2%
After cutting	Near roof	0.2%
After blasting	Near floor	0.2%
After blasting	Midway up	0.2%
After blasting	Near roof	0.3%

In the cut a maximum reading of 2.4% was obtained.

(d).../

(d) Normal work at face, top only being developed. Results are tabulated in Table VII.

TABLE VII

RESULTS OBTAINED IN SECTION 65 AT THE FACE WHERE THE TOP SEAM IS WORKED.

TIME OF TESTING	POSITION OF TESTING	% METHANE
Before drilling	Near floor	0.1%
Before drilling	Midway up	0.1%
Before drilling	Near roof	0.2%
After drilling	Near floor	0.05%
After drilling	Midway up	0.1%
After drilling	Near roof	0.1%
After blasting	Near floor	0.1%
After blasting	Midway up	0.1%
After blasting	Near roof	0.4%
In a drilled hole a reading of >5% was obtained.		

As a ventilation figure for this section was not available, the volume of methane per ton coal mined cannot be given.

(vi) SECTION 426.

This is a long wall section in the South Eastern part of the mine.

Surveys of this section were done on the 30th and 31st March by two officers.

A proposed survey for the 29th March, 1966 was called off by the mine management.

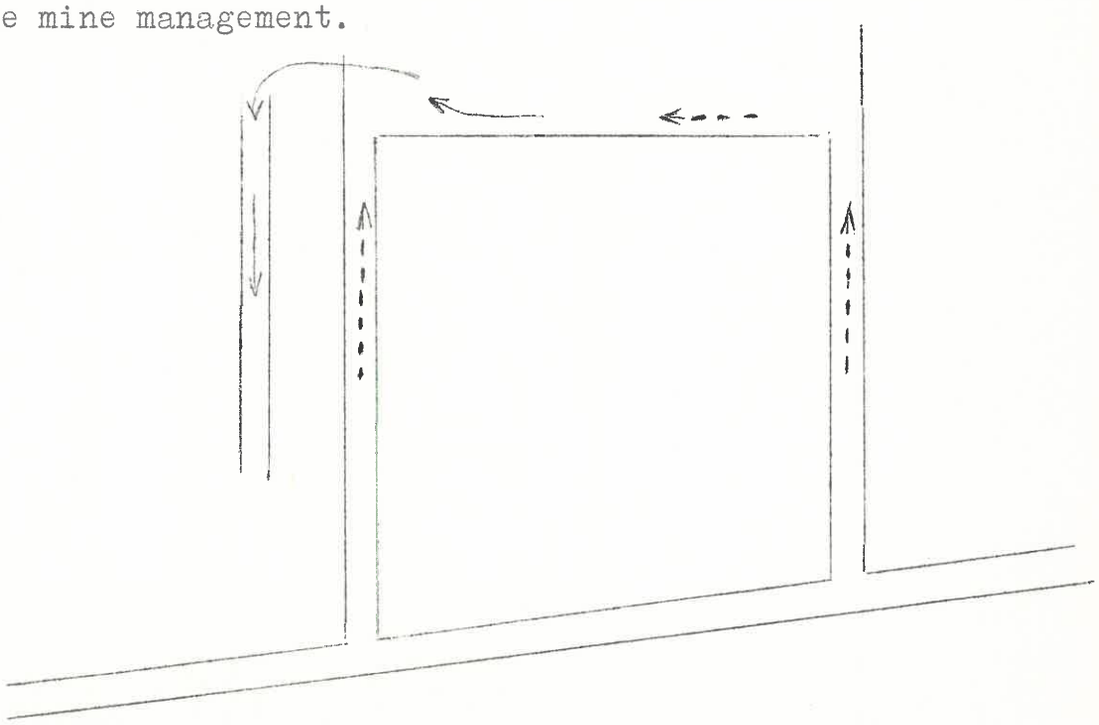

FIGURE 4.

Figure.../

Figure 4 is a sketch of the long wall section. The results obtained on the two days are given separately.

(a) Readings were taken in 5 minute intervals. It was attempted to take readings about 30' in front of the coal cutter. The cutter completed about 90% of the distance in 1 hr. 25 min. If cutting continuously, it can complete the whole distance in 1 hr. 10 min. The results obtained on the 30th March are tabulated in Table VIII.

TABLE VIII

RESULTS OBTAINED IN SECTION 426 AT THE WORKING FACE ON 30TH MARCH, 1966.

TIME	CHOCK NO.	% METHANE	NOTES
a.m.			
8.20	1	0.15%	Before commencing
8.55	7	0.25%	
9.00	19	0.35%	Some H_2S present
9.05	37	0.35%	
9.10	56	0.45%	
9.15	71	0.5%	
9.20	85	0.6%	
9.25	103	0.6%	Right against roof also .6%
9.30	114	0.6%	
9.35	132	0.6%	Belt stopped for a while
9.40	144	0.65%	
9.45	155	0.6%	
9.50	164	0.85%	
9.55	171	0.7%	Machine stopped for about 10 min.
10.00	178	0.6%	
10.05	178	0.6%	Some H_2S present
10.10	178	0.9%	
10.13	193	0.95%	Machine stopped again
10.16	193	1.0%	
10.20	193	0.8%	Abandon effort

At point 1 (see Fig. 4) the air returning through the goaf was tested. The percentage methane in this air remained constant at 2.3% from 7.45 a.m. to 10.45 a.m.

(b) The conveyor belt stopped after about 10 minutes of coal cutting. Although the coal cutter was idle, it was decided to go through the section anyway to obtain readings for methane concentrations when no coal is being cut. Results are tabulated in

Table.../

Table IX.

The return air was tested near point 1, but not at exactly the same spot as the previous day. These results are tabulated in Table X.

For the 30th March the following figures can be quoted:-

Average percentage methane (through goaf): 2.3%
Intake air into section: 44,200 c.f.m.*
Quantity coal mined: 460 tons.
Volume of methane per ton coal mined (based on 8 hour shift): approximately 1050 c.f.m.

TABLE IX

RESULTS OBTAINED IN SECTION 426 AT THE WORKING FACE ON THE 31 ST MARCH, 1966

TIME	CHOCK NO.	% METHANE	NOTES
a.m.			
8.15	12	0.3%	After about 5 minutes cutting
8.20	52	0.35%	Machine stopped
9.15	60	0.2%	Machine idle
	70	0.2%	Machine idle
	80	0.25%	Machine idle
	90	0.25%	Machine idle
	100	0.25%	Machine idle
9.20	110	0.25%	Machine idle
	120	0.3%	Machine idle
	130	0.3%	Machine idle
	140	0.4%	Machine idle
	150	0.4%	Machine idle
9.25	160	0.4%	Machine idle
	170	0.4%	Machine idle
	180	0.4%	Machine idle
	190	0.4%	Machine idle
	200	0.45%	Machine idle
9.30	Tailgate	0.5%	Machine idle

Table X.../

* The figure of 44,200 c.f.m. was given as the total intake to sections 426 and 431. No separate figures were available but the bulk of the air went through section 426.

TABLE X

RESULTS OBTAINED IN SECTION 426 AT THE RETURN AIRWAY ON THE 31ST MARCH, 1966.

TIME	READING NEAR FLOOR	READING MIDWAY UP	READING NEAR ROOF
a.m.			
7.36	2.4%	2.8%	2.6%
7.40	2.4%	2.7%	2.6%
7.45	2.4%	2.7%	2.7%
7.50	2.4%	2.7%	2.8%
7.55	2.5%	2.6%	2.6%
8.00	2.4%	2.6%	2.6%
8.05	2.4%	2.6%	2.8%
8.15	2.4%	2.6%	2.8%
8.25	2.4%	2.7%	2.9%
8.35	2.4%	2.6%	2.8%
8.50	2.4%	2.6%	2.6%
9.05	2.4%	2.8%	2.8%
9.20	2.4%	2.7%	2.8%

(vii) SECTION 431.

This section was preparing for long wall operations. A survey of this section was done on the 31st March, by one officer.

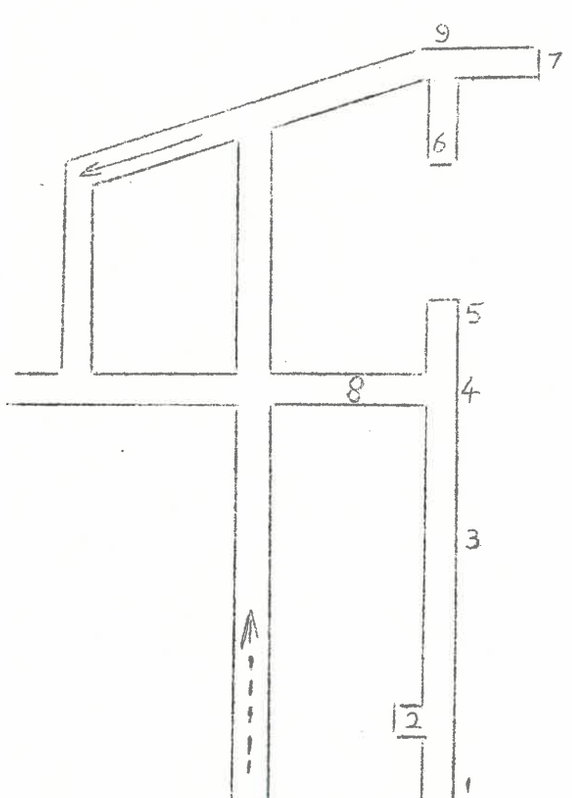

FIGURE 5

Figure.../

Figure 5 is a rough sketch of the section. Line brattices and pipes were used to get air to all the working faces.

Results are tabulated in Table XI.

No separate figure of air intake into this section was available.

TABLE XI

RESULTS OBTAINED IN SECTION 431.

TIME	POSITION OF TESTING	% METHANE	NOTES
a.m.			
8.20	1	0.4%	)
8.25	2	0.15%	)
8.30	3	0.6%	) No activities
8.35	4	0.4%	)
8.40	5	0.05%	)
8.45	8	0.2%	)
9.00	7	1.2%	Loading of coal
9.05	6	0.4%	Loading of coal
9.30	9	0.4%	Loading at points 6 and 7
9.45	6	0.4%	End of loading
10.30	6	0.4%	Beginning to cut coal
10.35	6	0.5%	Cutting coal
10.45	6	0.5%	Stopped cutting
10.55	6	0.6%	Cutting again
11.00	6	0.6%	After cutting

(viii) MAIN UPCAST IN SOUTHERN PART OF MINE.

Readings in the upcast air were taken on the 31st March by one officer.

Two returns make up the total upcast. Readings were taken in both returns. Air of return A came mainly from the centre portion of the workings and air of return B mainly from the South-Eastern part of the mine.

The results are summarised in Table XII.

Table.../

TABLE XII

RESULTS OBTAINED FOR THE MAIN UPCAST
IN THE SOUTHERN PART OF THE MINE

TIME	% METHANE - RETURN 1	% METHANE - RETURN 2
a.m.		
7.00	0.35%	0.45%
7.30	0.35%	0.45%
8.00	0.35%	0.45%
8.30	0.4%	0.45%
9.00	0.35%	0.45%
9.30	0.35%	0.45%
10.00	0.4%	0.45%
10.30	0.35%	0.45%
11.00	0.4%	0.5%
11.30	0.35%	0.45%

Volume of air from return 1 : 198,600 c.f.m.

Volume of methane in one 8-hour shift (based on .35% methane) : Approximately 335,000 c.f.

Volume of air from return 2 : 236,500 c.f.m.

Volume of methane in 8 hours (based on .45% methane) : Approximately 510,000 c.f.

PRETORIA.
3rd May, 1966.