REPORT ON THE EXPLOSION AT THE NO. 9 MINE OF THE WEST KENTUCKY COAL COMPANY, STURGIS, KENTUCKY.

By

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EXPLOSION AT THE NO. 9 MINE OF THE WEST KENTUCKY COAL COMPANY STURGIS, KENTUCKY.

About 8:45 A. M., June 8, 1925, an explosion occurred in the No. 9 Mine of the West Kentucky Coal Company, resulting in the death of seventeen men.

GENERAL INFORMATION

LOCATION

The No. 9 Mine of the West Kentucky Coal Company is located on the Illinois Central Railway about two miles northeast of Sturgis, Union County, Kentucky.

OPERATOR

The mine is owned and operated by the West Kentucky Coal Company, with offices in Sturgis, Kentucky. The officers in charge of the operation of the mine are as follows:

C. F. Richardson, President - Sturgis, Kentucky.
T. E. Jenkins, Vice-President and General Manager, - Sturgis, Kentucky.
T. F. Christian, General Superintendent - Sturgis, Kentucky.
W. A. Jones, Superintendent - Sturgis, Kentucky.
Neal McCann, Mine Foreman - Sturgis, Kentucky.

PRODUCTION AND EMPLOYEES

The mine is equipped to produce about 1500 tons of 2000 pounds per day. The daily average tonnage is about 1000 tons per day of eight hours. About 180 men are employed at this mine.

COAL BED

The coal bed worked is the No. 9 of the West Kentucky series and correlated with the No. 5 bed of both the Indiana and Illinois State Geological Surveys. It lies in the Carbondale formation of the Pennsylvania series.

The average thickness of the coal at this mine is about 4 feet, 10 inches and at this mine dips about 3-1/2 degrees in a direction of 15 degrees east of north.

The impurities in the coal consist of thin bands of sulphur. The roof is a hard black shale and is very good. The roof, to a limited extent, tends to become mixed with the road dust.

The floor is a soft fire clay and when wet heaves badly. A considerable amount of the fire clay becomes mixed with the road dust, particularly on the main roads.

DEVELOPMENT AND SYSTEM OF MINING

The mine is opened by two shafts, each about 420 feet deep. The main, or hoisting shaft, is about 200 feet north of the air and escapement shaft.

The No. 9 Mine is worked on the room and pillar method. The main entries extend in a general east and west direction from the shaft bottom. At present the majority of the workings are to the rise. The usual practice is to drive cross entries from the main entries either directly to the rise or quartering. From these rise entries or slant

entries the room entries are driven along the strike. The rooms are turned directly to the rise from the upper of the room entries.

In a few instances the room entries were driven to the rise and the rooms along the strike. The entries are all driven 12 feet wide with 15 feet pillars between. The rooms are driven 30 feet wide and about 500 feet deep. The room pillars are approximately 20 feet wide.

No attempt is made to recover either the room or entry pillars.

Because of the excellent roof, very little timber is needed along the entries. In a few places where breaks in the roof have occurred, three-piece sets are used. It is the general practice to set a row of heavy props along the haulage roads; these serve to both support the roof and as a support for the power lines.

BLASTING

The coal in this mine is all undermined with shortwall chain machines and shot with permissible powder.

The miners drill, load, and fire their own shots. The shooting is done by electric battery at any time during the shift that suits the convenience of the miner. No. 6 electric detonators are used.

The coal shoots very easily and the charges in any one hole are well withinthe permissible limits. Four holes are usually shot in a 30 feet room. The two center shots are loaded with two sticks each, while the rib shots usually only require 1-1/2 sticks each.

One day's supply of powder is taken into the mine in sacks by the miner. Copper-tipped tamping bars are usually used.

Prior to the use of permissible powder in this mine, coal fires were of common occurrence. No trouble from this source, however, has been experienced since the adoption of permissible.

About 8 tons of coal are obtained per pound of powder.

Machine cuttings are not loaded out prior to blasting.

HAULAGE

Haulage is performed by mules and electric locomotives. The main line haulage is by both trolley and storage battery locomotives. The gathering is all by mules.

The cars are of wooden construction and of the lift end-gate type, and hold about 2600 pounds of coal when topped from 4 to 6 inches.

The track gauge is 40 inches.

The haulage entries are laid with 40 pound steel, while the rooms and room entries are laid with 16 pound steel.

MOISTURE CONDITIONS

The coal is generally dry, although in places droppers are encountered in the roof and the faces in these places are generally quite wet.

No moisture was observed along any of the main entries; the room entries however, were moist in a few places. Generally, little evidence of moisture was to be observed on these entries.

In September, 1923 an investigation was made by the Bureau of Mines in the No. 9 Mine to determine the explosion hazard at this mine. This investigation included the taking of samples of mine air, roof, rib, and road dust and coal samples, and a large five-ton sample of coal which was shipped to the Experimental Mine of the Bureau, where a series of tests were run to determine its explosion hazard characteristics.

Following the tests at the Experimental Mine a report was furnished the company in which were embodied certain recommendations to lessen the explosion hazard at this mine. One of the recommendations was the application of rock dust to the roof, ribs and floor of the entries and other working places in the mine to neutralize the explosibility of the fine coal dust.

In line with these recommendations the company installed a grinding mill for the fine-grinding of shale from one of their mines, constructed a power dusting machine, and dusted the entries of the No. 9 Mine as well as their other dry dusty mines.

The following tables give the location and the analysis of samples of road and rib dust collected in September, 1923, at the time of the first investigation:

Can No.	Laboratory No.	Location
R 1040	96086	5th Left off West rise entry from No. 15 Room outby.
84328	96087	2nd Right off West slant from No. 24 Room outby.
R 1274	96088	2nd Right off West rise entry from No. 20 Room outby.
R 1270	96089	West rise entry outby 5th Left entry.
C 536	96090	East dip entry between No. 27 and No. 29 Rooms.
1630	96091	2nd Left off East slant from No. 13 Room inby.
R 1269	96092	West slant entry inby 2nd Right.
1183	96093	East slant entry between Main East and 1st Left off slant.

Can No.	Lab.No.	Moisture.	Vol. matter.	Fixed carbon.	Ash.	Moisture - ash	Cumulative percent through 48-mesh	100-mesh	200-mesh
R 1040	96086	6.1	26.9	37.8	29.2	35.3	61.5	38.9	24.5
84383	96087	9.5	31.2	41.6	17.9	27.2	30.5	5.9	1.2
R 1274	96088	5.9	22.1	42.3	19.7	25.6	59.3	37.4	25.6
R 1270	96089	4.4	21.2	25.1	49.3	53.7	56.8	34.7	18.4
C 536	96090	10.2	28.7	38.1	23.0	33.2	40.1	13.4	9.8
1630	96091	10.1	25.3	30.8	35.8	45/9	41.6	15.6	3.6
R 1269	96092	4.9	27.0	33.6	34.5	39.4	54.0	32.2	25.3
1183	96093	2.8	19.8	26.0	51.4	54.2	53.4	32.9	17.0
Average		6.7	25.0	34.4	32.6	39.3	49.6	26.4	16.9

The tests conducted at the Experimental Mine from the large sample of coal from this mine showed that the total incombustible content of the road dust must be:

(1) 40 percent to prevent ignition from a blown out shot with no gas present.

(2) 50 percent (estimated) to prevent ignition from a blown out shot with one percent gas present.

(3) 58 percent to prevent propagation of an explosion already started when there is no gas present.

(4) 71 percent to prevent propagation of an explosion already started when there is one percent of gas present.

The samples collected were all far too low in total incombustible, indicating that an explosion once started could readily be propagated by the fine dust along the entries.

On January 8th roof, rib and road dust samples were taken on entries in the advance of live sections of the mine that had been given a rock dusting of from 2 to 4 pounds per foot of entry. The following tables give the location, analysis and sizing tests of these samples:

Gas No.	Laboratory No.	Sample of:	Location
C 588	A 7779	Roof & Rib	2nd Left off East slant from No. 19 Room inby.
R 1010	A 7781	Road	2nd Left off East slant from No. 19 Room inby.
C 909	A 7780	Roof & Rib	3rd Right off West rise from No. 19 Room outby.
C 545	A 7791	Road	3rd Right off West rise from No. 19 Room outby.

Can No.	Laboratory No.	Sample of:	Location
F 77	A 7784	Roof & Rib	3rd Left off East slant 150 ft. from face outby.
F 79	A 7783	Road	3rd Left off East slant 150 ft. from face outby.
H 115	A 7786	Roof & Rib	4th Right off West slant.
5 180	A 7785	Road	4th Right off West slant.
A 743	A 7788	Roof & Rib	3rd Right off West slant between Rooms Nos. 26 and 28.
H 106	A 7787	Road	3rd Right off West slant between Rooms Nos. 26 and 28.
B 715	A 7790	Roof & Rib	6th Left West rise between Rooms Nos. 10 and 15.
F 499	A 7789	Road	6th Left West rise between Rooms Nos. 10 and 15.

Can No.	Lab. No.	Moisture.	Vol. matter.	Fixed carbon.	Ash	Moisture - ash	Cumulative percent through 48-mesh	100-mesh	200-mesh	
C 588	A 7779	6.3	21.5	24.8	47.4	53.7	74.5	59.5	48.4	R-R
R 1010	A 7781	6.2	26.2	34.1	33.5	39.7	70.5	51.2	35.7	R
C 909	A 7780	5.5	15.6	14.1	64.8	70.3	85.1	76.8	65.9	R-R
C 545	A 7791	5.7	22.5	26.0	45.8	51.5	72.9	55.4	39.2	R
C										
F 77	A 7784	7.8	17.4	19.1	55.7	63.5	66.5	42.5	16.4	R-R
F 79	A 7783	8.8	18.5	23.3	49.4	58.2	55.9	30.6	15.6	R
H 115	A 7786	4.9	16.7	18.7	59.7	64.6	85.5	74.9	60.6	R-R
5 180	A 7785	4.6	22.4	26.1	46.7	51.5	66.5	46.9	32.9	R
A 743	A 7788	2.5	17.3	16.8	63.4	65.9	83.3	70.8	53.3	R-R
H 106	A 7787	4.1	24.6	29.2	42.1	46.2	70.3	51.9	37.3	R
B 715	A 7790	5.2	10.0	4.3	80.6	85.7	90.5	80.5	61.1	R-R
F 499	A 7789	4.2	18.0	19.9	57.9	62.1	75.8	59.5	44.5	R

A study of the above table shows that the total incombustible (ash plus moisture) was raised by the one application of rock dust to a point where there was little danger of ignition of the dust even in the presence of one percent of methane and that the rib and roof dust had been made virtually safe from propagation when no gas was present. The ash content of the road dusts, however, was not high enough to prevent propagation. The entries of the live workings were therefore given a second application of rock dust and again sampled as follows:

Can No.	Laboratory No.	Sample of:	Location
Y	A 9181	Rib - Roof	2nd Left off East slant between Rooms Nos. 28 and 29.
R 212	A 9180	Road	2nd Left off East slant between Rooms Nos. 28 and 29.
38	A 9183	Rib - Roof	3rd Right West rise between Rooms Nos. 17 and 18.
X	A 9178	Road	3rd Right West rise between Rooms Nos. 17 and 18.
A 533	A 9185	Rib - Roof	4th Right West slant between Rooms Nos. 6 and 7.
A 5550	A 9176	Road	4th Right West slant between Rooms Nos. 6 and 7.
02538	A 9184	Rib - Roof	3rd Right West slant between Rooms 15 and 16.
755	A 9179	Road	3rd Right West slant between Rooms 15 and 16.
75	A 9182	Rib - Roof	6th Left off West Rise 600 ft. inby West rise.
97790	A 9179	Road	6th Left off West Rise 600 ft. inby West rise.

Can No.	Lab. No.	Moisture.	Vol. Fixed mat. carb. Combined	Ash	Moisture - ash	Cumulative percent through 48-mesh	100-mesh	200-mesh	
Y	A 9181	5.7	34.2	60.1	65.8	81.7	68.4	47.0	R-R
R 212	A 9180	2.8	25.2	72.0	74.8	80.0	66.9	66.5	R
38	A 9183	1.8	22.6	75.0	76.8	91.1	85.1	75.2	R-R
X	A 9178	2.1	19.9	78.9	81.0	89.9	77.2	61.1	R
A 535	A 9185	0.9	37.6	61.5	62.4	75.2	57.8	45.0	R-R
5550	A 9176	2.8	34.7	63.0	65.8	82.4	68.4	51.8	R
02538	A 9184	1.9	19.0	79.1	81.0	91.1	84.1	75.5	R-R
755	A 9177	2.4	29.1	68.5	70.9	88.2	78.0	59.7	R
75	A 9182	5.7	27.5	66.8	72.5	86.5	77.4	75.5	R-R
97790	A 9179	5.0	30.5	64.5	69.5	78.5	63.4	44.5	R

A study of the analyses of these last samples shows that the total incombustible (ash plus moisture) in every instance is well above the safe limit to prevent propagation when no methane is present and in the majority of cases is well above the safe limit to prevent propagation with one percent of methane present.

ROCK DUST

The dust used at this mine is obtained by fine-grinding the shale which occurs above the No. 12 coal bed. A sample of the dust was tested in the Pittsburgh Laboratory of the Bureau with the following results, as received:

	Per Cent	
	As received	Moisture free
Moisture at 105 degrees C	0.9	0.0
Ash	88.4	89.3
Carbon dioxide (CO_2).....	2.0	2.0
Combined water (above 105 deg. C)....	3.7	3.7
Total incombustible	95.0	95.0
Combustible (by difference).....	5.0	5.0

Free silica or quartz (SiO_2)..estimated..... 27 percent

SIZE TEST

	Cumulative, percent
Through 20-mesh	99.5
Through 200-mesh	67.1

MICROSCOPIC EXAMINATION

This dust is light gray in color. Mineralogically it contains about 25 per cent free silica or quartz. Kaolinitic material constitutes the most abundant constituent. Feldspar, sircon, tourmaline, and hornblende are present in minor amounts.

It will be observed that the dust contains about 27 percent free silica, which is rather high. Care should therefore be used to prevent men from breathing this dust at the grinding plant or during distribution.

It is not believed the dust after application presents any health hazard, as in no instance could it be noticed in the atmosphere after the passage of motor trips.

The sizing tests show that the dust is amply fine, 67.1 percent passing through 200-mesh. In fact, the writer is of the opinion that it might be advisable to so grind the dust that not over 50 percent would pass through 200-mesh, the resulting larger percentage

of coarse sizes it is believed would tend to prevent caking in the trough barriers and at the same time would lessen the expense of grinding.

METHOD OF DUST APPLICATION

The dust was applied to the haulage roads, room necks and crosscuts by means of an electrically driven distributor designed and built by the company. Two applications each of about three pounds per lineal foot of entry were found necessary to bring the total incombustible up to the required point. In the aircourse entries and at other points inaccessible to the dusting machinery, trough barriers have been erected. These troughs each hold about 500 pounds of dust.

VENTILATION AND GAS CONDITIONS

The mine is ventilated by a Jeffrey direct-connected steam driven fan located at the airshaft and so arranged as to be reversible. It is operated primarily as a blowing fan against an average water gauge pressure of two inches and is delivering about 87060 feet of air per minute. At the time of the investigation there were three principal splits in the air current: the Main East workings, the West rise entry workings, and the First Right and First Right slant workings. About 11,000 feet of air per minute is taken in a separate split up the East rise entry. There are, however, no live workings in this section.

It is the practice at this mine to conduct the air to the live workings and then return it through the worked out sections. The main haulage entries are in the most part on the return of the air.

Concrete stoppings are used on the main entries and wooden stoppings on the room entries. All overcasts are substantially built of

concrete. Wooden doors and canvas curtains painted with coal tar are used to deflect the air currents.

While the mine gives off a considerable quantity of methane, in January and February it was impossible to detect methane with the flame safety lamp in any section of the mine visited. The workings being continually swept with an ample current of air keeps the methane well diluted.

Open carbide lamps are used throughout the mine.

During an investigation in September, 1925, samples of mine air were taken at various points in the mine to determine the amount of methane given off. The following tables indicate the location where the samples were taken also the results of the analysis.

Bottle No.	Laboratory No.	Location
265 - 267	18753 -54	Under overcast Main East Entry 100 feet from shaft. Main Return for East side.
198 - 77	18755 -56	On West slant inby 2nd Right entry. Return for West slant.
1533-1554	18757 -58	On East slant outby 1st Left. Return from East slant.
258 - 262	18788 -89	On 2nd Right off West rise 400 feet inby from West rise. West rise return.
1424-1426	18790 -91	On Main West 75 feet East of West rise. Part of Main return West side.
615	19004	On West slant 60 feet outby 2nd Right.

Bottle Number	Laboratory Number	Location
655	19005	On West slant 50 feet inby 2nd Right. (Note: sample taken at same point as 198-77, but on different date)
626	19006	On West rise 60 feet inby 5th Left.
658	19007	On 4th Left off West rise 60 feet inby parting.

Bot. No.	Lab. No.	Methane. CH_4	Carbon dioxide. CO_2	Oxygen O_2	Nitrogen N_2	Vol.air cu. ft. per minute.	Cu. fts methane per 24 hours.	Relative humidity
265	18755	0.15	0.13	20.64	79.10	52465	60480	95 duplicates.
267	18754	0.00	0.07	20.89	79.04	52465		95 duplicates.
198 77	18755	0.16	0.11	20.66	79.07	15800	36000	95 duplicates.
	18756	0.15	0.14	20.65	79.06	15800	34560	95 duplicates.
1535	18757	0.17	0.12	20.62	79.09	23000	56160	100 duplicates.
1534	18758	0.18	0.15	20.69	79.98	25000	89040	100 duplicates.
258	18760	0.11	0.12	20.56	79.21	8000	1296	95 duplicates.
262	18759	0.12	0.10	20.62	79.16	8000	1296	95 duplicates.
1424	18790	0.08	0.10	20.67	79.15	34500	38880	90 duplicates.
1426	18791	0.08	0.12	20.64	79.16	34500	38880	90 duplicates.
615	19004	0.21	0.14	20.63	79.02	9240	27360	
655*	19005	0.23	0.11	20.66	79.00	7200	23040	
626	19006	0.07	0.11	20.58	79.14	11880	11520	
658	19007	0.01	0.07	20.78	79.14	9880	1416	

*Taken at same point as 198-77 but on a different date.

These analyses indicate that while the mine makes an appreciable amount of methane, the ventilation was adequate to dilute the methane well below the danger point.

In the investigation of January and February, samples of mine air were taken at the following points:

Bottle Number	Laboratory No.	Location
336	41722	East slant return at First Right.
344	41723	Face of 3rd Left heading off East slant.
426	41724	Main West return.
418	41725	Main East return outby East rise entry.
457	41726	Face of Room No. 17 off 3rd Right off West rise.
433-338	41727-8	Hoisting shaft Main return.
429	41729	Next to last crosscut 3rd Right aircourse of West rise.
438	41730	Face of Room No. 5, off 4th Right off West slant.
425	41731	Face of 4th Right aircourse, West slant.
415	41732	Face of Room No. 22 off 3rd Right off West slant.
428	41733	4th Right off West slant between Rooms Nos. 6 and 7.
328	41734	Crosscut outby face of Room No. 26 off 3rd Left off East slant.
332	41735	Face of Room No. 24 off 3rd Left off East slant.
709-712	41497-6	Aircourse 3rd Left off West slant 290 feet outby face.
34 - 24	41498-9	West slant 100 feet outby 4th Right.

Bottle Number	Laboratory No.	Location
101-106	41500-1	Intake to West Rise above 6th West.
108- 93	41502-5	Return from West Rise 100 feet from face of 3rd Right.
22 - 29	41504-5	Room No. 9 off 5th Left at 6th Left aircourse off West Rise.
287-826	41556-7	Return 3rd Left off East slant 150 feet from face.
103-102	41558-9	Main East return at overcast.
96 -104	41541-0	East slant outby 1st Left.

Bot. No.	Lab. No.	Methane. CH_4	Carbon dioxide. CO_2	Oxygen O_2	Nitrogen N_2	Vol air: cu. ft. per minute.	Cu. ft. methane per 24 hours.	Relative humidity
336	41722	0.36	0.12	20.49	79.03	6600	34560	
334	41723	0.38	0.16	20.62	48.84			90
426	41724	0.10	0.10	20.57	79.23	43550	61920	84
418	41725	0.16	0.11	20.63	79.10	15440	39240	
437	41726	0.22	0.16	20.28	79.34			92
338	41727	0.11	0.11	20.63	79.15	120000	207360	dupli-
443	41728	0.13	0.14	20.62	79.11	120000	207360	cates.
429	41729	0.20	0.15	20.41	79.24	4320	12960	95
438	41730	0.35	0.24	20.49	78.92			95
423	41731	0.18	0.16	20.64	79.02			87
415	41732m	0.18	0.15	20.52	79.15			85

Bot. No.	Lab. No.	Methane. CH_4	Carbon dioxide. CO_2	Oxygen O_2	Nitrogen N_2	Vel air cu. ft. per minute.	Cu. ft. methane per 24 hours.	Relative humidity.
428	41733	0.17	0.09	20.64	79.10	4545	11520	87
528	41734	0.52	0.22	20.45	78.85			92
532	41735	0.56	0.15	20.57	78.94			92
709	41497	0.10	0.10	20.75	79.05	9000	12960	84 duplicates.
712	41496	0.11	0.10	20.70	79.09			84
24	41498	0.23	0.14	20.63	79.00	5400	23040	95 duplicates.
54	41499	0.30	0.15	20.57	78.98			95
101	41500	0.17	0.15	20.51	79.17	9000	21600	85 duplicates.
106	41501	0.16	0.16	20.54	79.14			85
108	41502	0.21	0.15	20.36	79.28	5200	15800	86 duplicates.
93	41503	0.20	0.15	20.42	79.23			86
22	41504	0.17	0.19	20.44	79.20	4815	12960	90 duplicates.
29	41505	0.19	0.20	20.43	79.18			90
827	41536	0.21	0.11	20.70	78.98	5600	10080	98 duplicates.
826	41537	0.20	0.13	20.65	79.02			98
103	41538	0.13	0.12	20.67	79.08	56400		94 duplicates.
102	41539	0.13	0.11	20.67	79.09		67680	94
96	41541	0.16	0.12	20.71	79.02	23200	75400	90 duplicates.
104	41540	0.28	0.15	20.51	79.06			90

All of the samples indicated that the methane given off was well diluted and that the ventilation was ample.

Following the explosion samples were taken in the affected area as follows:

Bottle Number.	Laboratory Number.	Location.
611-612	42418-19	50 feet outby face of 4th Left aircourse off East slant.
621-622	42447-48	10 feet inby Room No. 31, 3rd Left off East slant.
628-629	42449-50	On East slant 75 feet outby 3rd Left. (This is return for the East slant section.)

Bottle Number.	Laboratory Number.	Methane. CH_4	Carbon dioxide CO_2	Oxygen O_2	Nitrogen N_2	Vol air cu. ft. per minute.	Cu. ft. methane per 24 hours.
611	42418	0.11	0.11	20.74	79.04	5000	4400 duplicates.
612	42419	0.12	0.11	20.74	79.03	5000	5200 duplicates.
621	42447	0.19	0.10	20.67	79.04	3360	9200 duplicates.
622	42448	0.19	0.11	20.66	79.14	3360	9200 duplicates.
628	42449	0.25	0.05	20.47	79.23		duplicates.
629	42450	0.19	0.12	20.62	79.07		duplicates.

These samples indicate about the same percentage of methane as the samples taken on previous occasions, and all indicate that there is ample air being circulated to keep the methane well diluted. They

further indicate, as pointed out in previous reports made on this mine, that the mine makes an appreciable amount of methane and that care must be continually exercised to prevent its accumulation.

STORY OF EXPLOSION

The explosion occurred at about 8:45 A. M., shortly after the day shift had started work and was confined to the undusted portions of the 3rd and 4th left entries off the East slant.

There were about 200 men in the mine on the day of the explosion; fifty-four of these were working in the East slant section.

There is no question in the minds of those who visited the East slant section following the explosion but that the rock dusting prevented the spread of the explosion, at least through the East slant section and possibly through the entire mine and was the means of saving a great many lives.

The parting on the 3rd Left entry is just inby the slant and too far back from the face for economical haulage. In order to put in a new parting nearer the face of this entry and not be interrupted by haulage, it was decided to move the men from the 3rd Left up to the 4th Left. On the morning of the explosion the men from the 3rd Left were just starting to work in the 4th. The men in Rooms Nos. 1 and 2, and at the face of the entries were at work in their respective places. The balance of the men were waiting along the 4th Left, most of them on the parting, for the motor to bring in the cars of tools from the 3rd Left.

At the time of the explosion the motorman was coming out of the 2nd Left with a trip of loads and although he felt the force of the explosion he was not hurt. The explosion had caused the trolley wire to become shorted, blowing out the circuit breaker on top and cutting off the power. As it is down grade from the 2nd Left to the Main East, the motorman coasted the trip as far down the Main East as it would go and ran to the bottom, giving the alarm.

The section boss in the 2nd East entries gathered the thirty-four men together who were working in these entries and led them safely to the shaft bottom.

The only person in the 3rd Left entry at the time of the explosion was a track layer who was supposed to go up as far as Room No. 25 for some tools.

The man working in the face of the 4th Left had finished drilling one shot hole at the face, had taken down his post and was back at the crosscut filing his drills preparatory to drilling a second hole. He had sharpened one drill and had one prong of the second completed when the explosion occurred.

The theory advanced by the company officials was that this man had drilled into a gas feeder in the hole he had completed and that his open lamp had ignited an explosive mixture that had accumulated at the head of the entry. Their reason for this theory is that when they got into the 4th on the recovery work they could hear the feeder.

The evidence, however, would appear entirely contradictory to this. First, the place had been cut the day before to a depth greater than the drill hole and had been examined the morning of the explosion and no gas found at the face of the entry. In the second place, if the miner had struck a gas feeder of this magnitude he would in all probability have lit the gas while drilling the hole or while taking down the post. Also no methane was observed in the entries during the recovery work following the explosion though the ventilation had been deranged for several hours. On the 15th, a week after the explosion, the shot hole was still making considerable noise, but mostly due to water, as the face of the entry is quite wet. No cap was obtained in a flame safety lamp when held at the mouth of the hole.

The evidence very clearly showed that the force of the explosion had come from the 3rd into the 4th. Their theory being that the gas explosion had gone into the 3rd, ignited the dust and then come back with renewed violence, the evidence of the direction of forces would seem to preclude any such possibility.

Word of the explosion was received by G. T. Powell, of the Evansville Station, at about 11:00 A. M. He immediately got in touch with the Vincennes Office, and J. F. Davies drove to Evansville, joining Mr. Powell and driving with him by truck to Sturgis with equipment from the Evansville Station, arriving at Mine No. 9 about 5:00 P. M. A. U. Miller arrived at Sturgis the morning of the 9th and also assisted with

the recovery work. By the time Mr. Powell and Mr. Davies arrived at the mine Mr. Christian, the General Superintendent, and rescue party had restored ventilation sufficiently to get to the 4th through Room No. 18 off the 3rd, recovering three bodies and locating several others. As the haulage and traveling road is normally the return it had been necessary to travel the air course from the shaft bottom to the left entries and, as this entry is very low and difficult to travel, it was decided to reverse the air in order to make it possible to use the haulage road and bring out the balance of the bodies. This was done and the bodies on the 4th were recovered by 3:00 P. M. the next day.

The body of the track layer in Room No. 50 off the 3rd, was recovered the day following. With the exception of the latter, all of the bodies were very badly burned.

No oxygen breathing apparatus was used during the recovery work. Gas masks belonging to the company, however, were used to good advantage.

On June 15th an investigation of the explosion was made. The investigating party consisted of the following: Messrs. Christian, Jones and McCann of the West Kentucky Coal Company, State Mine Inspector Boetger, and Messrs. Powell, Davies, Miller and Herbert of the Bureau of Mines.

Beginning on the 4th Left, it was very apparent that the force had all been outby. A new parting had recently been made on the 4th

Left haulage entry, necessitating the taking up of a considerable amount of fire clay bottoms. The fire clay had been scattered along the sides of the entry and had evidently acted as a barrier, as a heavy coating of the clay was observed on the ribs from the parting outby. A rib dust sample was taken on the outby end of this parting. The coal dust that makes up the combustible of this sample was largely deposited as a coating on top of the fire clay during the explosion.

No evidence of flame was observed outby point where the rib dust sample was taken, although the bodies on the 4th were all badly burned. From the point where Room No. 18 holes into the 4th to the face of these entries the flame had apparently gone towards the face, with little violence, as heavy deposits of coke were noted on the outby ribs of the crosscuts. Heavy deposits of coke were also observed on the inby side of a car in the last crosscut between the air course and the 4th Left, while at about the 3rd crosscut from the face, heavy deposits of coke in situ were observed, indicating intense heat with little violence. Against the upper rib of the 4th Left aircourse just opposite the crosscut from Room No. 18 there was a considerable deposit of dust and refuse, including the handle of a broken shovel and some cap pieces. Without question, this material came up out of Room No. 18 off the 3rd.

The greater part of the violence coming up out of Room No. 18 onto the 4th Left had evidently gone through the crosscuts to the upper or haulage entry, as the stoppings between these entries were blown towards the lower entry.

Rooms Nos. 18 to 24, off the 3rd Left, had only recently been driven up their required distance and stopped, and, as is customary in this mine a line of crosscuts had been driven through the room pillars at the face of the rooms. Along this line of crosscuts there was evidence of extreme heat and considerable violence. On the floor against the inby ribs were heavy deposits of dust and refuse, while the upper part of the inby ribs were swept clean. On the outby ribs heavy deposits of coke were observed, indicating that the force had been toward No. 18 Room.

At outby crosscuts between these rooms, the evidence was more or less contradictory. The most general direction, however, was towards Room No. 18. From Room No. 24 to No. 28 there was a gradual diminution of force. The force, however, still had a general outward direction. From Room No. 28 inby a distinct reversal of force was observed.

The body of the track layer was found in the crosscut between Room No. 29 and Room No. 30, and was the least burned of any of the men killed.

The direction of force from the mouth of Rooms No. 16 to No. 32 was all toward the entry. The entry steppings were all blown towards the aircourse.

On the 3rd Left entry no evidence of flame was observed beyond Room No. 17, and the violence on this entry did not extend beyond Room No. 14.

The following are the results on the as received basis of road and rib dust samples taken after the explosion:

Sample, Can No. B-686, Laboratory No. A-1452, taken on the left rib, 4th Left entry, just outby new parting beyond evidence of flame:

Moisture	Vol. Matter	Fixed Carbon	Ash	Thru 48-mesh	100-mesh	200-mesh
5.9	20.5	28.6	45.0	70.1	52.3	36.4

Sample, Can No. B-748, Laboratory No. A-1457L, taken on the left rib, 3rd Left entry, beyond any evidence of flame:

Moisture	Vol. Matter	Fixed Carbon	Ash	Thru 48-mesh	100-mesh	200-mesh
6.0	24.1	30.9	39.0	75.8	51.0	28.2

Sample, Can No. B-126, Laboratory No. A-1457Z, taken on the left rib, 3rd Left entry just inby Room No. 29:

Moisture	Vol. Matter	Fixed Carbon	Ash	Thru 48-mesh	100-mesh	200-mesh
15.9	18.6	24.9	40.6	62.0	38.9	25.6

Sample, Can No. B-959, Laboratory No. A-1457Z, taken along roadway on 3rd Left, at same point as rib dust Can No. B-126. There was evidence of intense flame where these samples were taken.

Moisture	Vol. Matter	Fixed Carbon	Ash	Thru 48-mesh	100-mesh	200-mesh
5.6	26.8	36.4	30.2	61.7	41.0	24.7

It was observed when taking all of the rib samples that a deposit of fine coal dust had occurred on top of the shale dust coating and probably subsequent to the passage of the flame. It is thought, therefore that the samples indicate a lower percentage of ash than obtained prior to the explosion.

CONCLUSIONS

(1) The evidence all seems to indicate that the explosion had its origin in Room No. 28 or Room No. 29 off the 3rd Left, and was in all probability, due to the ignition of a body of gas by the open light of the track layer in either of these rooms. The fire boss was supposed to have made all of the rooms off the 3rd the morning of the explosion. However, no marks were observed at the face of any of the long rooms off the 3rd Left to indicate that he had inspected them. It is therefore believed that either the fire boss failed to go beyond the last room crosscuts or that the gas had accumulated in the four hours that had elapsed between the time of his inspection and the time of the explosion.

(2) The initial gas explosion was propagated both inby and outby from the point of origin by coal dust.

(3) The explosion was confined to a very limited area by the shale dust that had been applied some five months previous.

(4) This explosion, as well as a number of others, has indicated the value of shale dust. They also indicate that the dusting should be carried up into the rooms.

(5) Since the explosion the entries and room necks have been given a very thorough rock dusting.

(6) Electric cap lamps are being installed in Mine No. 9, also in a number of other mines operated by this company.

(7) The company is certainly to be commended for its progressiveness in the adoption of such safety precautions.

Although the explosion hazard at these mines is no greater than at the other mines in this field, it was the first company in the State to adopt rock dusting, and is now the first to install electric cap lamps.

RECOMMENDATIONS

(1) That the rock dusting be extended up into the rooms. That particular care be taken to give a heavy application to any rooms connecting one entry to another, such as Room No. 18 off the 3rd Left, and that in addition dust barriers be erected in such rooms.

(2) That greater care be taken to see that machine cuttings are loaded out, as numerous piles of these cuttings were observed in rooms that had finished.

(3) That some thought be given and experimenting done on the application of water sprays to the machine cutter bars. If they can be applied economically, they would eliminate to a large extent the scattering of fine coal dust in the rooms and along the entries, and as a result fewer applications of rock dust would be necessary.

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