

REPORT OF EXPLOSION

No. 29 Mine

SUPERIOR SMOKELESS COAL AND MINING COMPANY

TAHOMA, LE FLORE COUNTY, OKLAHOMA

by

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REPORT OF EXPLOSION
NO. 29 MINE
SUPERIOR SMOKELESS COAL AND MINING COMPANY
TAHONA, LE FLORE COUNTY, OKLAHOMA.

At about 8:40 A. M., September 3, 1926, an explosion occurred in the No. 29 Mine of the Superior Smokeless Coal and Mining Company, Tahona, Oklahoma, resulting in the death of 16 men. The only man in the 7 $\frac{1}{2}$ West who escaped was a driver on the parting near the slope. Shortly after the first explosion a second slight explosion occurred caused by the ignition of gas on the 7th West Entry at about No. 3 Room. The men making their way out of the 7th West after the first explosion ran into the gas with their open carbide lamps, seven of them received slight burns.

At the time of the explosion there were 141 men in the mine, of these 125 escaped unassisted, the explosion having been confined to the 7 $\frac{1}{2}$ West Entry where it had its origin.

Last Spring the rooms and entries were rock dusted and rock dust barriers were erected at numerous points in the mine, and it is believed that the rock dust together with the moist condition of the entries was largely responsible for the confining of the explosion to the entries in which it originated.

LOCATION

The No. 29 Mine is located at Tahona, Le Flore County, Oklahoma, on the Midland Valley Railway and is a subsidiary of the

Peabody Coal Company of Chicago, Illinois. The principal office is at 332 South Michigan Avenue, Chicago, Illinois.

OFFICIALS

The principal officials of the company are as follows:

| | | |
|-----------------|----------------|-------------------|
| President: | G. W. Reed | Chicago, Illinois |
| Treasurer: | W. A. Fisher | Chicago, Illinois |
| Secretary: | Joseph Solari | Chicago, Illinois |
| Superintendent: | D. D. Griffith | Tahona, Oklahoma |
| Mine Foreman: | Joseph Herbert | Tahona, Oklahoma |

EMPLOYEES AND TONNAGE

The mine employs from 150 to 160 men underground and about 25 on top, and produces from 700 to 800 tons per day.

COAL BED

The mine is operating in the Lower Hartshorne Bed, also locally known as the Panama Bed. At this point the coal will average about 4' - 6" in thickness and dips to the south at an angle of from 12 to 15 degrees.

The analyses of face samples collected September 7, 1926, are as follows:

As Received:

| <u>Location in Mine</u> | <u>Lab. No.</u> | <u>Mois- ture.</u> | <u>Vol.</u> | <u>Fixed C.</u> | <u>Ash.</u> | <u>Sul- phur.</u> | <u>B.T.U.</u> |
|---------------------------------------------------------------------|-----------------|--------------------|-------------|-----------------|-------------|-------------------|---------------|
| Right rib 7 $\frac{1}{2}$ W. aircourse 100 ft. outby face of entry. | A24785 | 1.4 | 17.4 | 72.9 | 8.3 | .6 | 13990 |

| <u>Location in Mine</u> | <u>Lab. No.</u> | <u>Mois- ture.</u> | <u>Vol.</u> | <u>Fixed C.</u> | <u>Ash.</u> | <u>Sul- phur.</u> | <u>B. T. U.</u> |
|--------------------------------------------|---------------------|------------------------|-------------|---------------------|-------------|-----------------------|-----------------|
| Left rib Main slope 75' outby face. | A24786 | 3.4 | 15.8 | 74.3 | 6.5 | .7 | 13950 |
| Right rib 8 W. Entry 10' outby face. | A24787 | 3.5 | 15.5 | 73.6 | 7.4 | .8 | 13870 |
| 8 East Entry at face. | A24788 | 2.8 | 16.1 | 73.9 | 7.2 | 1.5 | 13970 |
| Composite of above. | A24789 | 2.8 | 15.9 | 73.8 | 7.5 | .8 | 13940 |

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Samples collected September 8, 1926 by W. W. Fleming, U. S. Geological Survey, and C. A. Herbert and J. B. Hynal of the U. S. Bureau of Mines.

Analyses by H. M. Cooper, U. S. Bureau of Mines, Pittsburgh, Penn.

ROOF

The roof is a strong dark shale.

FLOOR The floor is composed of alternate thin layers of shale or fire clay and coal.

MINING METHOD

This mine is operated on the room and pillar method, three slope entries being driven directly down the dip from the outcrop. The center entry is the intake air course and haulage road while the two outside entries are the returns. Room entries or lifts are turned at right angles to the slope along the strike about 250 feet apart. All entries are supposed to be 12 feet wide. The rooms are driven quartering with the pitch from the upper entry and are usually about 300 feet

in length and 25 feet wide with room pillars of about 15 feet.

The coal is all undercut by shortwall machines of the non-permissible type and loaded by hand. No attempt is made to recover any of the pillar coal. The percentage of extraction will probably not exceed 50%.

VENTILATION

The mine is ventilated by means of a low pressure steam driven centrifugal fan operating exhausting and is producing about 54,000 cubic feet of air per minute against a water gauge pressure of 1/2 inch.

There are three splits of air, the east side of the mine being on one split, the west side from the bottom of the slope to and including the 7th West forming the second split, the balance of the west side workings forming the 3rd split.

Samples of air were taken as follows:

1. Sample Bottles 826-827, Lab. No. 44188-44189, taken in Main Return just inby fan.
2. Sample Bottles 828-829, Lab. No. 44190-44191, taken on top of over-cast over main slope about 400 feet inby mouth of slope and in the return for the east side of mine.
3. Sample Bottles 806-807, Lab. No. 44186-44187, taken in Room No. 2 off the 7½ West where the room holes into the 7th West Entry and in the return for the West side of the mine below the 7th West.
4. Sample Bottle 821, Lab. No. 44192, taken at the face of the 7½ West air course.
5. Sample Bottle 820, Lab. No. 44194, was taken at the face of the 7½ Entry.
6. Sample Bottle 817, Lab. No. 44193, was taken at the face of No. 15 Room off 7½ West.

| | <u>Bet.</u> <u>No.</u> | <u>Lab.</u> <u>No.</u> | CO ₂ | O ₂ | CO | CH ₄ | N ₂ | <u>Cu. ft.</u> <u>Air per</u> <u>Minute.</u> | <u>CH₄ per</u> <u>24 hours</u> | |
|----|---------------------------|---------------------------|-----------------|----------------|------------|-----------------|----------------|----------------------------------------------------|----------------------------------------------|------------------|
| 1. | 826 827 | 44188 44189 | .15 .18 | 20.52 20.50 | 0.0 0.0 | .80 .79 | 78.53 78.53 | 54000 54000 | 621800 | Dupli- cates. |
| 2. | 828 829 | 44190 44191 | .14 .14 | 20.57 20.56 | 0.0 0.0 | .52 .50 | 78.38 78.30 | 17000 17000 | 122400 | Dupli- cates. |
| 3. | 806 807 | 44186 44187 | .11 .16 | 20.47 20.46 | 0.0 0.0 | 1.19 1.18 | 78.23 78.20 | 14400 14400 | 245500 | Dupli- cates. |
| 4. | 821 | 44192 | .10 | 18.6 | 0.0 | 14.6 | 66.7 | | | |
| 5. | 820 | 44194 | .10 | 11.9 | 0.0 | 36.9 | 51.1 | | | |
| 6. | 817 | 44193 | .10 | 14.8 | 0.0 | 14.7 | 70.4 | | | |

The above analyses indicate that without question the mine liberates a very large amount of methane (CH₄), entirely too much for an open light mine.

Analysis No. 1 from sample taken in the main return, shows 8/10 of one percent methane. By computation, therefore, the mine is found to liberate in the neighborhood of 600,000 cubic feet of pure methane each 24 hours.

Analysis No. 2 from sample taken in the return for the east side while showing a high percentage of methane, indicates that the east workings are receiving a more nearly adequate supply of air than those on the West side.

Analysis No. 3 from sample taken in the return for the west workings below the 7th West, shows a gas content of 1.19 percent, which

is extremely high and would indicate that the ventilation in this section should be materially increased.

Analyses Nos. 4, 5, and 6, taken at the face of the $7\frac{1}{2}$ West Entries and at the face of No. 15 Room, all show an extremely high methane content; in fact, an explosive mixture could be found with a flame safety lamp at the face of all the rooms off the $7\frac{1}{2}$ West. This of course is an extremely abnormal condition due to deranged ventilation, but again indicates the large amount of gas given off in this section of the mine.

The main return air courses, where observed, were not in very good shape and offered a considerable resistance to the flow of air because of gob and props set in the entry. If the condition of the air courses where observed is an indication of their condition generally, it is believed a very material increase in the ventilation could be obtained if these air courses were cleaned up and timbered with crossbars instead of with posts.

Two fire bosses are employed, one examining the east side and one the west side of the mine. It is the practice at this mine for the fire bosses to make their respective runs beginning at 3 A. M. and finishing about 6:30 A. M. They then go on top, mark up their board at the top of the slope, indicating which, if any, of the places had gas in them, then return to the mine and spend the balance of their shift looking after the ventilation, extending of curtains, etc., quitting at noon. Two fire runners are also employed to examine for fires following the shooting and to replace any curtains that may have been knocked down by the shooting.

The practice at this mine is to hang a curtain on the entry between each room, also to run a line curtain up each room and entry from the last cross cut to within a short distance of the face.

HAULAGE

Haulage on the slope is by means of single rope and steam driven engine; gathering and room entry haulage is by mule. The cars are of wood of the lift end gate type and hold about 1-1/4 tons with a topping of about 6 inches, track gauge, 36 inches.

LIGHTING

Underground lighting is all by open carbide lamps. Flame safety lamps of the key-locked type are used for testing by bosses.

MACHINERY UNDERGROUND

Underground machinery consists of electrically driven pumps, coal cutting machines and an electrically driven hoist at the bottom of the slope. These are all of non-permissible type and are all operated on 250 volt D. C. current. Wiring, where observed, was generally poorly installed.

EXPLOSIVES

The coal is all shot by permissible powder and fuse. Big Red #1, manufactured by the Equitable Powder Company, is the brand used, in cartridges 1 3/4" x 6". The same powder is used for brushing, although very little is used for this purpose. Three shots, two rib and one center, are usually required in rooms, and two rib shots in the entries. Shot holes are 2 1/4" in diameter and about 5 1/2 feet long. The maximum charge for any one hole is three sticks. Shots are all tamped

with clay sent in from the outside, the miner drills the holes, makes up the primer and clay dummies and the shotfirers charge and fire the holes after the men are out of the mine. Two shot firers are employed. During the month of August 1762 $\frac{1}{2}$ pounds of powder were used and produced 9309.6 tons of coal or 5.4 tons per pound of explosive. These figures include the small amount used for brushing.

DRAINAGE

The slope entries are wet also the room entries as far as the first partings. It is necessary to maintain a pump at the face of the slope and at points along the slope. These are operated by non-permissible motors. As the room entries are driven slightly to the rise the drainage in these entries is towards the slope. The coal is dry, the water coming mostly from the bottom.

The inside workings are dry and dusty; the room entries, while dry at the face get damp towards the slope. At the time of this investigation a considerable amount of moisture was being carried into the mine by the ventilating current and being deposited along the entries. The writer visited this mine during the past winter and at that time the reverse was true; the roadways were much drier and dustier than at present due to the ventilating current taking moisture out of the mine.

DUST

Because of the extremely soft friable nature of the coal there is a tendency for the entry ribs to continually slough off, and as a result there is always considerable fine coal dust present on them. Due also to the nature of the coal a great deal of fine dust is made at the face, a considerable portion of which is naturally carried with the air current and deposited back along the gob in the rooms and on the entries. Then too, the cars are

not tight and nearly all of them have one or more flat wheels caused doubtless by spragging them down out of the rooms. As a result the cars pound along the track, distributing the dust as they go.

ROCK DUST

Last April the mine entries and rooms were given an application of finely ground limestone dust. Application was made by means of an electrically driven distributor. Twenty barriers were also erected at various points in the mine, each barrier consisting of a bank of 32 troughs 6 feet long with 6 inch sides. The location of these barriers is indicated on the accompanying map. Due, however, to the continual sloughing of the ribs and the continual deposits of fine coal dust, the presence of the rock dust on the entries was not very apparent at the time of the investigation.

Samples of road and roof and rib dusts were obtained in the 8th West and the 8th East Entries, each sample being the composite of six separate samples taken at about 200 or 300 foot intervals and it is thought will give an indication of what condition the dusting was in on the 7 $\frac{1}{2}$ West where the explosion occurred.

(For table of analyses, see page 10.)

The moisture content of these samples is much lower than was expected. At the time the samples were taken the ribs and floor appeared damp.

The ash content is also lower than was expected and certainly low for a mine that had been thoroughly rock dusted only a few months previous to the taking of the samples, and is due to the sloughing of the ribs and to the large amount of fine coal dust that is continually

(As Received)

TABLE OF DUST SAMPLES

| Dust and location | Lab. No. | Moist- ture. | Vol. | Fixed C. | Ash | Cumulative of part thru 20-mesh | | | | | | V.M. Vol.+F.C. |
|-------------------------|----------|-----------------|------|----------|------|---------------------------------|------------|------------|------------|-------------|-------------|-------------------|
| | | | | | | On 20 | Thru 20 | Thru 20 | Thru 48 | Thru 100 | Thru 200 | |
| Roof & Rib 8th West. | A24781 | 4.3 | 19.9 | 45.7 | 30.1 | 51.2 | 48.8 | 100 | 58.3 | 42.3 | 31.9 | .303 |
| Road 8th West. | A24782 | 4.8 | 16.4 | 60.2 | 19.6 | 47.0 | 53.0 | 100 | 53.7 | 37.1 | 23.3 | .204 |
| Roof & Rib 8th East. | A24783 | 6.5 | 27.3 | 23.8 | 32.4 | 43.1 | 56.9 | 100 | 72.5 | 56.1 | 36.7 | .447 |
| Road 8th West. | A24784 | 6.9 | 16.9 | 57.8 | 18.4 | 50.5 | 49.5 | 100 | 47.4 | 26.9 | 12.8 | .226 |

Samples collected September 8, 1926, by E. W. Fleming, C. A. Herbert and J. B. Hynel.
Analyses by H. M. Cooper, U. S. Bureau of Mines, Pittsburgh, Penna.

being deposited. In order for the rock dust to be effective it will therefore be necessary to make applications at more frequent intervals and to try to eliminate as much as possible the formation of such large quantities of fine coal dust.

EXPLOSION DATA

An investigation of the explosion was made September 7 and 8th by W. W. Fleming of the U. S. Geological Survey, and officials of the coal company, C. A. Herbert and J. B. Hynal of the Bureau. Investigations were also made by the State Inspection Department previous and subsequent to the above dates.

The mine was working on the day of the explosion. There were 141 men in the mine at the time. These constituted the regular underground force with the exception of the machine runners; these latter were just preparing to go into the mine at the time of the explosion.

The fire bosses had made their usual inspection and had come to the outside at about 6:30 A. M., and marked up the board at the mouth of the slope, showing that the mine was free of gas. In making their inspections the fire bosses start at the bottom of the slope, so that the examination of the 7 $\frac{1}{2}$ West, where the explosion occurred, was made but a short time before the report was made on the board. After eating a lunch, the bosses went back into the mine. The fire boss for the west side had gone into the 7 $\frac{1}{2}$ West and was among those killed, his body being found on the entry between No. 15 and No. 16 Rooms.

The explosion was relatively mild, causing very little damage to the mine, having been confined to the pair of entries in which it or-

iginated. Some 25 stoppings were blown out and a rather heavy fall of rock occasioned on the 7 $\frac{1}{2}$ Entry between No. 14 and No. 15 Rooms. The damage could all be repaired and the mine made ready for operation in a very few days.

The direction of force from the next to the last cross cut on the 7 $\frac{1}{2}$ West Entry apparently had been outby. The board stoppings in the cross cuts between the entry and air course that had been blown out were blown towards the air course. About 16 of these stoppings towards the outby end of the entries were not blown out; trap doors at the parting near the slope were not damaged. From the 2nd to the last cross cut to the face of the entry the direction of force appeared to have been inby. At this cross cut the force had been from the entry to the air course.

In No. 17 Room the force appeared to have been outby towards the entry and towards the No. 16 Room. In No. 16 Room the forces again appeared to have been outby towards the entry and towards No. 15 Room. In No. 15 Room the forces were outby towards the entry.

EVIDENCE OF HEAT OR FLAME

There was little evidence of heat or flame. The only places where such evidence was observed were at the face of the air course and in No. 16 Room inby the last cross cut and in the last cross cut between No. 16 and No. 15 Rooms.

Deposits of coke were observed on a loaded car at the face of the air course. Deposits of coke were also observed on a car at the face of No. 16 Room and on props inby the last cross cut in this room.

Splinters on props near the face of this room were also charred. Deposits of coke were also observed in the cross cut between No. 16 and No. 15 Rooms. No evidences of flame were observed on either the entry or air course outby the last cross cut. Splinters on props were not charred; pieces of paper found along the entry showed no evidence of heat, neither did the threads from frayed pieces of curtain cloth.

The clothing had been burned from the body found at the face of the entry. The clothing on none of the others had been burned although they all showed some burns, those nearest the head of the entries naturally being burned the most severely. It is rather hard to understand why the bodies in the rooms outby the fault should all have been burned as much as they were without some evidence of flame in these rooms. Apparently the flesh burns were caused by the heat from the explosion and not by any actual flame. By referring to the map it will be observed that because of the rooms being driven quartering up the pitch, the last cross cuts in the rooms from No. 13 outby form a short, an almost direct connection from the entry, and may explain why the heat reached the men at the faces of the rooms.

The explosion without question had its origin near the head of the 7 $\frac{1}{2}$ West Entry and was due to the ignition of a body of gas, probably by an open light. Mr. Boyle, Chief State Mine Inspector, following his investigation, stated that in his opinion the explosion had its origin in No. 17 Room, and admitted that it was doubtless due to an open light. The coal company officials believe its origin was in the 7 $\frac{1}{2}$ West Entry inby the last cross cut, and due to the ignition of gas by an open light.

The body found at the face of the 7 $\frac{1}{2}$ West Entry was the most severely injured and burned of any of the men, and had apparently been thrown with considerable violence against the face. Other indications also indicated the forces inby from the last cross cut, which would indicate that either the explosion had its origin outby this point or that the body and other material had been thrown towards the face by retonation waves.

In No. 17 Room the indications were that the force had been outby towards the entry and also towards No. 16 Room, which gives support to Mr. Boyle's theory.

To the writer the evidence was hardly conclusive enough to determine the exact point of ignition except that it was inby Room No. 16.

The electric power is put on the wires at starting time and had been on the wires a little over an hour at the time of the explosion. The electric pumps had been in operation for perhaps an hour, the mining machines, as stated, were not in operation, the machine wires were back some distance from the face of the entries and there were no live wires into any of the rooms. The most probable source of ignition therefore was an open carbide lamp.

Apparently coal dust did not enter into the explosion to any extent, as the only evidence of coking was at the face of the air course, the face of No. 16 Room and in the cross cut between Rooms 15 and 16.

With the exception of the telephone on the 7 $\frac{1}{2}$ West, which was blown from its supports, none of the inside telephones were disturbed, and immediately after the explosion calls were put into the outside from the various sections of the mine to find out what had happened, and the men were thus told of the explosion and to come out of the mine at once. The explosion was scarcely felt on the east side of the mine and it was necessary to send in to many of the men to notify them to come out.

The explosion was heard at the mouth of the slope and was followed immediately by a cloud of grey colored dust and smoke.

The men coming out the 7th West Entry ignited a body of gas with their open lights at about No. 3 Room, causing a second slight explosion which was heard at the surface and also caused a second slight cloud of dust to be emitted from the slope. Seven men received light burns in this second explosion and several men making their way up the slope were knocked down. All of the men were out of the mine within 30 minutes after the explosion occurred.

RECOVERY WORK

As soon as word of the explosion was received at the McAlester Station of the Bureau, Mr. W. W. Fleming, District Mining Supervisor for the U. S. Geological Survey, got in communication with Mr. David Griffith, Superintendent, and was advised as to the extent of the explosion and that it would not be necessary to use apparatus in the recovery work. Mr. Fleming then proceeded to Tahona by auto and assisted in the recovery work.

Mr. John Hynal, Foreman of the McAlester Station and Mr. P. E. Keegan, Foreman of Car 6, were at Pittsburg, Kansas at the time of the explosion and were instructed to proceed at once to Tahona. The recovery work, however, had been completed by the time they arrived.

Ventilation was restored to the 7 $\frac{1}{2}$ West by hanging curtains where the stoppings had been blown out and the bodies all recovered within a few hours after the explosion occurred.

The coal company has realized the hazard of using open lights in this mine and for more than a year has wanted to install electric cap lamps but were prevented from doing so by Chief State Mine Inspector Ed Boyle, who had issued an order preventing their use in the mines in Oklahoma until the mines were rock dusted and all electrical equipment was of the permissible type. In April the company thoroughly rock dusted the mine and again sought permission from Mr. Boyle to install closed lights, but without avail. Since the explosion the company secured electric cap lamps to use during the cleaning up of the 7 $\frac{1}{2}$ West entries and it is understood that the company has ordered a full equipment of permissible cap lamps and expects to permit nothing but closed lights in the mine when it is again started up, notwithstanding Mr. Boyle's order. Other coal companies in Oklahoma have already taken similar action and it is not thought that Mr. Boyle will dare attempt to enforce his order in the case of the Superior Smokeless Coal and Mining Company any more than he has done in the case of the other operators.

The company also expects to again thoroughly rock dust the mine before it is started up.

The company is certainly to be commended because of its insistence on the use of closed lights and for rock dusting. The following recommendations are made with the thought of further reducing the explosion hazard at this mine:

RECOMMENDATIONS

1. That the ventilation be materially increased, particularly in the West split below the 7th West Entry, as it would appear that this is the section of the mine making the most methane at the present time. To accomplish this the slope air courses should be cleaned and the speed of the fan increased.

2. That all electrical equipment should be of the permissible type.

3. That the face of the rooms and entries be wet down before and after shooting.

4. That water be applied to the cutter bar of the mining machine to reduce the formation of coal dust. The Rock Island Coal Company is using water on the cutter bars in its Hartshorne, Oklahoma mines, and it is understood the results have been very satisfactory, with a very marked reduction in the amount of fine coal dust in the mine. Dampening of the machine cuttings as they are made acts in two ways to reduce the dust hazard (1st), it tends to prevent the fine coal dust from getting into the air at the face and later being deposited on the roof, ribs and timber in

the mine; (2nd) it tends to prevent the spillage of the fine dust through the cracks in the pit cars and it also tends to prevent the fine dust blowing off the cars. A reduction in the amount of coal dust deposited along the roadways will make each application of rock dust effective for a correspondingly longer time.

5. That ^{for testing purposes} nothing but permissible, magnetic-locked flame safety lamps be used. *In addition miners' lights should be the permissible magnetically locked electric lamps.*

6. That the cracks in the pit cars be tightened up to reduce the spillage of fine coal dust along the roads.

7. It is understood that the company has had a change of mining methods under consideration for some time, that it has been contemplating changing from the present rise room method to a room and pillar panel method with rooms each way along the strike from the panel entries. This method of mining is being used successfully elsewhere, and it is thought would be a big improvement over the present method, not only from an economical standpoint, but also because it would be much easier to ventilate the working places and keep them free of accumulations of gas than it is possible to do with the present method of mining. It is therefore recommended that earnest consideration be given to an early change in mining methods.

8. That the use of fuse be discontinued and all shots be fired electrically.

The writer wishes to express his appreciation for the courtesy and cooperation given the writer and his associates during the investigation by the officials of the company.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "C. A. Herbert".

C. A. Herbert,
District Mining Engineer.