

Sykesville Mine Disaster Documents

Sykesville Mine

Cascade Coal & Coke Company

Sykesville, Jefferson County, PA

Accident date: July 15, 1911

Number of items: 2 reports 1 picture and 4 maps

Material types: reports, maps, picture

Important persons mentioned: HI Smith, JT Ryan

Historical note: At 3:30 pm the night shift of 27 men and the fireboss and the pumpman entered the mine. Six of these men worked on the north side and the other 21 in the south workings. At about 8:05 pm an explosion killed those in the south workings. Most of the men came to their death by suffocation; only one showed signs of violence and several were more or less burned. Recovery was begun at once and all bodies had been removed by the following morning. The explosion originated at an entry face by ignition of gas and dust by the flame of a shot or by an open light. Permissible explosives and black powder were used with coal dust for stemming, fired from a dry battery. Ventilation was not carried to that face and only haulageways were sprinkled.

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Date	Type	Filed by	Subject	Size
7/15/1911	Preliminary report	Bureau of Mines	Mine explosion preliminary report	1 page
7/15/1911	Report	HI Smith & J T Ryan	Report of the Sykesville Mine Explosion	39 pages
7/15/1911	Picture		Scene at the explosion at the Sykesville Mine	1 page
	Map		Map shows Sykesville Mine Workings Cascade Coal and Coke Company	2 pages
	Map		Sketch no. 3 shows 3 rd	1 page

			right butt main heading off 9 th left	
	Map		Map Shows back heading 9 th left off main south of Sykesville mine sketch no. 2	1 page
7/15/1911	Map		Sketch showing explosion zone at the Sykesville Mine of the Cascade Coal and Coke Co.	1 page

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

MINE EXPLOSION

File No. 17-108

Mine Sykesville Location Sykesville, Jefferson County, Pa
Company Cascade Coal & Coke Co Mailing address Buffalo, New York
Date July 15, 1911 Time of day a.m. 8:05 p.m. Mine working or idle Working
Total employment 267 Underground 207 Shifts worked 2 Daily production (tons) 1300
Number men killed 21 Injured In mine 29
Number men escaped unassisted 8 Rescued 0 Barricaded No
Type (gas or dust) Gas Ignition source Open light or blow-out Rock-dusted No
Was breathing apparatus used No Gas masks shot Self-rescuers
Time required to reach explosion area not stated
Classification (gassy or nongassy) Gassy Methane exhausted (24 hours)
Number of main fans 16' Cappel (Blowing) Quantity air per minute
Ventilation (continuous or split) 2 splits Face (line brattice or fans) line brattice
Mine openings Shafts Principal Shaft
Coalbed Lower Freeport (D) Thickness 60-78" Volatile ratio Roof Swiss Floor fire clay
Mining system Room & pillar Pillars extracted
Room support: Main entries Intermediate Section
Transportation: Main Self dumping Cages Intermediate Locomotives Section Locomotives
Electricity (voltage ac or dc) 250 dc Face Portable lights
Principal mining machinery (continuous miners, conventional, etc.) Compressed-air
punchers
Was machinery permissible type A Was it permissible
Blasting and explosives: Coal Permissible & Black powder Grading or special use perm or B.P.
Cause of explosion Ignition of gas by open light or blow-out shot

Did explosion result in fire or were fires found No
Point of origin Face of aircourse at 3 Right off 8 left
Area affected 8 and 9 South workings
Was Bureau report made Yes Author(s) H. I. Smith & J. T. Ryan
If no Bureau report, what and by whom
Remarks

REPORT

of the

SYKESVILLE MINE EXPLOSION

SYKESVILLE, PA.

SATURDAY, JULY 15, 1911.

by

H. I. SMITH

and

J. T. RYAN.

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THE SYKESVILLE MINE EXPLOSION.

SYKESVILLE, PA.

Report by H. I. Smith, and J. T. Ryan.

Saturday, July 15, 1911, at about 8:05 p.m. an explosion occurred in the Sykesville Shaft Mine, resulting in the death of 21 men by suffocation, one of whom showed signs of violence, and several were more or less burned. None of the men in the affected section of the mine escaped.

GENERAL INFORMATION.

The Sykesville Shaft Mine is about one mile south of the town of Sykesville, Jefferson County, Pa., and twelve miles south of Du Bois on the Buffalo & Susquehanna Railroad. The town of Sykesville lies at an elevation of 1300 feet above sea level. The mine is owned and operated by the Cascade Coal & Coke Company, with main office at Buffalo, N.Y. At the time of the explosion the Superintendent was Mr. C.C. Gadd, and the Mine Foreman was Aden Hull.

GEOLOGY AND CHARACTER OF COAL.

Coal Bed. The coal bed worked at Sykesville is known as the Lower Freeport or D. seam. It is one of the upper beds of the Allegheny or lower productive measures of the Carboniferous age. The bed is from 5 to 7 1/2 feet in thickness. The coal is bituminous and strongly coking, and is straight grained.

Coal Samples. A full section sample of coal was taken at the third right main off eighth left (Laboratory No. 12,455 F) and another

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sample at the face of the eighth left main (Laboratory No. 13453.F)
The measurements are given in Table I, and the analyses in Table 2, in
the appendix to this report.

Roof: The main roof is a strong sandstone. In the north side workings the sandstone comes down to the coal, and in some instances cuts it out entirely. The distance between the coal and the overlying sandstone gradually increases toward the south workings so that in the extreme southern portion of the mine as much as 6 feet of roof coal and several feet of slate intervene.

Floor: The immediate floor is a hard fireclay, which is separated from a poor quality of hard sandstone by about 4 inches of brown limestone.

Moisture: The coal at the face is usually dry but the old workings are mostly moist, due to water standing in local dips. On the main south inbye the eighth right butt and on the eighth right butt a large quantity of water comes through the overlying strata in large drops.

Gas: The portion of the mine lying south of the main south entry gives off considerable gas. The amount of gas appears to increase as the burden over the coal becomes greater. The gas comes from the roof and from within the coal bed. After being exposed for some time the feeders exhaust themselves and are no longer audible. Detailed occurrences of gas are given elsewhere in this text. Two gas wells, about one half mile north of the shaft furnish gas for commercial purposes, which gas is said to be obtained from the strata immediately above the coal bed. (See sample No. 6)

DESCRIPTION OF THE SYKESVILLE MINE AND METHOD OF OPERATION.

Mine development: The Sykesville Mine has three shaft openings

one called the No.1, or hoisting shaft; another the air shaft and the third the man-way shaft. The No.1 or hoisting shaft is a three compartment shaft, two compartments being used for hoisting and the third for water, steam, and compressed air lines. This shaft is 180 feet deep. The air shaft, which is the downcast, is 300 feet south of shaft No.1 and 180 feet deep. The manway shaft, 6700 feet from the main shaft is the upcast. It is 12 x 12 feet, ~~is~~ 200 feet deep and is open to an entry connecting the third and fourth butts off the sixth right. The shaft is equipped with stairs but is seldom used for ingress or egress by the miners.

The mine is developed by two sets of main entries called the Main north and the main south headings. The main south has a bearing S.81° 44' W. to the property line, a distance of about 9400 feet, with an average ascending grade of about 1.1 per cent. The main north was driven N 73° 16' W at an average ascending grade of about 1.8 per cent for a distance of approximately 6200 feet, where the coal is practically cut out by the sandstone cap. At present a tunnel is being driven through the sandstone a distance of about 800 feet to tap a large territory of good coal beyond. Considering that the mine was only opened in 1904, the area covered by the workings is quite extensive, the main haulage road being over 9400 feet long.

System of working: The mine is worked double entry, room and pillar system. The panel system has not been maintained, and the rapid advancement of the main entries is due to the fact that no pillars have been removed; ~~no pillars have been removed~~ and only a few room necks have been turned, south of the main south heading.

Mining: The coal was all undercut by Harrison compressed air puncher machines operated under a pressure of 80 lbs. For drilling rock two Sullivan compressed air machines were used. The miners ^{do} did their own

blasting. The usual method was to bore a hole in each corner of the entry; firing one, and then loading out the coal ~~xx~~ before charging and firing the other hole.

Haulage: The coal is loaded into wooden cars of two ton capacity, and have 14 inch wheels. The management aimed to have the cars constricted as tight as possible. The loaded cars are heaped up slightly above the sides. The cars are hauled by electric motors operated by 250 volts. Five ton reel motors are used for gathering and ten ton motors for hauling on the main entries. Mules are not used in the mine. The coal is ^{discharged} dumped directly from the ^{self dumping} ~~automatic~~ cage on to the screens. The size of opening of screens can be varied from 2 1/2 to 4 inches. The coal that passes over the screens goes to the crushers and thence to the bins along with the screen coal, and from there to the large bin by means of a Jeffrey conveyor. From the large storage bin the coal is dumped into larrys and hauled to the ovens by electric motor.

Humidity: There was no method ^{employed to} ~~of watering~~ the dust at the face. The only moisture the air receives is that which it takes up in passing through the wet and abandoned workings. Steam was turned into the intake shafts in winter, principally to prevent freezing in the shaft.

Ventilation: The mine is ventilated by a 16 foot Cappel fan used as a blower, operated at 80 rpm. under 1 1/2 inch water gauge. The fan is near the top of the air shaft. The mine proper is ventilated by means of two splits of air, a third, or smaller split ventilates a small section of the abandoned workings near bottom of air shaft. One split ventilates all of the north workings, the other split ventilates all of the south workings. Before the air of this latter split reaches the eighth and ninth headings, it ventilates all the abandoned area up to this point. However, the air in passing through these workings which are very wet, becomes

humidified almost to dew point. (See photograph of map in appendix for ventilating system.)

Lighting: ~~At~~ The shaft bottom and ~~on~~ the main haulage ways are lighted with 16 c.p., 220 volt electric lights. The miners use open lights exclusively, mainly carbide lamps.

Explosives: Monobel No. 3, a permissible explosive, was introduced into the mine some time previous to the explosion on recommendation of the state mine inspectors. Up to that time, black powder had been used. The Monobel was taken into the mine in the miners' pockets, and kept near their working place in a wooden box. The law requires that the miner shall not take into the mine an amount in excess of that needed for one shift. Black blasting powder FFF and FFFF was still used by the miners in several of the working places; at least the state mine inspectors brought out two partly used cans, and the writers found two other cans containing black powder at the face of the headings. Whether the miners had been in the practice of mixing the permissible with the black powder or not the writers are not in a position to say, but where the black powder was found there was also found permissible powder in the box.

Test of explosives: A full box of monobel No. 3 powder was received at the Bureau of Mines testing station from the mine magazine. The physical and chemical analyses of the sample were similar to the sample submitted by the powder company, which had been previously tested, and so no further tests were deemed necessary. Double strength electric detonators were used. They were detonated by a dry battery.

Preparing shots: The men drilled the holes about five feet deep and charged them with from two to two and a half sticks of monobel No. 3. Fine coal dust was then used for stemming and a wood or iron bar was used for tamping.

STORY OF THE EXPLOSION.

Local conditions: Saturday, July 15, 1911, the day of the explosion is reported as having been a clear, warm day. The barometer on the day of the explosion and three days previous registered at Pittsburgh, the nearest United States Weather Bureau station, as follows:

	Pittsburgh.	Corrected to sea level.
July 12,	29.147	30.03
" 13,	29.255	30.14
" 14,	29.261	30.14
" 15,	29.246	30.13

The output of the mine was about 1300 tons per day at the time of the explosion, although the mechanical capacity was greater. The mine was being worked in ~~two~~ shifts, a total of 207 men being employed underground, 20 on the surface, and 40 more about the coke ovens. At 3:30 p.m. on the evening of July 15, the night shift of 27 men and the fire-boss and the pump man entered the mine. Six of these men worked on the north side and the other 21 on eighth and ninth south workings. The six men in the north workings and the fire-boss and pump-man were the only ones who escaped alive from the mine.

The explosion: The fire boss, John Brown, had completed his rounds and had just about reached the shaft bottom on his way from the south workings when he felt a slight concussion but thought it was caused by a man working in the pump room. He continued on his way to the shaft bottom. Here he was informed by telephone message from the engineer on the surface that something had happened, as the air pressure had suddenly dropped and the circuit breaker would not stay in. Mr. Brown went to the surface, and on examining the fan, which was a blower fan, found that the relief doors had been thrown open at 8:05 and remained open for 15 minutes as shown by the indicator. Mr. Null, the mine

foreman, who lives close by the mine, was notified and arrived within a few minutes.

Rescue work: Mr. Brown, the fire-boss, Mr. Null the mine foreman, and the machinist, equipped with Wolf safety lamps, descended the shaft and proceeded to investigate the south workings. They penetrated the main south heading to a point about midway between the fifth and sixth right, where they encountered after-damp, and were unable to proceed in this direction beyond the sixth right. Being satisfied that an explosion had occurred they went to the sixth right and out the air shaft. Mr. Null was partially overcome and had to be assisted up the stairway to the surface where he was soon revived. They hurried to the main shaft and telephoned Mr. Byrne, the mine inspector at Punxsutawney, who arrived about 11 p.m. In the meantime Mr. Null assumed charge, the superintendent being away, and organized rescue parties and immediately began rescue work. The party entered the mine by way of the main shaft and proceeded in by the main south heading, which becomes the intake airway beyond the automatic door, which is located 1500 feet from the shaft. They repaired the stoppings and erected temporary brattices, and had started up the eighth left entry when Mr. Byrne arrived and took charge of the work. About 3 a. m. Mr. Elias Phillips, mine inspector, from Du Bois who was not notified until after midnight, arrived in his automobile and relieved Mr. Byrne. About 8 a.m. the bodies on the eighth left back entry were recovered and removed to the surface. At 9 a.m. Sunday, all the bodies had been removed and taken to the Sykesville Hardware Company's store which had been converted into a temporary morgue.

Need of rescue apparatus: If full equipment of rescue apparatus with trained miners had been available immediately after the explosion, it is possible that the eight men found on the back entry of eighth left, would have been saved.

NOTES OF EVIDENCE OBTAINED BY THE BUREAU OF MINES ENGINEERS.

Personnel: On Sunday morning, July 16, one of the Pittsburgh newspapers contained a small account of the explosion. Mr H.M.Wilson, Engineer in Charge, saw this account, which was the first knowledge he had of the explosion. He immediately assembled Mr. Burrell and several men of Mr. Paul's division (Mr. Paul being at Wilkes-Barre at the time). Car No. 7, which had just been delivered at Pittsburgh a few days previous and had not yet been ^{fully} equipped, was hurriedly fitted with apparatus from the Pittsburgh station. At 1.10 p.m. a special engine hauled the car to the Union Station, where it was attached to a regular P.R.R. train and taken to Red Bank, Pa. From there it was taken by a special engine to Du Bois, and thence to Sykesville shaft, arriving there at 4.55 pm. The following men accompanied the car: Messrs. H.M.Wilson, Engineer in Charge; J.C.Roberts, Mining Engineer; George A. Burrell and Frank Seibert, Chemists; C.E.Stevenson, Wm. Burke, Wm. Raudenbush and W.D.Roberts, foreman and first aid miners. Immediately upon arrival at the mine, Mr.Wilson hunted up the officials and volunteered the services of himself and men. There was nothing they could do at the time as all the bodies had been recovered or located.

Preliminary investigation: About 9:30 p.m. Messrs. Burrell, ^{W.D.}/Roberts, Seibert, Burke, Stevenson and Raudenbush, equipped with rescue apparatus, entered the mine before ventilation was restored, for the purpose of taking samples of the mine air. The party was led by fire-boss Brown. Mr. Brown did not have any rescue apparatus. Mr. Burrell carried with him a canary bird in a cage. The party proceeded up the main south heading to the eighth left, thence up eighth left to second right butt and up the

second butt on to ninth left. Here the helmets were put on and the party proceeded to the face of the third butt off ninth left. These men were the first to explore this entry after the explosion. Mr. Burrell took samples of mine air at the face of this entry (See sample No. 3) and upon noticing that the canary bird showed no ill effects in this air he opened his helmet. Samples were also taken at a point 150 feet from the face of this entry (see sample No. 1); two other samples were also taken, one just inside the mouth of the first left off eighth left main (see sample No. 13) the other 50 feet inside of the mouth (see sample No. 14). This is the first case where birds were used by the Bureau of Mines in the exploration of a mine after an explosion, although they have been used in a similar manner in foreign countries.

Blood samples were taken by Mr. Burrell from three of the bodies in the morgue. The samples were taken from an artery in the upper part of the arm. Two of the samples showed complete saturation with carbon monoxide the third sample showed about 75 per cent saturation. (a)

FOOTNOTE: (a) It is supposed that a man dies when the blood is about 75 per cent saturated with CO, and could be saved at 50 per cent. saturation.

DETAILS OF EVIDENCE, ENTRY BY ENTRY: The writers, Messrs. Smith and Ryan, on the morning of July 22, seven days after the explosion, entered the mine accompanied by fire-boss Brown and Foreman Null, and began the investigation for the purpose of this report. Ventilation had been temporarily restored on the main entries. The work of restoring permanent stoppings and cleaning up the mine was being rapidly carried on. Some parts were difficult - - - -

to explore on account of falls, or on account of the ventilation not sufficiently having been/restored.

Main south headings: The first evidence of the explosion in these entries was observed near mouth of fifth right entry. The stoppings, (dirt and stone) were damaged and the tops blown out toward the back entry. Very little fine dust was found at this point. A sample of road dust was taken for 100 feet along the entry outside of the fifth right. (see analysis, Lab? No. 12500 F). Beyond the seventh left on the main south, all the stoppings were blown down, and toward the back entry up to the second stopping inbye the ninth left. From that point inbye the next two stoppings were slightly damaged. Beyond this a slight deposit of dust was found for some distance, but no other indication of disturbance. The entries were quite wet and fungus which had formed on the timbers, had not been disturbed. No gas could be detected anywhere at the face workings of main south headings.

Back entry of eighth left: The stoppings between main and back entries were blown down and toward the back entry up to the third butt right entry. Thirty feet inbye the point where the second right off the seventh left entry intersects the eighth left, a sample of the intake air was taken to determine if any methane was being generated in the workings up to this point. (See photograph of map.) (Note - This split ventilated all the abandoned workings to left of main south heading up to this point). (See analysis No. 11) On this back entry about opposite the second right butt a 6 inch air line was broken by the force of the explosion. On this back entry about 30 feet inbye the first left the first body was found. It was facing inbye. A

short distance beyond him the motorman's tool box was found; the motorman's body was found 325 feet inbye the tool box. Between the motorman and the next crosscut outbye, 7 other bodies were found, all facing inbye; none of these bodies were burned or showed signs of violence; the probability is that all of these men had travelled outbye beyond the point where their bodies were found, encountering heavy afterdamp had turned back. All of these men had travelled some distance from their working faces, two of them having travelled a distance of 1,000 feet. Very slight evidence of force was found at this point. The stoppings were not damaged and the door on the second left between the eighth main and back being only slightly damaged, the direction being inbye. From this point to the face of the eighth left back entry there were no indications of force.

First left butt off eighth left: The first left butt entries had been driven to the line and had not been worked for some time prior to the explosion. They were boarded off at the time of our investigation, and as ventilation had not been restored we did not enter them. Mr Stevenson, who took air samples at the mouth of this entry on the day following the explosion reported that the doors on the mouth of the entry were blown inbye with considerable force and that he was only able to penetrate the entry a distance of 50 feet on account of water.

Second left butt off eighth left: This pair of entries was examined by the mine inspectors and they reported that some gas was being generated, but everything was in a normal state and there was no visible indication of force. The two men who were working in

this entry at the time of the explosion were among those found on the eighth left back entry about 600 feet from their working face.

Third left butt off eighth left: Two men were working at the face in the third left butt which had only been driven about 100 feet. They were found on the back entry of the eighth left, a distance of 800 feet from their working face. These men had their dinner pails with them. There was no evidence of force in these entries. The only indication of an explosion was a slight deposit of soot.

Eighth left main: Two men were working at the face of the eighth left main. Their bodies were found on the back heading along with the other five. They had travelled about 900 feet. Everything appeared to be in normal condition at the face of this heading and outbye to the mouth of the fourth right butt. The stoppings were not damaged and only a slight deposit of soot was observed. Just outbye the mouth of the third left, for a distance of 30 feet gas feeders were audible, coming mostly from the roof and from within a few inches of the bottom of the coal. A motor and two cars were standing between the fourth right and parallel on the eighth left. They were not damaged and showed no evidence of explosive force. The motor was reversed, the brake set, and the trolley pole removed from the wire. The motorman's tool box was removed, as is the custom when the motorman leaves the motor; and as stated before, the tool box was found on the back entry of eighth left, a distance of 800 feet from the motor. Every indication showed that the motorman had left in no great hurry. The motor and surroundings were coated with soot. The canvas door at this point was not damaged. About 50 feet outbye the fourth right butt the door on second left

entry was slightly damaged, one of the boards being broken and the broken ends blown inbye. From this point outbye the dirt stoppings were not damaged until the first one inside the third right was reached. The top of this was blown toward the back entry. The door on the eighth main between the third right and parallel entry was blown inbye with considerable force. A large fall was encountered at the mouth of the third right; this fall extended in about 40 feet and beyond the point where the air door had stood. Considerable force was manifest at the mouth of the third right, being outward in direction as shown by several large timbers that had stood at the junction of these two entries, they were blown out about 20 feet beyond the fall. Just outbye this fall were 14 empty cars, most of them were badly wrecked. The top of the inbye car was blown completely off and carried outbye some distance. The four outside cars were also badly damaged. Continuing out the eighth left there was no coking or evidence of flame found, and as there were no timbers or obstructions on the entry there was little evidence of force shown, except the stoppings all being blown down and toward the back entry. A heavy layer of soot was deposited all along this entry.

Fourth right butt entries off eighth left: On the fourth right butts the only indications of the explosion was a deposit of soot which gradually diminished toward the face. The two men working in this heading were found just outbye the mouth of the entry on the eighth left and were found facing outbye. One had a broken jaw bone, and was lying across the track. The fracture was evidently caused by falling on the rail. The bodies were not burned.

Third right: (See sketch No. 1) At the mouth of the third right as stated before, there was a heavy fall of roof. The evidence of a terrific outbye force was shown by the heavy timbers being blown outbye allowing the roof to fall. The heavy dirt stoppings in the first and second breakthroughs were blown toward the back entry. The remaining inbye stoppings were not blown down. A heavy fall, extending 14 feet above the floor, was encountered inside the fourth breakthrough. Twenty feet outbye this fall was the end of the trolley wire on this entry. Extending inbye 250 feet from this fall was a large cavity in the roof due to previous falls; the entry varied in height from 10 to 14 feet. The mine inspectors when making their investigations found this cavity filled with gas. From about the center of this cavity outbye, a heavy deposit of coke was found on the inbye faces, and dust on the outbye faces. Inbye from about the center of the cavity the coke was deposited on outbye faces. Both coke and dust were plainly visible on the ties. The bottom was heavily coated with soot, especially in the vicinity of the cavity; the ribs were covered with a net work of soot filaments. Four empty cars were standing outbye the last breakthrough. They were not damaged by the explosion, but were heavily coated with coke, especially on outbye end of first car.

The main entry was driven about 100 feet beyond the last breakthrough. Ventilation was obtained by means of a line of cloth brattice to within 40 feet of the face. This line brattice was partly destroyed. Coke was found in small quantities on outbye faces all along the entry from last breakthrough to the end of the brattice. From the end of the brattice to the face no coke was found. A car, partly loaded, stood at the

face. A pile of coal from a recent shot lay at the face. A shovel, pushed into the coal pile and just ready to be lifted into car was found in place. A miner's cap and lamp lay about one foot from the shovel. The men evidently were in the act of loading the car when the explosion occurred. Their bodies were found at mouth of last break-through, badly burned about face. Conditions were normal at face and no evidence of heat or flame back to the end of the brattice. Back in the last diagonal haulage break-through was evidence of a considerable inbye force. Four empty cars in this break-through were badly wrecked. The dirt in the beds of the cars was all swept against the inbye end. This crosscut had been timbered and cross-barred. Three of the timbers on the right hand side, looking inbye, were blown down and carried several feet inbye. The loosened end of the cross-bars were all carried inbye and left standing at an angle of about 45 degrees. At the inbye end of the cross-cut a heavy fall was encountered. On attempting to raise the lamp into this cavity the gas exploded in the lamp. A sample of the air taken in this cavity showed 24.61 per cent. CH₄. (See analysis 15). The distance from end of break-through to face is 160 feet. A line of brattice cloth extended from the break-through a distance of 90 feet. This had all been blown down. Near end of the brattice was a loaded car with considerable coke on both outbye and inbye ends. The dry battery with firing wires ~~was~~ attached was found alongside of car, and the wires extended up to and under pile of coal at face. Fifteen feet inbye the end of the brattice cloth a miner's cap and two carbide lamps were found, also a watch which stopped at 3:55 was found in the coat, showing that the explosion did not stop the watch. A dinner pail, which had not been disturbed or opened,

was also found at this point. The mine inspector found a can of FFF black powder near here. A heavy coating of charred dust and soot covered everything. About 40 feet back from the face a break-through had been started and driven about 15 feet. There was slight deposit of coke on the outbye faces of rib projections of this break-through, but from that point to the face there was no evidence of an explosion. The fire bosses' mark was plainly seen on the last cross timber. The coal had been undercut at the face. A shot had been fired along the right rib and the broken coal had not been disturbed. The coal broke to the full depth of the hole, and there was no evidence of a blown-out shot. A five foot hole had been bored along the left rib but had not been charged. Gas could be heard coming from this hole. A cap could be detected on the Wolf lamp all along the face. A sample of air and gas was taken at the mouth of the drill hole, which showed 2.25 CH₄. (See analysis No. 16). The two men working in this place were found back at break-through, badly burned. The back entry of this pair, outside the haulage break through was entirely closed in by falls. When the inspectors made their investigation they were able to crawl over the falls and found accumulations of gas. We were informed that the entry was partly closed by falls prior to the explosion.

Second right off eighth left main: This pair of entries is the main intake air-way and haulage way for the ninth left workings. The break-throughs between the main and back were not closed. Both entries were very damp, especially the back entry which was the drainage way for the ninth left workings, and it contained many pools of water.

This pair of entries was examined very carefully, and except at the mouth, we found no indications of an inbye force. On the contrary the slight evidence of force that was found indicated an outbye movement, as shown by the slight deposit of dust on the outbye faces. The inbye faces were swept clean and had a glazed appearance. On the back entry the inbye faces were plastered with mud thrown up from the pools of water. Where this pair of entries intersected the ninth left entry, evidence of a terrific inbye force was apparent, expanding itself in all directions on the ninth left workings. The doors on the second butt entries between the ninth main and butt were blown inbye with terrific force. Travelling in the back entry of the ninth left evidence of an inbye force gathering momentum as it travelled, was shown. The first stopping was blown out toward the main. The remaining inbye stoppings were blown out on to the main entry and deposited against the opposite side. The force was so great in some places that it carried the track with it. Coke was found along this entry, mostly on the outbye face, and dust on inbye face. Two men working at the face of the back entry were found facing outbye at the point of last break-through, a short distance from the face. These bodies showed no signs of violence.

Ninth left main: (See sketch No.2) On the ninth left main directly opposite last break-through two men were working, making the first cut for the fourth butt. The machine runner's body was found lying across the machine. The scraper's body was found about 40 feet inbye, with the head toward the face of the coal. The ventilation was carried to face

of the ninth main by means of line brattices cloth from the last breakthrough. This brattice had been partly destroyed by the explosion, but had been repaired before this investigation. Ten feet back from face gas was escaping from the coal, and a sample of the gas was taken from a small cavity in the roof. (See sample No. 7). Thirty feet back from the face gas could be heard escaping from feeders along the right rib, about one foot from the bottom. The wolf lamp, on being held close to this rib showed a small cap while gas sample was being taken. (See sample No. 6). The face of this entry was very wet. There was no evidence of coke or dust at the face, but about 30 feet from the face, dust and soot were found adhering to the inbye face of the timbers and rib. Just outside of the last breakthrough coke was found on the inbye faces. Five empty cars were standing at the mouth of the last diagonal haulage breakthrough. Two of them were on the main track and two in the breakthrough. They were all wrecked. The one at the mouth of the breakthrough had the endgate blown off toward the back entry. A $\frac{1}{4}$ inch cap was detected in the safety lamp over a small fall near this point, about 130 feet from the face. A sample of air was taken at this point. (See sample No. 9).

From this point outbye the rib was charred considerably, as shown by the scaling of the coal. Coke was found on the outbye and dust on inbye faces. The track was shifted up the hill, and in places the rails were bent by the force of the explosion. On the ninth main, outside of the third butt, which is a continuation of the second butt off the eighth left, no coke was found, although there was considerable dust and soot. On the props at the mouth of the first right butt a coating of

dust about 1/8 inch thick was found on the inbye faces, and a thinner coating on the outbye face. The coal was chipped off by the heat. The track had been removed on this entry, from the third butt back to main south; the entry contained several pools of water. The explosion continued out these entries on to the south mains and apparently then dying out. Seventy five feet outbye the first right entry a gas sample was taken (See sample No. 10). This is a sample of the main return air from the eighth and ninth left workings. The difference in the methane content in the air at this point and where sample No. 11 was taken represents the methane being given off by the eighth and ninth left workings at the time of our investigation.

Third butt off the ninth left: (See sketch No. 3). This pair of entries is a continuation of the second right off the eighth left. Two men were working at the face of the back heading; their bodies were found at the last diagonal breakthrough about 130 feet from the face. They were found facing outbye and slightly burned. The entry dipped at the face, and at the time of this investigation was partly filled with water, preventing our reaching the face. A pile of coal could be seen, as if from a recent shot, but it was nearly covered with water. The fireboss who had been to the face before the water had accumulated, stated that the shot was a good one and part of it had been loaded out; the miners' shovels were lying on top of the remaining pile. This statement was verified by Mr. Burrell who took gas samples at the face on the day following the explosion. (See analyses No. 1, 2, and 3.) About 40 feet from the face there was a tool box on the right hand side,

with shovels and pick chained to the lock, also an auger extending out the inbye end of the box. The inbye end of the auger and shovels were covered with slate and dirt. The box was forced inbye as far as the slack chain would permit. The outbye end of the box was twisted away from rib, indicating an inbye force. A short distance outbye the tool box on the left side was a hand pump. Coke was found on the inbye side of the handle and the inbye flanges were plastered flush with mud and coke. Just inside the last break-through on the left side was another tool and powder box. It was plastered with coke on both inbye and outbye face, with more on the inbye face. Near the box, two carbide lamps, a miner's cap and a stick of monobel were found. A short distance outbye the box we found three detonators which had not been separated from each other, one of which had been exploded. The inspectors when making their examination found a 5 pound can partly filled with FF black powder, near this point. Five loaded cars were standing below the shoo-fly switch, the tops of which were swept outbye to some extent. The inbye end of the inside car was plastered with dust and road dirt about 4 inches thick. Mixed in this dirt were several pieces of heavy paper, such as is used in making cart-ridges for black powder.

On the switch at mouth of the shoo-fly, three empty cars were standing, but were not damaged. From this point out to the mouth of the entries there was no distinct evidence of the direction of the force. All the stoppings were completely blown down, and their remains so scattered that the direction in which they were blown could

not be determined.

Second right butt off ninth left: This pair of entries had been driven to the property line, a distance of 700 feet. The room necks had been turned and the entries temporarily abandoned. The stoppings in this pair of entries had been blown out from the back to the main entry. Evidence of heat was shown in these entries by heavy deposits of coke on the inbye face exposures of the room neck, while the outbye face exposures were plastered with charred dust. The deposit in No. 1 room neck was very heavy, but the deposits gradually decreased on going inbye to the fifth room neck. From the fifth room neck to the face the entries were damp and no coke was found.

First right off ninth left: This pair of entries had also been driven to the boundary line, a distance of 900 feet. The room necks were turned, and the entries temporarily abandoned. The stoppings were all blown down and toward the main entry. Dust was found on the neck of the fifth room on the inbye face exposures. Four different kinds of coke were also observed at this room neck, besides the stalactitic carbon. Coke 1/2 inch thick had been deposited on the inbye face. This could be removed in pieces as large as 8 inches long and from 3 to 4 inches wide. On the outbye face stalactitic carbon 1/2 inch long, and a mass of small silvery gray coke globules about 1/32 inch in diameter had formed about 1 1/2 to 2 feet from roof, while on the corner of the room neck there was considerable coke formed in situ. On the outbye face of room No. 7 silvery colored blister coke had

formed. From room No. 7 to Room No. 9 inclusive, coke was found on both exposures of room neck. The coking along this entry was evidence of the most intense heat in the mine. From room No. 8 the amount of coke gradually diminished toward the face and entirely disappeared at room No. 13. From here to the face the only evidence was a heavy deposit of dust. A short distance from the face a large fall had resulted from the explosion. No gas was detected over this fall by the Wolf safety lamp. There was another large fall at the face which extended into the last break-through. Gas sample No. 4 was taken over this fall. A sample of coke was taken in this pair of entries, (See dust sample No. 7).

Main south headings: The explosion wave passed out the eighth and ninth left headings in to the main south entries with considerable force, expending itself, and gradually dying out inbye and outbye along these entries and in the right entries as shown by evidence stated previously in this report.

Fifth right off main south: This entry was not being worked at the time of the explosion. The wood brattices at the mouth of entries were not damaged. A wooden air door at the first butt was blown inbye and the frame damaged. The next stopping inbye the air door had the top blown off toward the back. These were the only stoppings damaged in this entry. Beyond this point there was no trace of the explosion.

Sixth right off main south: This pair of entries was not being worked at the time of the explosion. The wooden stoppings at mouth were all blown inbye. The dirt stoppings between main and back were

all damaged as far as the second butt. The air door at first butt was blown inbye with considerable force. Dust was deposited all along the entries up to the fourth butt on both the inbye and the outbye faces. The greater amount of dust was on the outbye faces. At mouth of second butt some charred dust was found which was the only evidence of heat. Ten feet beyond sixth butt a sample of mine air was taken which represents the return air from all the north side workings. (see Sample No. 5.)

Seventh right off main south: The doors at the mouth of the seventh right were blown inbye. None of the stoppings between main and back were damaged. A slight deposit of dust on the inbye and outbye faces of rib exposures was observed up to the second butt.

Eighth right off main south: This pair of entries was very moist, and did not show any evidence of the explosion.

Main north headings: On the main north workings there were no signs of an explosion. The men who were working at the face of these entries escaped unharmed. At a point about opposite the second right off the main south a door was found blown down and toward north main. The door was rotten and a very slight force would have been sufficient to have blown it down. A sample of road dust was taken on this entry, where it had not been affected by the explosion. (see Sample No. 5.)

SUMMARY OF EVIDENCE OF COURSE TRAVERSED BY EXPLOSION.

The foregoing evidence appears to fix the source of the explosion in the third butt entries off the eighth left (see Sketch No.1)

The forces seem to have gone both inbye and outbye from a cavity in the third right butt off eighth left; however, as there is no way to account for an ignition at this point it must have originated near the face, and on reaching the cavity where it had room to expand it may have ignited some gas which caused an inbye force; or the movement may have been caused by a back lash.

The explosive wave increased in force as it passed out the third butt entry, as shown by the effect in the stoppings. The first two not being damaged and the two nearest mouth of entry being blown out completely. At the mouth of the ~~explosion~~^{entry} the explosion branched in three directions, the main branch continuing out the eighth left main with terrific force as shown by its effect on the 14 cars standing in the entry. One branch passed in the ~~left~~ eighth left main entry and gradually died out due to the dampness of the entries. Another branch crossed onto the back entry of the eighth left and thence into the first left entries, which were partly filled with water, where it died out. At the second right butt there was another division, the main branch continuing out the eighth left onto the main south and the other branch evidently going up the second right butt, although as stated before, no evidence of an inbye force was found except at the mouth and where they intersected the ninth left. There was not the slightest evidence of coke and very little dust in the second butt entries; the walls were moist in most places.

When the explosion wave reached the ninth left and expanded in these entries which were comparatively dry and dusty, it received added fuel, causing it to become more violent and then expanded in all directions. A wave returning down the second butt which we believe accounts for the slight evidence of an outbye force in this pair of entries. The

main branch continued up the back entry of ninth left. The dust added fuel and the violence increased as the distance covered increased, blowing the stoppings down with terrific force. No coke was observed until near the face of these entries (see sketch No. 2) but evidence of the most violent force observed anywhere in the mine was found along these entries, as the stoppings were blown out and across the entry with such force that the track was carried with them. Near the face some coking was observed. Two men on the ninth main were operating a coal cutting machine about 50 feet back from the face. The machinist's body was found lying across the machine while his helper was found in near the face of the entry. There was little evidence beyond the last diagonal break through to show the direction of the force. What evidence there was of inbye force was probably destroyed by the return or recoil wave which we think accounts for the coking on the inbye exposures found near the last breakthrough.

Another branch from this secondary explosion went up the third right (See sketch No. 3) but the evidence near mouth showed a terrific inbye force. All the stoppings between main and back were blown out and scattered so the direction was hardly determined. On the back entry from the diagonal crosscut the evidence showed an outbye force. Considerable coke was found, mostly on inbye exposures, showing that there was considerable flame.

Another branch of the explosion which burst out of the second butt off eighth left into the ninth main went out the ninth entries into the main south entry and expended itself inbye on the main south and on the seventh right entry, gradually dying out, due principally to the dampness and the character of dust. No coking was observed on the por-

tion of ninth entries traversed by this branch of the explosion, altho a slight charring of the ribs was observed in a few places. Very heavy deposits of fine dust covered everything. The track had been removed and the entries contained many pools of water. Branches of this wave went up the second and first right entries off the ninth left. The room necks had just been turned from these entries and temporarily abandoned. The evidence of the most intense heat in the mine was found in these entries and the faces of the room necks afforded a good place to observe the coking effect. In the second right, the coking was found almost entirely on the inbye exposures of the room necks while the outbye exposures were plastered with charred dust. Coke was found at the first room neck and gradually decreased inbye to the fifth room, and from that point to face no more coke was observed. In the first right entries the coking was slight up to the fifth room neck. From this point to the ninth room the coking was heavy and found mostly on the inbye faces. Four different kinds of coke were observed here showing intense heat. From ninth room the coking gradually decreased inbye and disappeared at room 13. From this point to face no coking was observed but a thick settlement of charred dust covered the floor.

CONCLUSIONS AND LESSONS.

Road and Coal Dust: To judge the conditions in the mine before the explosion by subsequent observation may not be conclusive evidence, nevertheless portions of the mine which were unaffected will furnish valuable clues. On the main north heading, dust had accumulated in noticeable quantities but not in a large amount. A sample was taken near the center of the track for a distance of about 300 feet, using the scoop

to pick up small amounts at regular intervals. It showed 23.6 per cent. ash and moisture. As we approached the rail the ash content would become greater, for the ash is derived principally from the sand used by the motor. Outbye the fifth right off the main south a sample of road dust taken in the same manner showed similar results.

In the eighth and ninth left workings pools of water were found at intervals. The roads were swept clean making it difficult to judge the road dust.

Comparing the analysis of the road dust with the average analysis of the face coal shows that the force of the explosion had died out when the percentage of moisture in the dust was 4.46 per cent above that of the face coal as received, and the ash content 7.2 per cent higher than that of the face coal. Whether or not this condition of the dust existed at the time of the explosion we are not in position to say. The sample of coke considering ash and moisture free, shows a loss of 7.14 per cent. volatile matter.

In the analyses given in tables 5 and 6, one of the chief points of interest is the dying out of the explosion along the main south headings when the ash and moisture^{contents} were so low. This may be accounted for by the company using large cars and prohibiting the miners from loading them above the sides, thus preventing the coal from falling off along the road. What coal did fall from the cars came principally from the cracks in small amounts. It was soon saturated with moisture and was packed firmly by the miners walking over it. The coal is not very friable. This is shown by a sample of the road dust in which only 268 grams passed through a 20 mesh sieve. About 66.4 per cent. of the sample was too coarse to readily propagate an explosion and would retard

the action of the remaining 23.6 per cent of dust, leaving but 6.5 per cent of the road dust as available volatile matter.

Methane: The mine was termed non-gaseous in the Mine Inspectors' Annual report, and open lights were used by the miners; however, gas feeders were audible in several places in the eighth left workings and at the face of the ninth left heading. It is customary in these places to use canvas brattice to keep the circulation close to the face, but in one instance the brattice was back 70 feet from the face. Methane was known to accumulate in cavities in the roof, and the usual practice was to blow it out with compressed air.

The return from the north workings showed practically no methane, while the south workings gave as high as 0.37 per cent in the return from the eighth left with about 17,300 cubic feet of air per minute. The ventilation, however, had not been completely restored in the south workings when the sample ~~were~~ was collected. This shows 64 cubic feet of methane per minute; or taking 5 per cent as the lower explosive limit, would give 76,800 cubic feet of fire damp per hour, which is capable of filling 1280 feet of entry per hour with an explosive gas.

Table No.7 shows the results from a number of mine air samples. Samples No.1,2 and 3 were taken in main headings off third left butt off ninth left about 9:00 p.m. on the day following explosion.

Sample No.1 was from near the mouth of this entry.

Sample No. 2 about 150 feet from the face.

Sample No. 3 was taken at the face.

Sample No. 4 was taken at the face of the first left butt off ninth left ten days after the explosion.

Sample No. 5 was taken on the sixth right main ten feet inside of the

sixth left butt. This sample is the return air and is to show the amount of methane being given off in the north workings.

Sample No. 6 was taken about one half mile from the Sykesville shaft from the top of a gas well. The well is only about 180 feet deep. The gas is reported to be found near the top of the coal. This sample contains more or less air.

Samples Nos. 7, 8, 9,,10, 11 and 12 were taken ~~from~~ about ten days after the explosion.

Sample No. 7 was taken from a small cavity in the roof about 10 feet from the face of ninth left main. Methane was ~~taken~~ being generated about one foot from the bottom of the coal.

Sample No. 8 was taken along the right rib of ninth left main about 30 feet from the face and one foot from bottom of the coal. The gas feeders were very audible. The Wolf safety lamp showed a distinct cap when held close to the rib near the feeders.

Sample No. 9 was taken about 130 feet from the face of ninth left main, in a small cavity in the roof. There were no audible feeders. The Wolf safety lamp gave a quarter inch cap.

Sample No. 10 was taken between the first butt and main south. This sample is to show the amount of methane in the return air coming out of ninth left heading. Compare with Samples No. 11 and No. 12.

Sample No. 11 was taken on the back heading of the eighth left 40 feet inbye the second butt entry off the seventh left. This sample is to show the amount of methane being generated in the workings up to this point.

Sample No. 12 was taken inbye second right butt. This sample is to show the methane contents of the air going from the eighth to the ninth left workings in first right butt off eighth left. Compare with Sample 11.

Sample No. 13 was taken at the mouth of the first left butt entry inside of canvas brattice.

Sample No. 14 was taken 5 feet inbye of No. 7. Samples No. 13 and 14 were taken about 26 hours' after the explosion. The mine air at this point had been disturbed but little.

Sample No. 15 was taken from a cavity in the roof over a recent fall at the end of the last breakthrough on the back-heading of the third right butt off eighth left.

Sample No. 16 was taken from a drill hole at the face of the back-heading. Gas could be heard escaping from this hole.

C O N C L U S I O N .

Cause of explosion: As stated before, the explosion originated at back entry of or near the face of/the third right butt off eighth left, and was caused by the ignition of gas either by an open light or by the flame from a shot in the face. The back entry of the third right was driven 160 feet beyond the last breakthrough and the line of brattice cloth was 70 feet from the face. The back entry was the intake and outbye the last breakthrough it was not used as a haulage way. It was partly closed by falls prior to the explosion, and at the time of this investigation it was impossible to crawl along it. These falls liberated methane, and may have also impaired the ventilation, or, as the inspectors state, the door on the eighth main used to divert the air up the third right back entry may have been left open. Either of these conjectures, along with the fact that the ventilation was back 70 feet from the face, would easily account

for an accumulation of gas in this entry, especially when one considers that, providing the ventilation was impaired, there was enough gas being generated in the workings in the eighth left entries to fill 940 linear feet of the entry per hour. A large part of this gas was probably coming from the third right butt entries. This amount of methane may have been in excess of the normal amount on account of the restoring of the ventilation. The fire boss had examined this entry at the beginning of the shift, and his mark was found at the face. Evidence also points strongly to the fact that a blower of gas was struck by the drill hole in the face, as we could hear the gas escaping from this hole ten days after the explosion, and a sample taken at the mouth of it showed 2.25 per cent methane. Any of the above may have allowed enough gas to accumulate, which aided by the dust thrown into suspension by the shot, could have been ignited by the flame of the shot, or possibly an open light. While this shot may not have direct bearing on the explosion, yet the explosion must have occurred at the time or very shortly after it was fired. The loaded car had been dropped down to the dinner buckets, and the men had taken the detonators and a stick of "monobel" out of the box to charge the other hole. They had evidently not returned to the face after firing the shot, as it was not disturbed, and the firing wire had not been detached from the battery, or the other ends removed from under the fallen coal. They were probably going to eat while waiting for the smoke to clear away, as is usually the custom. They had not done this, however, as their buckets had not been touched. That a

combination of "monobel" and black powder may have been used in that charge is very probable, as the mine inspectors found a ^{half full} ~~can~~ of FFF black powder in this entry. The flame from this charge may have ignited the gas that had accumulated at the face. The flame from the ignition of the gas was propagated along the entry to the cavity on the third right butt main as before mentioned, where there may have been an accumulation of gas. The dust thrown in suspension was ignited and the explosion propagated in the direction previously described.

CONCLUDING REMARKS: The mine as a whole was in good condition, and fairly well administered. The system of mining and the layout of the mine was good with the exception that the panel system was not maintained, many of the rooms being holed through into the next panel. The use of open lights could be criticized, especially in the eighth and ninth left workings, as these entries were known to generate methane and were working under a heavy cover and toward a mine that was using locked safety lamps exclusively, and for that reason great precautions should have been used in these workings.

The ventilation was carried by brattice cloth to the faces of the entries that were known to give off methane, but in the case of third right back entry off eighth left the line brattice was about 70 feet back from the face. The objection to this system of ventilation in use is that there are not sufficient splits. Too large an area is ventilated by one split. There was not one overcast in the mine. The management realized that their system was faulty, and had contemplated changing it; however, it was not done prior to the explosion, but immediately after

the disaster they began building ~~the~~ two overcasts so as to give the eighth and ninth entries each a separate split of air.

The explosives employed at the mine at the time of the explosion were of the permissible class, but no apparent check was kept on the men as to the amount each man carried into the mine. That explosives, other than permissible, were carried in is shown by the finding of cans of black powder in four different entries. The men usually kept the explosives locked in boxes near the working face. The men did their own shot firing, and the shots were not inspected before hand and coal dust was used for tamping.

The system of watering the mine and rendering the coal dust inert was inadequate, as the company depended solely on the passage of the air through the wet abandoned workings for humidifying. In the winter exhaust steam is turned into the down cast, mainly for the purpose of preventing freezing in the shaft. No method of watering the dust at the face is used, although there are precautions against fire, whereby the large pump can be connected on to the compressed air line, and in five minutes water can be discharged at every working place. This might be utilized for sprinkling the working faces. The only objection to it might be caused by water collecting in sags and reducing the capacity.

TABLE NO. 1.

STANDARD SECTION OF COAL BED, SYKESVILLE SHAFT MINE.

Laboratory No. 12,453, Section sample from face, third right butt off eighth left.

Laboratory No. 12,455, Section sample from pillar between eighth left main and back heading in last crosscut.

	Laboratory No. 12,453		Laboratory No. 12,455	
	ft.	in.	ft.	in.
Roof coal - - - - -	--	--	--	--
Draw slate- - - - -	--	--	--	--
Bony coal - - - - -	0	8	0	8
Coal - - - - -	0	7 1/2	0	8 1/2
Cannel coal - - - - -	0	3	0	5
Coal - - - - -	1	11	--	--
Bony coal - - - - -	0	0 1/2	0	1
Coal - - - - -	1	3 1/2	3	1
Mining slate- - - - - (a)	0	1 1/2	(a) 0	1 1/2
Coal - - - - -	0	9 1/2	0	9
	5	8 1/2	5	10 1/2

NOTE: (a) excluded from sample.

TABLE NO. 2.

PROXIMATE ANALYSIS OF SYKESVILLE COAL SAMPLES.

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	Laboratory No. 12,453		Laboratory No. 12,455	
	Sample as received.	Moisture and Ash free.	Sample as Received	Moisture and ash free
Moisture - - - - -	2.53	---	2.44	---
Volatile matter- -	29.50	32.79	28.44	31.91
Fixed carbon, - -	60.48	67.21	60.68	68.09
Ash, - - - - -	7.49	---	8.44	---
	100.00	100.00	100.00	100.00
Sulphur - - - - -	1.31	1.45	1.32	1.48

T A B L E 3.

SECTIONS OF ROOF COAL.

Laboratory No. 12,457 F. A section sample of roof coal was taken over the fall in the third right butt main off left eighth entry.

Laboratory No. 12,471 F. A section sample of roof coal was taken near the mouth of third right butt off the eighth left main entry from a cavity in the roof.

		Laboratory No. 12,457 F.		12,471 F.	
		ft.	in.	ft.	in.
Slate (roof) - - - - -		---	---	---	---
Bony coal - - - - -		0	1	0	8
Coal - - - - -		0	4	---	---
Bony coal - - - - -		0	0 1/4	---	---
Coal - - - - -		0	1 1/2	---	---
Slate - - - - -	(a)	0	1	(a)	0 2 1/2
Coal - - - - -	(a)	0	1 1/2	---	---
Sulphur - - - - -		0	0 1/4	---	---
Coal - - - - -		0	4	---	---
Slate - - - - -	(a)	1	9	---	---
Coal - - - - -		0	10	---	---
Slate - - - - -	(a)	0	3	---	---
Coal - - - - -		0	7	---	---
Bony - - - - -		0	3	0	11
Coal - - - - -		0	10 1/2	1	0 1/2
Slate - - - - -	(a)	0	4 1/2	---	---
		6	0 1/2	2	10

NOTE: (a) Excluded from sample.

T A B L E 4.

PROXIMATE ANALYSIS OF ROOF COAL SAMPLES.

		Laboratory No. 12,457 F.		12,471 F.	
		Coal as Received.	Moisture and Ash free.	Coal as Received	Moisture and Ash free.
Moisture	2.05	---	:	1.94	---
Volatile matter,	28.44	34.70	:	29.01	36.09
Fixed Carbon,	53.51	65.30	:	51.36	63.91
Ash	16.00	---	:	17.69	---
	100.00	100.00	:	100.00	100.00
Sulphur	4.01	4.89	:	2.28	2.84

T A B L E 5.

ROAD DUST ANALYSES.

 Laboratory No. 12,469)-- Road dust from north main heading unaffected
 (Sample No. 5)) by explosion.
 Laboratory No. 12,500)-- Road dust outbye the fifth right on south main.
 (Sample No. 6)) The explosive force died out on reaching this
) point.
 Laboratory No. 12,499)-- Road dust from center of track between seventh
 (Sample No. 7.) right and ninth left on main south.

	Per cent	:	Per cent		Per cent	%	%
Laboratory No. 12,469 F.	Moisture	:	Vol. matter	:	Fix'd Carbon	Ash	Sul:
As received, - - - - -	7.68	:	26.25	:	50.16	: 15.92	(1.16)
Ash and moisture free- -	----	:	34.35	:	65.65	: ---	(1.52)

Laboratory No. 12,500 F.							
As received, - - - - -	6.85	:	24.28	:	53.70	: 15.17	(0.98)
Ash and moisture free- -	--	:	31.13	:	68.87	: ---	(1.25)

Laboratory No. 12,499 F.							
As received, - - - - -	3.55	:	24.29	:	50.39	: 16.77	(1.25)
Ash and moisture free- -	--	:	32.53	:	67.47	: ---	(1.65)

T A B L E 6.

COKE DUST ANALYSES.

 Laboratory No. 12,470 F.)-- Coke taken from inbye side of ribs on main
 Sample No. 8,) heading of second right butt off the ninth left
 Laboratory No. 12,456 F.)-- Coke and dirt plastered against the inbye
 Sample No. 9.) side of empty car by force of explosion in
) back head of third right butt off ninth left.

Laboratory No. 12,470 F.	4.66	:	20.70	:	61.39	: 13.25	(1.45)
As received							
Ash and moisture free. -	--	:	25.21	:	74.79	: ---	(1.77)
Laboratory No. 12,456 F.							
As received - - - - -	12.94	:	21.23	:	37.31	: 28.52	(1.66)
Ash and moisture free - -	---	:	36.26	:	63.74	: ---	(2.84)

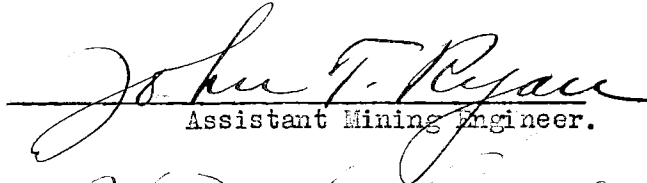
T A B L E 7.

GAS SAMPLES AFTER EXPLOSION, SYKESVILLE MINE.

Sample No.	Laboratory No.	CO ₂	O ₂	CO	CH ₄	N.
1	1775	0.05	20.32	00	0.45	79.18
	1776	0.07	20.29	00	0.44	79.20
2	1780	0.27	19.62	00	1.29	78.82
3	1777	0.16	20.10	00	1.12	78.62
4	1815	0.61	18.91	00	0.80	79.68
5	1807	1.83	18.33	00	0.02	79.82
	1808	0.09	20.48	00	0.00	79.43
6	1813	0.45	1.34	00	67.94	30.27
	1814	0.60	1.53	00	67.10	30.77
7	1819	0.35	15.82	00	19.32	64.51
8	1818	0.06	20.40	00	1.53	78.01
9	1805	0.44	19.65	00	1.15	78.76
	1806	0.49	19.75	00	1.15	78.63
10	1811	0.34	19.95	00	0.32	79.39
	1812	0.20	20.16	00	0.36	79.28
11	1809	0.33	20.22	00	0.06	79.39
	1810	0.04	20.40	00	0.09	79.47
12	1817	0.08	20.79	00	0.37	78.76
13	1779	0.08	20.80	.09	0.06	78.97
14	1778	0.08	20.56	.35	0.21	78.80
15	1804	0.15	12.91	00	24.61	62.33
16	1816	0.51	19.50	00	2.25	77.74

In closing, the writers wish to thank the officials of the company, especially Superintendent C. C. Gadd and Mine Foreman, Aden Hull for the courtesies extended us, and assistance rendered while making these investigations.

Respectfully submitted,

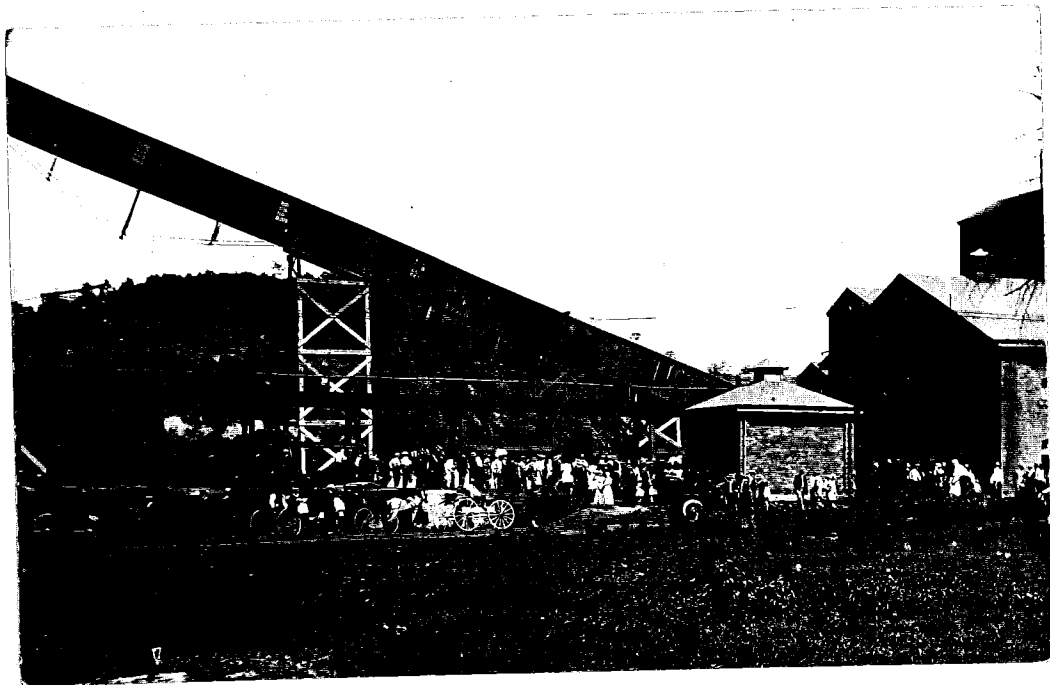

Assistant Mining Engineer.


Assistant Mining Engineer.

Pittsburgh, Pa. February 9, 1912.

PICTURE NO. 3

SCENE AT THE EXPLOSION AT
THE SYKESVILLE MINE



Scene at the explosion of the Sykesville mine.