REPORT OF EXPLOSION

YUKON NO. 1 MINE

YUKON-POCAHONTAS COAL COMPANY

YUKON, McDOWELL COUNTY, WEST VIRGINIA

MAY 22, 1928.

By

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Department of Commerce

Bureau of Mines

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Introduction.

About 7:45 P.M. May 22, 1928, an explosion occurred in the Yukon No. 1 mine of the Yukon-Pocahontas Coal Company, Yukon, McDowell County, West Virginia, resulting in the death of 17 men.

Yukon No. 1 and No. 2 mines are operated as separate mines, but are connected for ventilation and haulage purposes.

The explosion occurred during the night shift when there were 40 men in the mine, 23 of these or all but the 17 who were killed escaped unassisted and uninjured. It is believed that the explosion had its origin in 1st right off 19 left and was due to the ignition of gas by a mining machine. The explosion was propagated by coal dust but involved only a relatively small portion of the mine. The No. 2 mine was unaffected.

No rock-dusting or watering had been done in any portion of the mine. At the time of the explosion almost the entire personnel of the Safety Division of the Pittsburgh station of the Bureau of Mines, the crew of Car 3 and one of the crew of Car 7, located at Fairmont, West Virginia, were engaged in recovery work following a mine explosion in the Mather mine at Mather, Pa. Due

to the town of Yukon being isolated and without telephone connections with the larger telephone systems, news of the explosion was slow in spreading. Information that an explosion had occurred in the Yukon mine was received from the Associated Press by the Pittsburgh station of the Bureau of Mines about 10:00 A.M. May 23. A telegram was immediately sent to the Yukon-Pocahontas Coal Company to verify the report and asking if assistance was desired. A telegram was received from Mr. Hall, superintendent of the mine about 5:00 P.M. stating that no equipment was required but to send the nearest man available. In accordance with this request Mr. Claud P. Dempsey and Mr. Jesse Redyard, foreman miners of the Bureau of Mines assigned to Car 7, located at Fairmont, W. Va., were instructed to proceed to Yukon. Mr. Redyard, being on his way back to the car from the Mather mine explosion, was unable to leave as early as Mr. Dempsey, who arrived in Yukon about 7:30 P.M. on May 24th. Mr. Redyard arrived several hours later.

All of the bodies had been recovered prior to the arrival of any of the Bureau men.

Location and Ownership:

The Yukon No. 1 and No. 2 mines are located at Yukon, (railroad station Suzanna) McDowell County, West Virginia, and are operated by the Yukon-Pocahontas Coal Company. The mine is served by the Norfolk and Western Railroad.

The officials of the company are as follows:

C. Henry Harman, president, Tazewell, Virginia.

S. F. Harman, vice president and general manager, Yukon, W.Va.

M. H. Hall, superintendent, Yukon, W. Va.

Garfield Morley, mine foreman No. 1 mine, Yukon, W. Va.

George Stone, mine foreman No. 2 mine, Yukon, W. Va.

Lee Hall, fire boss No. 1 mine, Yukon, W. Va.

George Scott, fire boss No. 2 mine, Yukon, W. Va.

In addition to the above, James Wakely who was killed in the explosion, was a fire boss in the No. 1 mine.

Number of Employees and Production:

The No. 1 and 2 mines employ about 205 men, 170 of these being employed underground and about 35 on the surface. Under the present operating conditions about 1500 tons of coal per day are produced from both mines.

Surface Openings:

The No. 1 mine is opened at approximately tipple height by four drifts, two of which serve as intake airways and two as return airways. In addition, there are openings at No. 2 mine which are used for traveling and ventilation purposes only. The mines are connected underground for haulage and ventilation purposes. The coal from No. 2 mine is hauled through No. 5 right of No. 1 mine and thence to the surface. The ventilation from No. 2 mine is returned into the main return of No. 1 mine. Several connections exist between the

two mines inby 5 right off No. 1 mine, but these are believed to be sealed with water which has collected in local dips.

As the explosion occurred in the No. 1 mine and was localized, the following descriptive matter unless otherwise noted deals with the mine in which the explosion occurred.

Coal Bed:

The coal bed worked is the Beckley (locally known as War Creek). The bed averages about 5 feet thick with considerable variation in height. It is practically flat, dipping slightly to the north, but has frequent rolls or local dips. The coal is fairly hard/semi-bituminous with about 17 per cent volatile matter/ and with a ratio of volatile to total combustile of 20.1. The impurities in the coal consist of occasional streaks of mother coal, local slate partings and a small number of local sulphur streaks.

The roof is slate and varies in character as to its tendency to fall. The average depth of cover is about 400 feet.

The floor is a hard black slate. It is apparently not affected by moisture and does not readily become mixed with the coal.

Analyses of face samples of coal from the Beckley bed will be found in the appendix of this report.

Methods of Mining:

Room and pillar system of mining is employed. The mine is developed by two pairs of entries driven on about 50-foot centers, with a pillar of about 50 feet between them. Room entries,

designated as right and left, driven on about 50-foot centers, are turned off the main entries approximately every 400 feet. Rooms turned on about 60-foot centers are driven from both entries and aircourses. Due to difficulty in holding the roof in wide work, rooms are driven the same width as entries or about 18 feet wide. The coal is undercut by shortwall electric mining machines previous to blasting. Some pillars have been drawn, but no such work is being done at present in the No. 1 mine.

No mechanical loaders or conveyors are being used.

Although all the work is narrow, considerable timbering is required in certain places in order to hold the roof. Large falls which had occurred previous to the explosion were observed, especially on the main entries inby 18 left where about 700 feet of the main haulage road has been abandoned due to falls. No systematic timbering is used in rooms or entries.

Ventilation and Gases:

Two fans are used. The No. 1 mine is ventilated by a 5-foot Robinson reversible fan, operating exhausting. The No. 2 mine is ventilated by a 4-foot Robinson fan run blowing, the air from No. 2 mine being delivered into the main return of the No. 1 mine and exhausted through the No. 1 mine fan.

The fan at No. 1 mine has a rated capacity of about 120,000 cubic feet per minute. It is believed that at the time of the explosion about 102,000 cubic feet of air per minute was being exhausted against about 3 inches water gage.

The No. 1 mine fan is housed in a brick building situated about 20 feet to one side of the fan drift and is provided with a wood brattice instead of explosion doors. The fan is steam driven with an auxiliary electric drive in reserve.

Stoppings are constructed of brick, wood and canvas. Wooden doors are used for deflecting the air currents. Line brattices are employed in advancing work to conduct air to the working faces. The No. 1 mine is ventilated by a continuous air current. Both the No. 1 and No. 2 mines are rated as being gassy by the State Department of Mines, and are examined by fire bosses before the day shift enters the mines.

Tabulated results of the air analyses, discussion of ventilation and gas conditions will be found in the appendix of this report.

Haulage:

Mechanical haulage is used throughout both mines. One 15-ton Goodman trolley locomotive is used for main line haulage in No. 1 mine and an 8-ton Jeffrey trolley locomotive is used for hauling from No. 2 mine to No. 1 mine. Ten 6-ton Goodman cable reel locomotives are used for gathering the coal. Sixty pound rails are used on the main entries and thirty pound on the side entries. The track gage is 44 inches. Mine cars are constructed of steel, of the solid end type and have a capacity of about 2½ tons.

The main haulage is on intake air, but haulage locomotives are operated on return air at many places in the two mines.

Lighting:

All underground employees, except officials, use Edison permissible electric cap lamps. The officials use permissible flame safety lamps for illumination and examination purposes. Mining machine operators are also provided with permissible flame safety lamps for examination of working places previous to operating the machines. The main haulage is lighted at numerous places by electricity.

Underground Machinery:

The underground machinery consists of five electric pumps, three in No. 1 mine and two in No. 2 mine; one motor generator set in No. 1 mine, five Goodman shortwall mining machines, three in No. 1 and two in No. 2 mines; two haulage and ten gathering locomotives.

All underground electric equipment is of the non-permissible type and is operated on 275 volts direct current. The trolley wires are well hung and are fairly well guarded. Trolley lines are largely in intake air, but are also in return air at numerous places.

Explosives:

Permissible explosives Monobel #9 L.F. is used for blasting both coal and rock. No. 6 detonators and permissible blasting units are used. Explosives are hauled into the mine by electric locomotives

in a special insulated wood car, and distributed during the night shift.

Holes are about 1⅛ inches in diameter, about 6 feet deep and charged with about 1½ pounds of explosive. It is believed that coal dust stemming is largely used as no clay for stemming was observed. The miner drills, charges and fires his own shots. Shooting is done at any time during the working shift.

Drainage:

The accumulations of water are not very large. With the exception of local dips, all sections of the mine are comparatively dry. Five small electric pumps are required for both mines.

Dust:

There was considerable coal dust observed in all portions of the mine visited during the inspection. No watering is done to allay the dust at working faces or on the haulage roads. Very little inert material becomes mixed with the roadway accumulations excepting some sand deposited by the haulage locomotives at fairly steep places along the haulage roads.

Previous Explosions:

Three previous explosions have occurred in the Yukon No. 1 and No. 2 mines as follows: One in the fall of 1913 in the No. 1 mine which resulted in the death of 13 men when a body of gas was ignited by an open light; one on December 15, 1917, resulting in the loss of 18 lives from the same cause; and one on

March 28, 1924, in the No. 2 mine in which 26 men lost their lives from a similar cause.

Results of Investigation:

An investigation relative to the cause of the explosion was made on May 25 and 26, 1928, by the writer, assisted by Mr. Claud P. Dempsey and Jesse Redyard, foreman miners of the Bureau of Mines. During the investigation the following information was obtained:

On the evening of the explosion, 4 machine men had entered the No. 1 mine about 4:00 P.M. and the explosion occurred about 7:45 P.M. or about 15 minutes after the night mantrip with 13 men on it had entered the mine. The evidence obtained seems to indicate that the explosion was caused by an accumulation of gas which was ignited by the mining machine located in the face of 1st right entry off 19 left.

The explosion undoubtedly originated at this point as the forces were all outward from the face of the entry and evidence of extreme heat was indicated by the heavy deposits of coke and soot together with the fact that the two bodies recovered close to the face of 1st right were badly burned.

The mining machine was of a non-permissible type and evidently was in operation as evidenced by the controller of the machine being in the "on" or operating position. It had no doubt been in operation but a short time as it had just about completed "sumping" into the face.

The bodies of the two machine runners were found headed out one on each side of the mining machine trunks, located about 15 feet from the face. The men had more than likely moved a short distance after igniting the gas and before being overcome.

A cable reel locomotive used for "tramming" the mining machine into the working places was found about 25 feet from the face of the 1st right entry. A flame safety lamp for use of the machine crew in examining the working places was found on the outby end of the locomotive. It is believed that the machine crew failed to test for gas previous to going to the face. However, it is possible that such a test was made and the lamp brought back and placed on the motor after using it. In the event that the ventilation had been interrupted or the mining machine had cut into a "feeder" of gas, an explosive accumulation might have occurred in a short time. The entry was narrow, rising toward the face, coal only about 4 feet 6 inches high and gas was being liberated freely. The ventilation could have been interrupted very easily as any one of four doors being left open would have short-circuited the air and cut off the ventilation.

The other two machine operators were located at the face of 2nd left off 19 left and were evidently in the act of changing "bits" in the mining machine, when the explosion occurred.

After the explosion occurred they evidently ran out of the entry to 19 left and thence inby toward the face of 19 left. Their bodies were recovered on 19 left about 100 feet inby 2nd left. These two men showed no evidence of burns and were evidently overcome by afterdamp. Practically no evidence of violence or heat was shown in 2nd left entry. The dinner pails of the two machine men were found on the outby end of the electric locomotive used for "tramming" the mining machine. They showed no evidence of the explosion, being intact, clean and free of dust. Both of the machine crews had cut at least one other place previous to the one in which they were working when the explosion occurred.

Mine Conditions Prior to Explosion:

From information obtained during the investigation, the fan had been in continuous operation during the day and no work of an unusual nature was being done. Conditions in and around the mine were apparently normal with the exception that a severe thunder storm was raging on the outside. The fire bosses had reported no accumulations of gas on their examinations on the morning previous to the explosion.

Property Damage:

The explosion was moderate in violence and covered a comparatively small area. Several trap doors and about 25 stoppings were blown out. On May 25th the management started to remove the

debris which resulted from the explosion and to rebuild the stoppings which were destroyed. It is believed that three or four days would be sufficient time to restore the mine to normal operating conditions.

Forces:

The forces originated in the face of 1st right entry off 19 left and traveled outby this point. Little violence was in evidence in either the 1st right entry or aircourse. The trolley wire guard at the mouth of 1st right was not torn down by the explosion. A wood trap door at the mouth of 1st right was blown outby. At the mouth of 1st right there was a division of forces on 19 left. The force traveled inby toward the face of 19 left with rapidly decreasing violence. The three last stoppings were left intact; 2nd left off 19 left which is about 250 feet inby 1st right showed practically no evidence of violence. The forces which traveled outby 1st right seemed to increase in violence from the mouth of 1st right, all the stoppings between 1st right and the mouth of 19 left being destroyed. A door situated between 1st right and the mouth of 19 left was destroyed and pieces of it were blown a considerable distance outby. Some of the forces traveled through No. 2 and 3 rooms off 19 left aircourse to 18 left and thence outby to the main entry. The remainder of the forces traveled outby on 19 left to the main entry.

At the mouth of 19 left the forces again divided. They traveled inby with considerable but rapidly decreasing violence

toward the faces of the main entries. It is believed that a number of stoppings were not blown out in the vicinity of 20 left and the faces of the main entries. The forces continued outby from 19 left with considerable violence until they reached a point about opposite 15 left where they died out. Stoppings on both sides along the main entry from 19 left outby to 15 left were blown out. A trip of about twenty cars found in the 45° cut-off inby 18 left were wrecked on the outby end. Dust from the explosion traveled outby on the intake airway to beyond 7 left.

Evidence of Heat and Flame:

In the face of 1st right off 19 left there were thick deposits of soot and coke on top of the mining machine, electric locomotive, machine truck, track, etc. There were also deposits of coke on the cross bars of the 1st right entry. Heavy deposits of coke were found on the inby side of steel cross bars in the vicinity of the mouth of 1st right entry. This had evidently been blown into the channel of the steel timbers and lodged there. On the 19 left entry outby 1st right small deposits of coke were observed at various places along the entry. Heavy deposits of coke were observed on the steel timbers just inby the 45° cut-off on the main entry outby 19 left. Small deposits of coke were observed at various places along the main entries from a short distance inby 15 left to about 400 feet inby 19 left. Further evidence inby

this point was not obtained as the ventilation was only partially restored at the time of the investigation.

The two bodies that were found in the face of 1st right off 19 left were badly burned. The 13 bodies found around and in the trip of empty cars located in the 45° cut-off outby 19 left were also burned, but the two bodies found inby 2nd left off 19 left were not burned.

The writer is of the opinion that the principal factor in stopping the explosion was the lowering of pressure due to the expansion of gases in old and new workings. It may be possible that the relatively low ratio of volatile to total combustible matter of the coal dust may also have contributed to a slight extent in stopping the explosion.

Recovery Work:

The first word to reach the mine officials that an explosion had occurred was telephoned out of the mine by the attendant in the transformer station located at 7 left. The substation attendant assumed that something unusual had happened when he observed a great deal of dust in the air.

Immediately following, the mine officials notified the District Mine Inspector, William Prentice, located at War, W. Va., a distance of about 6 miles from the Yukon mine. Mr. Prentice arrived in a very short time and took charge of the recovery work. Additional help was obtained from the State Department of Mines

which sent Mr. Thomas Stockdale, district mine inspector, located at Bramwell, W. Va., and Mr. Percy Gillie, safety director, located at Welch, W. Va. One of the State rescue trucks equipped with oxygen breathing apparatus, gas masks, etc., was brought from Welch by Mr. Gillie. Other oxygen breathing apparatus, equipment, etc. and rescue crews were provided by the Consolidation Coal Company from their Coalwood and Caretta operations, which are located only a short distance from Yukon.

The recovery crews entered the mine by way of the main haulage road of the No. 1 mine to about 15 left. At this point the first open crosscut resulting from a destroyed stopping was found. Temporary canvas stoppings were then erected where necessary to enable the recovery crews to advance.

On reaching the 45° cut-off inby 18 left the bodies of 13 men were found around and in a trip of empty cars. These cars constituted the night mantrip which was being hauled into the mine by an electric locomotive. These 13 bodies were located about 11:30 P.M. on the night of May 22.

Due to inadequate ventilation recovery work from this point onward was slow. The remaining 4 bodies, mining machine operators, were eventually located and recovered by crews wearing oxygen breathing apparatus. Two of the bodies were found in the face of 1st right off 19 left and two along 19 left inby 2nd left. The latter two men had evidently travelled to this point from

the face of 2nd left after the explosion had occurred and were overcome by afterdamp. The total distance travelled by these two men was about 350 feet from the place where they had been working to where their bodies were found. The last bodies were recovered about 7:00 P.M. on May 23 or about 24 hours after the explosion occurred.

After the explosion 23 men employed in the No. 1 and No. 2 mines escaped uninjured. It is believed that all but 3 of these were employed in the No. 2 mine and that nearly all of them were unaware that an explosion had occurred until they were notified from the outside.

Summary and Conclusions:

The writer is of the opinion that the explosion was caused by an accumulation of gas in the face of 1st right entry off 19 left being ignited by a non-permissible mining machine and that the explosion was propagated by coal dust. As this coal has a relatively low ratio of volatile to total incombustible matter, and the dust contains considerable amounts of incombustible ranging from twenty to fifty-eight per cent as indicated in the analyses of dust samples of coal, it requires a rather violent start in order to make an extensive explosion, and in this case there was opportunity for expansion into other workings with the blowing out of the stoppings.

The accumulation of gas apparently was caused by a trap door being left open. The evidence seems to indicate that the machine crew failed to test for gas in 1st right entry off 19 left before starting the mining machine, but this is questionable as

the gas accumulation may have occurred after a test was made.

The above conclusions relative to the cause and point of origin seem to be clearly proven by the evidence of forces and heat, together with the conditions found in the face of 1st right entry off 19 left.

Lessons to be Learned from the Explosion:

1. Only permissible mining machines maintained in an efficient manner should be used.

2. Working faces should always be examined by a competent person before entering with a mining machine and tests for gas should be frequently made while the machine is in operation.

3. The use of doors for controlling ventilation is inefficient and hazardous and if doors must be used they should be erected in pairs, with interlocking devices so that one door is closed at all times.

4. It is believed that possibly two and at the most not over four men would have been killed by the explosion if the mine had been efficiently rock-dusted.

Coroner's Verdict:

A coroner's inquest to determine the cause of the explosion was held at Yukon on June 4, 1928. The verdict rendered by the coroner's jury was about as follows:

"That the 17 men who were killed in the Yukon No. 1 mine on May 22, 1928, met their death as a result of an explosion caused

by an ignition of gas. The gas being allowed to accumulate by a mine door being left open by machine men and the failure on the part of two machine men to test for gas with their safety lamp resulted in the explosion." In the verdict returned by the jury was also the statement that "we find the mine was in good condition, properly ventilated and inspected and mining laws complied with".

Recommendations:

1. That permissible mining machines, maintained in an efficient manner, should be used exclusively.

2. That a competent person examine working places for explosive gas before starting to operate a mining machine, and that frequent additional tests be made while the machine is in operation.

3. That rock-dust be distributed on all surfaces of all accessible workings including mine haulages, whether active or inactive on entries to the last break-through, in all rooms and pillar workings to within 40 feet of the face, and in all return airways.

4. Sufficient rock-dust should be applied so that the average analysis of samples of roof, rib and floor dust shall show at least 65 per cent of incombustible matter.

5. Samples of the dust on surfaces of rock-dusted entries, airways, rooms, etc., should be taken frequently and when the average per cent of inert material falls below the above amount in any section it should be re-dusted.

6. In addition to the generalized rock-dusting throughout the mine, rock-dust barriers should be erected at key positions.

7. That additional splits of air be provided preferably by overcasts/and that the use of doors be reduced to the minimum. Where it is impossible to avoid the use of doors, double doors with interlocking devices should be provided.

8. Water sprays should be used on cutter bars of mining machines. Machine cuttings should be loaded out while they are in a wet condition and before shots are fired. Water sprays should be provided for wetting loaded and empty trips.

9. Hose and water should be provided in all working places of surfaces at or near the face for washing down dust/and wetting coal before loading.

10. That all shot holes be tamped to the collar with incombustible stemming, and that shots be loaded and fired by shot firers using permissible explosives and shot firing equipment, after the regular shifts are out of the mine.

11. That only one day's supply of explosives should be taken into the mine at one time. Delivery of explosives should be made between shifts with an insulated car, while the electric current is cut off the mine.

12. That miners be required to keep their explosives in a tight box, provided with a lock and key, and that they keep explosives and detonators in separate containers at least 20 feet apart.

13. That permissible storage battery locomotives or animals be used for gathering coal and that if trolley pole locomotives are used they should only be operated on intake air fresh from the outside. In fact, careful consideration should be given to the elimination of all permanent wiring underground and to the operation of pumps, mining machines, haulage locomotives, etc., by the use of permissible storage battery equipment.

14. That the No. 1 and No. 2 mines should be separately ventilated with fans of sufficient capacity in order to increase the ventilating efficiency of both mines.

Acknowledgments:

The writer wishes to acknowledge his appreciation for the co-operation rendered and courtesies shown to the representatives of the Bureau of Mines during the investigation by the officials of the company and representatives of the State Department of Mines.

Respectfully submitted,

G. W. GROVE
Associate Mining Engineer.

A P P E N D I X

A composite analysis of six face samples of coal, as received, collected in the Warrior mine, which adjoins Yukon No. 1 mine and working the same bed are as follows:

Moisture	1.71
Volatile matter	17.57
Fixed Carbon	69.92
Ash	10.80
Sulphur	0.65
B. t. u.	13,670
Ratio $\frac{V}{V+F\ C}$	20.1

These samples were collected in September, 1924, by F. E. Cash of the Bureau of Mines and analysis made at the Pittsburgh Laboratory of the Bureau by H. M. Cooper, chemist.

Analyses of road, rib and roof samples, as received, collected by the writer, Claud P. Dempsey, and Jesse Redyard of the Bureau of Mines.

Lab. No.	Location	Kind of Sample	Combustible Vol. + F.C.	Incombustible Moisture + Ash	Sizing all thru 20 mesh		
					Thru 48 mesh	Thru 100 mesh	Thru 200 mesh
A-42538	Main haulage road opposite 15 left where explosion stopped	Road	62.9	37.1	49.8	24.1	10.9
A-42542	Main haulage road opposite 15 left where explosion stopped	Rib & Roof	65.0	34.0	81.8	70.8	59.8
A-42536	Inby end of 45° cut-off on main haulage	Road	41.7	58.3	58.8	30.5	17.8
A-42541	Inby end of 45° cut-off on main haulage	Rib & Roof	78.3	21.7	96.9	88.2	75.1
A-42540	1st break-through inby old 19 left on main haulage road	Road	72.0	28.0	62.0	33.9	13.6
A-42535	1st break-through inby old 19 left on main haulage road	Rib & Roof	81.2	18.8	96.4	89.0	75.9
A-42537	19 left aircourse outby #5 room	Road	69.4	30.6	62.9	38.5	25.4
A-42539	19 left aircourse outby #5 room	Rib & Roof	80.0	20.0	90.5	76.2	58.3

Analyses made June 5, 1928, at Bureau of Mines Laboratory, Pittsburgh, Pa., by H. M. Cooper, chemist.

The Bureau of Mines has found through its experiments on the explosibility of coal dust that all bituminous coal dust which will pass through a 20-mesh screen is explosive, and that the fineness of the dust and the amount of incombustible matter are two important factors in the propagation of coal dust explosions. It will be noted that samples of dust collected on 19 left and on the haulage road inby 18 and 19 left were low in incombustible matter and very high in 200 mesh dust. Doubtless the low incombustible content and fineness of the dust on the above entries, together with the speed and pressure of the explosion, indicate the reason for the explosion increasing in violence along these entries.

While the analyses of dust samples taken at about 15 left, or approximately where the explosion died out do not show a sufficient amount of incombustible material to prevent propagation under certain conditions, it may have contributed to some extent in stopping the explosion. However, the lowering of pressure due to the rapid expansion of the gases in old and new workings when stoppings were blown out is believed to be the principal factor in stopping the explosion.

The history of all four explosions which have occurred in Yukon No. 1 and No. 2 mines are practically the same in that the explosions originated by the ignition of gas. The

officials at the mine seemed to have the/impression mistaken that the dust in the Yukon mines was not explosive, this impression being based on tests and a report made by the Bureau of Mines on coal tested in the Bureau experimental mine. The tests referred to were made with coal collected from an adjoining mine. The tests conducted clearly show that the dust when in a cloud may be exploded unless mixed with sufficient incombustible matter to prevent propagation. All samples tested, with the exception of one, did not have sufficient incombustible content to prevent propagation of an explosion which might start with an explosion of a body of gas; and that to prevent an explosion in the presence of 1 per cent of gas there should be added from 50 to 55 per cent of rock dust.

Analyses of Air Samples Collected in
Yukon No. 1 Mine, May 25, 1928,
by the Writer, Claud P. Dempsey, and Jesse Redyard.

Lab. No.	Location	CO_2	O_2	CH_4	N_2	Cu. Ft. Air per minute	Vol. CH_4 per 24 hours
48286	Face 1st right off 19 left	0.20	19.6	4.6	75.6	Velocity too low to read	
48287	40 ft. from face of 1st right off 19 left	0.30	20.3	2.0	77.4	625	18,000
48288	19 left return 25 ft. inby 1st right	0.21	20.17	2.13	77.49	Velocity too low to read	
48289	Main return No. 2 mine at 5 right off No. 1 mine	0.08	20.75	0.44	78.73	31,420	199,077
48290	Main return No. 1 mine outby 13 left	0.18	20.54	0.77	78.51	34,770	385,530
48291	200 ft. inby No. 1 fan on main return from No. 1 and No. 2 mines	0.26	20.41	0.56	78.77	91,500	737,856

When the above samples were taken the ventilation had not been fully restored inby 16 left.

Analyses made June 13, 1928, at Bureau of Mines Laboratory, Pittsburgh, Pa., by W. P. Yant, chemist.

The above analyses show that No. 1 and No. 2 mines "make" over 700,000 cubic feet of methane every 24 hours and that No. 1 mine is generating approximately 400,000 cubic feet of the total amount. Undoubtedly the volume of gas will increase as development work advances and additional territory is opened.

It will be noted from the analyses that the total return from both mines is approximately 91,500 cubic feet per minute and that it contains 0.56 per cent methane. It is believed that such an amount of gas in the main return is dangerous, and it is recommended that the methane content in any split should never be greater than 0.5 per cent, and it is advisable to keep it as much below this figure as possible.

The ventilation should be improved by installing new fans, or operating the present fans more efficiently, by cleaning airways, constructing overcasts and splitting the ventilating current in order to efficiently ventilate all sections of the mines.

Serious consideration should be given to ventilating each mine separately as it is believed that with the present system the return airways are not large enough to allow the present fans to exhaust much over 120,000 cubic feet of air per minute. A mine which liberates as much gas as this one must have adequate ventilation, properly distributed, in order to prevent dangerous accumulations of explosive gas.

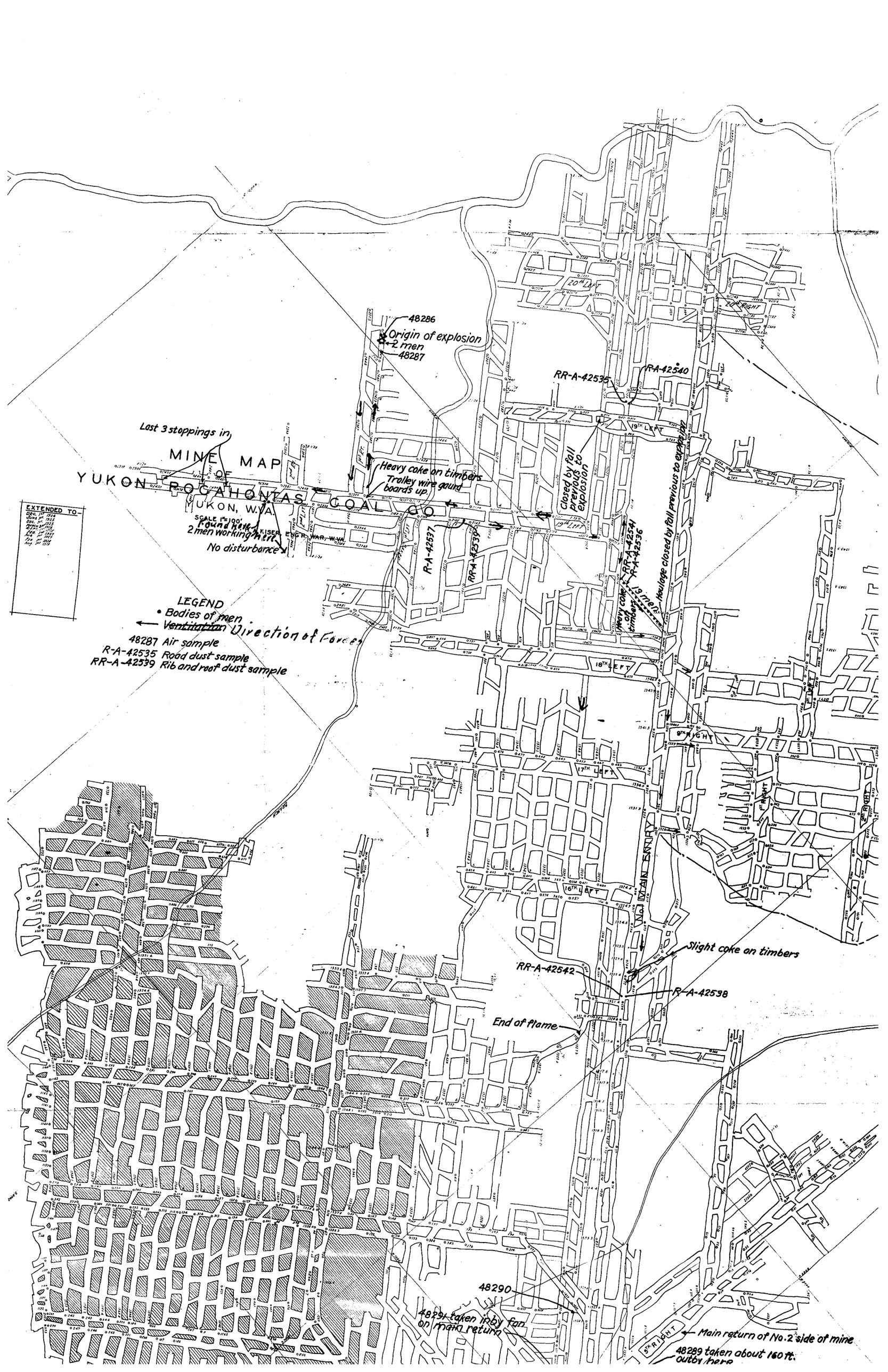
NAMES OF MEN KILLED BY THE EXPLOSION

White

James Wakely	Yukon, W. Va.	Burned
George Miller	Yukon, W.Va.	Burned
William Sayers	Yukon, W. Va.	Burned
J. B. Shamblin	Yukon, W. Va.	Killed by afterdamp
Audlin Lowe	Yukon, W. Va.	Killed by afterdamp
Joseph Maliski	Yukon, W. Va.	Burned
John Bavin	Yukon, W. Va.	Burned
John Brown	War, W. Va.	Burned
Fuller Honaker	Honaker, Va.	Burned
Silas Honaker	Honaker, Va.	Burned

Colored

Reed Johnson	Yukon, W. Va.	Burned
Enoch Holland	Yukon, W. Va.	Burned
Will Wade	Yukon, W. Va.	Burned
Joshua Boyhin	Yukon, W. Va.	Burned
William Fields	Yukon, W. Va.	Burned
Mack Weaver	Yukon, W. Va.	Burned
Earl Wilkinson	Yukon, W. Va.	Burned


MINE MAP
OF
YUKON POCAHONTAS COAL CO
YUKON, W.VA.
SCALE 1" = 100'
KISER ENGR. WAR, W.VA.
EXTENDED TO
LEGEND
Bodies of men
Ventilation Direction of Forces
48287 Air sample
R-A-42535 Road dust sample
RR-A-42539 Rib and roof dust sample
48286
Origin of explosion
2 men
48287
Last 3 stoppings in
Heavy coke on timbers
Trolley wire gound
boards up
Round here
2 men working here
No disturbance
RR-A-42535
RR-A-42540
Closed by fall previous to explosion
Heavy coke on timbers
Haulage closed by fall previous to explosion
R-A-42537
RR-A-42538
RR-A-42541
R-A-42536
Slight coke on timbers
RR-A-42542
R-A-42538
End of flame
48290
48291 taken in by fan on main return
Main return of No. 2 side of mine
48289 taken about 160 ft. outby here
MAIN ENTRY
No. 2
19TH LEFT
18TH LEFT
17TH LEFT
16TH LEFT
9TH RIGHT
8TH RIGHT
7TH RIGHT
6TH RIGHT
20TH LEFT
21ST RIGHT