FINAL REPORT
MINE EXPLOSION, KEEN MOUNTAIN MINE
RED JACKET COAL CORPORATION
HANGER, BUCHANAN COUNTY, VIRGINIA
APRIL 22, 1938

by

G. W. GROVE
Mining Engineer

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

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INTRODUCTION

A coal dust explosion occurred at about 4:45 p.m., April 22, 1938, shortly after most of the night shift had entered the mine, in the Keen Mountain mine of the Red Jacket Coal Corporation, resulting in the death of 45 men and the injury of 2 others.

All of the men who were in the section or part of the mine in which the explosion occurred were killed, with the exception of one man, and 3 men were killed on the outside of the mine. Most or all of the men were killed and injured by burns and violence.

At the time of the explosion, there were additional men (probably as many as 50 or 60) in another part of the mine which was not connected to the portion in which the explosion occurred. Had the two sections of the mine been connected, which will be done in the relatively near future, or had additional (understood to be about 12) men employed on the night shift in the affected portion and waiting on the outside, entered the mine, the loss of life would doubtless have been considerably increased.

The explosion was caused by the simultaneous firing of 3 "adobe" or "bulldozing" shots in the face of 1st left off the mains. The shots were apparently fired with 250 volts direct current and are believed to have contained 6 sticks of Lump Coal C permissible explosive

and 3 No. 6 electric detonators. The explosion was not extremely violent; however, all of the stoppings in the affected portion of the mine were destroyed, two small fans were demolished, and considerable damage was done to mine portals and a sand-house locomotive and cars on the outside of the mine.

The Keen Mountain mine is generally dry, with the exception of a few small local swales where water was observed, and no watering is done to allay coal dust. The mine is extremely dusty and although some rock-dusting, by hand application, had been done previous to the explosion, the amount used had little or no effect in stopping the explosion.

The Bureau of Mines at Norton, Virginia, was notified regarding the explosion about 5:00 p.m., and at Pittsburgh, Pennsylvania, by the Associated Press, at about 5:45 p.m., April 22, 1938.

As soon as possible after telephone calls to the mine from Norton, Virginia, and Pittsburgh, Pennsylvania, had provided information on the extent of the disaster, Bureau men and equipment were sent to Keen Mountain by automobiles, truck, and Mine Safety Car No. 8, which was located at Jenkinjones, West Virginia. The first Bureau representative arrived about 9:30 p.m., April 22, and the mine safety car arrived at about 2:30 a.m., April 23, 1938.

GENERAL INFORMATION

Location:

The Keen Mountain mine is at Hanger, Buchanan County, Virginia, and is served by a spur of the Norfolk and Western Railway which leaves the main line at Devon, West Virginia.

Ownership and operating officials:

The mine is owned and operated by the Red Jacket Coal Corporation, whose main operating office is at Red Jacket, West Virginia. In addition to the Keen Mountain mine, this company operates 6 other mines, five of these being at Red Jacket and one at Wyoming, West Virginia.

The officials are as follows:

L. E. Woods	President	Columbus, Ohio
J. E. Parker	Assistant to President	Red Jacket, West Virginia
N. B. Gurley	Chief Engineer	Red Jacket, West Virginia
E. F. Smith	General Superintendent	Red Jacket, West Virginia
J. R. Kirby	Superintendent	Keen Mountain, Virginia
H. F. Cook	Mine Foreman	Keen Mountain, Virginia
John Dameron	Night Foreman	Keen Mountain, Virginia

The sales agent is the Red Jacket Coal Sales Company, 115 East Rich Street, Columbus, Ohio.

Type of mine:

The Keen Mountain mine is opened by 21 drifts, which are about 600 feet above the valley containing the tipple and railroad. The drifts extend along the side of the mountain for a distance of about three-quarters of a mile. The drifts are in 6 groups, 4 of these groups having 3, one 4, and another 5 openings, driven on 60-foot centers.

A number of the openings have been made to permit rapid development, and will be abandoned as the mine advances. As the explosion was confined to two groups of drifts, having 7 openings, which were not connected with the remainder of the mine, this report will be largely restricted to the affected portion of the mine.

Coal bed:

The mine is working the lower Banner (locally called the Cary) bed, which averages about 57 inches in thickness. The coal is a medium volatile bituminous, is friable, contains no bands of impurities and no defined cleavage. The coal bed, so far as developed, is practically flat.

Analysis of face samples is given in Table No. 1.

Roof and floor:

The immediate roof is a slate, of medium to strong character, of varying thickness. A draw slate ranging from a few to several inches in thickness is found in some portions of the mine. In general, extensive timbering is not required to support the roof. The floor is a hard slate or sandstone.

Employees:

At the present time, there are about 350 men employed in and around the mine. Probably from 50 to 75 of these are employed on the outside, with the remainder working underground in day and night shifts, which are about equally divided. In the affected portion of the mine, there were about 60 men employed on each shift, or a total of about 120 men.

Production:

The mine is in the early stages of development and is producing about 2000 tons per day. The mine has been shipping coal since September 1937, and about 2300 tons is the maximum produced in a day. Nearly all of the coal is mechanically loaded. Eventually it is expected that the mine will be producing about 3000 or more tons per day.

Table No. 1.--Analysis of face samples, Keen Mountain mine, Red Jacket Coal Corporation.

Laboratory No.	Location	Percent - as received					
		Moisture	Volatile matter	Fixed carbon	Ash	Sulphur	B.t.u.
B-29342	Face 2nd left off No. 1 main	1.8	21.8	68.7	7.7	1.3	14,160
B-29343	Second left off No. 1 barrier entries	1.6	21.9	68.1	8.4	1.0	14,130
B-29344	Face No. 1 barrier entry	1.8	21.8	68.5	7.9	1.7	14,160
B-29345	Composite of 29342, 29343, and 29344	1.8	21.8	68.3	8.1	1.3	14,170

Samples collected by G. W. Grove, mining engineer, E. E. Quenon, principal safety instructor, and H. J. Van der Veer, junior mining engineer, Bureau of Mines, April 26, 1938.

Analysis made in Bureau of Mines laboratory, Pittsburgh, Pennsylvania, by H. M. Cooper, chemist.

SURFACE EQUIPMENT

Fans:

Previous to the explosion, 4 disc fans, operated exhausting, were used to ventilate the Keen Mountain mine. Two of these were used to ventilate the main and barrier entries, and were destroyed by the explosion, and the other two were used at other openings. The fans were all set in wood stopping placed directly in the drifts.

No water gauges or pressure-recording instruments were being used.

Headhouse and tipple:

A headhouse constructed of wood and corrugated galvanized iron is located near the mine opening. It is equipped with a rotary dump and hopper into which the coal is dumped.

From the hopper the coal is fed into a rope and button retarding conveyor. This conveyor is about 1200 feet long, on an inclination of about 24°, and extends down the mountainside from the headhouse to about the level of the top of the tipple. From the rope and button conveyor the coal is dumped on a belt conveyor about 400 feet long, which carries the coal to the tipple. The entire conveyor system is covered with corrugated sheet iron.

The tipple, constructed of concrete and steel, is provided with shaker screens of various sizes which permit loading of different sizes of coal ranging from nut to lump. No provisions are made for washing or air-cleaning the coal.

The tipple is a 6-track plant provided with loading booms and mechanical car spotters.

Explosives magazine:

An explosives magazine, constructed of wood and corrugated sheet iron, is located along the hillside between the main and barrier openings. When the mine was first opened, pellet powder and permissible explosives (Red Diamond No. 5 and Lump Coal C) were used. These were later replaced by Cardox for blasting coal.

At the time of the investigation, the following explosives were in the magazine: 19 cases of du Pont pellet powder, 2 cases of du Pont 40 percent gelatin dynamite, 2 cases of Austin Red Diamond No. 5, and 10 cases du Pont Lump Coal C; with about 2 additional cases of Lump Coal C lying loose on the floor.

It is understood that all of the explosives are to be removed from this magazine and moved to another magazine remote from the mine openings.

Lamp house:

The lamp house is located near the mine openings. It is equipped with 210 Model K Edison electric cap lamps, charging racks, etc.

It is believed that the lamps are numbered and are used for checking the employees in and out of the mine.

Miscellaneous surface buildings:

In addition to the surface buildings already described, there is a mine foreman's office and electric substation on the hill near the mine openings, and a large supply house and wash house adjacent to the tipple.

Outside haulage:

Haulage tracks extend from the various mine openings to the head house. These are laid with 60-pound rails of 48-inch gauge. Trolley wires are supported on steel supports and are about 6 feet above the rails. Haulage for supplies from the railroad and supply house in the valley is provided by an electric hoist at the head house and a track paralleling the conveyor. In addition, a narrow-gauge railroad, which uses the regular mine cars, winds around the hill, for a distance of about 3 miles, from the floor of the valley at the tipple to the mine openings. The motive power for this system is supplied by a 40-ton Shay steam locomotive.

UNDERGROUND EQUIPMENT AND HAULAGE

Coal-cutting equipment:

Coal is cut by 3 Jeffrey 29-U, 1 Jeffrey 29-C, and 1 Goodman mining machines equipped with 8-foot cutter bars. All of the coal (with the probable exception of that cut with the Goodman machine) is topcut.

Coal-loading equipment:

Eight Joy BU loading machines are used for loading coal. Three of these were in the area affected by the explosion.

Coal drills:

Holes for blasting are drilled by Chicago pneumatic electric drills using 2-1/2-inch augers.

Permissibility of cutting, loading, and drilling equipment:

No permissible plates were observed on the 2 mining and 3 loading machines and drills in the affected area; however, they appeared

to be well-enclosed and similar to permissible equipment. The writer was informed by one of the company officials that all of the mining machines, loading machines, and drills are the permissible type, and that all that is required to make them permissible is to attach the approval plate, which could be obtained by request from the manufacturers.

Haulage:

Main line tracks are laid with 60-pound rails and side entries and rooms with 30-pound rails, using a 48-inch gauge.

Mine cars are all-steel construction with solid bodies. Couplings are of the swivel type to permit dumping in the rotary dump without uncoupling. The cars are provided with roller-bearing wheels, and have a capacity of about 4 tons. They are not equipped with brakes.

Haulage is performed by 6- and 8-ton cable-reel locomotives for gathering purposes and 10- and 15-ton main line trolley locomotives. Clearance appeared to be ample in most of the mine; however, no shelter holes were observed. Trolley wires, where they remained in place after the explosion, appeared to be well-hung; however, no guarding of such wires was observed.

MINING METHODS AND CONDITIONS

Method of mining:

The Keen Mountain mine is worked by the room-and-pillar method. Main entries are 4 or 5 entry systems driven about 18 feet wide on 60-foot centers. Room entries are either double- or triple-entry systems, also driven about 18 feet wide on 60-foot centers.

Rooms are driven on about the same plan as the main and room entries. Pillars are extracted on the retreat. Only a few rooms had been driven and only about 3 pillars extracted at the time of the explosion, most of the work being concentrated on obtaining development.

Coal is topcut on advance mining and where possible on retreat work. Loading machines are used to load nearly all of the coal; a little hand loading is also done at times.

Electricity underground:

All of the mining machines, loading machines, drills, cable-reel and trolley-pole locomotives are operated with 250 volts direct current.

Timbering:

The roof of the mine appeared to be fairly good, and extensive use of crossbars is apparently not necessary, as no large falls occurred following the explosion even though some crossbars were knocked out by the force of the explosion.

Posting is done in entries and rooms where thought necessary.

Prepared cap pieces and wedges are provided.

Explosives practice:

Cardox shells about 2-1/2 inches in diameter are used for blasting coal. These shells are loaded by employees of the Cardox company and transported to working places in mine cars.

Each Joy loading machine crew has two men assigned to it who drill, charge, and fire the Cardox. From information obtained, no stemming is used to confine the Cardox shells in the holes during

blasting operations. Cardox shots are fired by means of nonpermissible batteries, and it is suspected sometimes with 250-volt direct current, any time during the shift.

Cardox is not used in a permissible manner unless the shells are tamped with incombustible stemming and fired with permissible shot-firing batteries. Numerous men have been injured and killed by the forcible ejection of unstemmed cardox shells from drill holes, and explosions and gas ignitions have been caused by firing them with live current and nonpermissible batteries; therefore, both of these precautions should be carefully observed.

Some adobe or bulldozing shots, in breaking rock, were also fired with permissible explosives and electric detonators. In one instance, at least, such shots were fired with live current, and doubtless caused the explosion.

Adobe or bulldozing shots should never be fired in a coal mine; a hole should be drilled in the rock or boulder, the explosives placed in the borehole, tamped well with incombustible stemming, the charge covered with about 15 to 20 pounds of rock dust, and fired with a permissible battery. And preferably this should be done when the working shift is not in the mine.

Ventilation:

The mine is rated as nongassy by the Virginia Department of Mines. A small amount of combustible gas was detected, with a flame safety lamp, during recovery operations (see appendix); however, this is believed to have been due to gases generated by the burning of coal dust by the flame of the explosion. After the completion of the recovery work, no explosive gas could be detected with a flame safety

lamp even though no ventilation had been reaching the working faces for from about 44 to 56 hours. Furthermore, air samples collected at the time the safety lamp was used, when analyzed, showed only traces of methane.

No examinations were made for gas by mine officials previous to the explosion.

The mine was ventilated by 4 small disc fans set in wooden stopping at the mouth of the entries. Two of the fans were demolished by the explosion and the other two were moved, after the explosion, to the barrier entries to provide ventilation during the recovery work.

The destruction of the two fans in the affected portion of the mine shows the result of setting fans directly in or in front of mine openings when an explosion occurs. Fans should be offset from direct line of the mine openings for a distance of 25 to 30 feet or more, and provided with explosion doors, so that in the event of an explosion they may, with a minimum amount of repairs, be serviceable.

The two fans used in ventilating the area affected by the explosion were located at the 1st main entry and at the 2nd or center barrier entry. Both of them were operated exhausting. The fan at the mains circulated air in a continuous current in the haulage road and parallel entry, around the faces of the mains, thence into 1st left off the mains, around the faces, to the left of the mains, then through the fan to the outside.

The barrier entries were ventilated by taking air in the 1st and 3rd entries and returning it through the fan in the center entry. The air entering the 1st entry was circulated around the faces

on the left side of the barrier entries and that entering the 3rd barrier entry traveled around the faces on the right side of the barrier entries. Both currents joined at or near the top of the center entry and returned to the outside.

The system of ventilation permitted most or all of the main line haulage to be operated in intake air.

A door was placed in each of the diagonal entries, which connected the mains and barrier entries, to keep the ventilation in the mains and barriers separated.

It is believed, from information obtained from company officials, that each fan was exhausting about 25,000 cubic feet of air per minute.

Stoppings in the explosion area were all destroyed. These were stated to have been constructed of wood. Consideration should be given to replacing these with incombustible material.

Air samples were collected after the explosion. Some of these, as previously stated, were obtained in places where the ventilation had been "out off" for a considerable period of time. Others were collected in moving air currents. The results of the analysis of these samples are shown in Table No. 2.

It will be noted from the table that small amounts (0.02 and 0.04 percent) of methane were found in only two of the air samples. These were both collected at places in which there had been no ventilation for a considerable period of time. None of the samples collected in moving air contained any methane. In view of the results of the analyses, the portion of the mine in which the explosion occurred can be considered as nongassy at the time of sampling.

Table No. 2.--Analyses of air samples, Keen Mountain mine, Red Jacket Coal Corporation, Hanger, Virginia

Bottle No.	Laboratory No.	Location	Percentage CO_2	Percentage O_2	Percentage CH_4	Percentage N_2	Cubic feet of air
281	62778	1st right off 1st left off 1st left off mains	0.14	20.83	0.00	79.03	No ventilation for about 46 hours
282	62779	2nd cross to left off barriers	0.14	20.72	0.04	79.10	No ventilation for about 56 hours
343	62780	1st left off No. 1 main	0.19	20.72	0.00	79.09	No ventilation for about 44 hours
344	62781	Face 2nd main heading	0.18	20.76	0.02	79.04	No ventilation for about 44 hours
451	62782	No. 5 (3rd opening) mains	0.06	20.91	0.00	79.03	5,985
452	62783	No. 6 (4th opening) mains	0.07	20.93	0.00	79.02	5,500
762	62784	No. 4 (2nd opening) mains	0.03	20.92	0.00	79.05	13,500
791	62785	2nd diagonal	0.05	20.92	0.00	79.04	17,400
792	66286	1st diagonal	0.05	20.91	0.00	79.04	15,000

Samples collected by G. W. Grove, M. C. McCall, E. E. Quenon, H. J. Van der Veer, and J. W. Pero, Bureau of Mines, April 25 and 26, 1938.

Analyses made June 7, 1938, at Bureau of Mines laboratory, Pittsburgh, Pa., by H. H. Schrenk, chemist.

Dust:

Much fine dust is made at the working faces by mining and loading machines and drilling and blasting operations. Additional dust is made by haulage operations and tramming mining and loading machines. It is believed that due to the character of the coal, top-cutting, and mechanical loading, the amount of dust is unusually high and that the proportion of very fine dust is also abnormally high. Provisions should be made to apply water to the cutter bars of mining machines, loading machines, at working faces before and after blasting, and on loaded and empty trips.

Rock dust in sufficient amounts to prevent propagation of a mine explosion should also be applied and maintained in all openings (entries, air courses, crosscuts, and rooms) to within about 25 feet of the faces.

The Bureau of Mines has found, through experiments on the explosibility of coal dust, that all bituminous coal dust which will pass through a 20-mesh screen is likely to be explosive; also, that the explosibility of the dust increases as the size of the dust decreases. The ratio of volatile matter to total combustible matter in coal is an indication of the explosibility of the dust. All other factors being equal, the higher the ratio of volatile to total combustible, the easier the dust will ignite and the more readily an explosion will propagate. However, some of the medium and low volatile coals, when once ignited, have been found to produce a more violent explosion than coals having a high ratio of volatile to total combustible matter. By reference to Table No. 1 of this report, it will

be noted that the volatile combustible ratio $\frac{V}{V. + F.C.}$ for the composite sample No. B-29345 is $\frac{21.8}{21.8 + 68.3}$ or 0.235.

In order to render the dust from this coal non-explosive when suspended in air, with no methane present, it is necessary to add sufficient inert material, such as rock dust, to raise the incombustible content to at least 60 percent. In the presence of methane it is necessary to add $(\frac{100 - 60}{5})$ or 8.00 percent of inert material to the above 60 percent for each percent of methane present in the air.

Some rock-dusting had been done by hand methods previous to the explosion; however, the amount applied was insufficient and had little or no effect on stopping the explosion.

Samples of roof and rib and road dust were collected in the area affected by the explosion. The analyses of these appear in Table No. 3.

From the analyses of dust samples in Table No. 3, it will be noted that the incombustible content of the samples collected at various places (see map) within the explosion area ranged from 10.6 to 30.5 percent; furthermore, that of the 16 samples collected only one contained 30.00 percent or more incombustible, or about one-half of the 60 percent incombustible which, it is estimated, is necessary to prevent propagation of an explosion by dust from the mine.

As the average ash content of the face samples (table 1) is 8.1 percent and 10 of the 16 dust samples show less than 15.00 percent, it is evident that the amount of rock-dusting done previous to the explosion was insufficient. The rock dust present may have served to slow down the explosion to some extent, but it had little or no effect in stopping it.

Table No. 3.--Analyses of dust samples, Keen Mountain mine, Hanger, Virginia

Laboratory No.	Location	Kind	Percent		Sizes through 20-mesh		
			Combustible	Incombustible	Percent through		
			V. + F.C.	Moisture + ash	48-mesh	100-mesh	200-mesh
B-29346	2nd left off mains near face	Floor	79.8	20.2	54.4	28.2	16.6
B-29347	do.	Rib & roof	82.6	17.4	Not sized - coke present		
B-29348	2nd left off mains near mains	Floor	69.5	30.5	58.7	35.4	20.2
B-29349	do.	Rib & roof	84.5	15.5		Not sized	
B-29350	No. 2 main entry 150 ft. outby 1st left	Floor	88.8	11.2	60.9	39.7	23.8
B-29351	do.	Rib & roof	86.8	12.2		Not sized	
B-29352	4th main entry 200 ft. outby 1st left switch	Floor	77.7	22.3	67.2	47.2	31.3
B-29353	do.	Rib & roof	80.9	18.1		Not sized	
B-29354	1st diagonal near barrier entries	Floor	89.4	10.6	66.0	40.2	26.2
B-29355	do.	Rib & roof	87.1	11.9		Not sized	
B-29356	3rd diagonal near barrier entries	Floor	88.4	11.6	62.0	36.3	22.5
B-29357	do.	Rib & roof	85.0	13.5		Not sized	
B-29358	No. 2 barrier entry 400 ft. from face	Floor	85.3	14.7	61.3	38.8	22.5
B-29359	do.	Rib & roof	85.7	12.7		Not sized	
B-29360	Last crosscut between 2nd and 3rd barrier entries	Floor	87.2	12.8	63.3	40.7	25.8
B-29361	do.	Rib & roof	85.0	13.6		Not sized	

Coked particles, in medium and large amounts, present in all samples.

Samples collected by G. W. Grove, E. E. Quenon, H. J. Van der Veer, and J. W. Pero, Bureau of Mines, April 26, 1938.
Analyses made at Bureau of Mines laboratory, Pittsburgh, Pa., May 9, 1938, by H. M. Cooper, chemist.

On the other hand, had the mine been adequately rock-dusted, the explosion would doubtless have been confined to a relatively small area, would not have attained the speed and pressure which it did, and would have resulted in few or no fatalities.

SAFETY CONDITIONS

Supervision:

The supervisory officials in the Keen Mountain mine consist of a mine foreman and a night foreman, together with a day and night section foreman in the area affected by the explosion. There are also probably additional section foremen in the remainder or unaffected portion of the mine.

The supervision in some respects is apparently good. On the other hand, it is definitely known that on the day of the explosion, at least three different times, adobe shots were fired, either with the consent or without the knowledge of the supervisory officials. In either event, proper supervision would have prevented this, as it was a direct violation of company rules which the officials should have known and enforced.

Company rules, in booklet form, are issued to each employee, but apparently no effort is made to examine the men relative to their knowledge of the rules or to instruct men regarding them. Some of the apparent laxity of supervision is probably due to the fact that the mine is a comparatively new operation, with a large proportion of the employees having worked for the company but a short time. However, this is all the more reason why the mine officials should be particularly alert to prevent violation of the safety rules and to enforce safe practices.

Safety meetings:

Monthly safety meetings are held for the employees and officials. The type of meetings is patterned after safety clubs or safety courts, at the West Virginia operations of the company, which try cases of infractions of safety rules. It is believed that if a chapter of the Holmes Safety Association were organized and affiliated with similar chapters at adjacent mines, such an organization and meetings would be of much value in the prevention of accidents and in the education of employees in safety at this and other mines in the district.

Protective clothing:

Hard caps and hard-toed shoes are worn by all employees. Some of the employees also at times wear goggles.

First aid and mine rescue:

No first-aid or mine-rescue training has been done at this mine or in this district. Some of the employees may have received such training at other operations previous to being employed at the Keen Mountain mine.

Arrangements should be made to train or retrain every employee in first-aid work and a selected number in mine-rescue work. A station containing 10 oxygen breathing apparatus, gas masks, gas detecting devices, etc., should be provided either at this mine or at a central station which would be available for all of the mines in the district.

First-aid equipment (bandages, splints, blankets, stretchers, etc.) should be provided and maintained in each section of the mine and

on the outside of the mine.

Safety organization:

No safety organization, other than the operating officials, is maintained at this or other mines of the company. A proper safety organization should be perfected and a safety director or safety engineer employed whose entire time should be devoted to the inspection of the company's mines and the promotion of safety activities.

Summary of safety conditions:

The Keen Mountain mine is to be commended on the use of permissible type mining machines, loading machines, and drills, on the use of Cardox and shot firers in blasting coal, on the use of permissible electric cap lamps, and on the use of protective caps and shoes.

DETAILS OF THE EXPLOSION

Mine conditions prior to explosion:

On the day of the explosion, the mine had operated in the usual manner. The day shift had left the mine and most of the night shift had entered or was about to enter the mine. From the location of those killed, it is evident that only a few of the men on the night shift had reached their working places and were at work.

Previous explosions:

No previous explosions have occurred in this mine or this district, and this is believed to be the first explosion in Buchanan County. A number of explosions have occurred in the past in Tazewell County, which adjoins Buchanan County.

Property damage:

The explosion covered the entire portion of the mine which was connected to the entries in which the explosion originated, an area about 2,000 feet long and 1,500 feet wide. It destroyed all of the stoppings in this area, damaged 7 drift mouths, destroyed 2 fans, and badly damaged 2 mine locomotives and a sand house on the outside of the mine.

With the exception of the destruction of stoppings, knocking out timbers and tearing down some of the trolley wires, no extensive property damage resulted inside of the mine. A number of local falls occurred due to the knocking out of timbers and heat. However, none of these were extensive.

The unaffected portion of the mine could have been put in operation in a day or two and the affected section within a week. However, due to cleaning up the entire mine and properly rock-dusting it prior to resuming operations, about two weeks will be required to do this work.

Forces:

The forces of the explosion were not extremely violent within the explosion area. They extended from the point of origin down 1st left off the mains, inby and outby, to the outside, on the mains; through the diagonal entries from the mains to the barrier entries. After reaching the barrier entries, the forces divided and traveled inby and outby to the outside. The forces erupted violently from all of the drift mouths in the affected area, and apparently as much or more violence was present at these points as anywhere in the mine.

Evidence of heat and flame:

Heat and flame extended into all or nearly all of the affected portion of the mine and for a considerable distance outby all of the drift mouths of the affected area.

Heavy deposits of coke were present in most of the faces of working places, on many posts and crossbars throughout the explosion area, and in numerous places on the floor. All of the dust samples collected contained from medium to large amounts of coke.

Origin of the explosion:

The origin of the explosion was the ignition of dust as a result of the simultaneous firing of 3 adobe shots, fired with live electric current obtained from the trolley wire, in the face of 1st left off the mains. The shots were evidently fired to break a piece of slate which came down when the place was topcut by the mining machine. After the slate came down on top of the coal, it was barred from the cut to the top of the pile of machine cuttings (bug dust) in the face of the place before blasting.

From information obtained from the employee who carried the explosives into the mine and the day section foreman who handled the explosives before turning it over to the night shift shot firer and driller, the shots contained 6 sticks of 8-inch by 1-1/2-inch (2.6 pounds) of du Pont Lump Coal C (permissible explosive) and 3 No. 6 electric detonators. That 3 detonators were used and three shots fired is evidenced by the finding of 3 pairs of detonator wires still attached to the blasting cable after the explosion and by the appearance of the broken slate. That the shots were fired by trolley wire

current is evidenced by the fact that the outby end of the blasting cable was found in the hands of the shot firer, who was close to an electric drill the cable of which was attached to a trolley wire carrying 250 volts direct current. In addition to this, no shot-firing battery was found on, or in proximity to, the shot firer's body. It is believed that the explosives and detonators (made up into 3 shots) were placed on the piece of slate to be blasted (one near the center and one near each side), covered with machine cuttings and probably small pieces of slate prior to firing the shots.

From further information obtained, there were apparently 2 adobe shots fired in this same place on the same day by the day shift. However, these were fired separately and not as much explosives used, and nothing occurred.

Although the explosives is generally believed to have (and probably did) ignited the dust which caused the explosion, there is a strong possibility that the firing of the shots raised the dust in suspension and that the dust cloud was ignited by an electric arc or spark from the detonator leg wires or the firing cable. The conclusions regarding the origin of the explosion are based on the evidence and conditions in the face of 1st left off the mains, the direction of forces which radiated from this point, and the location of coke on posts outby this point. Moreover, with the exception of one mining machine at one of the faces, which may or may not have been in operation, there is no evidence that any of the other mining or loading machines were in operation. The exact igniting agent, as previously stated, may have been either the explosive or an electric arc or spark from the electric current used in firing the shot.

The accompanying map shows the point of origin of the explosion, the direction of forces, extent of flame and violence, direction of air currents, location of bodies, and points at which face coal, coal-dust, and air samples were collected. An accompanying sketch also shows details and conditions as found at the point of origin of the explosion and in the immediate vicinity.

Rescue and recovery operations:

The first indications that an explosion had occurred was when smoke and flame, accompanied by concussion and a loud report, issued from the drift mouths of the main and barrier entries. The concussion was felt a considerable distance and the noise for a mile or two.

As soon as possible after the explosion, the local superintendent and the mine foreman, assisted by other employees, rescued an injured man on the outside and another a short distance inside one of the drift mouths, recovered the bodies of three men killed on the outside, and attempted to enter the mine.

Owing to the destruction of the two fans used to ventilate the portion of the mine in which the explosion occurred, recovery work was halted and delayed until a fan which was at another portion of the mine was moved, installed, and put in operation at one of the barrier entries. This required about 1-1/2 to 2 hours. In the meantime, the Virginia Department of Mines was notified and adjacent mining companies in Virginia and southern West Virginia were called upon for assistance.

One of the Virginia district inspectors arrived at the mine

about 2 hours after the explosion. The Chief Inspector and the 2 other district inspectors arrived later. Officials and workmen from adjoining and adjacent mines also began to arrive shortly after the explosion. As soon as the newly-installed fan was put in operation and sufficient air was available, recovery crews entered the barrier entries and started working their way into the mine. The party advanced up the barrier entries, building temporary canvas stoppings and carrying fresh air with them. As recovery work progressed, it was found that the fan was not providing sufficient air and another fan was obtained and installed in another of the barrier entries. Both of the fans were operated blowing.

The recovery crews worked their way into the faces of the barrier entries and places leading off to the right and left of these entries were explored. All of the bodies located on the barrier entries were recovered at about 4:30 a.m. on the morning of April 23. The recovery crews then returned to the outside.

Following this, another party was organized, entered the barrier entries, and explored the diagonal entries, which connect the barrier and main entries, by carrying fresh air with them. On reaching the main entries, fresh air was advanced by means of temporary stoppings into the main entries and entries leading off to the left of the main entries. This portion of the mine was completely explored and the last bodies were recovered about 2:30 p.m., April 23, or about 22 hours after the explosion occurred. A list of the killed and injured appears in the appendix.

Recovery work having been completed, all men were taken out

of the mine and the entrance "fenced off" by the State inspectors pending an investigation, which was started on Monday forenoon, April 25, 1938.

No oxygen breathing apparatus was used in the exploration or recovery work, although apparatus from Bureau of Mines Car No. 8, the Bureau of Mines Norton truck, and a West Virginia Department of Mines truck was available.

All-Service gas masks were used in a few instances, by crews, totaling about 30 minutes per man, to explore dead ends and recover bodies near the faces of some of the working places. Gas masks were also used to a small extent to make observations and to use gas detecting devices in return air currents.

Oxygen breathing apparatus crews were present from the following companies: Pocahontas Fuel Company, Jenkinjones, West Virginia; Virginia Iron, Coal & Coke Company (2 teams), Toms Creek, Virginia; Lake Superior Coal Company, Superior, West Virginia; New River & Pocahontas Consolidated Coal Company, Berwind, West Virginia; together with one of the West Virginia Department of Mines rescue trucks. As stated previously, no oxygen breathing apparatus was worn; however, the men composing these crews actively assisted in the recovery operations.

In addition to the oxygen breathing apparatus crews, officials and workmen from the following companies also assisted with the recovery work: Pocahontas Fuel Company, Pocahontas, Virginia, and Jenkinjones, West Virginia; Pond Creek Pocahontas Coal Company, Bartley, West Virginia; Jewell Ridge Coal Company, Jewel Ridge, Virginia;

Stonega Coke & Coal Company, Big Stone Gap, Virginia; Raven Red Ash Coal Company, Raven, Virginia; Page Pocahontas Coal Company, Page, Virginia; and from other companies.

Mr. C. P. Kelly, Chief Inspector, and district inspectors W. J. Elgin, O. F. Gibson, and E. F. Fullen of the Virginia Department of Mines, and E. L. Chatfield and W. L. Lyons, district inspectors of the West Virginia Department of Mines were also present and assisted with the recovery work.

Activities of the Bureau of Mines:

The Bureau of Mines was notified regarding the explosion at Norton, Virginia, about 5:00 p.m., and at Pittsburgh, Pennsylvania, by the Associated Press, at about 5:30 p.m., April 22, 1938. The Bureau's personnel at Norton and Car No. 8, located at Jenkinjones, were notified, and as soon as possible left for the mine. Mr. G. T. Powell, junior safety instructor, left Norton, Virginia, by auto about 6:30 p.m., and arrived at the mine about 9:30 p.m. Mr. M. C. McCall, associate mining engineer, left Car No. 8 at Jenkinjones, West Virginia, by auto about 8:30 p.m. and arrived at the mine about 10:30 p.m. Mr. E. E. Quenon, principal safety instructor, was working at Kenvir, Kentucky, and on being notified about the explosion he left Kenvir by auto truck about 5:30 p.m. and arrived at the mine about 11:30 p.m. Mr. H. J. Van der Veer, junior mining engineer, with Car No. 8, left Jenkinjones, West Virginia, about 8:30 p.m. The car was moved by a special locomotive and arrived at the mine about 2:30 a.m., April 23, 1938. Mr. J. W. Pero, assistant safety instructor, was working at Charleston, West Virginia, was notified about the explosion, and left there by auto about 9:30 p.m., arriving at the mine about 3:30 a.m., April 23, 1938.

All of these men assisted with recovery operations after their arrival until all of the bodies were recovered.

Following the completion of the recovery work and a decision of State inspectors and company officials as to the time an investigation would be started, Mr. G. W. Grove, mining engineer, proceeded from Pittsburgh, Pennsylvania, to Keen Mountain, Virginia, to conduct an investigation for the Bureau of Mines.

Investigations of the explosion:

An investigation to determine the cause and origin of the explosion was conducted on April 26, 1938, by the following persons: T. B. Morton, Commissioner of Labor, State of Virginia; C. P. Kelly, Chief Inspector, and W. J. Elgin, O. F. Gibson, and E. F. Fullen, district inspectors, of the Virginia Department of Mines; G. W. Grove, mining engineer, M. C. McCall, associate mining engineer, and E. E. Quenon, principal safety instructor, of the Bureau of Mines; and Messrs. J. E. Parker, assistant to president, E. F. Smith, general superintendent, N. B. Gurley, chief engineer, Fred Cook, superintendent, and George Schaller, superintendent, of the Red Jacket Coal Corporation.

Previous to starting the investigation, a conference attended by the above persons together with Dr. Walter N. Polakov, director of engineering, and Lee C. Burke, field representative, United Mine Workers of America, was held regarding representatives of the United Mine Workers being included in the investigating party. A report of this conference appears in the appendix.

After a thorough investigation of conditions around the mine

openings and the affected area underground, several witnesses were examined regarding their knowledge of the explosion. A report of the testimony obtained appears in the appendix.

Following the submittal of a report regarding the explosion by the Virginia Department of Mines to the Governor of Virginia, the Governor appointed a commission to hold hearings to determine the cause and fix responsibility for the explosion. The following persons were named as the commission by the Governor: E. B. Norris, Dean, Virginia Technical School of Engineering, Blacksburg, Virginia (chairman); J. D. Rogers, vice president, Stonega Coke & Coal Company, Big Stone Gap, Virginia; John Saxton, district president, United Mine Workers of America, Norton, Virginia; T. B. Morton, Commissioner of Labor, Richmond, Virginia; and W. H. Nichols, of the Virginia Industrial Commission, Richmond, Virginia.

This commission met at Richlands, Virginia, May 10 and 11, 1938, and testimony was gathered from officials and workmen of the Red Jacket Coal Corporation, inspectors of the Virginia Department of Mines, and the Bureau of Mines. No report of the committee's findings has been made to date; however, little if any additional evidence was obtained by the hearings.

A number of members of the Virginia legislature also attended the hearings for the purpose of obtaining information which might be used in a revision of the Virginia mining laws. These legislators, constituting a committee, were as follows: Scott H. Litton (chairman), V. C. Smith, C. M. Hunter, and H. M. Bandy, House of Representatives; and Senators Charles E. Burke and R. R. Parker.

State inspectors' conclusions:

The Virginia State inspectors decided that the explosion was caused by the firing of an adobe shot at the face of 1st left off the mains.

Summary of evidence:

The writer is of the opinion that the explosion was caused by the simultaneous firing of 3 adobe shots at the face of 1st left off the mains and that the coal dust put in suspension by these shots was ignited either by the explosive or by an electric arc or spark from the detonator leg wires or the firing cable.

Propagation of the explosion was aided by the dust placed in suspension by the shot and by additional dust thrown in suspension by the advance air waves of the explosion.

This statement is based on evidence and conditions previously described in this report.

Lessons to be learned:

1. That explosions can occur in any bituminous coal mine if coal dust is suspended in the presence of flame or an electric arc.

2. That water should be used on mining machines, loading machines, before and after blasting, and on loaded and empty trips to allay dust at working faces and along haulage roads.

3. That in order to prevent propagation of an explosion, all openings within a mine, air courses, crosscuts, haulageways, entries, and rooms, must be properly and adequately rock-dusted and must be so maintained.

4. That adobe or bulldozing shots should not be fired in a coal mine; the rock to be blasted should be properly drilled, the hole charged with permissible explosives, the explosives properly tamped with incombustible stemming, the charge covered with several pounds of rock dust and fired with a permissible shot-firing battery.

5. That a shot should not be fired by current from a trolley-wire power cable.

6. That officials and workmen should be instructed regarding the dangers of firing adobe or bulldozing shots.

7. That closer and more efficient supervision would have disclosed the firing of previous adobe shots, the intention of the workmen to fire those which caused the explosion and prevented the firing of such shots.

Recommendations:

The following recommendations are made with a view of preventing future explosions and for the safety of the men and the mine.

1. Provisions should be made to apply water to the cutter bars of mining machines and loading machines while they are in operation. Water should also be used freely at the working faces before and after blasting, along haulage roads, and on loaded and empty trips to allay coal dust.

2. Rock dust should be applied to all openings, airways, entries, haulageways, rooms, and crosscuts to within at least 40 feet of the working faces in sufficient amounts so the incombustible content will be at least 60 percent.

3. Samples of the rock dust in place should be frequently collected in numerous places throughout the mine and when analyses of such samples disclose that there is less than 60 percent incombustible present in any portion of the mine, it should be immediately redusted to the extent that the required amount or more of incombustible matter will be present.

4. No adobe or bulldozing shots should be fired in a coal mine; the rock to be shot should be properly drilled, a small charge of permissible explosives placed in the borehole, the explosive tamped with incombustible stemming, the entire charge covered with about 15 or 20 pounds of rock dust and fired with a permissible shot-firing battery.

5. Cardox shells used for blasting coal should be confined in the borehole with incombustible stemming, well tamped, and fired with a permissible shot-firing battery. Moreover, when firing Cardox shells, the shot firer and all others should be at least 100 feet away from the shot and around at least one right angle turn, so as to be protected in case the Cardox shell is ejected from the borehole when the shot is fired.

6. Shot firers should be thoroughly instructed by the officials regarding the handling, charging, and firing of explosives and Cardox shells.

7. Adequate ventilation properly directed, distributed, and controlled should be present in every working place at all times.

8. A proper fan or fans located on the surface, offset about 25 or 30 feet from the opening or openings at which placed, equipped with a water gauge or pressure recording device, should be provided.

9. Permissible electric equipment, maintained in a permissible manner, should be used exclusively throughout the mine.

10. All employees in and around the mine should be given a thorough course of first-aid training. New employees should be trained shortly after employment and all employees retrained annually.

11. Proper first-aid equipment (bandages, splints, blankets, etc.) should be provided on each section underground and on the surface.

12. A mine-rescue station containing at least 10 sets of oxygen breathing apparatus, gas masks, and gas detecting devices should be provided at the mine or in the district.

13. A number of selected employees (15 to 20) should be given a course of instructions in the use and care of oxygen breathing apparatus and in rescue and recovery operations. Employees trained in this work should be given additional training at least every six months.

14. The wearing of protective caps and shoes by all employees should be continued and all employees should wear goggles, preferably during the entire shift, but in any event when using striking tools, emery wheels, or doing other work where chips or particles are likely to fly.

15. Electric cap lamps should be well-maintained at all times to insure the best possible light throughout a shift.

16. Sufficient competent supervisory officials should be provided and be on duty at all times, particularly on the night shift,

to insure adequate supervision and that the company's safety rules and the State mining laws are not violated.

ACKNOWLEDGMENTS

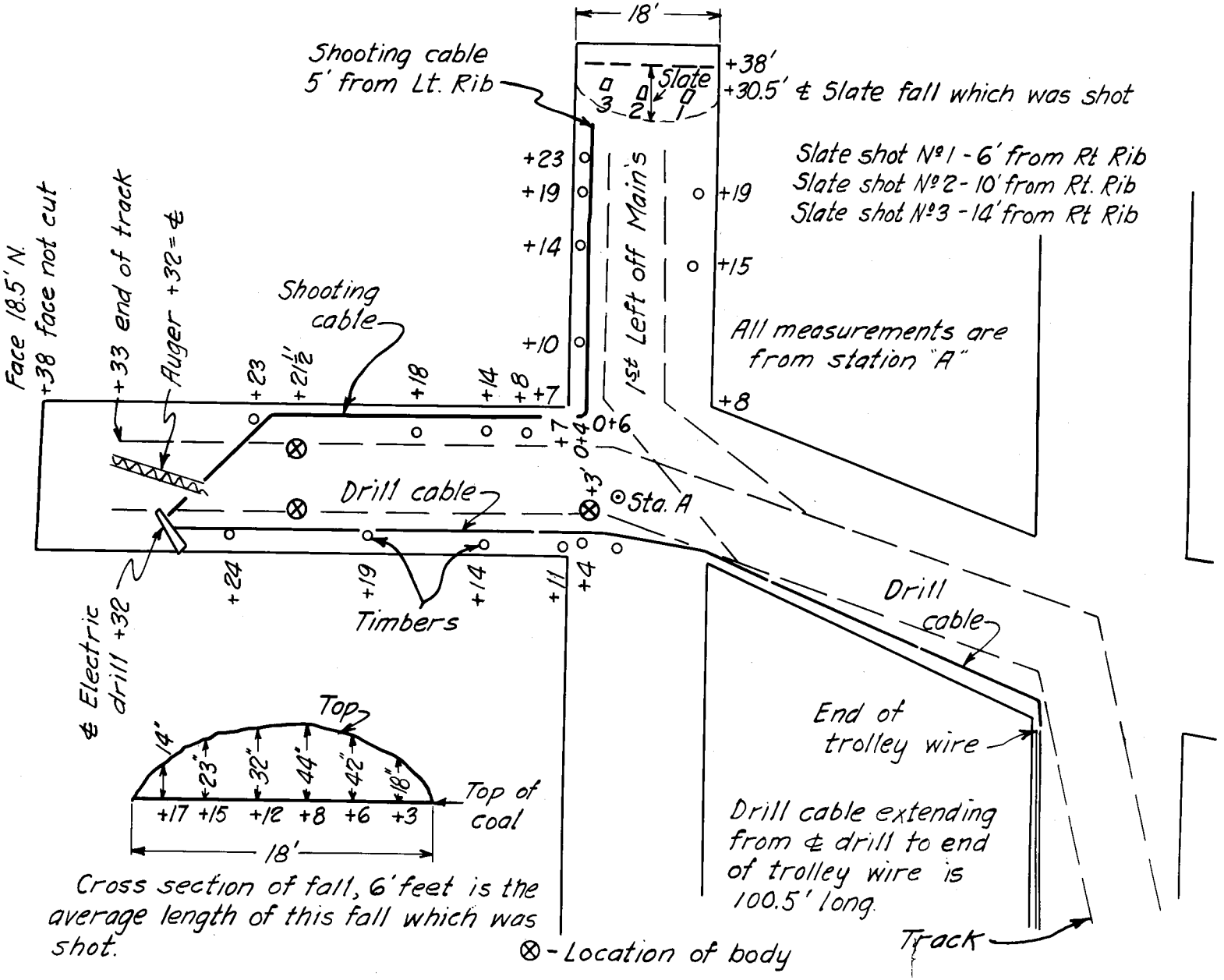
The writer wishes to express his appreciation for the cooperation shown and courtesies extended by officials of the operating company, particularly to Mr. J. E. Parker, assistant to the president, Mr. E. F. Smith, general superintendent, Mr. N. B. Gurley, chief engineer, and Mr. George Schaller, superintendent of the Wyoming mine; to Mr. T. B. Morton, Commissioner of Labor of Virginia, and to Mr. C. P. Kelly, Chief Inspector, and other inspectors of the Virginia Department of Mines; also to Messrs. McCall, Quenon, Van der Veer, Pero, and Powell of the Bureau of Mines.

Respectfully submitted,

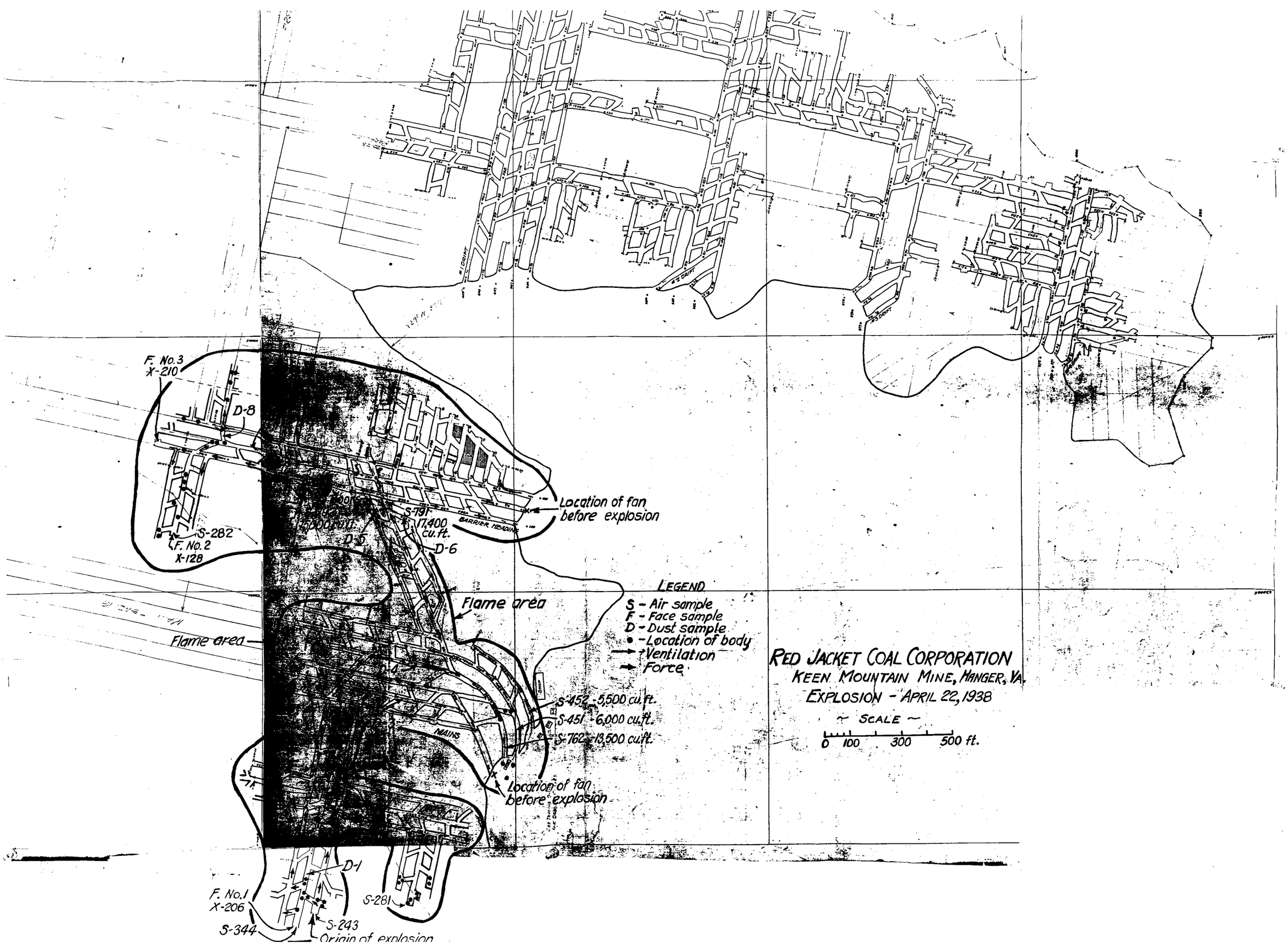
G. W. GROVE
Mining Engineer

Approved:

D. HARRINGTON
Chief, Health and Safety Branch



Keen Mountain Mine Explosion - April 22, 1938


F. No.3
X-210
D-8
S-282
F. No.2
X-128
S-191
17,400
cu.ft.
D-6
Location of fan
before explosion
Flame area
Flame area
LEGEND
S - Air sample
F - Face sample
D - Dust sample
● - Location of body
Ventilation
Force
S-452 - 5,500 cu.ft.
S-451 - 6,000 cu.ft.
S-762 - 13,500 cu.ft.
MAINS
Location of fan
before explosion
D-1
F. No.1
X-206
S-281
S-344
S-243
Origin of explosion
RED JACKET COAL CORPORATION
KEEN MOUNTAIN MINE, HANGER, VA.
EXPLOSION - APRIL 22, 1938
SCALE
0 100 300 500 ft.

Return air readings during recovery operations,
Keen Mountain mine, Red Jacket Coal Corporation,
April 22 and 23, 1938

Date	Time	CO (percent)	Remarks
4-22-38	11:00 p.m.	0.25	One fan running
do	11:30 p.m.	.3	CH_4 trace
do	11:40 p.m.	.35	CH_4 2 percent by indicator in Wolf Safety Lamp
do	11:45 p.m.	.5	CH_4 - no trace in lamp
4-23-38	12:15 a.m.	.45	No trace of CH_4
do	1:00 a.m.	.3	Started second fan. No CH_4 showing in lamp
do	2:00 a.m.	Trace	No curtains being put up. All rescue men outside
do	3:00 a.m.	.2	No CH_4 showing. Seven bodies brought out - this makes 8
do	4:15 a.m.	Trace	
do	5:00 a.m.	.3	
do	6:00 a.m.	.25	
do	7:30 a.m.	.3	
do	8:00 a.m.	.4	
do	9:00 a.m.	.35	
do	9:30 a.m.	.3	
do	10:00 a.m.	.4	
do	10:30 a.m.	.45	
do	11:00 a.m.	.4	
do	11:15 a.m.	.2	
do	12:00 noon	.5	W. J. German and self checked
do	1:00 p.m.	.2	
do	1:15 p.m.	.2	
do	1:35 p.m.	Zero	All curtains are now placed

All readings made about 150 feet inby opening of 2nd main entry by G. T. Powell, Bureau of Mines, Norton, Virginia.

List of employees killed and injured

Hammond Varney	Married Machine operator Wife Dorothy Varney Keen Mountain Va. Children: None
Ernest Boyd	Married Machine helper Wife Tilman Boyd Carlin Hill Ala. Children: Four
Arvil Street	Married Driller Wife Margaret Street Vansant Va. Children: One
Coy Reed	Married Brakeman Wife Anna Reed Pardee Va. Children: None
J. L. Blevins	Married Motorman Wife Virgie Blevins Hanger Va. Children: One
Kilmer Patrick	Married Trackman Wife Mrs. Kilmer Patrick Omar W. Va. Children: Five
Edward Gilly	Married Timberman Wife Laura Gilly Vansant Va. Children: Two
Claude Dollar	Single Trackman Notify Ed Dollar Anawalt W. Va.
J. W. Combs	Married Driller Wife Mrs. J. W. Combs Honaker Va. Children: One
Glenn Ratliff	Single Slateman Father T. W. Ratliff Hanger Va.
Orville Norris	Single Slateman Father L. F. Norris Keen Mountain Va.
F. L. Bucklen	Married Slateman Mother Sarah Bucklen Grimsleyville Va. Children: Two
Marcus Thacker	Married Trackman Wife Frances Thacker Hangar Va. Children: Two

O. C. Hitchcock	Married Loading machine operator Wife Ernestine Hitchcock Monaville W. Va. Children: None
Charles Keen	Married Slateman Wife Josie Keen Keen Mountain Va. Children: Four
W. H. Grant	Married Driller Wife Crecie Grant Hanger Va. Children: Five
Lee Marshall	Married Trackman Wife: Fay Marshall Keen Mountain Va. Children: Three
W. E. Willis	Married Loading machine helper Wife Millie Willis Coburn Va. Children: Two
Walker Sutherland	Married Timberman Wife Garnet Sutherland Colley Va. Children: One
Ancil Owens	Married Timberman Wife Mary Owens Hanger Va. Children: Four
Cedric Sutherland	Married Brakeman Wife Bernice Sutherland Clintwood Va. Children: Four
Drew Howard	Single Loading machine operator Sister Anna Belle Howard Elliottville Ky.
Charles Miller	Married Loading machine operator Wife Martha Miller Keen Mountain Va. Children: One
E. H. Sisk	Married Timberman Wife Alice Sisk Keen Mountain Va. Children: Four
R. H. Gentry	Divorced Loading machine helper Daughter Juanita Gentry Seco Ky.
Granville Goins	Married Trackman Wife Sarah E. Goins Page Va. Children: Three
Harvey Keen	Married Driller Wife Julia Keen Hanger Va. Children: Seven

John Rowe	Married Trackman Wife Guida Rowe Hanger Va. Children: One
Smith Arrington	Married Drilling and shooting Wife Emma Arrington Bee Va. Children: Three
F. M. Radcliff	Married Foreman Wife Lyda Radcliff Coalfork W. Va. Children: Unknown
D. E. Compton	Married Drilling and shooting Wife Leona Compton Grimsleyville Va. Children: Five
Harper Lester	Married Timberman Wife Clara Lester Paynesville W. Va. Children: None
Floyd A. Compton	Single Trackman Mother Mrs. John Compton Grundy Va.
C. C. Compton	Married Drilling and shooting Wife Orpha Compton Marvin Va. Children: None
Tom May	Married Motorman Wife Leola May War Eagle W. Va. Children: Three
Lonnie May	Married Timberman Wife Ona May War Eagle W. Va. Children: Four
Thomas Ratcliff	Married Trackman Wife Louisa Ratcliff Bee Va. Children: Seven
Arvil Collins	Married Slateman Notify Myrtle Vastine Mt. Heron Va. Children: Two
Rodney Crigger	Married Timberman Wife Mrs. Rodney Crigger Naugatuck W. Va. Children: None
Ed Boyd	Married Machine Operator Wife Anice Boyd Honaker Va. Children: One
Robert Watson	Married Machine helper Wife Ethel Watson Honaker Va. Children: Four

C. S. Matney	Single Track helper Brother Henry Matney Hurley Va.
Luther Sizemore	Married Slateman Wife Pansy Sizemore Keen Mountain Va. Children: One
L. B. Hagy	Married Drilling and shooting Wife Sollie Hagy Grimsleyville Va. Children: Four
John C. Compton	Married Foreman Wife Mrs. John C. Compton Grundy Va. Children: Five

Injured

John W. Elam	Single Joy loader helper Notify W. W. Elam Caney Ky.
Clarence B. Combs	Married Brakeman Wife Ora Combs Hanger Va. Children: Three

Memorandum of Conference between Dr. Walter N. Polakov, Director of Engineering, United Mine Workers of America, and Mr. J. E. Parker, Assistant to President, Red Jacket Coal Corporation, at Keen Mountain, Virginia, April 25, 1938.

PRESENT AT CONFERENCE: Dr. Walter N. Polakov, Director of Engineering, United Mine Workers of America.

Mrs. B. G. Polakov, Secretary to Dr. Walter N. Polakov.

Mr. Lee C. Burke, Field Representative, District 28, United Mine Workers of America.

Mr. Thomas B. Morton, Commissioner of Labor and Industry, Commonwealth of Virginia.

Mr. C. P. Kelly, Chief Mine Inspector, Commonwealth of Virginia.

Mr. J. E. Parker, Assistant to President, Red Jacket Coal Corporation.

Mr. O. F. Gibson, Mine Inspector, Commonwealth of Virginia.

Mr. E. F. Fullen, Mine Inspector, Commonwealth of Virginia.

Mr. G. W. Grove, Mining Engineer, United States Bureau of Mines.

Mr. E. F. Smith, General Superintendent, Red Jacket Coal Corporation.

STATEMENT OF J. E. PARKER:

There has been a request by Dr. Walter N. Polakov, representing the United Mine Workers of America, that we include in the inspection party covering the initial investigation Monday morning, April 25, 1938, a representative of the United Mine Workers of America, in the

name of Lee C. Burke, District 28. Dr. Walter N. Polakov stated that John L. Lewis instructed him to visit Keen Mountain prior to the initial investigation and request that a representative of the United Mine Workers of America be included in the inspection party. I stated to Dr. Walter Polakov that our position in the matter was that due to prevailing conditions, the Keen Mountain mine of the Red Jacket Coal Corporation was in the hands of the State, and unless the Chief Mine Inspector or the Commissioner of Labor who represent the Commonwealth of the State of Virginia, would be willing to assume all responsibility, the Red Jacket Coal Corporation did not feel that the request was reasonable and were recognizing the State as authority.

After considerable discussion, I asked Mr. Kelly, Chief Mine Inspector of the Department of Labor of the Commonwealth of Virginia, if it were not true that Messrs. E. F. Fullen and O. F. Gibson, Inspectors of the Commonwealth of Virginia, and included in the party of the initial investigation were members in good standing of the United Mine Workers of America. Messrs. Fullen and Gibson were summoned, and admitted that they were in good standing, being members of locals Benidict No. 6372, and Imboden No. 6355, respectively. I stated to Dr. Polakov that since the State Department of Mines were operating under the direction of the Commissioner of Labor and Industry, representing the Commonwealth of Virginia, and the fact that two members of the initial inspection party were members of the United Mine Workers of America, and in good standing, we could see no cause for further considering the matter, and proceeded to the mine for the inspection.

Testimony by witnesses questioned by authorities of the Commonwealth of Virginia, United States Bureau of Mines, and Red Jacket Coal Corporation officials, in regard to explosion of Keen Mountain mine, at 4:45 p.m., Friday, April 22, 1938. The following testimony closes investigation by the Commonwealth of Virginia.

PRESENT:

Representing Commonwealth of Virginia

Mr. C. P. Kelly, Chief Mine Inspector

Mr. W. J. Elgin, District Mine Inspector, Upper Buchanan Smokeless Field

Mr. O. F. Gibson, District Mine Inspector

Mr. E. F. Fullen, District Mine Inspector

Representing United States Bureau of Mines

Mr. George Grove, Mining Engineer

Mr. M. C. McCall, Associate Mining Engineer

Representing Red Jacket Coal Corporation

Mr. J. E. Parker, Assistant to President

Mr. E. F. Smith, General Superintendent

Mr. J. R. Kirby, Superintendent, Keen Mountain operation

Mr. N. B. Gurley, Chief Engineer

Mr. A. F. Cook, Superintendent, Red Jacket Mine

Mr. H. F. Cook, Mine Foreman, Keen Mountain operation

Mr. Don Browning, Section Foreman, Day Shift, First Left off Mains

Mr. Ray McClure, Slateman, Day Shift, First Left Off Mains

Mr. Wright Thompson, Day Driller and Shooter, First Left off Mains

Present for ten (10) minutes explaining maps: Sam Miniaci, Resident Engineer, Keen Mountain plant

ABSENT: G. F. Schaller, Superintendent Wyoming plant (At mines with Bureau of Mines party).

The detailed investigation made by the Department of Labor of the Commonwealth of Virginia, the United States Bureau of Mines, and the Red Jacket Coal Corporation establishes as nearly as possible that the dust explosion originated in the face of the first member of first left off of mains, at which location slate was shot at the time of the explosion, and the following witnesses were examined under that presumption.

The meeting was called to order by Mr. Parker, at about 8:15 a.m., April 26, 1938.

The first witness examined was Mr. Ray McClure.

Mr. McClure was questioned in regard to his knowledge of certain slate which was later shot at the face of the first member of first left off of mains. He stated that in moving some slate at about 2:50 p.m., on the afternoon of the explosion, he had mashed a finger and had gone outside for medical attention; that he did not prepare the particular shot under discussion, but that the assistant boss (unnamed) sent out for the explosives. He stated that "dobie" shots were customary. He stated that Mr. Curry brought the explosives in (Lump Coal "C"). He then described the method of "dobie" shooting, stating that it was their practice to lay the sticks of explosives side by side on top of the slate to be shot, placing thereon pieces of slate or rock,

and covering the whole with coal dust. In response to questions as to how thick the large piece of slate was, the shooting of which is thought to have caused the explosion, he stated that it was approximately thirty (30) inches thick on one edge, tapering off to nothing at the other.

Mr. McClure was further asked by Mr. Parker how many sticks of powder were used to shoot the slate that was shot on his shift. Mr. McClure's answer was that six (6) sticks of powder were used, three on one shot and three on another. Mr. McClure was then questioned by Mr. Kelly as to what shots he fired and the position and condition of the slate. McClure replied that the place had been cut and before any coal had been removed, slate had fallen on the cut, stating at the time that the coal being cut at the top of the seam permitted them to "dobie" shoot by laying the powder on the slate, and wedging slate between the "dobie" shots and the top. Mr. Kelly asked Mr. McClure if he had used bug dust in the process of preparing his shot. Mr. McClure replied that he had. Mr. Gibson then asked the question if six sticks of powder were received, and the slate had been shot on the cut, why were two shots fired. Mr. McClure replied that as the slate fell from the top, part of it had fallen on the machine cuttings and part remained on the cut. One shot being applied to the piece on the cut, the other shot being applied to the piece on the machine cuttings. Mr. Parker questioned Mr. McClure as to the number of caps used to fire both shots. Mr. McClure replied that two caps were used. Mr. McClure was then questioned in general discussion how the large piece of slate in question was found in the room and necessary to be shot. McClure explained that following the shooting of the two "dobie" shots on the

day shift, the slate had been cleaned up and loaded out, Mr. Browning, Section Foreman, substantiating this statement by stating that two cars of slate had been loaded prior to shooting and loading the coal. Mr. McClure further stated that the entire cut of coal had been loaded out and the place again cut, but before coal had been loaded from the cut, it was found that the top was working, and they felt too dangerous to remain in the place until slate had been taken down. They notified the Section Foreman and instructions were given that the slate be taken down. Mr. McClure was again questioned as to the approximate thickness of the slate, and replied that it tapered to a feather edge, and appeared about thirty inches thick at the thickest point. Mr. Browning was then questioned as to what he intended to do with the slate. He stated that he had instructed Mr. Curry to go outside and bring him six to eight sticks of powder so this piece of slate could be shot. Mr. Parker questioned Mr. Browning as to the character of the slate, whether it was hard or soft. Mr. Browning stated that it was soft slate, and it was his intention to drill it with coal drill, they being supplied with several augers on the shift which permitted them to use the coal drill when necessary to drill slate.

Mr. Kelly questioned Mr. Browning as to how many "dobie" shots he had fired. Mr. Browning stated that he had not had occasion to shoot any slate of this thickness since up to that time all of the shots being fired were on much smaller pieces of slate, and that it was not has intention to "dobie" shoot the slate. Mr. Browning stated that Mr. Curry returned with the powder at about 3:45 p.m., and since it was time for the shift to change, and the crew wanting to leave, he told

his men to go outside and he would have the slate shot by the night shift. Mr. Browning stated it was always his intention to walk part way outside and put his time down before completing the shift, and on his way down the entrance, he met two men coming in on the night shift. He was asked by Mr. Kelly who these men were. Mr. Browning stated he did not know, since he was not acquainted with the night shift, but understood that they were the men employed to prepare the places, which was customary. He told the men there was a large piece of slate down, gave them the location, and that it would have to be moved before the place could be loaded out, at which time he gave them the powder and caps, which was handed to him by Mr. Curry, and which he had estimated to be six or eight sticks of powder. Mr. Smith then questioned Mr. Browning as to whether the powder was in a powder bag or wrapped up. He said he was not sure, but thought it was wrapped up and was a package about six inches in diameter, and one stick in length. A general discussion was then had as to the approximate number of sticks that might have been in a loose package of powder of this approximate diameter. Mr. Parker stated that since the Lump Coal "C" powder measures one-one-half inches in diameter it was hardly possible that more than six or eight sticks could have been in the bundle of powder. Mr. Browning then stated that he proceeded to go outside, and met Mr. Radcliff, the Section Foreman on the night shift, in the Cardox house, and told him that he had handed one of the night shift the bundle of powder. Mr. Kelly then asked Mr. Browning why he told Mr. Radcliff he had handed the night shift man the package of powder. Mr. Browning stated that it was a rigid rule of the company that no powder was

to be left in the mine at the end of the shift, and that it was the instruction of the Mine Foreman that all unused powder be brought to the outside. Mr. Radcliff then proceeded inside and stated that he would have the slate shot. Mr. Browning was then questioned by Mr. Kelly as to how much time elapsed between that and the time of the explosion. Mr. Browning stated that he did not know exactly, but it would appear to him that it was an hour's lapse of time between the time he had handed the man on the night shift the powder and the time of the explosion. Mr. Smith then questioned Mr. Browning as to whether or not Mr. Radcliff told him he was going to "dobie" the shot. Mr. Browning said he did not.

Mr. Parker asked the question of Mr. Browning who was his shot firer on the day shift? Browning replied that Mr. Roy Thompson was his shot firer. The question was then asked where was Mr. Thompson? Mr. Thompson was located on the hill, at work, and was instructed to attend the investigation immediately. Mr. Thompson returned and was immediately questioned by Mr. Kelly:

Q: What is your position?

A: Shooter and day driller.

Q: Where do you work?

A: First left off of main.

Q: Have you shot much slate?

A: No sir.

Q: Do you practice "dobie" shooting?

A: I have only shot one "dobie" shot in the two months that I have been here, and that on the morning of the explosion.

Q: Where did you work before coming here?

A: West Virginia.

Q: What company in West Virginia?

A: West Virginia Coal and Coke Company.

Q: Did you practice "dobie" shooting?

A: Yes sir, it is a common practice in West Virginia, and is used commonly at West Virginia Coal and Coke Company.

Mr. Thompson was then asked by Mr. Kelly how he prepared a "dobie" shot. Mr. Thompson replied that he laid the powder on the rock and covered it with pieces of slate or rock.

Q: Did you ever use bug dust in "dobie"-ing?

A: Yes sir. Wet bug dust.

Q: Did you use bug dust on the shot you fired on the morning of the explosion?

A: Yes sir.

Q: Which shot did you fire?

A: I shot the piece of slate on top of the cut and not the piece that was wedged down.

Mr. Thompson also stated that he brought the explosives (Lump Coal "C"), six sticks and two caps, to shoot the slate which was on top of the cut. This was in the early afternoon. He was then asked how thick the slate on top of the cut was, but did not answer. Mr. Elgin then questioned Mr. Browning what the thickness of the slate was, and Mr. Browning indicated "so thick", indicating about fifteen inches between his hands.

Mr. Thompson, in response to further questioning, stated that

he did not use all of the six sticks (Lump Coal "C") at once, using three sticks on two different shots at this location.

Mr. Parker asked the question of those making inspection of the location where it is believed the explosion originated, whether or not, in their opinion, it was generally agreed that the location of the slate and conditions as described were true. It was generally agreed and accepted that the testimony as given to this point was correct.

Mr. Grove, of the Bureau of Mines, entered into discussion and stated that three detonators were used in connection with the "dobie" shot presumed to have caused the explosion, stated that six wires (three pairs) remained attached to the shooting cable, which statement was agreed upon by all of the inspection party as correct.

Mr. Kelly asked the question of Mr. Henry Cook whether "dobie" shooting was a common practice. Mr. Cook stated slate was "dobied" as a common practice where it was too thick for the hand hammers. Mr. Kelly then asked Mr. Cook if he was worried about the dust condition in the mine, and Mr. Cook said that he was not. A discussion of rock-dusting followed. The last rock-dusting in first left off mains was done on Wednesday, the 20th, two days before the explosion. This was testified to by Mr. Kirby, and Mr. E. F. Smith.

Mr. Elgin stated that the first rock dust was used on or about January 19; the rock dust was on the job at the time of his inspection of that date.

Questioned by Mr. Fullen, he asked if dust ever caught fire by contact with a burning locomotive or machine cable, or otherwise. He was answered by Mr. H. F. Cook that it did not at any time.

Mr. Henry Cook was then questioned by Mr. Parker as follows:

Q: At any time did the company gob bug dust?

A: No sir.

Q: Did we not bring the dust outside and dump it through the slate dump?

A: Yes.

Q: Did we not stock slack for a whole month in order to give running time, using three trucks and other equipment for the purpose?

A: Yes.

Through Mr. Kirby the fact was established that Cardox was introduced on the last day of January, 1938, and had been in use 100 percent since that time.

Questions by Mr. Smith to Mr. Grove followed, requesting his suggestion as how to best make the mine safe. Mr. Grove answered him that the situation would require rock dust plus water, that both were needed. Mr. Parker suggested the use of lump calcium chloride. Mr. Grove stated that he felt that this was not to be recommended, as it had been tried in various locations, and went on to call attention to the effect on men, clothing, and equipment, stating that in his opinion water was the best solution. He then told those present of the practices of the Tennessee Coal, Iron and Railway Company (division of the U. S. Steel Corp.) near Birmingham, Alabama, where Messrs. Ball and McCue had perfected a method of introducing water in the inby end of the cutting bar on their mining machines, and stated that while these gentlemen had a patent on the process, that they were very generous in

permitting anyone to use it without cost. He also stated that the New River Company, at McDonald, West Virginia, used this method as well as others. Mr. Parker stated that we would make an immediate investigation of this practice with the idea of putting it into use at once.

Before closing the investigation, Mr. Parker asked Mr. Kelly if he and his investigators were satisfied with the procedures of the Red Jacket Coal Corporation. Mr. Kelly replied he was well satisfied with the attitude of the Company, and at this point, Mr. Grove of the Bureau of Mines stated that he had had considerable experience in the past in dealing with investigations following disasters such as has been experienced at Keen Mountain, and stated in all of his experience he has never seen any investigation conducted in a more open and aboveboard and fairer manner.

_____Correct _____Approved

6—137

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

E—DESCRIPTION OF MINE

(1) State Virginia (2) County Buchanan (3) Town Hanger (Post office)

(4) Mine sample of Face Coal - Medium Volatile Bituminous - CG. (5) Coal field Grundy (6) District Buchanan

(7) Mine Keen Mountain (a. Name) Drift (b. Kind of opening—if shaft give depth) Approx. 1800' (c. Height of opening above sea level)

2 mi. W. of Hanger (d. Distance and direction from town) (e. Sec., T., and R., if necessary) N. & W. R.R. (f. Railroad connections)

Hanger (g. Shipping point) (h. State if wagon mine or prospect and give distance from shipping point)

(8) Coal bed Lower Banner (a. Name) (b. Geologic system)

(c. Formation) (d. Dip, degrees) (e. Strike, direction)

(9) Mining system Room & Pillar (Long wall, room and pillar, panels, etc.) (10) Undercutting Overcutting (Hand or machine)

(11) Explosives Cardox - Lump Coal "C" (a. Used for coal) (b. Used for roof or floor)

(12) Operator Red Jacket Coal Corp. (Name and address)

(13) Sales agent (Name and address) opened Sept. 20,

(14) Output per day 2100 tons (Average—gross or net tons) (15) Maximum day's output 2250 tons (During past year) (16) Last year's output 1937. (Gross or net tons)

(17) Output from advance workings, percent 98% (At present) (18) Lifetime of mine 50 (Years—estimated)

(19) Run-of-mine, percent (Of output shipped) (20) Is coal screened? Yes (21) Type of screens Lip and Vibrating

(22) Type of washer none (23) Percent of coal washed none

(24) Maximum size washed (25) Sizes produced any (Washed coal)

(26) Sizes produced any (Of coal not washed) (27) Is coal picked? no (State whether on car or belt)

(28) Percent of coal coked none (At mine) (29) Sizes coked none (Screenings, crushed, washed, etc.)

(30) Type and number of ovens (31) Remarks (For any additional information indicate after subject by mark X if additional information is given here)

(32) Can Nos. X-206 : X-128 : X210 : : : (Give Nos. of all samples forwarded)

(33) Laboratory Nos. B-29342 343 : 344 - Composite B-29345. : (Laboratory to fill in immediately below corresponding can number)

(34) Mine sampled at 3 (Number) points, by Grove, Quenon, VanderVeer & Pero, (Collector) (Office) on 4/26/38 (Date), 19

Norton, Va.

Above information copied from Card A by F.E.H. on May 10, 1938., 19

U.S. GOVERNMENT PRINTING OFFICE 6—8740

6-139

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

G—COAL-ANALYSIS REPORT

Test No. _____ Lab. No. B-29342

Sample of Medium Volatile Bituminous Coal-CG. Face Coal. Can No. X-206

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine Face 2nd left off No. 1 main.

Method of sampling Standard Gross weight, lbs. _____ Net weight, grams 1181.0

Date of sampling 4/26/38 Date of Lab. sampling 5/4/38 Date of analysis 5/4/38

B. of M. or U. S. G. S. section B. of M. Collector Grove, Quenon, Pero, Vander-Veer.

		Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Air-dry Loss	1.3				
Proximate Analysis	Moisture	.6	1.8		
	Volatile matter	22.1	21.8	22.3	24.2
	Fixed carbon	69.5	68.7	69.8	75.8
	Ash	7.8	7.7	7.9	
		100.0	100.0	100.0	100.0
Ultimate Analysis	Hydrogen				
	Carbon				
	Nitrogen				
	Oxygen				
	Sulphur	1.3	1.3	1.3	1.5
	Ash				
British thermal units		14340	14160	14420	15660
Softening temperature of ash		2840 ° F.			

Date May 10, 1938 (Signed) H. M. Cooper.
Chemist.

U. S. GOVERNMENT PRINTING OFFICE 6—8404

Form 6—138

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

Can No. X-206

F—SAMPLING REPORT

Lab. No. B-29342

(1) State Virginia (2) County Buchanan (3) Town Hanger (Post office) (4) Mine Keen Mountain

(5) Sample of Medium Vol Bit Coal-CG. Face Coal. (6) Analysis desired Prox.

(7) Method of sampling Standard (Describe if other than standard)

(8) Location in mine Face 2nd left off #1 Main (Distance and direction from opening. Locate with respect to rib, room, pillar, aircourse, entry, etc.)

(9) Date 4/26/38 (Of sampling), 19

(10) Coal, dry or moist Dry (11) Gross wt., lbs. 20 (Sample cut) (12) Net wt., lbs. 5 (Sample mailed)

(13) Sample from fresh or weathered coal Fresh

(14) Roof Hard Slate (Kind and quality)

(15) Draw slate or roof coal Draw Slate (Description and thickness)

(16) Floor Hard - smooth (Kind, soft or hard, smooth or rough)

(17) Vertical depth from surface to point of sampling, feet 500'

No.	Section of Bed	Ft.	Ins.	No.	Section of Bed	Ft.	Ins.
1		4	6	10			
2				11			
3				12			
4				13			
5				14			
6				15			
7				16			
8					Total thickness of bed	4	6
9					Thickness in sample	4	6

(18) Excluded from sample, marked X, section Nos. none

(19) Send analysis to G.W.Grove (20) Collector Grove, Quenon, Pero VanderVeer (21) Office Pgh., Pa.

Above information copied from B card by F.E.H. on May 10, 1938., 19

U.S. GOVERNMENT PRINTING OFFICE 6—6098

6-139

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

G—COAL-ANALYSIS REPORT

Test No. _____ Lab. No. B-29343

Sample of Medium Volatile Bituminous Coal-CG. Face Coal. Can No. X-128

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine 2nd left off #1 barrier entries.

Method of sampling Standard Gross weight, lbs. 20 Net weight, grams 1247.0

Date of sampling 4/26/38 Date of Lab. sampling 5/4/38 Date of analysis 5/4/38

B. of M. or U. S. G. S. section B. of M. Collector Grove, Quenon, Pero, VanderVeer

		Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Air-dry Loss	1.1				
Proximate Analysis	Moisture	.5	1.6		
	Volatile matter	22.2	21.9	22.3	24.4
	Fixed carbon	68.8	68.1	69.1	75.6
	Ash	8.5	8.4	8.6	
		100.0	100.0	100.0	100.0
Ultimate Analysis	Hydrogen				
	Carbon				
	Nitrogen				
	Oxygen				
	Sulphur	1.0	1.0	1.0	1.1
	Ash				
British thermal units		14290	14130	14350	15700
Softening temperature of ash		2910+ ° F.			

Date May 10, 1938 (Signed) H. M. Cooper.
Chemist.

U. S. GOVERNMENT PRINTING OFFICE 6—8404

Form 6—138

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

Can No. X-128

F—SAMPLING REPORT

Lab. No. B-29343

(1) State Virginia (2) County Buchanan (3) Town Hanger (Post office) (4) Mine Keen Mountain

(5) Sample of Medium Vol Bit Coal-CG. Face Coal. (6) Analysis desired Prox.

(7) Method of sampling Standard (Describe if other than standard)

(8) Location in mine 2nd left off No. 1 barrier entries. (Distance and direction from opening. Locate with respect to rib, room, pillar, aircourse, entry, etc.)

(9) Date 4/26/38 (Of sampling), 19

(10) Coal, dry or moist Dry (11) Gross wt., lbs. 20 (Sample cut) (12) Net wt., lbs. 5 (Sample mailed)

(13) Sample from fresh or weathered coal Fresh

(14) Roof Hard slate (Kind and quality)

(15) Draw slate or roof coal Draw slate (Description and thickness)

(16) Floor Hard - smooth (Kind, soft or hard, smooth or rough)

(17) Vertical depth from surface to point of sampling, feet 500'

No.	Section of Bed	Ft.	Ins.	No.	Section of Bed	Ft.	Ins.
1		4	9	10			
2				11			
3				12			
4				13			
5				14			
6				15			
7				16			
8					Total thickness of bed	4	9
9					Thickness in sample	4	9

(18) Excluded from sample, marked X, section Nos. none

(19) Send analysis to G.W.Grove (20) Collector Grove, Quenon, Pero, Vanderveer (21) Office Pgh., Pa.

Above information copied from B card by F.E.H. on May 10, 1938., 19

U.S. GOVERNMENT PRINTING OFFICE 6—6098

6-139

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

G—COAL-ANALYSIS REPORT

Test No. _____ Lab. No. B-29344

Sample of Medium Volatile Bituminous Coal-CG. Face Coal. Can No. X-210

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine Face No. 1 Barrier entry

Method of sampling Standard Gross weight, lbs. 20 Net weight, grams 1156.0

Date of sampling 4/26/38 Date of Lab. sampling 5/4/38 Date of analysis 5/4/38

B. of M. or U. S. G. S. section B. of M. Collector Grove, Quenon, Vanderveer & Pero

		Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Air-dry Loss 1.3					
Proximate Analysis	Moisture	.5	1.8		
	Volatile matter	22.1	21.8	22.2	24.1
	Fixed carbon	69.4	68.5	69.8	75.9
	Ash	8.0	7.9	8.0	
		100.0	100.0	100.0	100.0
Ultimate Analysis	Hydrogen				
	Carbon				
	Nitrogen				
	Oxygen				
	Sulphur	1.7	1.7	1.7	1.9
	Ash				
British thermal units		14340	14160	14410	15670
Softening temperature of ash		2780 ° F.			

Date May 10, 1938 (Signed) H. M. Cooper.
Chemist.

U. S. GOVERNMENT PRINTING OFFICE 6—8404

Form 6—138

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

Can No. X-210

F—SAMPLING REPORT

Lab. No. B-29344

(1) State Virginia (2) County Buchanan (3) Town Hanger (Post office) (4) Mine Keen Mountain

(5) Sample of Medium Vol Bit Coal-CG. Face Coal. (6) Analysis desired Prox.

(7) Method of sampling Standard (Describe if other than standard)

(8) Location in mine Face No. 1 barrier entry. (Distance and direction from opening. Locate with respect to rib, room, pillar, aircourse, entry, etc.)

(9) Date 4/26/38 (Of sampling), 19

(10) Coal, dry or moist Dry (11) Gross wt., lbs. 20 (Sample cut) (12) Net wt., lbs. 5 (Sample mailed)

(13) Sample from fresh or weathered coal Fresh

(14) Roof Hard Slate (Kind and quality)

(15) Draw slate or roof coal Draw Slate (Description and thickness)

(16) Floor Flint Rock Sandstone (Kind, soft or hard, smooth or rough)

(17) Vertical depth from surface to point of sampling, feet 500'

No.	Section of Bed	Ft.	Ins.	No.	Section of Bed	Ft.	Ins.
1	No Impurities	4	8	10			
2				11			
3				12			
4				13			
5				14			
6				15			
7				16			
8				Total thickness of bed		4	8
9				Thickness in sample		4	8

(18) Excluded from sample, marked X, section Nos. none

(19) Send analysis to G.W.Grove (20) Collector Grove, Quenon, Pero (2) VanderVeer Office Pgh., Pa.

Above information copied from B card by FEH on May 10, 1938., 19

U.S. GOVERNMENT PRINTING OFFICE 6—6098

6-139

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

G—COAL-ANALYSIS REPORT

Test No. _____ Lab. No. B-29345

Sample of Medium Volatile Bituminous Coal-CG. Can No. _____

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

~~xxxxxxxxx~~ Composite of B-29342, 343 and 344.

Method of sampling _____ Gross weight, lbs. _____ Net weight, grams _____

Date of sampling _____ Date of Lab. sampling _____ Date of analysis 5/4/38

B. of M. or U. S. G. S. section B. of M. Collector Grove, Quenon, VanderVeer & Perc

		Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
	Air-dry Loss 1.2				
Proximate Analysis	Moisture	.6	1.8		
	Volatile matter	22.1	21.8	22.2	24.2
	Fixed carbon	69.1	68.3	69.6	75.8
	Ash	8.2	8.1	8.2	
		100.0	100.0	100.0	100.0
Ultimate Analysis	Hydrogen	4.6	4.7	4.6	5.0
	Carbon	81.6	80.5	82.0	89.4
	Nitrogen	1.3	1.3	1.3	1.5
	Oxygen	2.9	4.1	2.5	2.6
	Sulphur	1.4	1.3	1.4	1.5
	Ash	8.2	8.1	8.2	
		100.0	100.0	100.0	100.0
British thermal units		14350	14170	14430	15730
Softening temperature of ash		° F.			

Date May 10, 1938 (Signed) H. M. Cooper.
Chemist.

U. S. GOVERNMENT PRINTING OFFICE 6—8404

6-261

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

DUST-ANALYSIS REPORT

Test No. _____ Lab. No. B-29346

Sample of Floor dust (through 20-mesh screen). Can No. 1

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine 2nd Left off Mains near face.

Method of sampling Standard Gross weight, lbs. _____ Net weight, gms. 155.0

Date of sampling 4/26/38 Date of Lab. sampling _____ Date of analysis _____

For B. of M. section Mine Accident Collector Grove, Quenon & Pero

	Air-dry Loss	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		.6		
	Volatile matter				(a)
	~~Fixed carbon~~ Comb.		79.8	80.3	
	Ash		19.6	19.7	
			100.0	100.0	
Ultimate Analysis	Hydrogen				
	Carbon		GRAMS	PERCENT	
	Nitrogen	On 20-mesh	32.0	20.6	
	Oxygen	Through 20-mesh	123.0	79.4	
	Sulphur	Total wt. of sample	155.0	100.0	
	Ash				
		ALCOHOL COKE TEST:			
Calorific value determined	Calories	Coked particles present - Medium.			
	British thermal units				

Screen test,		*Cumulative per cent.*
	through 20 mesh	100
	through 48 mesh	54.4
	through 100 mesh	28.2
	through 200 mesh	16.6

Area from which sample was taken (sq. ft.) _____

Date, May 9, 1938 (Signed) H. M. Cooper., *Chemist.*

U. S. GOVERNMENT PRINTING OFFICE

[a] This figure is the ratio of volatile combustible to total combustible.

6—8752

6-261

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

DUST-ANALYSIS REPORT

Test No. _____ Lab. No. B-29347

Sample of Rib & Roof dust (through 20-mesh screen). Can No. 1

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine 2nd Left off Mains near face

Method of sampling Standard Gross weight, lbs. _____ Net weight, gms. 45.0

Date of sampling 4/26/38 Date of Lab. sampling _____ Date of analysis _____

For B. of M. section Mine Accident Collector Grove, Quenon & Pero

	Air-dry Loss	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		1.3		
	Volatile matter				(a)
	Fixed Carbon Comb.		82.6	83.7	
	Ash		16.1	16.3	
			100.0	100.0	
Ultimate Analysis	Hydrogen				
	Carbon		GRAMS	PERCENT	
	Nitrogen	On 20-mesh	11.0	24.4	
	Oxygen	Through 20-mesh	34.0	75.6	
	Sulphur	Total wt. of sample	45.0	100.0	
	Ash				
		ALCOHOL COKE TEST:			
Calorific value determined	Calories	Coked particles present - Large amount.			
	British thermal units				

	Cumulative per cent.
Screen test, through 20 mesh	100
through 48 mesh	
through 100 mesh	NO SIZE
through 200 mesh	

Area from which sample was taken (sq. ft.) _____

Date, May 9, 1938 (Signed) H. M. Cooper., *Chemist.*

U. S. GOVERNMENT PRINTING OFFICE

[a] This figure is the ratio of volatile combustible to total combustible.

6—8752

6-261

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

DUST-ANALYSIS REPORT

Test No. _____ Lab. No. B-29348

Sample of Floor dust (through 20-mesh screen). Can No. 2

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine 2nd Left off Mains - near Mains

Method of sampling Standard Gross weight, lbs. _____ Net weight, gms. 202.0

Date of sampling 4/26/38 Date of Lab. sampling _____ Date of analysis _____

For B. of M. section Mine Accident Collector Grove, Quenon & Pero

	Air-dry Loss	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		.6		
	Volatile matter				(a)
	~~Fixed~~ Comb.		69.5	69.9	
	Ash		29.9	30.1	
			100.0	100.0	
Ultimate Analysis	Hydrogen				
	Carbon		GRAMS	PERCENT	
	Nitrogen (On 20-mesh)		30.0	14.9	
	Oxygen (Through 20-mesh)		172.0	85.1	
	Sulphur (Total wt. of sample)		202.0	100.0	
	Ash				
		ALCOHOL COKE TEST:			
Calorific value determined	Calories	Coked particles present - Medium Amount.			
	British thermal units				

	Cumulative per cent.
Screen test, through 20 mesh	100
through 48 mesh	58.7
through 100 mesh	34.5
through 200 mesh	20.1

Area from which sample was taken (sq. ft.) _____

Date, May 9, 1938 (Signed) H. M. Cooper., *Chemist.*

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(a) This figure is the ratio of volatile combustible to total combustible.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

DUST-ANALYSIS REPORT

Test No. _____ Lab. No. B-29349

Sample of Rib & Roof dust (through 20-mesh screen). Can No. 2

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine 2nd Left off Mains near Mains

Method of sampling Standard Gross weight, lbs. _____ Net weight, gms. 33.0

Date of sampling 4/26/38 Date of Lab. sampling _____ Date of analysis _____

For B. of M. section Mine Accident Collector Grove, Quenons, Pero.

	Air-dry Loss	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		1.6		
	Volatile matter				(a)
	~~Fixed carbon~~ Comb.		84.5	85.8	
	Ash		13.9	14.2	
			100.0	100.0	
Ultimate Analysis	Hydrogen				
	Carbon		GRAMS	PERCENT	
	Nitrogen	On 20-mesh	4.0	12.1	
	Oxygen	Through 20-mesh	29.0	87.9	
	Sulphur	Total wt. of sample	33.0	100.0	
	Ash				
		ALCOHOL COKE TEST:			
Calorific value determined	Calories	Coked particles present - Small amount.			
	British thermal units				

Screen test,		*Cumulative per cent.*
through 20 mesh		100
through 48 mesh		
through 100 mesh		NO SIZE
through 200 mesh		

Area from which sample was taken (sq. ft.) _____

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DUST-ANALYSIS REPORT

Test No. _____ Lab. No. B-29350

Sample of Floor dust (through 20-mesh screen). Can No. 3

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine No. 2 Main entry, 150' outby 1st Left.

Method of sampling Standard Gross weight, lbs. _____ Net weight, gms. 177.0

Date of sampling 4/26/38 Date of Lab. sampling _____ Date of analysis _____

For B. of M. section Mine Accident Collector Grove, Quenon & Pero

	Air-dry Loss	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		1.0		
	Volatile matter				(a)
	Fixed Carbon		88.8	89.7	
	Ash		10.2	10.3	
			100.0	100.0	
Ultimate Analysis	Hydrogen				
	Carbon		GRAMS	PERCENT	
	Nitrogen	On 20-mesh	38.0	21.5	
	Oxygen	Through 20-mesh	139.0	78.5	
	Sulphur	Total wt. of sample	177.0	100.0	
	Ash				
		ALCOHOL COKE TEST:			
Calorific value determined	Calories	Coked particles present - very small amount.			
	British thermal units				

	Cumulative per cent.
Screen test, through 20 mesh	100
through 48 mesh	60.9
through 100 mesh	39.7
through 200 mesh	23.8

Area from which sample was taken (sq. ft.) _____

Date, May 9, 1938 (Signed) H. M. Cooper., *Chemist.*

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DUST-ANALYSIS REPORT

Test No. _____ Lab. No. B-29351

Sample of Rib & Roof dust (through 20-mesh screen). Can No. 3

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine No. 2 Main Entry, 150' outby 1st Left.

Method of sampling Standard Gross weight, lbs. _____ Net weight, gms. 59.0

Date of sampling 4/26/38 Date of Lab. sampling _____ Date of analysis _____

For B. of M. section Mine Accident Collector Grove, Quenon & Pero

	Air-dry Loss	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		1.5		
	Volatile matter				(a)
	~~Fixed~~ Comb.		86.8	88.2	
	Ash		11.7	11.8	
			100.0	100.0	
Ultimate Analysis	Hydrogen				
	Carbon		GRAMS	PERCENT	
	Nitrogen	On 20-mesh	2.0	3.4	
	Oxygen	Through 20-mesh	57.0	96.6	
	Sulphur	Total wt. of sample	59.0	100.0	
	Ash				
		ALCOHOL COKE TEST:			
Calorific value determined	Calories	Coked particles present - Small amount.			
	British thermal units				

	Cumulative per cent.
Screen test, through 20 mesh	100
through 48 mesh	
through 100 mesh	NO SIZE
through 200 mesh	

Area from which sample was taken (sq. ft.) _____

Date, May 9, 1938 (Signed) H. M. Cooper., *Chemist.*

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DUST-ANALYSIS REPORT

Test No. _____ Lab. No. B-29352

Sample of Floor dust (through 20-mesh screen). Can No. 4

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine 4th Main entry, 200' outby 1st Left Switch.

Method of sampling Standard Gross weight, lbs. _____ Net weight, gms. 136.0

Date of sampling 4/26/38 Date of Lab. sampling _____ Date of analysis _____

For B. of M. section Mine Accident Collector Grove, Quenon & Pero

	Air-dry Loss	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		.6		
	Volatile matter				(a)
	Fixed carbon Comb.		77.7	78.2	
	Ash		21.7	21.8	
			100.0	100.0	
Ultimate Analysis	Hydrogen				
	Carbon		GRAMS	PERCENT	
	Nitrogen On 20-mesh		20.0	14.7	
	Oxygen Through 20-mesh		116.0	85.3	
	Sulphur Total wt.	of sample	136.0	100.0	
	Ash				
		ALCOHOL COKE TEST:			
Calorific value determined	Calories	Coked particles present - Very small amount.			
	British thermal units				

	Cumulative per cent.
Screen test, through 20 mesh	100
through 48 mesh	67.2
through 100 mesh	47.2
through 200 mesh	31.3

Area from which sample was taken (sq. ft.) _____

Date, May 9, 1938 (Signed) H. M. Cooper., *Chemist.*

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DUST-ANALYSIS REPORT

Test No. _____ Lab. No. B-29353

Sample of Rib & Roof dust (through 20-mesh screen). Can No. 4

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine 4th Main Entry, 200' outby first W. Switch.

Method of sampling Standard Gross weight, lbs. _____ Net weight, gms. 52.0

Date of sampling 4/26/38 Date of Lab. sampling _____ Date of analysis _____

For B. of M. section Mine Accident Collector Grove, Quenon & Pero

	Air-dry Loss	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		1.4		
	Volatile matter				(a)
	~~Fixed carbon~~ Comb.		80.9	82.0	
	Ash		17.7	18.0	
			100.0	100.0	
Ultimate Analysis	Hydrogen		GRAMS	PERCENT	
	Carbon				
	Nitrogen On 20-mesh		2.0	3.8	
	Oxygen Through 20-mesh		50.0	96.2	
	Sulphur Total wt. of sample		52.0	100.0	
	Ash				
		ALCOHOL COKE TEST:			
Calorific value determined	Calories	Coked particles present - Very small amount.			
	British thermal units				

	Cumulative per cent.
Screen test, through 20 mesh	100
through 48 mesh	
through 100 mesh	NO SIZE
through 200 mesh	

Area from which sample was taken (sq. ft.) _____

Date, May 9, 1938 (Signed) H. M. Cooper., *Chemist.*

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DUST-ANALYSIS REPORT

Test No. _____ Lab. No. B-29354

Sample of Floor dust (through 20-mesh screen). Can No. 5

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine 1st diagonal, near barrier entries

Method of sampling Standard Gross weight, lbs. _____ Net weight, gms. 189.0

Date of sampling 4/26/38 Date of Lab. sampling _____ Date of analysis _____

For B. of M. section Mine Accident Collector Grove, Quenon & Pero

	Air-dry Loss	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		.8		
	Volatile matter				(a)
	~~Fixed carbon~~ Comb.		89.4	90.1	
	Ash		9.8	9.9	
			100.0	100.0	
Ultimate Analysis	Hydrogen				
	Carbon		GRAMS	PERCENT	
	On 20-mesh Nitrogen		40.0	21.2	
	Through 20-mesh Oxygen		149.0	78.8	
	Total wt. of sample Sulphur		189.0	100.0	
	Ash				
		ALCOHOL COKE TEST:			
Calorific value determined	Calories	Coked particles present - Large amount.			
	British thermal units				

	Cumulative per cent.
Screen test, through 20 mesh	100
through 48 mesh	66.0
through 100 mesh	40.2
through 200 mesh	26.2

Area from which sample was taken (sq. ft.) _____

Date, May 9, 1938 (Signed) H. M. Cooper., *Chemist.*

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DUST-ANALYSIS REPORT

Test No. _____ Lab. No. B-29355

Sample of Rib & Roof dust (through 20-mesh screen). Can No. 5

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine 1st Diagonal, near barrier entries.

Method of sampling Standard Gross weight, lbs. _____ Net weight, gms. 27.0

Date of sampling 4/26/38 Date of Lab. sampling _____ Date of analysis _____

For B. of M. section Mine Accident Collector Grove, Quenon & Pero

	Air-dry Loss	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		1.6		
	Volatile matter				(a)
	~~Fixed carbon~~ Comb.		87.1	88.5	
	Ash		11.3	11.5	
			100.0	100.0	
Ultimate Analysis	Hydrogen				
	Carbon		GRAMS	PERCENT	
	Nitrogen	On 20-mesh	2.0	7.4	
	Oxygen	Through 20-mesh	25.0	92.6	
	Sulphur	Total wt. of sample	27.0	100.0	
	Ash				
		ALCOHOL COKE TEST:			
Calorific value determined	Calories	Coked particles present - Medium amount.			
	British thermal units				

	Cumulative per cent.
Screen test, through 20 mesh	100
through 48 mesh	
through 100 mesh	NO SIZE
through 200 mesh	

Area from which sample was taken (sq. ft.) _____

Date, May 9, 1938 (Signed) H. M. Cooper., *Chemist.*

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DUST-ANALYSIS REPORT

Test No. _____ Lab. No. B-29356

Sample of Floor dust (through 20-mesh screen). Can No. 6

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine 3rd diagonal near barrier entries

Method of sampling Standard Gross weight, lbs. _____ Net weight, gms. 163.0

Date of sampling 4/26/38 Date of Lab. sampling _____ Date of analysis _____

For B. of M. section Mine Accident Collector Grove, Quenon & Pero

	Air-dry Loss	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		.7		
	Volatile matter				(a)
	~~Fixed carbon~~ Comb.		88.4	89.0	
	Ash		10.9	11.0	
			100.0	100.0	
Ultimate Analysis	Hydrogen				
	Carbon		GRAMS	PERCENT	
	Nitrogen (On 20-mesh)		37.0	22.7	
	Oxygen (Through 20-mesh)		126.0	77.3	
	Sulphur (Total wt. of sample)		163.0	100.0	
	Ash				
		ALCOHOL COKE TEST:			
Calorific value determined	Calories	Coked particles present - Large amount.			
	British thermal units				

Screen test,		Cumulative per cent.
through 20 mesh		100
through 48 mesh		62.0
through 100 mesh		36.3
through 200 mesh		22.5

Area from which sample was taken (sq. ft.) _____

Date, May 9, 1938 (Signed) H. M. Cooper., *Chemist.*

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BUREAU OF MINES

DUST-ANALYSIS REPORT

Test No. _____ Lab. No. B-29357

Sample of Rib & Roof dust (through 20-mesh screen). Can No. 6

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine 3rd diagonal near barrier entries

Method of sampling Standard Gross weight, lbs. _____ Net weight, gms. 42.0

Date of sampling 4/26/38 Date of Lab. sampling _____ Date of analysis _____

For B. of M. section Mine Accident Collector Grove, Quenon & Pero

	Air-dry Loss	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		1.5		
	Volatile matter				(a)
	~~Fixed carbon~~ Comb.		85.0	86.3	
	Ash		13.5	13.7	
			100.0	100.0	
Ultimate Analysis	Hydrogen		GRAMS	PERCENT	
	Carbon				
	On 20-mesh		2.0	4.8	
	Nitrogen				
	Through 20-mesh		40.0	95.2	
	Oxygen				
	Total wt.	of sample	42.0	100.0	
	Sulphur				
	Ash				
		ALCOHOL COKE TEST:			
Calorific value determined	Calories	Coked particles present - Large amount.			
	British thermal units				

	Cumulative per cent.
Screen test, through 20 mesh	100
through 48 mesh	
through 100 mesh	NO SIZE
through 200 mesh	

Area from which sample was taken (sq. ft.) _____

Date, May 9, 1938 (Signed) H. M. Cooper., *Chemist.*

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BUREAU OF MINES

DUST-ANALYSIS REPORT

Test No. _____ Lab. No. B-29358

Sample of Floor dust (through 20-mesh screen). Can No. 7

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine No. 2 Barrier entry 400' from face.

Method of sampling Standard Gross weight, lbs. _____ Net weight, gms. 148.0

Date of sampling 4/26/38 Date of Lab. sampling _____ Date of analysis _____

For B. of M. section Mine Accident Collector Grove, Quenon & Pero.

	Air-dry Loss	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		.6		
	Volatile matter				(a)
	~~Fixed carbon~~ Comb.		85.3	85.8	
	Ash		14.1	14.2	
			100.0	100.0	
Ultimate Analysis	Hydrogen				
	Carbon		GRAMS	PERCENT	
	On 20-mesh Nitrogen		40.0	27.0	
	Through 20-mesh Oxygen		108.0	73.0	
	Total wt. of Sulphur	sample	148.0	100.0	
	Ash				
		ALCOHOL COKE TEST:			
Calorific value determined	Calories	Coked particles present - Large amount.			
	British thermal units				

	Cumulative per cent.
Screen test, through 20 mesh	100
through 48 mesh	61.3
through 100 mesh	38.8
through 200 mesh	22.5

Area from which sample was taken (sq. ft.) _____

Date, May 9, 1938 (Signed) H. M. Cooper., *Chemist.*

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BUREAU OF MINES

DUST-ANALYSIS REPORT

Test No. _____ Lab. No. B-29359

Sample of Rib & Roof dust (through 20-mesh screen). Can No. 7

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine No. 2 barrier entry, 400' from face.

Method of sampling Standard Gross weight, lbs. _____ Net weight, gms. 40.0

Date of sampling 4/26/38 Date of Lab. sampling _____ Date of analysis _____

For B. of M. section Mine Accident Collector Grove, Quenon & Pero

	Air-dry Loss	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		1.6		
	Volatile matter				(a)
	~~Fixed C~~ Comb.		85.7	87.1	
	Ash		12.7	12.9	
			100.0	100.0	
Ultimate Analysis	Hydrogen				
	Carbon		GRAMS	PERCENT	
	Nitrogen	On 20-mesh	1.0	2.5	
	Oxygen	Through 20-mesh	39.0	97.5	
	Sulphur	Total wt. of sample	40.0	100.0	
	Ash				
		ALCOHOL COKE TEST:			
Calorific value determined	Calories	Coked particles present - Large amount.			
	British thermal units				

	Cumulative per cent.
Screen test, through 20 mesh	100
through 48 mesh	
through 100 mesh	NO SIZE
through 200 mesh	

Area from which sample was taken (sq. ft.) _____

Date, May 9, 1938 (Signed) H. M. Cooper., *Chemist.*

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DUST-ANALYSIS REPORT

Test No. _____ Lab. No. B-29360

Sample of Floor dust (through 20-mesh screen). Can No. 8

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine Last X-cut between #2 and #3 Barrier entries.

Method of sampling Standard Gross weight, lbs. _____ Net weight, gms. 151.0

Date of sampling 4/26/38 Date of Lab. sampling _____ Date of analysis _____

For B. of M. section Mine Accident Collector Grove, Quenon & Pero

	Air-dry Loss	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		.7		
	Volatile matter				(a)
	~~Fixed~~ Comb.		87.2	87.8	
	Ash		12.1	12.2	
			100.0	100.0	
Ultimate Analysis	Hydrogen				
	Carbon		GRAMS	PERCENT	
	Nitrogen	On 20-mesh	36.0	23.8	
	Oxygen	Through 20-mesh	115.0	76.2	
	Sulphur	Total wt. of sample	151.0	100.0	
	Ash				
		ALCOHOL COKE TEST:			
Calorific value determined	Calories	Coked particles present - Large amount.			
	British thermal units				

	Cumulative per cent.
Screen test, through 20 mesh	100
through 48 mesh	63.6
through 100 mesh	40.7
through 200 mesh	25.8

Area from which sample was taken (sq. ft.) _____

Date, May 9, 1938 (Signed) H. M. Cooper., *Chemist.*

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BUREAU OF MINES

DUST-ANALYSIS REPORT

Test No. _____ Lab. No. B-29361

Sample of Rib & Roof dust (through 20-mesh screen). Can No. 8

Operator Red Jacket Coal Corp. Mine Keen Mountain

State Virginia County Buchanan Bed Lower Banner

Town Hanger

Location in mine Last X-cut between #2 and #2 barrier entries.

Method of sampling Standard Gross weight, lbs. _____ Net weight, gms. 30.0

Date of sampling 4/26/38 Date of Lab. sampling _____ Date of analysis _____

For B. of M. section Mine Accident Collector Grove, Quenon & Pero

	Air-dry Loss	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		1.4		
	Volatile matter				(a)
	~~Fixed carbon~~ Comb.		85.0	86.2	
	Ash		13.6	13.8	
			100.0	100.0	
Ultimate Analysis	Hydrogen				
	Carbon		GRAMS	PERCENT	
	Nitrogen (On 20-mesh)		2.0	6.7	
	Oxygen (Through 20-mesh)		28.0	93.3	
	Sulphur (Total wt. of sample)		30.0	100.0	
	Ash				
		ALCOHOL COKE TEST:			
Calorific value determined	Calories	Coked particles present - Large amount.			
	British thermal units				

	Cumulative per cent.
Screen test, through 20 mesh	100
through 48 mesh	
through 100 mesh	NO SIZE
through 200 mesh	

Area from which sample was taken (sq. ft.) _____

Date, May 9, 1938 (Signed) H. M. Cooper., *Chemist.*

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 281 Laboratory No. 62778

Sample of mine air

Mine Keen Mountain Operator Red Jacket Coal Corp.

State Virginia County Buchanan

Town Hanger Name of coal bed Lower Banner

Location in mine 1st right off 1st left off 1st left off 1st main

Method of sampling vacuum Date sampled 4-25-38 Hour 1:00 p.m.

Velocity air - Area - Quantity -

Pressure on seal Barometer: Inside Outside

Temperature: Wet bulb °F. Dry bulb °F. Humidity

Mailed Received 4-29-38

Collector M. C. McCall, Assoc. Min. Engr.
(Name and title)

Laboratory No.	62778		Ethane (C_2H_6)		
Bottle No.	281				
Carbon dioxide (CO_2)	0.14		Hydrogen sulphide (H_2S)		
Oxygen (O_2)	20.83		Unsaturated hydrocarbons (C_2H_4, etc.).		
Hydrogen (H_2)			Sulphur dioxide (SO_2)		
Carbon monoxide (CO)					
Methane (CH_4)	0.00				
Nitrogen (N_2)	79.03				
Total	100.00				

Remarks:

Date 5-7-38 (Signed) H. H. Schrenk.
Chemist.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 282 Laboratory No. 62779

Sample of mine air

Mine Kean Mountain Operator Red Jacket Coal Corp.

State Virginia County Buchanan

Town Hanger Name of coal bed Lower Banner

Location in mine 2nd Cross to left off barrier entry

Method of sampling vacuum Date sampled 4-25-38 Hour 4:30 p.m.

Velocity air -- Area -- Quantity --

Pressure on seal Barometer: Inside Outside

Temperature: Wet bulb °F. Dry bulb °F. Humidity

Mailed Received 4-29-38

Collector G. W. Grove, Mining Engr.
(Name and title)

Laboratory No.	62779		Ethane (C_2H_6)		
Bottle No.	282				
Carbon dioxide (CO_2)	0.14		Hydrogen sulphide (H_2S)		
Oxygen (O_2)	20.72		Unsaturated hydrocarbons (C_2H_4, etc.).		
Hydrogen (H_2)			Sulphur dioxide (SO_2)		
Carbon monoxide (CO)					
Methane (CH_4)	0.04				
Nitrogen (N_2)	79.10				
Total	100.00				

Remarks:

Date 5-7-38 (Signed) H. H. Schrenk.
Chemist.

6—8409 U.S. GOVERNMENT PRINTING OFFICE

6-213

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 343 Laboratory No. 62780

Sample of mine air

Mine Keen Mountain Operator Red Jacket Coal Corp.

State Virginia County Buchanan

Town Hanger Name of coal bed Lower Banner

Location in mine 1st left off #1 main (Face)

Method of sampling vacuum Date sampled 4-26-38 Hour 11:40 a.m.

Velocity air -- Area -- Quantity --

Pressure on seal ____ Barometer: Inside ____ Outside ____

Temperature: Wet bulb ____°F. Dry bulb ____°F. Humidity ____

Mailed ____ Received 4-29-38

Collector VanderVeer, Jr. Min. Engr., Quenon, Sr. Saf. Instr.
(Name and title)

Laboratory No.	62780		Ethane (C_2H_6)	
Bottle No.	343			
Carbon dioxide (CO_2)	0.19		Hydrogen sulphide (H_2S)	
Oxygen (O_2)	20.72		Unsaturated hydrocarbons (C_2H_4, etc.).	
Hydrogen (H_2)			Sulphur dioxide (SO_2)	
Carbon monoxide (CO)				
Methane (CH_4)	0.00			
Nitrogen (N_2)	79.09			
Total	100.00			

Remarks: ____

Date 5-7-38 (Signed) H. H. Schrenk.
Chemist.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 344 Laboratory No. 62781

Sample of mine air

Mine Keen Mt. Operator Red Jacket Coal Corp.

State Virginia County Buchanan

Town Hanger Name of coal bed Lower Banner

Location in mine Face of 2nd main heading

Method of sampling vacuum Date sampled 4-25-38 Hour 11:41 a.m.

Velocity air -- Area -- Quantity --

Pressure on seal ____ Barometer: Inside ____ Outside ____

Temperature: Wet bulb ____°F. Dry bulb ____°F. Humidity ____

Mailed ____ Received 4-29-38

Collector M. C. McCall Assoc. Min. Engr.
(Name and title)

Laboratory No.	62781		Ethane (C_2H_6)		
Bottle No.	344				
Carbon dioxide (CO_2)	0.18		Hydrogen sulphide (H_2S)		
Oxygen (O_2)	20.76		Unsaturated hydrocarbons (C_2H_4, etc.).		
Hydrogen (H_2)			Sulphur dioxide (SO_2)		
Carbon monoxide (CO)					
Methane (CH_4)	0.02				
Nitrogen (N_2)	79.04				
Total	100.00				

Remarks: ____

Date 5-7-38 (Signed) H. H. Schrenk.
Chemist.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 451 Laboratory No. 62782

Sample of mine air

Mine Keen Mtn. Mine Operator Red Jacket Mines

State Virginia County Buchanan

Town Hanger Name of coal bed Lower Banner

Location in mine No. 5 mains

Method of sampling vacuum Date sampled 4-26-38 Hour 1:45 p.m.

Velocity air 95 Area 63 Quantity 5985

Pressure on seal ____ Barometer: Inside ____ Outside ____

Temperature: Wet bulb ____°F. Dry bulb ____°F. Humidity ____

Mailed ____ Received 4-29-38

Collector Vander Veer - Jr. M. Engr. Pero Asst. Saf. Instr.
(Name and title)

Laboratory No.	62782		Ethane (C_2H_6)		
Bottle No.	451				
Carbon dioxide (CO_2)	0.06		Hydrogen sulphide (H_2S)		
Oxygen (O_2)	20.91		Unsaturated hydrocarbons (C_2H_4, etc.).		
Hydrogen (H_2)			Sulphur dioxide (SO_2)		
Carbon monoxide (CO)					
Methane (CH_4)	0.00				
Nitrogen (N_2)	79.03				
Total	100.00				

Remarks: ____

Date 5-7-38 (Signed) H. H. Schrenk.
Chemist.

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BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 452 Laboratory No. 62783

Sample of Mine Air

Mine Keen Mt. Mine Operator Red. Jacket Mines

State Virginia County Buchanan

Town Hanger Name of coal bed Lower Banner

Location in mine No. 6 main

Method of sampling vacuum Date sampled 4-26-38 Hour 1:30 a.m.

Velocity air 90 Area 61 Quantity 5500

Pressure on seal ____ Barometer: Inside ____ Outside ____

Temperature: Wet bulb ____°F. Dry bulb ____°F. Humidity ____

Mailed ____ Received 4-29-38

Collector Pero, Jr. S. Instr. - Vander Veer, Jr. Min. Engr.
(Name and title)

Laboratory No.	62783	Ethane (C_2H_6)	
Bottle No.	452		
Carbon dioxide (CO_2)	0.07	Hydrogen sulphide (H_2S)	
Oxygen (O_2)	20.91	Unsaturated hydrocarbons (C_2H_4, etc.).	
Hydrogen (H_2)		Sulphur dioxide (SO_2)	
Carbon monoxide (CO)			
Methane (CH_4)	0.00		
Nitrogen (N_2)	79.02		
Total	100.00		

Remarks: ____

Date 5-7-38 (Signed) H. H. Schronk.
Chemist.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 762 Laboratory No. 62784

Sample of mine air

Mine Keen Mountain Operator Red Jacket Coal Corp.

State Virginia County Buchanan

Town Hanger Name of coal bed Lower Banner

Location in mine #4 main at Stat. 1 + 00

Method of sampling vacuum Date sampled 4-26-38 Hour 2:00 p.m.

Velocity air 180 Area 75 Quantity 13,500

Pressure on seal ____ Barometer: Inside ____ Outside ____

Temperature: Wet bulb ____°F. Dry bulb ____°F. Humidity ____

Mailed ____ Received 4-29-38

Collector Vander Veer Jr. Min. Engr. Pero Jr. Saf. Instr.
(Name and title)

Laboratory No.	62784		Ethane (C_2H_6)		
Bottle No.	762				
Carbon dioxide (CO_2)	0.03		Hydrogen sulphide (H_2S)		
Oxygen (O_2)	20.92		Unsaturated hydrocarbons (C_2H_4, etc.).		
Hydrogen (H_2)			Sulphur dioxide (SO_2)		
Carbon monoxide (CO)					
Methane (CH_4)	0.00				
Nitrogen (N_2)	79.05				
Total	100.00				

Remarks: ____

Date 5-7-38 (Signed) H. H. Schrenk.
Chemist.

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BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 791 Laboratory No. 62785

Sample of mine air

Mine Keen Min. Mine Operator Red Jacket Mines

State Virginia County Buchanan

Town Hanger Name of coal bed Lower Banner

Location in mine 2nd Diagonal

Method of sampling vacuum Date sampled 4-26-38 Hour 11:40 a.m.

Velocity air 256 Area 68 Quantity 17400

Pressure on seal Barometer: Inside Outside

Temperature: Wet bulb °F. Dry bulb °F. Humidity

Mailed Received 4-29-38

Collector Vander Veer, Jr. Min. Engr.
(Name and title)

Laboratory No.	62785	Ethane (C_2H_6)	
Bottle No.	791		
Carbon dioxide (CO_2)	0.05	Hydrogen sulphide (H_2S)	
Oxygen (O_2)	20.91	Unsaturated hydrocarbons (C_2H_4, etc.).	
Hydrogen (H_2)		Sulphur dioxide (SO_2)	
Carbon monoxide (CO)			
Methane (CH_4)	0.00		
Nitrogen (N_2)	79.04		
Total	100.00		

Remarks:

Date 5-7-38 (Signed) H. H. Schrenk.
Chemist.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 792 — Laboratory No. 62786

Sample of mine air

Mine Keen Mtn. Mine — Operator Red Jacket Mines

State Virginia — County Buchanan

Town Hanger — Name of coal bed Lower Banner

Location in mine 1st Diagonal

Method of sampling vacuum — Date sampled 4-26-38 — Hour 11/30 a.m.

Velocity air 250 — Area 60 — Quantity 15000

Pressure on seal ______ Barometer: Inside ______ Outside ______

Temperature: Wet bulb ______ °F. Dry bulb ______ °F. Humidity ______

Mailed ______ Received 4-29-38

Collector E. E. Quenon, Prin. Saf. Instr.
(Name and title)

Laboratory No.	62786		Ethane (C_2H_6)			
Bottle No.	792					
Carbon dioxide (CO_2)	0.05		Hydrogen sulphide (H_2S)			
Oxygen (O_2)	20.91		Unsaturated hydrocarbons (C_2H_4, etc.).			
Hydrogen (H_2)			Sulphur dioxide (SO_2)			
Carbon monoxide (CO)						
Methane (CH_4)	0.00					
Nitrogen (N_2)	79.04					
Total	100.00					

Remarks:

Date 5-7-38 — (Signed) H. H. Schrenk.
Chemist.

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