FINAL REPORT, GAS AND DUST EXPLOSION, MACBETH MINE, HUTCHINSON COAL COMPANY, MACBETH, W. VA., MARCH 11, 1937

By

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and

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DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

C O N T E N T S

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By K. L. Marshall and M. C. McCall

Introduction:

An explosion of gas and coal dust occurred about 7:50 p.m., March 11, 1937, in the MacBeth mine of the Hutchinson Coal Company, at MacBeth, W. Va., resulting in the deaths of 18 men who were all in the explosion zone. Some of these men were killed by flame and violence, while others were killed by carbon monoxide or a deficiency of oxygen.

This is the second explosion which has occurred in this mine in less than seven months. An explosion which killed 10 men occurred in this mine September 2, 1936, and was investigated by C. W. Owings and P. P. Senio of the Bureau of Mines. The general information contained in this report is taken from the report of the previous explosion, with only the additions and corrections made necessary by this interval of time.

Location:

The MacBeth mine is located in Logan County, W. Va., at MacBeth. The mine is served by the Chesapeake and Ohio Railway. The mine is owned and operated by the Hutchinson Coal Company, Fairmont, W. Va., with local offices at MacBeth, W. Va. The principal operating officials are:

M. L. Hutchinson,	president,	Fairmont, W. Va.
T. E. Johnson,	vice president,	Fairmont, W. Va.
W. H. Myers,	general superintendent,	MacBeth, W. Va.
H. N. Clendening,	mining engineer,	MacBeth, W. Va.
K. W. Stafford,	mine foreman,	MacBeth, W. Va.

Employees:

The average employment is about 238 men, of which number 26 are employed on the surface and the balance are employed underground on two shifts. There are approximately 122 coal loaders employed, 80 on the day shift and 42 on the night shift.

Mine openings:

The coal is reached by a slope 640 feet long driven at an angle of 36 degrees and two shafts about 135 feet deep. The shafts are driven 300 feet apart with one of them about 75 feet from the slope.

Coal bed:

The mine is developed in the Eagle coal bed which averages about 4 feet in thickness. The bed has a general dip less than 2 degrees westward but has quite sharp local rolls.

The roof is shale, and disintegrates upon exposure to air; for this reason coal is top cut to permit some coal to remain as immediate roof to protect the shale above.

Coal in the adjoining Dehue mine has been sampled by Bureau of Mines representatives. The average analysis of this coal is as follows: moisture, 2.5 percent; volatile matter, 33.7 percent; fixed carbon, 59.8 percent; ash, 4.3 percent; sulphur, .7 percent; B.t.u, 14,320.

The volatile ratio of this sample is .36 and indicates that the coal dust is highly explosive when suspended in a suitably dense cloud in air.

Method of mining:

Coal is extracted on a room and pillar panel system. A set of 6 entries extend from the bottom of the slope to the barrier pillar which

separated the Dabney mine of the same company from the MacBeth mine. Room entries are driven, right and left from the mains, in pairs at 350-foot intervals. These room entries are driven on 50-foot centers at widths which the writers think are excessive for the character of the roof. Room 1 is driven 250 feet from the main entry air course and room 2 is driven 90 feet inby room 1. These rooms are driven to intersect the air course on the next room entry, and thus act as additional air courses to replace the main air courses which were driven wide and caved. Rooms 7, 8, 13, and 14 are driven in the same manner for the same purpose. When room entries reach their limits rooms are turned and extracted on an advancing pillar line. Because of falls or small amounts of water encountered on entries it has been the practice to abandon the entry or pick it up from the inby side. This practice has caused much confusion and has made it necessary to extract coal backwards as well as to cause haulage to be done on return air. It has also made the problem of ventilation, as it is now done, complicated, inadequate, and inefficient. This failure to follow and maintain the original projection of entries can well be deemed the underlying cause of the two recent explosions which the mine has suffered. Coal is top-cut by Jeffrey 29-B nonpermissible-type mining machines and is hand loaded.

On main entries some crossbars are used to support the roof, but in general support is made by posts set 3 or 4 feet apart on both sides of the track with no attempt being made to obtain clearance.

Rooms are timbered with split posts, cap-boards, and wedges. The posts are set about 4 feet apart and are carried within about 7 feet of the face before cutting.

Haulage:

The track is laid to a gauge of 48 inches; about 40-pound rails laid on wooden ties are used in entries, while 20-pound rails laid on steel or wooden ties are used in rooms. Cross cuts, where not filled with rock and other debris, are used for shelter holes. Cars of 3-ton capacity are made of wood and steel with solid bodies, and no end gate. Coal is hauled on the main line by a 15-ton General Electric trolley locomotive, and a 10-ton Goodman 343 trolley locomotive. Coal is gathered by an 8-ton Jeffrey M. H. 100 cable reel locomotive; 3 Jeffrey M. H. 88 6-ton cable reel locomotives; and 3 6-ton General Electric M. H. A. cable reel locomotives. Main haulage is on intake air and gathering haulage is on return air. Trolley wire is partially guarded at switches by flexible rubber guards.

Lighting:

All underground employees use Edison Model K permissible electric cap lamps. Officials and machine men carry the permissible type Wolfe flame safety lamp, in addition to the cap lamp. Haulways are illuminated by unguarded incandescent electric light bulbs installed at switches, and taped directly to trolley wire or feeder line without fuse protection.

Machinery underground:

Coal is mined with 5 nonpermissible, Jeffrey 29-B arcwall, mining machines. Water is pumped by 4 nonpermissible-type pumps. Electric power underground is 250 volts direct current, except for the 110-volt alternating circuit used to supply current to the incandescent bulbs lighting the slope; 0000 trolley wire, supplemented by a 500,000, circular

mil feeder line is used to carry power in the mine. Main line track is bonded and cross bonded. Sectional switches are used at the mouth of room entries and on main lines. Each trolley cut-out switch is connected to both the trolley wire and feeder cable, which seems to the writers to almost defeat the advantage of the feeder circuit.

Explosives:

Permissible explosives, Dupont's Lump Coal "C", 1-1/4" x 8", are used for blasting, and are delivered to the various sections by a powder-car. Miners store explosives in a canvas bag, along with detonators which are in an insulating, cylindrical, wooden box. Miners are limited to a day's supply of explosives. Shots are fired by the miners with a dry cell battery, having recessed terminals, at any time during the shift. Holes are cleaned with a steel scraper which has the other end copper-sheathed and is used to tamp clay stemming.

Drainage:

The mine, which is very dry, is dewatered by the use of 2 small gathering pumps installed at local dips; a two stage, centrifugal, 300-gallons-per-minute pump, and a 3 stage, centrifugal pump with a capacity of 600 gallons at a 330-foot head. All of the pumps are driven by open type electric motors, with the latter two in the main pump station being operated infrequently and on return air. In addition to the pumps a water box was used to transport water from one local depression to another.

Ventilation:

Ventilation is provided by a 4- by 10-foot Robinson multiblade centrifugal fan operated exhausting. The fan is driven through "V" belt,

10 section, by a 100-horsepower, 220-volt, 60-cycle, 3-phase induction motor, and was reported to have produced about 85,000 cubic feet of air per minute at about 1.7 inch water gauge. The fan is in a fireproof setting of brick and steel construction, is equipped with explosion doors and is reversible.

After the explosion in September 1936 a Bureau engineer found the fan delivering 73,000 cubic feet of air per minute, and after repairs were made to doors and stoppings following this recent explosion, the writers could only find approximately 59,000 cubic feet of air per minute returning to the fan.

As reported to the writers, all the air reaching active workings was taken into Second West Mains, and into 14 and 15 right entries, where a natural or at least dependent split was made, one split going to 16, 17, 18 right off Second West Mains and thence to all workings to the left of Second West Mains. The second split went to the top of 14 right off of Second West Mains, thence through workings of 13 and 12 right development, which was sealed on outby ends, thence by or through some 3000 feet of robbed or pillaring work, thence to workings at the head of Main North, thence through or by the worked-out or abandoned sections on the East Side of the mine.

All indications point to the fact that the ventilation at MacBeth mine had become inefficient and insufficient due, it is believed, to the following conditions which have, no doubt, occurred progressively over a number of years:

First, failure to maintain development in accordance with the original projections, as (a) Third West Main entries

were not driven; (b) 12 right entries off Second West Mains were not properly driven; (c) 13 right entries off Second West Mains were not cleaned up and re-established after the explosion of September, 1936.

Second, air courses which had fallen-in, at many points in almost every section of the mine had not been cleaned-up or properly re-established by driving continuous new air courses.

Third, a proper split system, to provide an adequate quantity of fresh air with limited "duty", was not used, due no doubt in recent years to not being able to move air in sufficient quantity to the working sections to allow splitting.

Fourth, when supplemental rooms, etc., were used as airways, they were not properly guarded from the effects of pillar extraction and subsequent blocking of the airway.

Fifth, the lack of adequate airways and of splits with resulting free movement of fairly large volumes of air to working faces, made necessary the use of an excessive number of doors, checks, and line brattice which might reasonably be expected to have reduced still further the small quantity of air available.

Sixth, the second intake airway paralleling the main haulage has caved at a number of places, and the main haulage is so low and tight from "gobbed" waste at places that the writers found the main return air to the fan was checked decidedly as trips passed the tight points on this Main West haulage.

The ventilation observations and sampling and quantity studies were made by the writers some twenty days after the explosion of March 11, and although the explosion did cause some change and interference to the ventilation when studied, still the writers are forced to believe that the six major causes of poor ventilation listed above were present before the explosion occurred.

The following air samples were taken during the investigation and were analyzed in the Gas Laboratory of the Pittsburgh Experiment Station of the Bureau. Since there had been no active work done at the faces for some twenty days, the samples show a minimum condition of gas liberation, but also show a general gassy condition of all parts of this mine, including old workings, and further, that gas liberation is slow but continuous over a long period of time, so that all standing or worked-out areas, as well as active workings, are potentially dangerous.

The analyses further show that on April 6, 1937, twenty-seven days after the last active working of the mine, there was a methane liberation of 408,000 cubic feet in 24 hours. It is also indicated that the right split carried more gas than the left split and, further, that all the old workings of the north and east are still liberating gas freely. Under such conditions, men or electric equipment should not be permitted to work in air that has passed through or by worked-out or abandoned areas. All pillar lines, if possible, should be ventilated by cross-ventilation and "bleeder" system. This can be done for the right side of 2 West Mains by driving 3 West Mains and for the left side of 2 West Mains by extending 1 West Mains. Broken or "sawtooth" pillar extraction as performed in 5 and 6 right off 2 West Mains, and

Table 1.- Analysis of mine air samples, MacBeth mine, March and April 1937

Air Sample No.	Location in mine	Percent				Cu. ft. of air per minute	Cu. ft. methane per 24 hours
		Carbon dioxide	Oxygen	Methane	Nitrogen		
939	40' outby pump in 14 room 14 right	0.05	20.54	1.79	77.62	1,000	25,700
502	18 right A. C. outby last X-cut	0.04	20.76	0.24	78.96	3,000	10,300
782	Pillar 10 room 11 right entry	0.18	20.52	1.37	77.93	drift	
780	12 right A. C. above 8 room	0.04	20.90	0.02	79.04	drift	
779	Manway 30' outby 2 right, 2 West Main	0.08	20.74	0.34	78.84	8,000	39,100
781	1 left off 3 East Main North	0.10	20.78	0.30	78.82	14,000	60,400
940	Mouth of 12 left	0.07	20.86	0.26	78.81	6,000	32,400
501	At Bore hole Pump Station	0.16	20.62	0.37	78.85	drift	
503	Overcast from West Side	0.10	20.76	0.17	78.97	25,000	61,200
504	East Bleeder Near Fan	0.30	20.15	0.96	78.59	18,000	248,832
505	All return to fan except East Bleeder	0.12	20.75	0.27	78.86	41,000	159,408
	Total gas liberation April 6, 1937						408,240

as again started at top of 8 left off 2 West Mains is decidedly dangerous in a gassy mine.

Coal dust:

The coal is quite friable and in the operations of cutting, blasting and loading a large amount of fine coal dust is made, which is found deposited on roof, rib, timbers and floor throughout the mine. The cars, when kept in repair, are of solid construction without end-gates, and if they are not excessively topped the spillage on roadways should not be excessive; however, it was noticed on some parts of the main haulage entries that rock and track cleanings had been gobbed along the entries until the angle of repose had been attained and all crevices and offset ledges were completely loaded with fine coal and dust. Sampling in September, 1936, and March, 1937, shows that 20 to 25 percent of the mine's 20 mesh dust is of the impalpable fineness of 200 mesh dust, which is about the average condition found in coal mining.

The coal of the Eagle bed has a volatile to volatile plus fixed carbon ratio of about .36, which places it high in the class of flammable dust coals in the Bureau's tests and also is proven in practice by the destructive explosions in mines operating in this bed.

The reasons for a coal dust explosion are basically very simple. When fine coal dust is suspended in air it is in extremely intimate contact with the oxygen of the air; one might say almost "dissolved" in the oxygen: this gives a condition which is the basis of the manufacture of most high explosives; then when an ignition source of heat or flame is introduced, the combustion takes place with an extremely high speed of flame propagation which we call an explosion. If the coal dust is so

wetted, which is hard to do or maintain, so that it cannot be raised into a cloud in air, or if the dust is so admixed with incombustible matter that the burning combustible cannot maintain an ignition temperature, then there can not be a coal dust explosion.

The following table gives the results of analyses of dust samples taken during the investigation.

Samples B-20889 and B-20890 are representative samples of dust found on Roof and Rib and on Floor of normal room, and may be considered as an average dust condition in development.

Samples B-20885 and B-20886 are samples taken at each end of the water-filled sumps at 7 and 8 rooms between 11 and 12 right entries and are of almost identical character when air-dried; however, when picked up, sample B-20885 was water dripping mud, which was deposited over all surfaces and timbers outby the water hole, and produced when the explosion swept this water into suspension, and by which the flame of the explosion going outby toward 11 right entry was extinguished. It was found there had been flame at the point where Sample B-20886 was taken.

Sample B-20887, taken on curve going into 13 right entry is from a point of great violence and speed of the explosion.

Sample B-20888 is from the area in 14 right entries where the explosions met, and also shows an average condition of dust on secondary haulage.

The total incombustible, moisture plus ash, of the samples run from 10 percent to 26 percent. To make this dust non-explosive from 37 percent to 53 percent additional incombustible (rock dust) must be added.

Table 2.- Analyses of dust samples, MacBeth mine, March, 1937

Laboratory No.	Location in mine	Percent				Screen test Percent	
		Moisture	Volatile matter	Fixed carbon	Ash	On 20-mesh	Through 20-mesh
B-20887	Mouth of 13 right, 2 West	1.2	22.3	52.1	24.4		
B-20885	8 room, 11 right to 12 right, 2 x cut inby 11 right	1.1	23.3	52.0	23.6		
B-20886	8 room, first x cut inby 12 right A. C.	1.5	25.9	49.7	22.9		
B-20888	50' outby 7 room on 14 right A. C.	1.8	26.9	57.1	14.2		
B-20889	13 room 1 x cut inby 17 right A. C. Rib and Roof	1.0	21.8	67.6	9.6	15.4	84.6
B-20890	13 room 1 x cut inby 17 right A. C. Floor	.9	26.8	63.3	9.0	26.8	73.2
						48-mesh	55.6
						100-mesh	37.6
						200-mesh	26.2

Rock dust:

The Bureau of Mines has made exhaustive tests over many years on the effectiveness of rock dusting in preventing the ignition and propagation of coal dust explosions, and the test work has been confirmed by explosions in operating mines being stoped by properly applied rock dust.

There is no advantage, or possibility of preventing a mine explosion, by use of rock dust in an inadequate amount or improperly applied. This has been clearly demonstrated at this mine, where it is reported some rock dusting had been done before both the September, 1936, explosion and also before the March, 1937, explosion.

Rock dust must be applied to every surface of the mine, entries, airways, rooms and cross cuts and preferably kept within twenty feet of the working faces. The amount of rock dust must be sufficient to give, in representative samples carefully taken from all parts of the mine at intervals of not over 500 feet, total incombustible content of not less than 65 percent, where the air traveling is free from methane, and 70 percent where up to one percent of methane may be present.

Since it is almost impossible to obtain these percentages where rock dust is superimposed on large deposits and accumulations of fine coal dust, it is advisable to wash down the heavy coal dust deposits with water before the rock dust is applied. This will allow a saving in rock dust and assure a high incombustible content, which will stand pollution for a longer period before re-dusting is necessary.

To protect the efficiency of the rock dust and extend the interval between re-dusting periods, many companies use water on cutting

machines and to wet coal pile and wash down face areas while loading, so that the fine coal dust is not thrown into the air current and carried and later deposited on the mine surfaces. Where such use of water at the face is practiced, the Bureau has reports of companies having rock dust remain effective for two years as compared to three months where water was not used.

Rescue and recovery operations:

About 7:50 p.m. March 11, the night mine foreman and a crew of 27 men, who were on the slope bottom, felt a concussion and were enveloped by dust. There was no question but that all of these men realized an explosion had occurred, and most of them immediately ran to the surface. The night foreman called the surface from the slope bottom and requested that the mine foreman be notified and that the chief mechanic check on the condition of the fan. Recovery work was begun immediately and the first band of men, headed by the mine foreman, K. W. Stafford, using a locomotive for transportation met a machine crew, which had been working in 11 right entry, on the Second West Mains. This machine crew had survived the forces of the explosion and had found and were riding a locomotive which a track man had abandoned at 8 right entry. The rescuers and the machine crew traded locomotives, with the latter continuing to the surface.

The first rescue crew pulled the power off the Main North entry as they advanced on the 2 West Mains. This act caused the brakeman on a locomotive in the North entry to investigate the cause of the loss of power. He learned of the explosion and returned up the North entry to warn about 12 men that an explosion had occurred. All of these men

came from the mine unassisted.

State mine inspector R. V. Waldron was notified, in Logan, of the explosion and was underground in the mine by 8:30 p.m. He was closely followed by Inspector J. H. Hansford. Other state inspectors who followed later were: Chief Inspector M. P. Rhinehart, Young Lawson, R. L. Jenkins, W. L. Lyons, E. L. Chatfield, N. W. Jones, I. O. Shumate, and R. Lilly, and Mine-rescue Instructor H. P. Farley.

The Bureau of Mines was notified by the Associated Press about 8:30 p.m. Messrs. G. W. Grove, K. L. Marshall, M. C. McCall, F. E. Griffith, Harry Burdelsky, and Edward Thomas assisted in recovery work. Mr. Thomas arrived at the mine about 1:30 a.m. March 12 and accompanied M. C. McCall into the mine at 6 a.m., the latter having reported at 5 a.m.

Rescue teams, one from Charples, W. Va., and the other from Dehue, W. Va., reported and were in the mine within an hour after the explosion occurred. Teams from Omar, W. Va., Holden, W. Va., and Chattaroy, W. Va. arrived later and assisted with the recovery work.

The first rescue party located and recovered the bodies of a motorman and brakeman about 9:30 p.m. The motorman was found on the 2 West Main haulway outby 13 right entry while the brakeman was found on the side track in the adjoining intake airway. Both men had been killed by violence, the brakeman having had both shoes and a leg blown off. The interval of time between the finding of the first two bodies and 6 a.m. of the 12th was devoted to the restoration of the ventilation in 2 West Mains to 16 right entry. At 7 a.m. the body of the section foreman, who had also been killed by violence, was found on 16 right entry between 1 and 2 room. Later in the day bodies were recovered in

13 and 14 rooms off the 16 right air course and in 14 and 13 rooms off 17 right entry. At this point recovery operations were made impossible by roof conditions, falls and inadequate ventilation. Recovery operations were then begun in 14 right entry off 2 West Mains, and later in the day two machine men were recovered in 14 room outby 13 right entry (source of ignition).

A concentrated rock loading and clean-up schedule to enter the 17 and 18 right territory was then started. On the 14th a miner's body was recovered from the 18 right entry air course from a point in line with 5 room. On the 15th a body was recovered from a breakthrough near the face of number 11 room and another body was recovered in the breakthrough between 11 and 12 rooms off/right entry. All of the recovery was seriously hampered by falls of roof and the remaining 4 bodies were under and back of a fall in 18 right entry and air course. This fall had caved the length of the entry to a height of about 8 feet. To facilitate the recovery of these bodies it was decided to extend 12 room off 17 right entry to intersect the face of 18 right entry and air course, thus making it possible to continue recovery work from the faces of 18 right and from 10 room off 17 right entry. On March 24 a body was recovered near the face of 18 right air course. On the 26th a body was recovered in the last breakthrough in 18 right entry. On the 27th the remaining 2 bodies were recovered, one in the last breakthrough in 18 right entry and the other inby the same breakthrough.

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Origin and scope of explosion:

The action of the explosion as reconstructed by the writers during an investigation lasting ten days after the recovery of the bodies,

is thought to be as follows:

An accumulation of gas was ignited by electric arc from sliding the nip of the trailing cable of the mining machine on the trolley wire as it was being trammed out of 13 right workings to the high point of 14 room (barrier room) east of 13 right entry (see map). Controls show this machine was moving out, having completed cutting in this section. Dust was ignited and propagated the explosion south and west from this point. Propagation eastward at this point was prevented by water and damp conditions.

The explosion went down 13 right entry with great force, obliterating concrete block seals at the mouth of these entries, then spread both inby and outby on the Second West entries. Outby the explosion died out; due, it is believed, to rock dust, road sand, standing water or damp conditions, and room for expansion. Going inby on the Second West entries, the explosion attained tremendous velocity, in both main intakes and in the manways, reaching estimated speeds of 12,000 feet a second or greater as indicated by streamlined dust deposits on reverse side of standing posts. The explosion propagated with great speed and violence into 14 right entry; and although there are indications that the upper section of this entry was inflamed by the original ignition, yet the ingoing forces on 14 entry were much greater than the outgoing forces, which appear to have met at about 8 room.

The initial explosion traveled westward through 13 and 14 rooms (barrier) with flame and considerable speed, throwing stoppings at head of 13 right outby, and going into 16 right with flame and violence from the inby end of rooms 13 and 14 even though there were some local pools of water at that point.

Uncompleted rooms on 16 and 17 right entries showed coke as the flames burned out in these places; rooms 10 and 9 outby were completed, and the explosion flamed through them into 18 right work and faces, where it hit with force sufficient to wreck three cars ahead of a gathering motor in 18 right air course. The explosion's force outby on 16, 17, and 18 right was met by the force coming inby from the Second West entries, up 15, 16, and 18 right, at about the line of 5 and 6 rooms crossing these entries and from which 17 right entries were picked up. The entire Second West Section inby 11 right entries was inflamed, outby 11 right forces did damage to stoppings and doors as far as 9 left, and the blast caused a dust cloud to form clear to the main slope.

Conclusions:

The writers are of the opinion that this explosion was caused by inadequate ventilation, distributed in a most unsafe manner, due to the wide deviation from the original mine projection and system of development.

The immediate ignition source was most likely the electric arc, between nip of cable and trolley wire, while tramming a nonpermissible arcwall mining machine from room 13 to the high point in room 14 off 13 right entry of 2 West Main.

This point is probably not over 20 feet from the point given as the most probable point of ignition of the explosion of September 2, 1936, by a nonpermissible gathering locomotive.

Recommendations:

The U. S. Bureau of Mines has not, nor desires, any regulatory authority over privately owned coal mines. Investigations, reports and

recommendations are made, not in a critical sense, but in the hope that the information obtained and adoption of recommendations made will prevent the occurrence of future disasters and add to the safety and efficiency of the mines in this country.

The writers recommend that:

Ventilation

1. Main airways, both intake and return, should be cleaned up or provided, as by driving new parallel entries and extending First and Third Main West Entries, so that at least 100,000 cubic feet of air per minute will enter the mine and not less than 75 percent of the total will be available in the active face workings.

2. Overcasts should be erected and the air so split that neither men nor machinery shall have to work in air that has passed through or by a worked-out or abandoned area.

3. All permanent stoppings (those having an expected duty of over one year) should be built of incombustible material and be kept air tight.

4. Projections should be made, and so followed in development that the air may be carried in the most simple and direct manner to the faces, without "looping", and with the use of a minimum number of doors.

5. Where doors are used they should be erected in pairs (air-locks) at such a distance apart that a trip of cars may be taken through without having more than one door open at a time, or causing a direct short-circuiting of the air.

6. At least 10,000 cubic feet of air per minute should be passed through the last open cross cut, at the furthest duty of each

split, and further, where check-curtains, or temporary door and line-brattice must be used, a quantity of air should be provided so that not more than one-third of the available air need be forced behind such line-brattice to maintain a clear and safe condition at the face.

Rock dust

7. The application of rock dust should be continued until all openings (entries, air courses, rooms and breakthroughs) are adequately dusted.

8. A sufficient quantity should be applied so that the average analyses of samples of roof, rib, and floor dust of all openings shall show at least 63 percent of incombustible material.

9. Rock dust should be kept advanced at all times to include the last open breakthrough, and preferably be kept to within about 20 feet of the face.

10. To make it more readily possible to attain a sufficiently high incombustible content in the rock dusted openings, accumulated coal dust should be washed from ribs, roof, and timbers before applying rock dust, and further to increase the effective life of the rock dust applications it is suggested that the use of water on cutting machines and for washing down and wetting the face regions before blasting and while loading out the coal should be considered.

Electrical equipment

11. Only permissible electrical equipment should be used, when such equipment is to be used, in other than pure intake air, fresh from the outside. Such equipment, if used, should be maintained in a permissible condition at all times.

Blasting

12. Blasting, even with permissible explosives, should be done in a permissible manner under proper regulations, as to handling, storage and procedure and also with full supervision of competent officials.

Inspection

13. Inspections for explosive gas and other conditions should be made by a competent official before miners enter a working place, before and after blasting, and before a mining machine or other electrically operated equipment enters a working place.

Mine rescue training

14. A crew of not less than ten selected men accustomed to hard work under conditions in this mine should be trained in the use of oxygen breathing apparatus, and be kept efficient by regularly scheduled practice and study periods.

Acknowledgments:

The writers wish to express their appreciation for the cooperation shown and courtesies extended by officials of the operating company and the Chief of the West Virginia Department of Mines and his personnel.

Respectfully submitted,

K. L. Marshall

K. L. MARSHALL
Mining Engineer

M. C. McCall

M. C. McCALL
Assistant Mining Engineer

APPENDIX

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 939 Laboratory No. 61464

Sample of mine air

Mine MacBeth Operator Hutchinson C. Co.

State W. Va. County Logan

Town MacBeth Name of coal bed Eagle

Location in mine 40' Outby pump 14 room 14 right

Method of sampling vac Date sampled 4-2-37 Hour noon

Velocity air -- Area -- Quantity --

Pressure on seal Barometer: Inside Outside

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

Mailed Received 4-9-37

Collector K. L. Marshall, Mining Eng.
(Name and title)

Laboratory No.	61464		Ethane (C_2H_6)		
Bottle No.	939				
Carbon dioxide (CO_2)	0.05		Hydrogen sulphide (H_2S)		
Oxygen (O_2)	20.54		Unsaturated hydrocarbons (C_2H_4, etc.).		
Hydrogen (H_2)			Sulphur dioxide (SO_2)		
Carbon monoxide (CO)					
Methane (CH_4)	1.79				
Nitrogen (N_2)	77.62				
Total	100.00				

Remarks:

Date 4-16-37 (Signed) L. B. Berger for H. H. Schrenk
Chemist.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 502 Laboratory No. 61456

Sample of mine air

Mine MacBeth Operator Hutchinson C. Co.

State W. Va. County Logan

Town MacBeth Name of coal bed Eagle

Location in mine 18 right S.C. out by last Xcut

Method of sampling Vac. Date sampled 4-5-37 Hour 10 a.m.

Velocity air Area Quantity

Pressure on seal Barometer: Inside Outside

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

Mailed Received 4-9-37

Collector K. L. Marshall Mining Eng.
(Name and title)

Laboratory No.	61456		Ethane (C_2H_6)		
Bottle No.	502				
Carbon dioxide (CO_2)	0.04		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)	0.24				
Nitrogen (N_2)	78.96				
Total	100.00				

Remarks:

Date 4-16-37 (Signed) L. B. Berger for H. H. Schrenk, Chemist.

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6-213

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 782 Laboratory No. 61463

Sample of mine air

Mine MacBeth Operator Hutchinson C. Co.

State W. Va. County Logan

Town MacBeth Name of coal bed Eagle

Location in mine Pillar 10 Room 11 Rt off 2 W Main

Method of sampling Vac. Date sampled 3-23-37 Hour 12:20 p.m.

Velocity air -- Area -- Quantity --

Pressure on seal Barometer: Inside Outside

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

Mailed Received 4-2-37

Collector K. L. Marshall, Mining Eng.
(Name and title)

Laboratory No.	61463		Ethane (C_2H_6)		
Bottle No.	782				
Carbon dioxide (CO_2)	0.18		Hydrogen sulphide (H_2S)		
Oxygen (O_2)	20.52		Unsaturated hydrocarbons (C_2H_4, etc.)		
Hydrogen (H_2)			Sulphur dioxide (SO_2)		
Carbon monoxide (CO)					
Methane (CH_4)	1.37				
Nitrogen (N_2)	77.93				
Total	100.00				

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Remarks:

Date 4-16-37 (Signed) L. B. Berger for H. H. Schrenk.
Chemist.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 780 Laboratory No. 61461

Sample of mine air

Mine MacBeth Operator Hutchinson C. Co.

State W. Va. County Logan

Town MacBeth Name of coal bed Eagle

Location in mine Pick up off 12 a.c. above 8 room

Method of sampling Vac. Date sampled 3-30-37 Hour 10 a.m.

Velocity air -- Area -- Quantity --

Pressure on seal ____ Barometer: Inside ____ Outside ____

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

Mailed ____ Received 4-9-37

Collector C. L. Marshall, Mining Eng.
(Name and title)

Laboratory No.	61461		Ethane (C_2H_6)		
Bottle No.	780				
Carbon dioxide (CO_2)	0.04		Hydrogen sulphide (H_2S)		
Oxygen (O_2)	20.90		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				

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Chemist.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 779 Laboratory No. 61460

Sample of mine air

Mine MacBeth Operator Hutchinson C. Co.

State W. Va. County Logan

Town Macbeth Name of coal bed Eagle

Location in mine Mainway 30' outby 2 Right 2 W Main

Method of sampling Vac. Date sampled 3-23-37 Hour 1 p.m.

Velocity air 2 32 Area 132 Quantity 8230

Pressure on seal ____ Barometer: Inside ____ Outside ____

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

Mailed ____ Received 4-9-37

Collector K. L. Marshall, Mining Eng.
(Name and title)

Laboratory No.	61460		Ethane (C_2H_6)		
Bottle No.	779				
Carbon dioxide (CO_2)	0.08		Hydrogen sulphide (H_2S)		
Oxygen (O_2)	20.74		Unsaturated hydrocarbons (C_2H_4, etc.).		
Hydrogen (H_2)			Sulphur dioxide (SO_2)		
Carbon monoxide (CO)					
Methane (CH_4)	0.34				
Nitrogen (N_2)	78.84				
Total	100.00				

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Remarks: ____

Date 4-16-37 (Signed) L. B. Berger for H. H. Schrenk.
Chemist.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 781 Laboratory No. 61462

Sample of mine air

Mine MacBeth Operator Hutchinson C. Co.

State W. Va. County Logan

Town MacBeth Name of coal bed Eagle

Location in mine 1st left off 3 east at Blank entry

Method of sampling vac. Date sampled 3-25-37 Hour 1 p.m.

Velocity air 195 Area 74.7 Quantity 14,560

Pressure on seal ____ Barometer: Inside ____ Outside ____

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

Mailed ____ Received 4-9-37

Collector K. L. Marshall, Mining Eng.
(Name and title)

Laboratory No.	61462		Ethane (C_2H_6)		
Bottle No.	781				
Carbon dioxide (CO_2)	0.10		Hydrogen sulphide (H_2S)		
Oxygen (O_2)	20.78		Unsaturated hydrocarbons (C_2H_4, etc.).		
Hydrogen (H_2)			Sulphur dioxide (SO_2)		
Carbon monoxide (CO)					
Methane (CH_4)	0.30				
Nitrogen (N_2)	78.82				
Total	100.00				

Remarks: ____

Date 4-16-37 (Signed) L. B. Berger for H. H. Schrenk.
Chemist.

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UNITED STATES
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BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 940 Laboratory No. 61465

Sample of mine air

Mine MacBeth Operator Hutchinson C. Co.

State W. Va. County Logan

Town MacBeth Name of coal bed Eagle

Location in mine Mouth of 12 left

Method of sampling Vac. Date sampled 4-5-37 Hour 11 a.m.

Velocity air 75.5 Area 88 Quantity 6650

Pressure on seal ____ Barometer: Inside ____ Outside ____

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

Mailed ____ Received 4-9-37

Collector H. L. Marshall, Mining Eng.
(Name and title)

Laboratory No.	61465		Ethane (C_2H_6)		
Bottle No.	940				
Carbon dioxide (CO_2)	0.07		Hydrogen sulphide (H_2S)		
Oxygen (O_2)	20.86		Unsaturated hydrocarbons (C_2H_4, etc.).		
Hydrogen (H_2)			Sulphur dioxide (SO_2)		
Carbon monoxide (CO)					
Methane (CH_4)	0.26				
Nitrogen (N_2)	78.81				
Total	100.00				

Remarks: ____

Date 4-16-37 (Signed) L. B. Berger for H. H. Schrenk.
Chemist.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 501 Laboratory No. 61455

Sample of mine air

Mine MacBeth Operator Hutchinson C. Co.

State W. Va. County Logan

Town MacBeth Name of coal bed Eagle

Location in mine at Bore hole pump station

Method of sampling Vac. Date sampled 4-6-37 Hour 11:15 a.m.

Velocity air -- Area -- Quantity --

Pressure on seal ____ Barometer: Inside ____ Outside ____

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

Mailed ____ Received 4-9-37

Collector K. L. Marshall, Mining Eng.
(Name and title)

Laboratory No.	61455		Ethane (C_2H_6)		
Bottle No.	501				
Carbon dioxide (CO_2)	0.16		Hydrogen sulphide (H_2S)		
Oxygen (O_2)	20.62		Unsaturated hydrocarbons (C_2H_4, etc.).		
Hydrogen (H_2)			Sulphur dioxide (SO_2)		
Carbon monoxide (CO)					
Methane (CH_4)	0.37				
Nitrogen (N_2)	78.85				
Total	100.00				

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Remarks: ____

Date 4-16-37 (Signed) L. B. Berger for H. H. Schrenk.
Chemist.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 503 Laboratory No. 61457

Sample of mine air

Mine MacBeth Operator Hutchinson C. Co.

State W. Va. County Logan

Town MacBeth Name of coal bed Eagle

Location in mine 0 cast from west side

Method of sampling Vac. Date sampled 4-6-37 Hour 11 a.m.

Velocity air 415 Area 61.5 Quantity 25,522

Pressure on seal Barometer: Inside Outside

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

Mailed Received 4-9-37

Collector K. L. Marshall, Mining Eng.
(Name and title)

Laboratory No.	61457		Ethane (C_2H_6)		
Bottle No.	503				
Carbon dioxide (CO_2)	0.10		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)	0.17				
Nitrogen (N_2)	78.97				
Total	100.00				

Remarks:

Date 4-16-37 (Signed) L. B. Berger for K. L. Schrenk.
Chemist.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 504 Laboratory No. 61458

Sample of Mine air

Mine MacBeth Operator Hutchinson C. Co.

State W. Va. County Logan

Town MacBeth Name of coal bed Eagle

Location in mine East Bleeder

Method of sampling Vac. Date sampled 4-8-37 Hour 11 a.m.

Velocity air 330 Area 54 Quantity 17,820

Pressure on seal ____ Barometer: Inside ____ Outside ____

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

Mailed ____ Received 4-9-37

Collector K. L. Marshall Mining Eng.
(Name and title)

Laboratory No.	61458		Ethane (C_2H_6)		
Bottle No.	504				
Carbon dioxide (CO_2)	0.30		Hydrogen sulphide (H_2S)		
Oxygen (O_2)	20.15		Unsaturated hydrocarbons (C_2H_4, etc.)		
Hydrogen (H_2)			Sulphur dioxide (SO_2)		
Carbon monoxide (CO)					
Methane (CH_4)	0.96				
Nitrogen (N_2)	78.59				
Total	100.00				

Remarks: ____

Date 4-16-37 (Signed) L. B. Berger for H. H. Schrenk.
Chemist.

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UNITED STATES
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BUREAU OF MINES

GAS ANALYSIS REPORT

Bottle No. 505 Laboratory No. 61459

Sample of mine air

Mine MacBeth Operator Logan

State W. Va. County Logan

Town MacBeth Name of coal bed Eagle

Location in mine Return of North & East to fan

Method of sampling vac Date sampled 4-6-37 Hour 9 a.m.

Velocity air 700 Area 59 Quantity 41,300

Pressure on seal Barometer: Inside Outside

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

Mailed Received 4-9-37

Collector K. L. Marshall, Mining Eng.
(Name and title)

Laboratory No.	61459		Ethane (C_2H_6)		
Bottle No.	505				
Carbon dioxide (CO_2)	0.12		Hydrogen sulphide (H_2S)		
Oxygen (O_2)	20.75		Unsaturated hydrocarbons (C_2H_4, etc.).		
Hydrogen (H_2)			Sulphur dioxide (SO_2)		
Carbon monoxide (CO)					
Methane (CH_4)	0.27				
Nitrogen (N_2)	78.86				
Total	100.00				

Remarks:

Date 4-16-37 (Signed) L. B. Berger for H. H. Schrenk.
Chemist.

6—8409 U. S. GOVERNMENT PRINTING OFFICE

Form 6–137

U. S. BUREAU OF MINES

E—DESCRIPTION OF MINE

(1) State West Virginia (2) County Logan (3) Town MacBeth (Post office.)

(4) Mine sample of Dust (Material—for coal give classification.) (5) Coal field Logan (6) District Rum Creek

(7) Mine MacBeth (a. Name.) Slope (b. Kind of opening—if shaft give depth.) 600' (c. Height of opening above sea level.)

(d. Distance and direction from town.) (e. Sec., T., and R., if necessary.) C. & O. (f. Railroad connections.)

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

(8) Coal bed Eagle (a. Name.) (b. Geologic system.)

(c. Formation.) 1.8 W. (d. Dip, degrees.) (e. Strike, direction.)

(9) Mining system (Long wall, room and pillar, panels, etc.) (10) Undercutting Top Cutting (Hand or machine.)

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

(12) Operator Hutchinson Coal Co., MacBeth (Name and address.)

(13) Sales agent (Name and address.)

(14) Output per day 1300 (Average—gross or net tons.) (15) Maximum day's output 1400 (During past year.) (16) Last year's output (Gross or net tons.)

(17) Output from advance workings, per cent (At present.) (18) Lifetime of mine (Years—estimated.)

(19) Run-of-mine, per cent (Of output shipped.) (20) Is coal screened? (21) Type of screens

(22) Type of washer (23) Per cent of coal washed

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

(26) Sizes produced (Of coal not washed.) (27) Is coal picked? (State whether on car or belt.)

(28) Per cent of coal coked (At mine.) (29) Sizes coked (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. 1, 2, 3, 4, 5, and 6. (Give Nos. of all samples forwarded.)

(33) Laboratory Nos. B-20885 to B-20890 inclusive. (Laboratory to fill in immediately below corresponding can number.)

(34) Mine sampled at 5 (Number.) points, by K. L. Marshall, Pgh., Pa. (Collector.) (Office.) on Apr. 5, 1937, 19 (Date.)

Above information copied from Card A by F.E.H. on April 12, 1937., 19

6—6372

6-261

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

DUST-ANALYSIS REPORT

Test No. _____ Lab. No. B-20890

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

Operator Hutchinson Coal Co., MacBeth Mine MacBeth

State W. Va. County Logan Bed Eagle

Town MacBeth

Location in mine 13 Room 1 X cut inby 17 Rt. A. C.

Method of sampling Standard Gross weight, lbs. _____ Net weight, gms. 104.0

Date of sampling 4/5/37 Date of Lab. sampling 4/10/37 Date of analysis _____

For B. of M. section Mine Accident Collector K. L. Marshall

	Air-dry Loss .0	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		.9		
	Volatile matter		26.8	27.0	29.7 [a]
	Fixed carbon		63.3	63.9	70.3
	Ash		9.0	9.1	
			100.0	100.0	100.0
Ultimate Analysis	Hydrogen				
	Carbon		GRAMS	PERCENT	
	Nitrogen On 20-mesh		38.0	26.8	
	Oxygen Through 20-mesh		104.0	73.2	
	Sulphur Total wt. of sample		142.0	100.0	
	Ash				
Calorific value determined	Calories				
	British thermal units				

Screen test,		Cumulative per cent.
through 20 mesh		100
through 48 mesh		55.6
through 100 mesh		37.6
through 200 mesh		26.2

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

Date, April 14, 1937 (Signed) H. M. Cooper, *Chemist.*

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

U. S. GOVERNMENT PRINTING OFFICE 6—8752

6-261

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

DUST-ANALYSIS REPORT

Test No. _____ Lab. No. B-20887

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

Operator Hutchinson Coal Co., MacBeth Mine MacBeth

State W. Va. County Logan Bed Eagle

Town MacBeth

Location in mine Mouth of 13 Rt.

Method of sampling _____ Gross weight, lbs. _____ Net weight, gms. 56.0

Date of sampling 4/1/37 Date of Lab. sampling 4/10/37 Date of analysis _____

For B. of M. section Mine Accident Collector K. L. Marshall

	Air-dry Loss .0	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		1.2		
	Volatile matter		22.3	22.6	30.0 [a]
	Fixed carbon		52.1	52.8	70.0
	Ash		24.4	24.6	
			100.0	100.0	100.0
Ultimate Analysis	Hydrogen				
	Carbon				
	Nitrogen				
	Oxygen				
	Sulphur				
	Ash				
Calorific value determined	Calories				
	British thermal units				

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

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

Date, April 14, 1937 (Signed) H. N. Cooper., *Chemist.*

[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-20885

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

Operator Hutchinson Coal Co., MacBeth Mine Mac Beth

State W. Va. County Logan Bed Eagle

Town MacBeth

Location in mine 8 room, 11 Rt. to 12 Rt. at 2nd x cut inby 11 Rt.

Method of sampling Grab Gross weight, lbs. _____ Net weight, gms. 34.0

Date of sampling 3/31/37 Date of Lab. sampling _____ Date of analysis 4/10/37

For B. of M. section Mine Accident Collector K. L. Marshall

	Air-dry Loss	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		1.1		
	Volatile matter		23.3	23.6	31.0 [a]
	Fixed carbon		52.0	52.5	69.0
	Ash		23.6	23.9	
			100.0	100.0	100.0
Ultimate Analysis	Hydrogen				
	Carbon				
	Nitrogen				
	Oxygen				
	Sulphur				
	Ash				
Calorific value determined	Calories				
	British thermal units				

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

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

Date, April 14, 1937 (Signed) H. H. Cooper., *Chemist.*

[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. S-20886

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

Operator Hutchinson Coal Co., MacBeth Mine MacBeth

State W. Va. County Logan Bed Eagle

Town MacBeth

Location in mine 8 room first X-cut inby 12 Rt. A.C.

Method of sampling Grab Gross weight, lbs. _____ Net weight, gms. 169.0

Date of sampling 3/31/37 Date of Lab. sampling 4/10/37 Date of analysis _____

For B. of M. section Mine Accident Collector K. L. Marshall

	Air-dry Loss .6	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture	1.0	1.5		
	Volatile matter	26.1	25.9	26.4	34.3 [a]
	Fixed carbon	49.8	49.7	50.3	65.7
	Ash	23.1	22.9	23.3	
		100.0	100.0	100.0	100.0
Ultimate Analysis	Hydrogen				
	Carbon				
	Nitrogen				
	Oxygen				
	Sulphur				
	Ash				
Calorific value determined	Calories				
	British thermal units				

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

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

Date, April 14, 1937 (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-20888

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

Operator Hutchinson Coal Co, MacBeth Mine MacBeth

State W. Va. County Logan Bed Eagle

Town MacBeth

Location in mine 50' outby 7 room 14 Rt. A. C.

Method of sampling Grab Gross weight, lbs. _____ Net weight, gms. 124.0

Date of sampling 4/4/37 Date of Lab. sampling _____ Date of analysis 4/10/37

For B. of M. section Mine Accident Collector K. L. Marshall

		Air-dry Loss .8	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		1.0	1.8		
	Volatile matter		27.1	26.9	27.3	32.0 [a]
	Fixed carbon		57.6	57.1	58.2	68.0
	Ash		14.3	14.2	14.5	
			100.0	100.0	100.0	100.0
Ultimate Analysis	Hydrogen					
	Carbon					
	Nitrogen					
	Oxygen					
	Sulphur					
	Ash					
Calorific value determined	Calories					
	British thermal units					

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

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

Date, April 14, 1937 (Signed) H. M. Cooper., *Chemist.*

[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-20889

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

Operator Hutchinson Coal Co., MacBeth Mine MacBeth

State W. Va. County Logan Bed Eagle

Town MacBeth

Location in mine 13 Room 1 X cut 1nby 17 Rt. A. C.

Method of sampling Standard Gross weight, lbs. _____ Net weight, gms. 44.0

Date of sampling 4/5/37 Date of Lab. sampling _____ Date of analysis 4/10/37

For B. of M. section Mine Accident Collector K. L. Marshall

	Air-dry Loss .0	Coal (Air dried)	Coal (As received)	Coal (Moisture free)	Coal (Moisture and ash free)
Proximate Analysis	Moisture		1.0		
	Volatile matter		21.8	22.0	24.3 [a]
	Fixed carbon		67.6	68.3	75.7
	Ash		9.6	9.7	
			100.0	100.0	100.0
Ultimate Analysis	Hydrogen				
	Carbon		GRAMS	PERCENT	
	Nitrogen	On 20-mesh	8.0	15.4	
	Oxygen	Through 20-mesh	44.0	84.6	
	Sulphur	Total wt. of sample	52.0	100.0	
	Ash				
Calorific value determined	Calories				
	British thermal units				

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

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

Date, April 14, 1937 (Signed) H. M. Cooper., *Chemist.*

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

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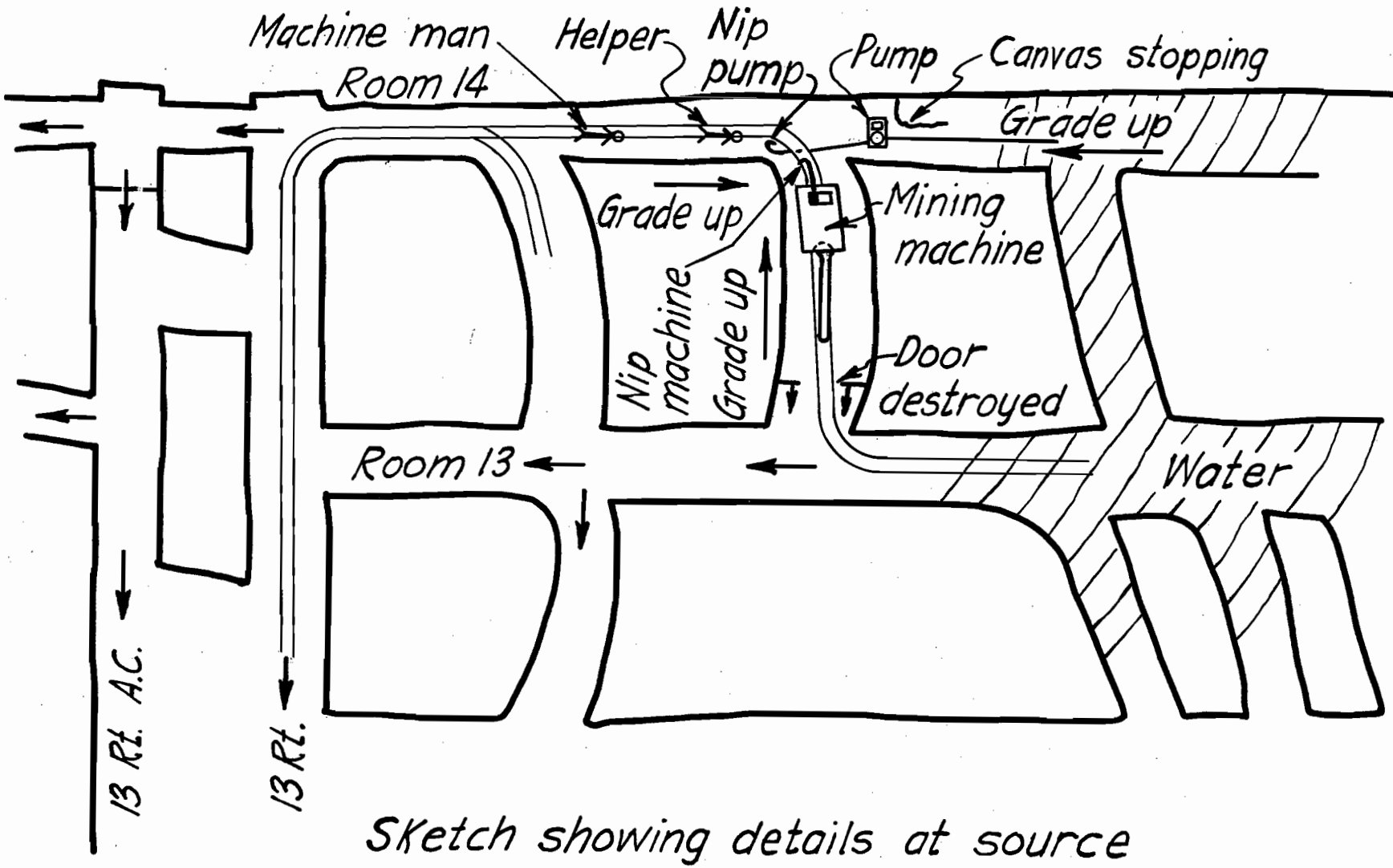

Sketch showing details at source of explosion, MacBeth Mine.

Mar. 11, 1937

M.C.M.S