Reports

FINAL REPORT ON A GAS AND DUST EXPLOSION IN THE NELMS MINE OF THE OHIO & PENNSYLVANIA COAL COMPANY AT NELMS, HARRISON COUNTY, OHIO, ON NOVEMBER 29, 1940

By

J. J. Forbes
Supervising Engineer
Safety Division

G. W. Grove
District Engineer

C. W. Owings
Mining Engineer

and

James Westfield, Jr.
Assistant Mining Engineer

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

CONTENTS

	Page
Introduction	1
General information	1
Location	1
Company officials	2
Mine openings	2
Coal bed	2
Underground mining methods, conditions, and equipment	3
Method of mining	3
Ventilation and gases	3
Haulage	10
Lighting	11
Machinery underground	11
Explosives	17
Drainage	18
Dust and rock dust	18
General safety conditions	28
First aid and mine rescue	28
Safety organization	28
Supervision and discipline	28
Mine conditions prior to explosion	28
Previous explosions in nearby mines	29
Explosion information	29
Story of the explosion	29
Recovery operations	29
Property damage	31
Details of forces and evidence	31
12 north	31
7 and 8 east	31
Room 10	32
Room 11	33
Room 12	34
Room 13	34
9 and 10 east	35
A, B, and C north	36
State inspectors' conclusions	38
Summary of evidence	39
Probable cause of the explosion	40
Lessons to be learned from the explosion	41
Commendable practices	41
Recommendations	41
Ventilation	41
Electricity	42
Dust	43
Explosives and blasting	44
General	45
Acknowledgment	45
Appendix	47
Mine map	
Sketch of explosion area	
Sketch showing details of explosion in room 13 off 7 and 8 east entries.	

FINAL REPORT ON A GAS AND DUST EXPLOSION IN THE NELMS MINE OF THE OHIO & PENNSYLVANIA COAL COMPANY AT NELMS, HARRISON COUNTY, OHIO, ON NOVEMBER 29, 1940

By J. J. Forbes, G. W. Grove, C. W. Owings, and James Westfield, Jr.

INTRODUCTION

A gas and dust explosion occurred in the Nelms mine of the Ohio & Pennsylvania Coal Company at Nelms, Ohio, about 1:20 p.m., November 29, 1940, while 135 men were underground. The 31 men in the 7 and 8 east section of the mine were killed from carbon monoxide poisoning and burns but the remaining 104 men escaped uninjured and unassisted from the mine. It is believed that the explosion was initiated at or near the face of room 13, driven from 8 east air course, by an ignition of gas from a permissible mining machine or an electric drill, both of which wore definitely in a non-permissible condition. It is believed that the electric drill was the most likely source of ignition. The explosion undoubtedly was propagated by gas and dust.

The explosion was restricted to the 7 and 8 east section, although forces extended beyond this area. Rock dust was applied along haulage roads and rock-dust barriers were said to have been erected in air courses in the explosion area, but the effect, if any, of the rock-dusting upon arresting the explosion could not be determined. Water is used to some extent during cutting of coal and tops of loaded cars are wetted before leaving the main side track for the shaft bottom. One of two mining machines in the explosion area was using water on the cutter bar.

The Bureau of Mines was notified of the explosion by the Associated Press about 3:15 p.m., November 29, 1940. F. E. Griffith, who was at Neffs, Ohio, was notified of the explosion and instructed by J. J. Forbes, supervising engineer of the Safety Division, to proceed to the mine; he arrived about 4:00 p.m. M. J. Ankeny, J. W. Pero, and F. G. Anderson left the Pittsburgh, Pa., station in a mine rescue truck at 3:45 p.m., arriving at the mine about 7:00 p.m. J. J. Forbes and G. W. Grove left Pittsburgh, Pa., about 8:00 p.m. and arrived at the mine about 10:30 p.m. About 5:00 a.m., November 30, 1940, C. W. Owings, James Westfield, Jr., H. R. Burdelsky, and E. E. Quenon were notified to proceed to the Nelms mine. All of these men except E. E. Quenon left Pittsburgh, Pa., at 5:30 a.m., arriving at the mine about 8:15 a.m.; Mr. Quenon arrived about 9:00 a.m. E. L. Christensen was later called at Johnstown, Pa., and he arrived at the mine shortly after noon of that day. The Bureau of Mines men entered the mine and assisted in restoring stoppings and advancing the air in the explosion area. Later they assisted in locating and recovering bodies of the dead men.

GENERAL INFORMATION

Location

The Nelms mine is situated at Nelms, Harrison County, Ohio, about 4 miles east of Cadiz, Ohio, which is the post office for the mine. The Wheeling & Lake Erie Railway serves the mine.

Company Officials

The Ohio & Pennsylvania Coal Company owns and operates the Nelms mine. The principal officials at the time of the explosion were:

J. C. Nelms	Vice President	Union Commerce Bldg., Cleveland, Ohio.
H. J. Nelms	General Superintendent	Cadiz, Ohio
John Mullon	Mining Engineer	Cadiz, Ohio
Robert Browning	Mine Foreman	(Deceased)

Mine Openings

Two shafts have been sunk to intersect the Middle Kittanning coal bed, about 452 feet from the surface at the shafts. The hoisting shaft is 12 feet wide and 18 feet long, supported with wooden timbering and wooden lagging. The material and air shaft is 13 feet wide and 22 feet 6 inches long, lined with brick and with a brick curtain wall between the supply and air compartments. The two shafts are about 200 feet apart.

Coal Bed

Development is in the Middle Kittenning coal bed, which is of the Carboniferous age, Pennsylvanian period, and the Allegheny formation. The average thickness of the bed is 6 feet, consisting mainly of coal, although a bony stratum, 1 to 3 inches thick, occurs near the middle of the bed. An occasional sulphur-bearing shale also occurs in the bed. Two samples of coal were taken underground in working sections of the mine. The analyses of these samples on an "as received" basis are:

	Laboratory No.	
	B-58359	B-58358
	Percent	Percent
Moisture	3.1	3.2
Volatile matter	38.0	36.7
Fixed carbon	48.5	52.3
Ash	10.4	7.8

The ratio of volatile matter to total combustible was 43.9 and 41.2, respectively.

The coal is overlain by a gray shale that breaks and falls readily. In parts of the mine a streak of coal 3 to 4 inches thick occurs several feet above the main bed, and this is overlain by a stratum of sandstone several feet thick. Where the thin streak of coal occurs, it is found that the roof falls frequently and in turn allows the sandstone to fall.

UNDERGROUND MINING METHODS, CONDITIONS, AND EQUIPMENT

Method of Mining

The present system of mining is a modified room-and-pillar, panel method. The distances between sets of entries vary, but on an average the cross or secondary main entries are 6,000 feet apart, six entries comprising each set. Room entries are generally driven triple, 16 to 18 feet wide, leaving a 24-foot pillar between entries. Crosscuts are 60 feet or less apart. Rooms are driven 250 feet long and 24 feet wide with a 13-foot pillar between rooms. Rooms are turned from the entries and air courses. The roof falls so readily that no pillars are extracted in most sections of the mine.

Coal is undermined at the face with Goodman Universal mining machines that are of a permissible type, but one of these machines in the explosion area was in a nonpermissible condition. A drilling crew accompanies the mining machine crew and drills the holes at the top of the coal bed and a snubbing hole about the center of the face while the coal is being undercut. The reports of the State mine inspector indicate that holes had been drilled on the solid prior to the explosion.

The mine is completely mechanized, all coal being loaded by Joy loading machines that are of a permissible type; but the machines examined did not have a permissible plate on them, and one machine in the explosion area was in a nonpermissible condition. The coal is loaded into mine cars that are hauled by open-type cable-reel locomotives. The loading machines obtain power from a feed wire, usually several break-throughs back from the face. The loading machines have twin-conductor cables that are attached to the feed wire and a ground wire with fused nips. The locomotives use a single-conductor cable.

Extensive timbering is required along the entries, posts, wooden crossbars, steel H-beams, and iron rails being employed to support the roof. In rooms posts and crossbars are set to hold the roof. Where the bars are so close to the face that they are in the way of the loading machine, a center post is set and the end post is removed during loading on one side and it is then reset. No timbering rules are formulated, but a timberman is a member of each loading unit and it is his duty to make the places safe. Apparently men are well protected at the working faces.

Ventilation and Gases

Air is exhausted from the mine by a Jeffrey 6- by 12-foot centrifugal fan, delivering about 108,742 cubic feet of air per minute against a water-gage pressure of 4.1 inches. The fan is housed in a brick building set about 20 feet from the shaft opening. A steel duct connects the fan to the shaft and steel doors allow the direction of the air to be changed. A steel explosion door is incorporated in the fan duct, directly over the air compartment of the shaft. The fan is run continuously, and if it stops for any reason men are required to leave the mine and are not allowed to re-enter until after a fire-boss examination of the mine has been made. Such an examination is not started until 3 hours after the fan has started running again.

The ventilating current is divided into four splits. According to company officials, the ventilation was coursed as described below. Practically all of the 3 and 4 south area has been worked out and concrete seals, said to average about 2 feet in thickness, have been erected across the abandoned entries. The air travels in on Nos. 1 and 2 south off main west as far as 13 and 14 west, at which point there is an overcast; from this point the air travels inby on the middle entries. Inby 27 and 28 east off 1 south the 1, 2, 3, and 4 south entries off main west are sealed and the air is directed into 1 and 2 west. A small part of the air splits and returns along 4 south, sweeping the seals; the rest of the air ventilates the faces of 1 and 2 west off 4 south, returns through 3 and 4 west off 4 south, and sweeps the seals across the 1, 2, 3, and 4 south entries. A regulator at this point controls the air in this split. The air travels along 1 south, crosses the overcast at 13 and 14 west, and returns along 3 and 4 south to the main return.

The main intake is again split at 14 south, the air intaking on 13 south air course, 13 south, and 14 south entries, passing to the face of these entries, ventilating No. 5 section near the face of 14 south, where a mechanical unit operates, and returning through the abandoned workings to the right and through 7 and 8 west to 15 and 16 south and 16 south air course to the main return.

The main split of air in the mine starts at main west, intaking 56,112 cubic feet of air per minute on 11 north air course, 11 north and 12 north entries, part of which is conducted to 7 east and 7 east air course in the explosion area. Prior to the explosion a door at B north and doors forming an air lock opposite room 11 deflected the air inby. The last two crosscuts between 7 and 8 east were open. Brattice-cloth curtains across 8 east and 8 east air course deflected the air into room 18 and across the faces of rooms 17, 16, and 15 to the faces of 1 and 2 butt rooms off room 13. Check curtains across room 13 just outby No. 1 butt room, and between 1 and 2 butt rooms, directed the air to the face of room 13.

Double and triple thicknesses of brattice cloth formed stoppings between rooms 13 and 14. A line of wooden stoppings was in the crosscuts between Nos. 10 and 11 rooms. The air passed across the faces of rooms 12 and 11 and through the last crosscut to room 10. There it divided, part passing through a regulator into 9 east and part returning through No. 10 room to 8 east and 8 east air course to B and C north. The air traveled up B and C north, ventilating rooms 1, 2, 3, and 4 off C north, then traveled into 9 and 10 east entries, joining the air current from room 10. The air current then swept the face of 10 east and 10 east air course and out 10 east air course to C north. Check curtains deflected some air into the rooms off 10 east air course. From the faces of C and B north, the air traveled down A north to 8 east and 8 east air course.

From 8 east the air passes out the 13 north, 14 north, and 14 north air courses to main west. The east entries between main west and 7 east have been sealed, with 6-inch pipes carrying air from these seals into the return air. The west butt entries inby main west are not sealed, the air being deflected into them.

A pair of airlock doors on the main west haulage road is installed in such a manner that air leaks through them to provide additional intake air to this split. A brattice-cloth stopping in the overcast on 2 main west about 150 feet inby 14 north deflects the air into 1 and 2 main west to 17 north, joining the additional air leaking through the airlock doors, ventilating these workings, where a mechanical loader was working, thence to the face of main west and into 24 south. In 24 south the air is coursed through 1 and 2 west, where another mechanical loader is working, then into 3 and 4 west, where still another unit is working, and to the pillar workings at the head of 24 south. These pillars are being extracted with a Joy loading unit. The air current returns from 24 south to 3 and 4 main west, ventilates the idle workings in 17 south, and thence out 3 and 4 main west to the fan.

On this split there are six Joy loaders with the regular units of mining machines, drills, and gathering locomotives. There are approximately 80 men on this split per shift.

A short split of air ventilates the seals across the main east entries.

Ventilation conditions on November 19, 1940, according to the company, were as follows:

The return from main south was 56,880 cubic feet of air per minute with a methane content of 1.7 percent, which is equivalent to liberation of methane at the rate of 1,392,422 cubic feet in 24 hours. The intake to 14 south was approximately 20,000 cubic feet of air per minute, the return from this section being measured with returns from the main west. The return from these two sections was 59,136 cubic feet of air per minute, which is close to the intake to these two areas of 56,112 cubic feet per minute measured by F. E. Griffith of the Bureau of Mines on December 6. This air was regulated on November 19 so that approximately 20,000 to 22,000 cubic feet of air per minute was directed inby main west into 7 and 8 east, and 18,000 or 19,000 cubic feet of air per minute was allowed to leak through airlock doors on main west haulage inby 14 south to join the return from 7 and 8 east. The return from 8 east and main west normally contains approximately 0.7 percent methane. The return from 14 south and main west on November 19 contained 1.15 percent methane in 59,136 cubic feet of air per minute, equivalent to liberation of 979,292 cubic feet of methane in 24 hours.

At the main overcast near the shaft on November 19, 1940, there was 103,659 cubic feet of air per minute with a methane content of 1.35 percent, equivalent to 2,015,131 cubic feet of methane in 24 hours. The main return on this day contained 1.32 percent methane in approximately 135,000 cubic feet of air per minute, measured in the center of the entry. On this basis the mine was liberating at that time 2,566,350 cubic feet of methane in 24 hours.

Air samples were collected in the explosion area and in the returns from the various splits in the mine on December 6, 1940. The analyses are given in table 1. Ventilation had been restored for about 24 hours, but the conditions indicated apparently are not entirely normal. In the explosion area at the face of room 13 off 8 east air course, the air contained 2.26 percent methane with the line brattice within about 8 feet of the face. As this

represents conditions one week after the explosion when less methane probably was being liberated than on the day of the explosion, it appears that there probably was an explosive mixture at or near the face at the time of the explosion. The velocity was too low to measure with an anemometer in room 10, but the air contained 1.08 percent methane. This represents the return from No. 2 section. The full return from sections No. 2 and No. 4 was 8,050 cubic feet per minute; and with a methane content of 1.60 percent, the liberation of methane was at the rate of 185,472 cubic feet in 24 hours. This is equivalent to 7,728 cubic feet in 1 hour, which is sufficient to form an explosive mixture of 5 percent methane, to fill an entry 2,209 feet long with a cross section of 70 square feet. If the door at the mouth of B north entry had been open for half an hour it could have allowed enough methane to accumulate to form an explosive mixture capable of filling over 1,000 feet of entry. Part of the intake to this section, measured on 7 east, 30 feet inby 11 north, contained 0.14 percent methane. The return from the explosion area, augmented by methane picked up from the old workings inby main west, measured in two entries, contained 1.15 percent methane in 17,374 cubic feet of air a minute, and 0.96 percent methane in 5,852 cubic feet of air a minute. The total liberation of methane in 24 hours averages 367,056 cubic feet from the explosion area.

The return air measured in 4 west entry and the parallel return entry contained 1.20 and 1.07 percent methane which, in the volumes of air coming from this section, indicated a liberation of 796,608 cubic feet of methane in 24 hours. Practically the full return measured near the shaft bottom contained 1.46 percent methane in 108,742 cubic feet of air a minute, indicating that more than 2 million cubic feet of methane is liberated in a day at the Nelms mine. These figures show that the classification of this mine as "gassy" by the State Division of Mines is justified.

According to company figures, the methane content in the returns from the main sections of the mine ranged from 1.15 to 1.7 percent. The analyses of samples collected by the Bureau of Mines following the explosion show that the returns were carrying from 0.96 to 1.92 percent methane, and the entire mine was liberating more than 2,000,000 cubic feet of methane in a day. Undoubtedly part of the methane shown in these samples is due to gas bleeding from the sealed areas. On the other hand, the methane in the returns from the active areas alone apparently ranges from 0.70 to over 1 percent methane. This mixture of air and gas indicates that at working places considerably higher concentrations may exist under normal conditions, and under abnormal conditions, such as may exist for a short time when the coal is undercut and drilled simultaneously, an exceptionally high concentration of methane is liable to occur at any time.

In a mine that liberates methane as rapidly as the Nelms mine, particularly during undercutting, drilling, and blasting, the air used to ventilate the working faces (usually four or five) of a section served by a mechanical unit (mining machine, drill, loading machine, and gathering locomotive) should pass directly into the return, and should not be used to ventilate any ohter active workings or pass over any other electrical equipment, whether permissible or nonpermissible.

TABLE 1. - Analysis of mine air samples collected in Nelms mine, December 6, 1940

Laboratory No.	Location in mine	Percent				Volume of air, cu. ft. per min.	Methane, cu. ft. in 24 hours
		Carbon dioxide	Oxygen	Methane	Nitrogen		
66504	Face of room 13, off 8 east air course	0.13	20.31	2.26	77.30	Low velocity	-
66505	Full return, section No. 2, near face of room 10, 8 east air course	0.15	20.55	1.08	78.22	do.	-
66502	8 east, 10 ft. inby 11 north, full return, sections Nos. 2 and 4	0.12	20.41	1.60	77.87	8,050	185,472
66499	7 east, 30 ft. inby 11 north, intake to sections 2 and 4	0.10	20.84	0.14	78.92	3,445	6,912
66493	1 west return, 30 ft. inby 12 north section	0.21	20.36	1.15	78.28	17,279	286,128
66494	2 west return, 60 ft. inby 12 north section	0.24	20.46	0.96	78.34	5,852	80,928
66496	Main west return	0.24	20.26	1.37	78.13	Low velocity	-
66497	4 west entry return air at main return	0.23	20.16	1.20	78.41	17,374	300,096
66503	In entry parallel to Lab. No. 66497	0.24	20.24	1.07	78.45	32,230	496,512
66498	At regulator in return from section No. 14 south	0.25	20.06	0.77	78.92	3,445	6,912
66501	30 ft. inby 4 south off main return	0.21	20.26	1.92	77.61	22,491	621,792
66495	40 ft. inby 3 south off main return	0.19	20.33	1.72	77.76	13,843	342,720
66500	Main east near upcast shaft, at bottom	0.06	20.71	0.19	79.04	Low velocity	-
66492	Main return near upcast shaft, at bottom	0.18	20.23	1.46	78.13	108,742	2,286,144

The practice of having a unit restricted to four or five working places necessitates cutting, drilling, and blasting a single working place two or three times during a shift. Evidence was found that the cutting and drilling alone in at least one place liberated one or more so-called feeders of gas, and in the same section on a preceding shift loading had to be discontinued at this working face due to the liberation of a dangerous quantity of methane. If this condition exists in this one place, there is at all times danger that it may occur elsewhere in the mine. Under these conditions there is at all times danger of an explosive mixture of methane and air being carried over the mining machines, drills, loading machines, and particularly over the open-type locomotives and pumps. This causes a grave hazard due to the fact that the mixture may not only be carried over the open-type equipment, which in itself may arc and cause an ignition of gas, but also carries the gas over the nips of the gathering locomotives as well as the loading machines and mining machines at the point of contact with the power wire. If for any reason strain is placed upon the cables, there is apt to be arcing or sparking at these contacts. In 10 east air course a definitely open-type locomotive was being operated on return air and the nip on the cable from this locomotive was attached to the power on the return air. This condition is not necessarily peculiar to the Nelms mine, but may exist in other mechanized mines.

The return air from the explosion area was carried into the main west section, where four additional mechanical units were being operated and on haulage roads where trolley locomotives were operated. Although additional air was taken into the circuit in the main west section, there was still a definite hazard from ignition of gas in view of the fact that if a sudden outburst of gas had occurred in the explosion area it could have been carried over four additional units besides the two in the 7 and 8 east section. The practice of not bonding the rails into the end of power lines creates a hazard from arcing or sparking at the rails when electrical equipment is operated at or near the faces. In addition to the hazard of gas itself, dust raised into suspension during mining operations increases the explosion hazard.

It is believed that the system of ventilation should be changed so that each working unit will be on a separate split and that the intake air should pass over the active workings into the worked-out or abandoned sections. For instance, in 8 east it would have been safer to have conducted the air up room 10, allowing it to sweep the faces of rooms 10, 11, 12, and 13, and then ventilate the faces of rooms 14 to 18 which had been abandoned. The air should be conducted to working faces by means of well-constructed line brattices, in sufficient volume to allow a velocity of at least 100 feet per minute to sweep the working face and as much more as is necessary to dilute the air below the danger point and to carry it away.

The main return on December 6, 1940, contained 1.46 percent methane, which is considered to be a definitely hazardous concentration. In fact, the Mine Safety Board in its Decision 9 states:

If the air in the split which ventilates any group of workings contains more than 1-1/2 percent of inflammable gas, these workings shall be considered to be in a dangerous condition, and only men who have been officially designated to improve the ventilation and are properly protected shall remain in or enter said workings.

To obtain a safe limit of methane, the volume of air flowing will probably have to be at least doubled.

It is recommended that the return air from any split should not contain more than 0.5 percent methane and, in order to do that, it probably will be necessary at least to double the amount of air now reaching the active working faces, inasmuch as the returns generally contained an average of more than 1 percent methane. Good mining practice is to have approximately 10,000 cubic feet of air per minute passing through the last break-through in each set of room entries in hand loading. Where the advance is so rapid in mechanical mining, and under conditions as found at the Nelms mine, it is believed that at least twice this volume of air should be made to circulate in the last break-through of each set of entries. In order to obtain the necessary increase in the volume of air, it is essential that air courses should be kept open and free of obstructions. Under present conditions in parts of the mine, two and three entries are used for return airways but, due to falls, frequently only one, occasionally two, of these entries are only partly open and, even so, the air is made to flow from one entry to the other, taking a zigzag path, and at times the air is directed upward due to a fall, all of these conditions increasing the resistance to air flow and making it difficult to pass the required amount of air.

It is recommended that the air courses be put in such condition that they will carry the air properly. In future development, particularly in the main west section, especially where it is proposed to carry the 15, 16, 17, and 18 north entries an estimated distance of 14,000 feet, care should be taken to timber the entries so that they will not fall in, cause obstructions, and make adequate ventilation difficult.

Returned air courses were traveled from A north to main south, and the conditions of these entries were observed. The entries were kept open throughout this section, but at a number of places the air could travel on only one of the three air courses. Concrete-block stoppings were used on the main entries; wooden stoppings were erected on secondary entries; and brattice-cloth stoppings were used in rooms and some less important entries. On the main entries, doors about 2 by 3 feet in cross section were placed in the stoppings opposite the abandoned butt entries.

Worked-out areas are securely sealed and vented with suitable pipes on return airways. In one area under seal a borehole has been drilled to the worked-out area, and at the top of the hole a 6-inch pipe is extended about 10 feet into the air, terminating in a 180° curved joint. This arrangement provides relief of pressure from the area. The sealed areas contribute largely to the methane in the main return air.

Line brattices are used extensively throughout the mine to course the air to the faces of rooms and entries. Wooden doors are employed to deflect air into room entries; these doors are generally erected singly, although they are occasionally erected in pairs to form air locks.

The mine is sectionalized, so that not more than two mechanical units operate in any one section. This is a commendable practice and may have been responsible for saving a number of lives in this explosion.

Air on the main returns near the shaft bottom is sampled periodically, and the samples are analyzed with a modified Orsat gas analysis apparatus. This is a commendable practice. It is recommended that the returns from each split be sampled at least once a week.

Four fire bosses are employed to make an examination of every working place and adjacent areas every morning before the second shift enters the mine. Each unit has a unit boss who tests for gas with a flame safety lamp. There is an assistant mine foreman on each shift in addition to a general mine foreman on the second shift and his assistant on the third shift.

The method of cutting and drilling simultaneously tends to increase the rate of liberation of methane during these operations, and for that reason more frequent testing for gas is required. It is believed that the unit foreman should test for explosive gas, not only before beginning to cut or to drill, but also at least every 15 minutes during cutting of coal; and if this is not feasible, then the machineman or driller should be required to hold a State certificate of competency as a fire boss, or equivalent, and he should test for gas before starting to cut or to drill and every 15 minutes during cutting and drilling or at the end of sumping, cutting across, and upon pulling out of the cut, as well as after drilling each hole in the coal.

Haulage

Rails on main haulage are 60- and 40-pound to the yard; in working sections 25-pound rails are used. The rails are laid on a 48-inch gage. The width of 18 feet on entries allows a clearance of 4 or more feet to be maintained on the side opposite the trolley wire. Shelter holes are provided not more than 60 feet apart, crosscuts being utilized for refuge in many instances. Wood and steel cars are provided for haulage, with swivel couplings so that the cars may be dumped in a rotary dump. The cars are tight and allow little fine coal to spill onto the road bed. The capacity of the cars is 5 tons, hand-loaded, but about 3-3/4 tons, loaded mechanically. Coal is hauled in the sections with 13 6-ton Goodman cable-reel locomotives, and on main haulage with two 10-ton Goodman trolley locomotives. Two 5-ton Goodman locomotives are used in the fresh air near the shaft bottom, their condition being such that they were ordered from the active sections of the mine by the mine inspector prior to the explosion.

Main haulage is on intake air, but much of the secondary or intermediate and section haulage is on return air. As far as could be determined, trolley wire is kept at least two break-through lengths from the face of entries and rooms, or in what is loosely termed "intake" air.

Lighting

Fixed lights are placed at turnouts from the main haulage, at pumps, and at other special points where lights are required. Miners wear permissible Portable Lamp and Equipment Company cap lamps; and the mine foremen, section bosses, and fire bosses also carry permissible Koehler flame safety lamps.

Machinery Underground

All machinery underground is electrically operated and, with the exception of the locomotives and pumps, all electrical equipment was said to be of permissible types when installed.

Power is transformed to 250 volts direct current at substations on the surface and near the dump underground. Power wires are taken into the mine through the intake shaft and through a drill hole. Wherever possible, transmission lines are placed on intake air. Rails are bonded, and a ground wire is run beside the rails and attached to the rails at each bond. The power system is sectionalized by switches at main junctions and at each set of room entries.

The cable-reel locomotives have a single conductor cable, relying on the rails for the negative current return. Beyond the end of the trolley wire the rails are not bonded, making the liability of sparking of wheels at the rails a real hazard. It is recommended that to overcome this danger, permissible storage battery locomotives be used. If this is not done, the sparking hazard may be greatly reduced if the electrical parts of the cable-reel locomotives are made explosion proof, if a double-conductor cable is used, if a positive insulation is inserted between the rails just inby the end of the trolley wire so as to insulate the track inby from the track outby this point, and if the locomotives are given a thorough inspection once a week to insure that the electrical parts are in safe condition.

Coal is mined with Goodman Universal mining machines, some bearing a permissible plate showing that this type of machine has approval No. 108. A photograph of this approval plate is shown in figure 1. The caution statements should be given close attention. The eight Joy 7BU loading machines are of a permissible type, but the machines examined did not bear a permissible plate. These machines have twin-conductor cables, with fused nips which attach to the trolley wire and the ground wire. Although the caution on the permissible plate shown in figure 2 recommends that these machines should have a special ground connection, there was no special ground wire. It is recommended that a three-conductor cable be used with a special ground connection, or that a separate ground cable be used.

Coal is drilled with Chicago Pneumatic Tool Company drills that were claimed to be of the 2HF permissible type, but they were not identical to the approved machines in that the cable was attached to the drill with a plug fixed to the housing, and the switch cover and compartment varied from the approved designs. Three of these drills in the explosion area were examined and found to have 8 out of 10 bolts on the switch cover missing.

F I G U R E I

PERMISSIBLE
ELECTRICALLY OPERATED
COAL CUTTING EQUIPMENT

APPROVAL  **NO.** [redacted]

ISSUED TO THE

GOODMAN MANUFACTURING COMPANY

CAUTION

THIS EQUIPMENT IS NOT PERMISSIBLE EXCEPT
WHEN USED UNDER THE FOLLOWING CONDITIONS:

1. GENERAL SAFETY: Frequent inspections must be made. All electrical parts, including the trailing cable and the wiring, must be kept in a safe condition. There must be no openings into the casings of the electrical parts. A permissible junction box must be used in connecting to the power circuit unless connection is made in pure intake air.

2. FASTENINGS: All bolts, nuts, screws and other means of fastening must be in place, properly tightened and secured. All screw or hinged covers must be kept locked or sealed. Only one key or sealing tool shall be available and it shall be in the care of an authorized person.

3. RENEWALS AND REPAIRS: Inspections, repairs or renewals of electrical parts must not be made unless the trailing cable is entirely disconnected from the circuit furnishing the power and the cable must not be connected again until all parts are properly reassembled. Special care must be taken in making renewals or repairs. Leave no parts off. Use new parts exactly like those furnished by the manufacturer. When any lead entrance is disturbed, the leads must be replaced and fastened, or resealed in the approved manner.

4. CABLE REQUIREMENTS: An approved-type trailing cable, adequately protected by fuses or other automatic circuit-interrupting devices must be used. Special care must be taken in handling the cable to guard against mechanical injury and wear. Spliced cables must not be used unless the splices are properly made and vulcanized.

5. SPECIAL REQUIREMENTS FOR D. C. EQUIPMENT: The positive side of the trailing cable must be connected to the positive side of the machine. The operating voltage of 500-volt equipment must not exceed 500 volts at the motor terminals.

6. GROUNDING: It is recommended that the frame of this machine be connected to an effective ground. The power wires must not be used for grounding.

F I G U R E 2

PERMISSIBLE
ELECTRICALLY OPERATED
COAL LOADING MACHINE

APPROVAL [redacted] **NO.** [redacted]

ISSUED TO THE

JOY MANUFACTURING COMPANY

CAUTION

THIS EQUIPMENT IS NOT PERMISSIBLE EXCEPT
WHEN USED UNDER THE FOLLOWING CONDITIONS:

1. GENERAL SAFETY: Frequent inspections must be made. All electrical parts, including the trailing cable and the wiring, must be kept in a safe condition. There must be no openings into the casings of the electrical parts. A permissible junction box must be used in connecting to the power circuit unless connection is made in pure intake air.

2. FASTENINGS: All bolts, nuts, screws and other means of fastening must be in place, properly tightened and secured. All screw covers must be kept locked or sealed. Only one key or sealing tool shall be available and it shall be in the care of an authorized person.

3. RENEWALS AND REPAIRS: Inspections, repairs or renewals of electrical parts must not be made unless the trailing cable is entirely disconnected from the circuit furnishing the power and the cable must not be connected again until all parts are properly reassembled. Special care must be taken in making renewals or repairs. Leave no parts off. Use new parts exactly like those furnished by the manufacturer. When any lead entrance is disturbed, the leads must be replaced and fastened, or repacked in the approved manner.

4. CABLE REQUIREMENTS: An approved-type trailing cable, adequately protected by fuses or other automatic circuit-interrupting devices must be used. Special care must be taken in handling the cable to guard against mechanical injury and wear. Spliced cables must not be used unless the splices are properly made and vulcanized.

5. SPECIAL REQUIREMENTS FOR D. C. EQUIPMENT: The positive side of the trailing cable must be connected to the positive side of the machine. The operating voltage of 500-volt equipment must not exceed 500 volts at the motor terminals.

6. GROUNDING: It is recommended that the frame of this machine be connected to an effective ground. The power wires must not be used for grounding.

These variations render the machine nonpermissible. The drill cable attaches to the mining machine cable at the reel on the truck.

Under the present system of bonding and carrying power into the working places, there is a definite hazard from area and sparks at the rails, and from the frames of the machines. It is recommended, therefore, that in addition to insulating the rails beyond the end of the trolley wire a positive ground system be carried to the points of attaching power cables, and that the loading machines, drills, and mining machines be provided with separate ground wires or cables.

Cables are spliced permanently underground with the Newman-type of mechanical splice. The splices are covered with tape. It is recommended that only temporary splices be made underground and that permanent splices be made as soon as possible outside of the mine and that the joints be vulcanized.

Power enters the mine with a potential of 250 volts, but most of the motors on face equipment are rated at 210 volts to allow for a drop in voltage between the generators and the working faces.

Explosives

Coal is blasted with Monobel C, a permissible explosive, and rock is broken with Gelobel, also a permissible explosive. The explosives are 1-1/4- by 8-inch sticks, restricted to four sticks per hole, with an average of 2-1/2 to 3 sticks per hole. The permissible limit for this explosive is 5 sticks. Austin No. 6 detonators are used to fire the charges; the ends of the leg wires are provided with a shunt. Duplex cables are used by the section or unit foremen to fire the charges, with a permissible Everready dry-cell battery. Charges are confined in the holes with stemming consisting of a paper dummy filled with rock dust, placed against the last stick of cartridge, and dummies filled with machine cuttings fill the remainder of the hole. It is recommended that only incombustible stemming be employed. The holes are fired at any time on the shift. The snubbing shot in the center of the face is usually shot first, is loaded out, and the other holes are then fired. The holes are drilled during cutting and they may, at times, be drilled too deep if they are drilled before that part of the face has been undercut.

Explosives are sent into the mine in a special car consisting of a wooden box covered on the inside with 3/8-inch rubber belting, over which 3/4-inch tongue-and-groove lumber is placed, held with wooden dowels. The detonators are placed in a wooden box provided with hooks to allow the box to be hung on the side of a car. A special trip is used to transport the explosives and tools. The first car behind the locomotive is the explosives car, followed with several tool cars in the last of which is hung the detonator box. In the sections, the explosives are stored in special wooden boxes placed in crosscuts. The explosives and the detonators are supposed to be kept at least 25 feet apart. The maximum amount allowed for each unit is 200 sticks of explosives for three shifts.

During the investigation it was observed that as many as four holes were loaded with the shunts removed from the leg wires. This is a dangerous practice. It has long been recognized that the safest method is to charge and fire holes one at a time, and that shunts should not be removed until the shot-firing cable is to be attached to the leg wires.

Drainage

The mine is generally damp, but is dry in many places. There is enough water to require at least 4 alternating-current and 18 direct-current motor-driven pumps. These pumps are open types and constitute an explosion hazard where they are placed on return air. A pump was in the explosion area on 10 east air course near the rooms where explosive gas was reported for several days prior to the explosion. It is recommended that permissible-type motors be employed to run all underground pumps, and that the pumps be located on pure intake air.

Dust and Rock Dust

The mine is dry in places, although it was difficult to collect dust samples in many places due to the damp condition of the roadway and to the presence of drops of water on the roof and ribs. It is believed that there was enough dust present in most of the active parts of the mine to allow propagation of an explosion. Samples taken in the unaffected parts of the mine show a combustible content of 60.1, 83.1, and 49.1 percent in the rib and roof dust, and 67.5, 79.2, and 71.0 percent in the road dust at the same points. This indicates that the dust is explosive unless treated with the required amount of rock dust.

The haulage roads are rock-dusted, and in the present active, or recently active, section of the mine shelf-type rock-dust barriers are erected on return air courses as indicated on the map. These barriers are situated in the main west section and in the explosion area. The machine cuttings generally are watered during cutting, and all loaded trips are wetted before they leave the junction of main west and 12 north.

Steel tanks about 20 inches square and 4 to 6 inches high are placed on top of the mining machines and filled with water. A pet-cock with a 1/8-inch opening is placed at the lower right corner of the box, and a short length of hose directs water onto the ingoing bits of the mining machine during cutting of coal.

The cars are topped with coal and probably tend to spill coal along haulage roads. In the trackless entries there are numerous falls, and there is not much exposure of ribs and combustible dust on the roads. These falls also form some natural rock dust barriers. Occasional pools of water may act as natural barriers.

The mine uses rock dust, a Diamond Machine Company rock-dusting machine being employed for this purpose. As the mine operates on a three-shift basis, rock-dusting can be done only on Sundays or idle days. With mechanical loading, this allows a considerable advance to be made between applications of rock dust. The explosion area, according to company records, was

rock-dusted 12 days prior to the explosion, and the other active areas were rock-dusted on December 5, 1940, after the disaster. The mine was sampled on December 6, 1940, by E. E. Quenon of the Bureau, Gilbert Archers of the State Division of Mines, and one of the company employees. The results of analysis of these samples are given in tables 2 and 3.

The samples collected in the explosion area are not representative of average mine conditions, and for that reason these samples have been averaged separately. In table 2 the rib-and roof-dust samples in the explosion area have an average volatile matter content of 19.3 percent, and a fixed carbon content of 50.5 percent, or an average total combustible content of 69.7 percent. The moisture ranges from 1.4 to 10.9 percent, with an average of 5.6 percent. The ash, including extraneous inert matter, ranges from 18.8 to 33.3 percent, with an average of 24.7 percent. The total incombustible content, that is moisture plus ash, averages 30.3 percent. The analyses of the four samples taken outby A north show a total incombustible content of 33.3 to 40.2 percent, all of which are higher than the average and higher than any other samples in this group. All of the samples in this group, including the four on the 7 and 8 east entries and air courses, contain coke, indicating that the flame traveled at least this far. It was stated by a company employee that part of a rock-dust barrier located near these points of sampling on 8 east and 8 east air course had been found. The Bureau investigators did not find evidence of these barriers.

The mine outside of the explosion area was so wet that it was difficult to collect samples; however, seven samples were taken. Three of these were in non-rock-dusted zones. The average combustible content was 41.4 percent, as compared to 69.7 percent in the explosion zone. The moisture content, 5.5 percent, is practically the same throughout the mine. The ash averaged 53.1 percent; and in the samples containing rock dust the ash ranged from 59.6 to 89.0 percent, showing the influence of the rock dust. When the moisture is added to these results, the rock-dust samples have a total incombustible ranging from 64.7 to 90.7 percent, although the average for all of these samples is only 58.6 percent.

The average analysis of the dust in the explosion area was volatile matter, 20.0 percent; fixed carbon, 41.6 percent; total combustible, 61.6 percent; moisture, 3.4 percent; ash, 35.0 percent; and total incombustible, 38.4 percent. The total incombustible in the four samples collected outby A north ranged from 40.4 to 54.1 percent. These figures indicate that the high inert content of the dust at this point, combined with other factors, probably assisted in arresting the flame of the explosion. The samples outside the explosion area contained an average combustible content of 48.2 percent and a total incombustible content of 51.8 percent, although the rock-dust samples contained from 61.8 to 80.5 percent.

Table 2. - Analysis of rib- and roof-dust samples collected in Nelms mine, December 6, 1940

Laboratory No.	Location in mine	Percent combustible			Percent incombustible			Percent
		Volatile matter	Fixed carbon	Total combustible	Moisture	Ash	Total incombustible	Through 20-mesh
	Explosion							
B-58276	No. 13 room off 8 east air course, 90 ft. outby face	15.6	55.5	71.1	4.4	24.5	28.9	86.3
B-58278	Mouth of 2nd roof off 13 room off 8 east air course	12.8	55.4	68.2	7.6	24.2	31.8	94.4
B-58280	No. 12 room off 8 east air course, 300 ft. outby face	19.7	53.9	73.6	1.4	25.0	26.4	98.0
B-58282	7 east entry, 10 ft. outby chute to No. 11 room	17.7	57.1	74.8	3.1	22.1	25.2	95.6
B-58270	9th east entry between 8 and 9 room off 10 east a.c.	22.4	55.7	78.1	2.7	19.2	21.9	70.0
B-58272	10 east entry between 8 and 9 room off 10 east a.c.	19.8	53.3	73.1	8.1	18.8	26.9	81.4
B-58274	10 east air course between 8 and 9 room	19.3	56.1	75.4	3.2	21.4	24.6	80.6
B-58264	Mouth 9 east entry off C north	21.7	48.0	69.7	3.1	27.2	30.3	97.2
B-58266	Mouth 10 east entry off C north	18.3	50.7	69.0	10.9	20.1	31.0	80.4
B-58268	Mouth 10 east air course off C north	19.9	50.2	70.1	6.5	23.4	29.9	94.3
B-58258	30 ft. outby chute leading to "B" north	21.2	45.5	66.7	6.6	26.7	33.3	96.6
B-58260	10 ft. inby 9th crosscut on 8 east entry	20.1	39.7	59.8	8.2	32.0	40.2	92.5
B-58256	10 ft. inby 7th crosscut on 7 east air course	19.4	45.2	64.6	8.2	27.2	35.4	98.4
B-58262	40 ft. outby 8th crosscut on 8 east air course	21.6	40.4	62.0	4.7	33.3	38.0	93.5
	Average, in explosion area	19.3	50.5	69.7	5.6	24.7	30.3	89.9

Table 2. - Analysis of rib- and roof-dust samples collected in Nelms mine, December 6, 1940 (cont'd.)

Laboratory No.	Cumulative percent, 100% through 20-mesh: 48-mesh	100-mesh	200-mesh	Amount of coke	Remarks
B-58276		No size		Soot and coke noted	No rock dust noted
B-58278		No size		do.	do.
B-58280	98.3	93.5	78.8	do.	do.
B-58282	93.3	79.7	55.0		do.
B-58270		No size		Soot and coke noted	do.
B-58272		No size		do.	do.
B-58274		No size		do.	do.
B-58264		No size		Soot streamers 1-1/2 inches long	do.
B-58266		No size		2-inch soot streamers	do.
B-58268		No size		Soot streamers	do.
B-58258		No size		Coked particles present, large amount	Entry rock-dusted
B-58260		No size		do.	No rock dust noted
B-58256		No size		do.	do.
B-58262		No size		do.	do.
Average, in explosion area	95.8	86.6	66.9		

Table 2. - Analysis of rib- and roof-dust samples collected in Nelms mine, December 8, 1940

Laboratory No.	Location in mine	Percent combustible			Percent incombustible			Percent
		Volatile matter	Fixed carbon	Total combustible	Moisture	Ash	Total incombustible	Through 20-mesh
	Outside explosion area							
B-58284	No. 2 main west entry on haulageway, 100 ft. inby 12 north			9.3	1.7	89.0	90.7	89.5
B-58288	12 north haulage, 50 ft. inby main west haulage			26.8	13.6	59.6	73.2	87.5
B-58286	14 south haulage, 25 ft. inby main west haulage			35.3	2.9	61.8	64.7	80.6
B-58290	600 ft. outby face 1 main west entry			60.1	3.7	36.2	39.9	69.6
B-58292	600 ft. outby face 2 main west haulage			25.9	3.2	70.9	74.1	75.5
B-58296	600 ft. outby face 3 main west	34.2	48.9	83.1	2.0	14.9	16.9	73.0
B-58294	600 ft. outby face 4 main west			49.1	11.7	39.2	50.9	75.7
	Average, outside of explosion area	34.2	48.9	41.4	5.5	53.1	58.6	78.8

Table 2. - Analysis of rib- and roof-dust samples collected in Nelms mine, December 8, 1940 (cont'd.)

Laboratory No.	Cumulative percent, 100% through 20-mesh			Amount of coke	Remarks
	48-mesh	100-mesh	200-mesh		
B-58284	96.8	87.1	77.3		Rock-dusted 12/5/40
B-58288	90.2	82.0	71.5		do.
B-58286	88.1	78.7	68.0		do.
B-58290		No size			No rock dust; floor very damp; droppers on roof
B-58292		No size			Rock dusted 12/5/40; roof and floor wet
B-58296	51.3	24.9	13.9		No rock dust; roof and floor wet
B-58294		No size			do.
Average, outside of explosion area	81.6	68.2	57.7		

Table 3. - Analysis of road-dust samples collected in Nelms mine, December 6, 1940

Laboratory No.	Location in mine	Percent combustible			Percent incombustible			Percent
		Volatile-matter	Fixed carbon	Total combustible	Moisture	Ash	Total incombustible	Through 20-mesh
	Explosion area							
B-58277	No. 13 room off 8 east air course, 90 ft. outby face	22.6	55.5	78.1	3.8	18.1	21.9	53.4
B-58279	Mouth of 2nd room off No. 13 room off 8 east air course	16.5	50.6	67.1	8.9	24.0	32.9	64.2
B-58281	No. 12 room off 8 east air course, 300 ft. outby face	21.1	55.7	76.8	2.5	20.7	23.2	69.4
B-58283	7th east entry, 10 ft. outby chute to No. 11 room	14.5	27.9	42.4	2.6	55.0	57.6	78.7
B-58271	9 east entry between 8 and 9 rooms off 10 east air course	22.3	54.0	76.3	3.0	20.7	23.7	87.6
B-58273	10 east entry between 8 and 9 rooms off 10 east air course	22.4	54.2	76.6	4.3	19.1	23.4	95.6
B-58275	10 east air course between 8 and 9 rooms	16.5	46.1	62.6	3.1	34.3	37.4	63.4
B-58265	Mouth 9 east off "C" north	10:6	14.9	25.5	1.4	73.1	74.5	64.8
B-58267	Mouth 10 east off "C" north	23.6	53.0	76.6	1.5	21.9	23.4	62.7
B-58269	Mouth 10 east air course off "C" north	20.4	47.2	67.6	8.5	23.9	32.4	80.1
B-58259	30 ft. outby chute leading to "B" north on 7 east entry	19.9	26.0	45.9	1.5	52.6	54.1	71.0
B-58261	10 ft. inby 9th crosscut on 8 east entry	24.6	35.0	59.6	2.4	38.0	40.4	64.9
B-58257	10 ft. inby 7th crosscut on 7 east air course	21.9	30.6	52.5	2.1	45.4	47.5	75.5
B-58263	40 ft. outby 8th crosscut on 8 east air course	23.2	31.0	54.2	2.2	43.6	45.8	66.2
	Average, in explosion area	20.0	41.6	61.6	3.4	35.0	38.4	71.3

Table 2. - Analysis of rib- and roof-dust samples collected in Nelms mine, December 6, 1940 (cont'd.)

Laboratory No.	Cumulative percent, 100% through 20-mesh: 48-mesh	100-mesh	200-mesh	Amount of coke	Remarks
B-58277		No size			
B-58279	71.0	45.7	27.9		
B-58281	72.3	50.9	35.3		
B-58283	46.8	28.4	21.0		
B-58271	85.9	72.0	54.8		
B-58273	91.8	80.4	65.8		
B-58275	75.0	43.2	26.4		
B-58265	36.0	18.1	11.8		
B-58267		No size			
B-58269	75.7	56.5	40.9	Coke particles present; very large amount	
B-58259	64.3	31.6	20.8	Very small amount	
B-58261	98.7	35.4	23.5	do.	
B-58257	66.6	42.2	25.2	Small amount	
B-58263	53.8	28.5	15.8	Trace	
Average in explosion area	69.0	44.4	30.8		

Table 2. - Analysis of rib- and roof-dust samples collected in Nelms mine, December 8, 1940 (cont'd.)

Laboratory No.	Location in mine	Percent combustible			Percent incombustible			Percent
		Volatile matter	Fixed carbon	Total combustible	Moisture	Ash	Total incombustible	Through 20-mesh
	Outside explosion area							
B-58289	12 north entry, 50 ft. inby main west haulway			37.9	1.8	60.3	62.1	74.5
B-58285	2 main west entry, on haulway 100 ft. inby 12 north			24.3	2.1	73.6	75.7	80.9
B-58287	14 south haulage road, 25 ft. inby main west			38.2	3.4	58.4	61.8	81.5
B-58291	600 ft. outby face 1 main west entry			67.5	6.4	26.1	32.5	52.1
B-58293	600 ft. outby face 2 main west entry			19.5	1.0	79.5	80.5	73.0
B-58297	No. 3 entry main west, 600 ft. outby face	33.3	45.9	79.2	4.5	16.3	20.8	74.5
B-58295	No. 4 entry main west, 600 ft. outby face	30.1	40.9	71.0	2.9	26.1	29.0	68.6
	Average, outside explosion area	31.7	43.4	48.2	3.2	48.6	51.8	72.2

Table 2. - Analysis of rib- and roof-dust samples collected in Nelms mine, December 8, 1940 (cont'd.)

Laboratory No.	Cumulative percent, 100% through 20 mesh			Amount of coke	Remarks
	48-mesh	100-mesh	200-mesh		
B-58289	74.7	62.3	53.1		Rock-dusted 12/5/40
B-58285	74.4	58.0	45.4		do.
B-58287	71.4	54.6	44.0		do.
B-58291	86.3	35.1	22.7		Not rock-dusted; roof and floor wet
B-58293	37.9	18.0	11.7		Roof and floor wet; rock-dusted 12/5/40
B-58297	55.8	32.0	18.6		Not rock-dusted; roof, ribs, and floor wet
B-58295	44.0	21.8	13.3		do.
Average, outside explosion area	63.5	40.3	29.8		

The explosibility of coal dust is measured by the ratio of the volatile matter to total combustible, which in this mine exceeds 41, or about the index of the explosibility of the coal at the experimental mine. On this basis 61 to 62 percent inert matter is required to prevent propagation of an explosion. This is a minimum, and it is recommended that the dust in the Nelms mine contain at least 65 percent incombustible matter. For each 0.1 percent of gas in the air current, 1 percent incombustible matter should be added to the above figure. Based on the percentage (1.46%) of gas in the return air, the dust should contain 80 percent incombustible matter to insure against propagation of an explosion.

GENERAL SAFETY CONDITIONS

First Aid and Mine Rescue

No first-aid and mine-rescue training has been given to employees in the Nelms mine, but some men have received the training in first aid at other mines prior to being employed by the Ohio & Pennsylvania Coal Company. It is recommended that all employees be trained in first aid and that at least 10 men be given the Bureau of Mines course in mine rescue.

Safety Organization

No safety organization of all employees is maintained at this mine, according to information furnished by the company. A safety inspector devotes all of his time to inspecting the mine and giving special attention to ventilation. The management appears to be sincerely interested in safety and has adopted many safety practices not legally required.

Supervision and Discipline

Each section consists of one unit of 11 or 12 men, generally working 4 or 5 contiguous places. A unit foreman is in charge of such a unit, performing all the duties of a foreman in addition to firing all shots. Generally men are working in only two places at the same time, that is, loading in one place and cutting and drilling in the other; therefore, a foreman could visit each place every half an hour and certainly he should visit each place once an hour. It is understood that visits are made at intervals within these limits. In most of the places in 7 and 8 east, line brattices had evidently been in place at the time of the explosion, indicating that spervision was generally good. On the other hand, enough attention was not, apparently, being given to keeping ventilation adequate, as the door at the mouth of B north was reported to have been latched open for about 25 minutes on the day before the explosion. At the time of the explosion, according to testimony given at a hearing conducted by the Ohio Department of Industrial Relations following the explosion, two loaded cars were standing in the door between A and B north on No. 4 section, and loaded cars were in a check curtain between rooms 12 and 13 in No. 2 section.

MINE CONDITIONS PRIOR TO EXPLOSION

The weather was cloudy with a low temperature on the morning of November 29, 1940. The low barometer would tend to allow an increase in the normal flow of methane from the coal. The mine had worked the previous day and night and was in normal operation at the time of the explosion.

The loading machine crew, completing its shift at 11:00 p.m. on November 28, had stopped loading at the face of room 13 off 8 east air course on that evening because of gas given off by the coal after blasting. A cut of coal in the face of a crosscut to room 12 was then loaded out; and this opened the crosscut, allowing the air to pass through it, and this helped to clear the gas out of the face of room 13.

PREVIOUS EXPLOSIONS IN NEARBY MINES

There have been no explosions reported to have occurred in Harrison County, but an explosion occurred in the Willow Grove mine, about 25 miles from the Nelms mine, on March 16, 1940, in which 72 men were killed. This was an ignition of dust by black blasting powder in pellet form.

EXPLOSION INFORMATION

Story of the Explosion

About 1:20 p.m., the safety inspector for the company was in 1 east off 12 north when he was knocked down by a sudden rush of air. He was partly dazed and went into the return air course, but realized that there had been an explosion and that he would be in the afterdamp. He observed that the air which had stopped flowing temporarily was again flowing in its natural direction, and he then went to the 12 north junction to telephone the outside. When he arrived there he found that the dispatcher had felt the concussion and had telephoned to the main south and main west sections, where, he was told, everything was functioning normally. He tried to telephone to the 8 east section but could get no answer, concluding from this that the explosion was in this section.

The main-line motorman felt the concussion and told the mine superintendent, who was in the dispatcher's office near the foot of the shaft, that "something was wrong" inside of the mine as he had felt a strong "wind". The superintendent then called the 12 north junction and learned that the explosion was in the 8 east section. He then telephoned the general superintendent, outside, who immediately entered the mine. The Ohio Department of Industrial Relations and the Division of Mines in Columbus were notified of the explosion about 2:20 p.m. The Associated Press notified the Bureau of Mines in Pittsburgh, Pa., about 3:15 p.m. The Bureau of Mines immediately called the mine and offered the services of the personnel of its Safety Division.

The men in the main south and main west sections were notified of the explosion and were ordered to leave the mine immediately. No one outside of the explosion area was injured and all escaped unassisted.

Recovery Operations

The time of arrival at the mine of the Safety Division personnel has been given in the introduction to this report. The first Bureau man to arrive was F. E. Griffith, and he went underground immediately after arriving. He assisted the State and company men to replace stoppings on 12 north as far as 7 and 8 east and later as far as 3 north on 8 east. The concentration of

carbon monoxide was high, and the quantity of air available was small. N. J. Ankeny, and later J. J. Forbes, entered the mine upon their arrival and assisted in restoring ventilation. Gas masks were worn to make short exploration trips into the returns from the explosion area to ascertain if there were any fires and to determine the carbon-monoxide content of this air. No smoke or other evidence of fire was found. Considerable care was exercised in recovery operations due to the fact that even when ventilation was advanced, carbon monoxide appeared to hang persistently to holes in the roof and in the broken rock on the floor. It was difficult to restrain men from pushing forward too rapidly. An official of a neighboring company disregarded instructions, went beyond the fresh air, and was affected by the carbon monoxide.

During the night of the 29th and the early morning of the 30th, brattice-cloth stoppings were placed in break-throughs between 7 and 8 east as far as the chute to B north. A stopping was also placed across 7 east at this location to deflect all the air into 7 east air course in order to provide more velocity of the air. Even so, the volume and velocity of air were not sufficient to move the afterdamp adequately; and the roof conditions were so hazardous that it was decided to employ a Joy loading machine to load out the rock on 7 east, so that the roof could be made safe and wooden stoppings could be erected to provide a larger quantity of air to clear the noxious gases from the air inby. At this time the air was traveling into 7 east and 7 east air course to B north and then across to 8 east air course to the section return entries on 12 north. The body of a mechanic was located on 7 east about 100 feet outby B north chute.

Shifts had been irregular during the first 24 hours of recovery operations, but on the evening of the 30th regular 6-hour shifts were established. An exploration of the area inby B north on the evening of the 30th was made, and no carbon monoxide or methane was discovered as far as room 10 off 8 east air course. The air was advanced this far, and stoppings were placed across 8 east and 8 east air course just inby B north.

The shift entering the mine at midnight, November 30, erected a stopping across 8 east air course just outby room 10. Ventilation was conducted to the faces of the 7 and 8 east and their air courses and to the face of room 15 by 7:00 a.m. December 1, 1940. The following shift carried ventilation as far as the intersection of 9 east and room 10. Eleven men were located, five in room 13 off 8 east air course, four at the face of room 11, and two between the 4th and 5th crosscuts in room 11.

The afternoon shift on that day located an additional body at the face of room 13 and then restored ventilation in 9 and 10 east. Two bodies were located in room 10 off 10 east air course; the foreman was found at room 7 on 10 east air course; four men were located in room 3, and three men in room 2 off C north. All of these bodies were recovered and sent outside. Later this shift discovered four more bodies in room 1, C north, but the roof was so dangerous that considerable timbering was required to make recovery of the bodies safe.

Ventilation of the explosion area was completed on December 1, and 27 bodies had been recovered at that time. Two more bodies were located under falls after considerable digging, on December 2. Another body was found

under a thick rock fall on the afternoon of December 3, and the last body was located under a small fall in room 4, C north, about 3:00 p.m., December 4.

Conditions were extremely hazardous throughout recovery operations. The roof was badly broken and presented a constant danger. The methane content of the air, even after restoration of ventilation, was high, necessitating working without flame safety lamps in some instances. The recovery work was carried out under the supervision of inspectors of the Ohio Division of Mines and Bureau of Mines engineers; through the coordination and cooperation of these, together with the officials of the mining company, the recovery operations were completed without injury to anyone in spite of the dangerous conditions.

Property Damage

Property damage was confined to stoppings blown out on 12 north inby 9 and 10 west and to damage in the entire 7 and 8 east section. All the stoppings in this section were blown out, extensive falls occurred in all entries and rooms in this section, and many cars were damaged. Most of the mobile equipment was only slightly damaged, although two of the three locomotives were under thick falls and must have sustained considerable damage. It is reported that this section of the mine will not be reopened, except to recover equipment. The rest of the mine was ready to resume operations several days after the explosion and did start on December 16.

Details of Forces and Evidence

The investigation of the explosion was made by representatives of the Division of Mines of the Ohio Department of Industrial Relations, coroner's office, United Mine Workers of America, company officials, and J. J. Forbes, G. W. Grove, C. W. Owings, and J. Westfield, Jr., of the Bureau of Mines. Details of the explosion were collected by C. W. Owings and J. Westfield, Jr., who have placed these data on detailed sketches. The direction of ventilation on these maps is indicated by long thin arrows, whereas direction of forces is indicated by short thick arrows.

12 North:

The first evidence of the explosion was a brattice-cloth stopping in the overcast in main west several hundred feet inby 12 north; it was blown outby. This stopping deflected the return air from the explosion area into the main west, and it is likely that the short-circuiting of this air may have saved the lives of the men in this section. Stoppings between the haulage road and the return entries inby 9 and 10 west were blown toward the return air courses.

7 and 8 East:

The 7 and 8 east entries and their air courses, forming a 4-entry system had extensive falls throughout their entire length, and the stoppings in these entries were practically demolished. The mechanic's shanty on 7 east just outby the chute to 5 north was completely wrecked; and the telephone at this

location was blown outby about 100 feet, while the bell piece was found in a crosscut about 50 feet outby the box. The mechanic was found about 50 feet outby the shanty. Pieces of the door between 7 and 8 east in the chute to B north were found on the right rib, having been blown outby its original position. These forces then indicated the explosion coming out of B north and outby on 7 and 8 east.

Inby B north there were numerous falls and small debris, blown outby. No positive evidence of coke was found on these four entries. Opposite the crosscut leading to room 11 were two empty cars, on the track, but with the wheels on the right side lifted off the track. Beside these cars and on the right rib were found pieces of a door, containing part of the hinges and a post with the other part of the hinges. The forces were definitely out of room 11 at this point. A trolley wire switch was found 45 feet outby its location on the inby rib of the crosscut to room 11. Twenty-five feet inby the two cars (previously mentioned) was a trip of seven empty cars with crossbars and debris blown outby. Opposite the next crosscut inby, opposite the pillar between rooms 12 and 13, two cars had been blown toward the right rib, and the wood on the left side had been blown in, showing considerable force out of rooms 12 and 13.

It will be observed from the map of the section that the first room is No. 10 and the last room is No. 18. The property line cuts across the top of these rooms at an angle. A low area or "swamp" cuts across the 7 and 8 east entries several hundred feet inby C north, and another swamp crosses the lower parts of the rooms 10 to 18.

Room 10:

On 8 east opposite the first crosscut to 8 east air course outby room 10, considerable debris was piled against the right rib, indicating forces out of room 10. In room 10 there were numerous falls, but in several places where there were no falls, posts and crossbars were found blown outby. Near the mouth of the room, the road dust contained considerable sand, and a pool of water was found here and on 8 east air course. There were room necks driven in the left rib of room 10, and in the neck just outby the 3rd crosscut to room 11 was found the first sign of coke, on the outby rib of the room neck. This was plastic coke, apparently coked while traveling, indicating outward forces. This same condition was found in each room neck until the room neck between 4th and 5th crosscuts to room 11 was reached. Here there was no coke. The next room neck inby was opposite the 6th crosscut, and here coke was found plastered on the inby rib of the room neck. The same condition existed on all the remaining room necks. Considerable debris had been thrown against the face of room 10; coke had been blown against this face, and other dust had been coked in place on the face of the room. Evidence of force passing through the connection of 9 east at the face of room 10 and into 9 east was found, but there was no evidence of debris or coke on the right rib at the face of room 10 to indicate that forces had passed from 9 east into room 10. It is concluded that no explosion forces came into room 10 from 9 east, that forces came into room 10 from room 11, with the most force traveling along the chute from room 13 to room 11, these forces dividing in room 11, passing inby and outby, part passing into room 10 at the next (6th) crosscut inby and part through the next (5th) crosscut outby. This division of forces continues

in room 10, part going outby and part inby to the face of room 10 and through to 9 east.

Room 11:

Roof falls extended throughout most of room 11 with forces definitely outby from the chute to room 12, which was the 5th crosscut. Forces were inby from this chute. The directions of force in the crosscuts were not uniformly in one direction, some going into room 10 and others into room 11, as indicated by pieces of the wooden brattices in both rooms. The 4th crosscut between rooms 11 and 12 was known locally as the "dinner hole" where the men kept their dinner buckets. Three explosives boxes and one detonator box were stored in this crosscut, an explosives box at the inby and outby ribs at room 11, a detonator box at the inby rib at room 12, and an explosives box at the outby rib. These boxes had been blown into room 12 and outby in this room. Pieces of the boxes and unexploded detonators were reported found by company employees while restoring ventilation, for a distance of several hundred feet in room 12.

The last crosscut between rooms 11 and 12 was 72 feet from the face of room 11. About 50 feet from the face was found the gathering locomotive, partly covered with a fall. The motorman was on top of the locomotive with his feet on the bumper. The brake was off, the direction lever was in the inby direction, and the controller was in the off position. The section foreman was face down, head inby, between the locomotive and the right rib. The Joy loader operator was between the two cars, head down towards the right rib, and his legs across the bumpers. Opposite him on the right rib was found a shot-firing cable, wound on a wooden bar, ends of cable not twisted together. Another cable, with ends untwisted and on its reel, was found on the left rib, just inby the bumpers of the two cars. The front wheels of the second car were off the track, and it is presumed that the Joy operator and the brakeman were in the act of rerailing the car. Blocks under the wheels appear to substantiate this opinion. The brakeman was found in a hole on the left rib, head towards the face and facing the rib, opposite the inby car.

The Joy loading machine was near the middle of the room, 2 feet from the face. This machine has an automatic cut-off, and it was impossible to determine whether the machine was running; however, while the clutch controlling the digging arms was in the "on" position, the loading clutch was in the "off" position. Apparently the machine was not working at the time of the explosion. The permissible plate could not be found on this machine, although it was said to be a permissible type. One bolt was missing from the upper cover on the front of the controller box, and the large, round screw-type cover on the side of this box was loose, so that four threads were showing. These deficiencies rendered the unit nonpermissible.

The coal had been undercut on the left rib, starting 21 feet 6 inches from the face and ending 6 feet from the face. The inby end of the cut had been blasted, and the other holes were loaded. One hole was about 6 inches from the roof and 16 feet from the face. Two holes, one 6 inches and the other 3 feet 6 inches from the roof, were 20 feet 6 inches from the face, and another hole near the roof was 22 feet 6 inches from the face. The leg wires of the detonators had the shunts removed.

Debris and parts of a line brattice, which apparently had been within about 8 feet of the face, were blown into the right rib at the face. These and other data show that the main force was into the face of room 11 and that there is no evidence that an explosion initiated in this room.

Room 12:

Extensive falls of roof were found in room 12 outby the chute to room 13. Details of conditions at this chute are shown in the sketch of this location. Five loaded cars were in this chute. The timber on these cars indicated forces from the face of room 12 and from room 13. A crossbar just outby this chute had the post on the left rib blown out, and the bar was blown outby being found practically parallel to the right rib.

Two loaded cars were in the chute between rooms 12 and 13; and the bumpers of these cars were directly under a crossbar on which were nails and a small piece of brattice cloth, indicating that a check curtain had been in this chute at this point. It was supposed to be the practice to pull the curtain down between the cars, but it is not certain that this had been done. If not, then most of the air would have short-circuited through this chute and up room 11. The trolley and ground wires terminated on the inby rib of the chute at the junction with room 13. Forces were definitely from room 13 towards room 12 in this chute and outby room 13 at this point.

Room 13:

At the nips of the mining machine near the chute from room 12, pieces of charred dummy paper were found. Between this point and the last crosscut to room 12 crossbars and posts and part of the line brattice indicated forces outby. At the mouth of No. 2 butt room, from room 13, was a pile of rock dust, evidently used for making dummies. At the face of room 13 there was considerable evidence of force and flame, heavy coke being found on the roof. The crosscut to room 12 was 24 feet from the face. On the right rib of room 13 the coal had been undercut for a distance of 22 feet and to within 1 foot of the face of the room. Thirteen feet from the face of the right rib a hole had been drilled in the coal 9 inches from the roof, and directly under this hole, 2 feet 10 inches from the roof, was a second hole, 2 feet 2 inches deep, in which was an auger protruding 1 foot 10 inches. Dust at the mouth of both of these holes was coked and gas was issuing from these holes.

A mounted Chicago Pneumatic Tool Company drill was found on the floor angling toward the left corner of the rib and face of the room. This drill was reported to have been a permissible type, but no permissible plate could be found on it. The disconnecting switch is not found on permissible drills, and the assembly is different from that found on any of the permissible drills manufactured by this company. The cover of the switch on the drill had 8 out of 10 bolts missing, making it nonpermissible. The direction lever was for drilling in and the controller was in the "on" position, indicating that the drill probably had been in operation at the time of the explosion. The shovel for removing the machine cuttings from the kerf on the right rib was found under the kerf near the drill. A Goodman Universal mining machine, which is a permissible type, was found practically parallel to the face of the room with the end of the cutter bar in position to start sumping into

the coal. The controller was in the "on" position. The cover on the bearings of the lever was loose, leaving a clearance estimated to be about 1/64 inch. The top cover of the controller box had 4 out of 8 bolts missing. The jack pipes were in position and the cable was in place, indicating that the machine was probably in the act of sumping into the coal.

At the face of the room, 6 inches from the roof and about 6 inches from the left rib, a hole had been drilled from which gas was issuing. In the center of the room two holes had been drilled, one 6 inches and the other 2 feet 10 inches from the roof. Gas was issuing from both of these holes. Gas was also issuing from the inby end of the kerf on the right rib.

The driller was found face down with his head towards the right rib and his feet angling towards the corner of the face and left rib. The driller's helper was found face up, head lying on the cutter bar of the mining machine and feet pointing towards the drill. The machine helper was found lying outby near the rear end of the mining machine, face up, head towards the rib, and feet pointing towards the drill; his legs were over those of the machineman, whose head was against the left rib and pointing outby. The timberman was also against the left rib with his head outby. In the center of the room, about 12 feet from the face, with head towards the left rib and face towards the right rib, was found the trackman under some timber and a fall.

The leg on the crossbar just inby the drill on the right side of the room was leaning inby at the roof. Two crossbars and their legs were found under the fall outby the drill with the ends of the right rib considerably farther outby than the ends toward the left rib.

The line curtain could not be found after the explosion, but it was reported that on the morning of the explosion a check curtain had been placed just outby the crosscut leading to room 12, and that a line curtain had been extended along the right rib about 4 feet from the rib to within probably 8 feet of the face.

During recovery operations an explosive mixture of methane was found at the face of this room, and one week after the explosion, after a line brattice had been erected in this place and air had circulated for about 24 hours, 2.26 percent methane was found near the roof at the face of the room.

The indications are that work was being conducted in a normal manner in this room at the time of the explosion and that forces appear to radiate from this room.

9 and 10 East:

There were few falls in 9 and 10 east and 10 east air course. On 9 east there had been a considerable number of crossbars and timber blown towards C north, and the same condition prevailed in 10 east and 10 east air course. The direction of forces as indicated by the movement of posts and crossbars and other debris, together with splinters on posts and a cable blown outby, definitely establishes that the explosion came from No. 10 room into 9 east. Coke, splinters on posts, and debris indicated that the explosion traveled

from 9 east through the last crosscut to 10 east air course. In the last room off 10 east air course the post had been blown from the left end of the first crossbar, and brattice cloth and debris had been blown into this corner, indicating forces into this room and outby on 10 east air course. A cable-reel locomotive was found 16 feet inby the 10 east air course in this room. The brake was set tight, the control lever was in the "off" position, and the reverse lever was set for tramming out of the room. There is no doubt that this locomotive was not in operation at the time of the explosion. The man that normally operates the locomotive was found about 30 feet inby the locomotive controller, with head facing outby. His helper was found on the left rib 16 feet inby the locomotive controller, with head pointing into the rib. A car, three-fourths loaded with ties and posts, was attached to the inby end of the locomotive. A cable with considerable slack in it was attached to the inby end of this car, with the other end fastened to the last crossbar in the room. Considerable coke was found in this room. The indications in this room were that the forces were all inby, that the locomotive was not in operation, and that the men were not close enough to the controls to have been in the act of turning the power off or on.

The mine foreman was on the 10 east air course just inby the chute from 10 east and just outby room No. 8. He was found face down with his head against the left rib. His cap lamp was between him and the chute with the lamp cord pointing outby. A door in this chute had been blown from 10 east towards 10 east air course. The mine foreman's flame safety lamp was found under this door by company employees while restoring ventilation in this section. Just inby the mine foreman, a piece of charred paper had been blown against the rib with other debris, indicating flame at this point. A pump in the crosscut between 10 east and 10 east air course about opposite room 4 was moved toward 10 east. This pump was driven by an open-type electric motor. It is not known whether this pump was operating at the time of the explosion; however, the direction of forces in these entries is definitely from room 10 toward C north, and this makes it improbable that the explosion started at this point. At the junction of these three entries and C north, dust, timber, and other debris had been blown on the left rib of C north, indicating forces coming out of 9 and 10 east and 10 east air course. These forces then turned outby on A, B, and C north, as indicated by debris.

A, B, and C North:

Outby 9 east extensive falls had occurred in A, B, and C north. Apparently, the force of the explosion dislodged timbers, allowing the roof to fall. Room necks had been turned about every 37 feet on the right rib of C north, but in the sketches of the section only four rooms actively involved in the explosion have been shown.

In room 4 a car containing four or five posts was on the track, and on the inby rib near the corner under a fall was found the driller in this section. An empty car was found just inby the mouth of room 3, and a mining machine was in the mouth of the room on the truck and practically coupled to the truck. The controller was in the "off" position, and the machineman was on top of the machine with his head towards the right rib. There was no permissible plate on this machine; however, it appeared to be in a tight condition. The motorman of the intermediate locomotive was found at the mouth of the room

at the right rib with head outby. Beside him were three boxes of machine bits. The machine helper and the drill helper were found in the room, heads pointing outby. The drill was buried under a fall on the left side of the mining machine. When examined, 8 out of 10 bolts on the switch cover were missing. A third drill was uncovered during recovery operations and placed on top of the fall. It also had 8 out of 10 bolts missing on the switch cover. In testimony given at the hearing following the investigation it was stated that this condition of the drills was usual practice in order to enable the driller to readily remove the cover to make repairs on the switch. At the face of room 3 five holes had been drilled, four in the top about 6 inches from the roof, and a snubbing hole in the center of the face about 2 feet from the roof. In the left rib one hole was 7 feet deep, while the second hole beside it was more than 8 feet deep. The cutter bar of the mining machine is 7-1/2 feet long; hence, it is presumed that the second hole was drilled because the first would have been on the solid. These holes had not been loaded. The face had been undercut and presumably the mining machine was just being loaded onto the truck at the time of the explosion. Sharp drill steels were on C north about 5 feet outby room 3.

Opposite room 2 were two empty cars, the outby car probably being off the track, although this could not be determined, and forced against and beside an empty car on the curved track loading into room 2. This indicated force traveling outby. A cable-reel locomotive was attached to the car on the track leading into room 2. It was under a fall of rock but when the rock was removed the controller, although bent, appeared to have been in the "off" position. In front of the locomotive were two cars; one contained timber, and the second or inby car was under the end of the boom of a Joy loading machine and partly loaded with coal. The loading machine had practically cleaned up all loose coal in the room, but it was still at the face. There was no coal on the conveyor, and it was impossible to determine whether the machine was in operation. The operator of the loader was at the mouth of the room against the right rib, face outby. The motorman and brakeman were in room 2 between the right rib and the partly loaded car, with their heads facing toward the right rib.

In the mouth of room 1 a loaded car was on the curved track in such position that apparently the locomotive could not clear it in passing. Four holes had been drilled in the face of room 1, had been loaded, and the shunts had been removed from the leg wires. The place had been undercut and machine cuttings were still at the face. A timberman was on a pile of machine cuttings near the face, with his head toward the face. Another timberman and a trackman were lying face down with their heads toward the face, while a second trackman was lying face down with head pointing out of the room. Opposite room 1 on the entry the brakeman of the intermediate locomotive was found lying face down, with his head pointing outby, and a drag was lying beside him. Just outby room 1 at the mouth of the chute leading to B north the section foreman was found, face down, with his head pointing toward room 1.

Two boxes of explosives were found in the crosscut opposite rooms 1 and 2. The boxes had been blown toward B north and explosives spilled in the crosscut. About 150 unexploded detonators were also in this crosscut, blown against the edge of a fall in B north. Nearly opposite the next crosscut inby on B north several empty mine cars were under falls. The condition and number of cars could not be determined.

The motorman of the gathering locomotive found at room 2 was under a thick fall of rock opposite the first break-through outby the chute leading from B north to C north at room 1. At this point five drill augers were uncovered under the fall. Apparently there was considerable violence at this point because the motorman had few of his clothes remaining on his body and his legs were mutilated. The fall was so high at this point that it was difficult to determine conditions; however, the outby end of the intermediate locomotive was uncovered apparently on the switch leading into the chute to A north where loaded cars were stored until a trip had been made up. Two cars were in this chute, one completely in the chute, and the inby end of the second car was at the rib of B north. A door had been in this chute about 8 to 10 feet inby the B north rib. The door itself could not be found, but part of the frame was still in place. Forces at this point evidently passed from B north toward A north. Although the door could not be found due to the extensive falls at this point, it appears most likely that the door had been open at the time of the explosion and that the two cars were standing in the doorway. If this condition existed, air would be short-circuited from the rooms on C north and to some extent on 9 and 10 east, but it would not affect materially the ventilation in rooms 16 to 18 off 8 east air course.

The forces in A, B, and C north, based upon the data discussed, were outby from 9 east to 8 east air course. Coke in the rooms off C north indicated that flame probably extended throughout A, B, and C north.

STATE INSPECTORS' CONCLUSIONS

The State inspectors have not issued a statement as to their conclusions up to the writing of this report, but a public hearing was held at Cadiz, Ohio, under the direction of the Director of the Ohio Department of Industrial Relations, December 9 to 12, inclusive. During this hearing the inspector in charge of this district, John Harris, read from fire-boss reports showing that explosive gas was found on November 23 in room 1, section 4, old works; on November 24 in rooms 1, 2, and 3, section 4, old works; on November 27 and 29 in room 1, old works. District inspectors have inspected this mine six times since January 22, 1940. Although the law does not require such frequent inspections, it is the policy of the Division of Mines to inspect mechanized mines every six weeks. The reports of the inspections are not made public and are not posted at the mine, so that detailed information contained in these reports was not available. However, certain information contained in these reports was made public at the hearing. The last inspection was made on November 27, 1940, two days before the explosion. At that time the mine was idle; hence, it was brought out, the air readings obtained should be better than under normal operating conditions. In the explosion area gas from an estimated 1 percent to an explosive mixture was found in room 13, and gas was found generally in the explosion area. The section foreman was told to clear out the gas immediately and other officials of the mine were given the same information, at which time steps were taken immediately to make necessary changes. This report also recommended that the entire mine be rock-dusted; that the company stop drilling holes on the solid; that better air be provided for 20 south pillar; that the trolley-wire guards be replaced in 12 north; and that holes 2 feet on the solid are inexcusable.

Chief Inspector Marcus Kerr and other inspectors of the Ohio Division of Mines who expressed an opinion on the probable point of origin of the explosion stated that it was their belief that the explosion started at or near the face of room 13 off 8 east air course, but they did not assign a source of the ignition. It was also their opinion that the explosion was caused by a gas ignition due to inadequate ventilation at the face of room 13 at the time of the explosion.

SUMMARY OF EVIDENCE

The inner door on the air lock at the mouth of room 11, 8 east air course, in which there was an opening about 8 by 12 inches, had been repaired about an hour before the explosion. This leak would not necessarily cause a short circuit in the air at this point unless the other door in the air lock were left open. Loaded cars were in the chute between rooms 12 and 13, at which point a check curtain was used to deflect the air. The cars may have lifted the curtain, which would have short-circuited the air going to the face of room 13. It was reported that a check curtain had been erected outby the last crosscut to room 12 in room 13 and that a line brattice had been erected probably within about 8 feet of the face. However, a room neck was being started on the right rib, the first out just having been completed, with the outby end of the undercut approximately opposite the inby rib of the crosscut leading to room 12. According to company employees, the normal practice would have been to take down the line brattice during cutting if no dangerous accumulation of methane was found in the working place, but the line brattice would not have been taken down if dangerous quantities of gas had been found. Before this cut was started the safety inspector for the company had inspected this room and had found it practically free of gas; therefore, it seems reasonable to assume that the curtain had been taken down during cutting and drilling of the room neck on the right rib at the face of room 13. Two loaded cars were found in the chute between A and B north, where there was a door. It is believed from evidence obtained that this door was open at the time of the explosion. On the day prior to the explosion the door leading into B north had been left open for approximately 25 minutes. This fact and the condition found in this chute tend to show that the motorman on the intermediate locomotive was apt to be careless in closing ventilating doors.

Two days before the explosion the State district inspector found from 1 percent to an explosive mixture of methane at the face of room 13. On the morning of November 29 the fire boss found about 2 percent of methane at the face of room 13, but this accumulation had been moved before the explosion. After the explosion, during the investigation, an explosive mixture of gas was found at the face of room 13 and strong feeders of gas were found issuing from the drill holes and the kerf. These facts seem to show that ventilation at times was not sufficient to keep the face of room 13 clear of gas.

Evidence indicates that the direction of forces radiates from room 13, moving outby on rooms 10 to 18 off 8 east air course and outby on 7 and 8 east and their air courses, also from the face of room 10 into 9 and 10 east and 10 east air course, into A, B, and C north, and outby along these entries to 8 east air course, joining forces at this point and proceeding outby towards 12 north. Visual evidence of coke in the explosion area, from large amounts in some of the face regions to lesser amounts in other places,

together with the coke found in the dust samples collected, indicates that coal dust entered into the propagation of the explosion.

Flame apparently extended as far as A north on 7 and 8 east and probably slightly farther outby, as indicated by coke in place and in dust samples. The incombustible content in dust samples collected near the limit of flame on these entries was high enough to indicate the possibility that this dust may have assisted in stopping the explosion. The extensive falls also form more or less natural rock-dusting, pools of water at the foot of rooms 10 to 18 and across the entries near C north probably assisted in stopping the explosion, and room for expansion was also a factor.

There was no visual evidence of rock dust in the explosion area; however, a company official stated that rock dust had been applied on haulage entries and had been applied in room 11 twelve days before the explosion. It could not be determined to what, if any, extent rock-dusting limited the propagation of the explosion, but if the rooms and entries in the explosion area had been rock-dusted adequately it is improbable that the explosion would have propagated to the extent that it did.

At least three electric drills, one mining machine, and one loading machine found within the explosion area were in nonpermissible condition. One of the drills and the mining machine were in room 13, the Joy loading machine was in room 11, and two drills were found on C north near room 3. Of these pieces of equipment the electric drill and the mining machine at the face of room 13 were in all probability in operation at the time of the explosion.

Shot holes charged and stemmed were found in room 11 off 8 east air course and in room 1, C north entry, but the shot-firing cables in room 11 were wrapped on the reel and there was no evidence of any cable in room 1 on C north entry. The only evidence of blasting in the area was on the left rib near the face of room 11. This shot evidently had been fired some time prior to the explosion. It is believed, therefore, that blasting did not enter into the cause of the explosion.

No evidence of smoking was found during the investigation and no suggestion that men had been or were smoking in the mine was developed during the hearing following the explosion.

PROBABLE CAUSE OF THE EXPLOSION

It is the opinion of the Bureau of Mines investigators that the explosion occurred at or near the face of room 13 off 8 east air course by the ignition of explosive gas; that the accumulation of gas occurred as a result of gas given off during drilling and cutting operations and insufficient ventilation to dilute and carry away the explosive gas, which may have been caused by a derangement in ventilation; and that the source of ignition was an electric arc or spark from a nonpermissible drill or mining machine, both of which apparently were in operation at the time of the explosion; of these two the drill appears to be the more likely cause of the ignition. It is further believed that coal dust aided in the propagation of the explosion.

LESSONS TO BE LEARNED FROM THIS EXPLOSION

There are four outstanding lessons to be learned from this explosion:

1. The rapid advancement with mechanical mining results in an increased liberation of gas and an increased amount of dust, in any given period. This condition is naturally enlarged where double and triple shifting is followed, and in order to provide reasonable protection for the employees, it is necessary that there be sufficient air in circulation at all times to dilute and render harmless the gas which is being liberated, and that measures must be taken to allay the coal dust at its source.

2. In order for sufficient ventilation to reach working faces, it is necessary that adequate air courses be provided and kept free of obstructions; that airtight stoppings, preferably of incombustible material, be erected; that overcasts be used instead of doors; and that where doors are used, they should always be erected in pairs to form air locks.

3. Permissible equipment, unless properly maintained, will provide no protection against ignitions of gas, and may even be more hazardous than open equipment in that it may be the cause of a false sense of security.

4. Propagation of explosions cannot be prevented unless all openings are adequately rock-dusted to within about 40 feet of the face, and be so maintained. One of the reasons why the explosion area was not rock-dusted as it should have been may be because there is insufficient time between shifts when triple shifting is done to properly rock-dust under the methods and equipment now used.

COMMENDABLE PRACTICES

The management of the Nelms mine is to be commended on the use of permissible electric cap lamps, flame safety lamps and explosives, and for the use of protective caps by the employees. It is also to be commended on the use of insulated explosives cars, the sealing of abandoned areas with bleeder pipes and seals on the return air, the development of the mine so as to segregate the three producing sections (which may have prevented additional loss of life), the rock-dusting which has been done, and the periodic collection and analyzing of air samples in the main returns; also, upon the employment of a safety inspector whose full time is devoted to problems in connection with ventilation, an efficient checking system, and the practice of applying water on the cutter bars of mining machines, all of which are commendable practices.

RECOMMENDATIONS

The following recommendations are made in the belief that their adoption will materially lessen the chances of an explosion occurring in this mine in the future.

Ventilation

1. The amount of air provided should be sufficient to ventilate the mine so that the return from any split will not contain more than 0.5 percent methane.

2. Air courses should be kept free of obstructions at all times so that enough air will be delivered to each working section to allow a minimum of 20,000 cubic feet of air per minute to pass through the last break-through in each set of entries or to the farthest point in the split.

3. The air should be so coursed and directed that a minimum velocity of 100 feet per minute will be made to sweep the face of each working place.

4. Sufficient splits of air should be provided so that not more than one section or working unit will be on one split of air.

5. The cutting, drilling, and blasting of the coal should be so regulated that the liability of liberation of exceptionally large quantities of methane and the possibility of dangerous mixtures of methane and air being carried over electrical equipment will be greatly decreased.

6. Stoppings on face and butt entries should be tightly constructed of incombustible material.

Electricity

1. Trolley wires and bare feeder wires should not be installed in the mine in other than pure intake air; (a) air which has not passed through or by any active workings and (b) air which has not passed through or by any inactive workings, unless these are sealed effectively; and (c) air which is free from poisonous gas and by analysis contains not less than 20 percent oxygen (dry basis) and not over 0.05 percent of inflammable gas; nor should they be installed past open rooms, whether working or abandoned, or in entries or other workings which act as return for open active or inactive workings.

2. All electrical equipment used at or near the face of the workings such as mining machines, loading machines, drills, and pumps, should be of the permissible type and this equipment should be maintained in a permissible condition. Such equipment should be connected at its source of power by means of permissible junction boxes. When trailing cables fail, they should be replaced by standby cables, and the defective cable should be taken to the surface to be repaired. A separate ground wire should be provided for mining machines, loading machines, and drills.

3. Gathering and haulage locomotives when operated in other than pure intake air should be of a permissible type.

4. Electric pumps should be installed in pure intake air wherever possible. When it is necessary to install pumps on return air, they should be of the permissible type and should not be started or stopped until an examination of the surrounding air indicates than an explosive mixture of methane and air is not present.

5. All permissible electrical equipment should be inspected daily by a competent person, and a written report made on the condition of such equipment. It should be the duty of the person making the inspection to see that (a) such equipment is maintained in a permissible condition, and (b) that it

is not used in a nonpermissible manner. All permanent cable splices should be vulcanized, and all major repairs to electrical equipment should be done in the shop, preferably on the surface.

6. The unit foreman should test for gas at least every 15 minutes during the cutting and drilling of the coal. If this is not possible, then the machineman or driller should be required to have a fire boss' certificate of competency or equivalent, and he should test for gas after sumping into the coal, cutting across and pulling out of the kerf, as well as before and after drilling each hole in the coal.

Dust

1. Provision should be made for applying water on the cutter bars of all mining machines. The practice of applying water on the cutter bars of mining machines should be continued to the extent that the coal cuttings will be thoroughly wetted as the cutting is being done.

2. All working places should be thoroughly wetted with water in the face regions before and after blasting.

3. Water should be applied to the coal as it is being loaded by the loading machines.

4. The tops of loaded cars should be thoroughly wetted in the working places to avoid the distribution of coal dust along haulage roads.

5. The coal face and the working place 40 feet therefrom should be kept free of coal dust by the use of water.

6. Consideration should be given to the use of wetting agents to increase the efficiency of the water in allaying the dust.

7. To prevent the coal from shaking off the cars along the haulage road and being ground to dust, the coal cars should not be overloaded.

8. Haulage entries should be kept free from spillage of coal and deposition of float dust. At places where haulage entries are excessively dusty, provision should be made to sprinkle or wet the floor.

9. Rock dust should be applied to every mine surface, including haulage entries, trackless entries, return airways, rooms, and pillar workings to within 40 feet of the working faces if water is used. If water is not used in working places, rock dust should be maintained to within one cut of the face.

10. The rock dust should be applied to the roof, ribs, floors, timbers, and other mine surfaces in such quantities that the incombustible content will not be less than 65 percent at all times without the presence of gas, and for each 1/10 percent of gas present in the air current, 1 percent additional rock dust should be added.

11. Dust samples should be collected at frequent intervals at designated points in the mine to maintain a check on the condition of the dust as to explosibility. Redusting should be done before the incombustible content falls below a safe limit, as stated in the preceding recommendation.

12. Return airways, trackless entries, and rooms that have not previously been rock-dusted should be cleaned of fine coal dust before rock dust is applied.

13. Provision should be made in stoppings between the intake and return airways to convey rock dust into the returns by means of the hose of a high-pressure rock-dusting machine or any other adequate method. Airtight trap doors or capped pipes in the stoppings are suggested if a high-pressure rock-dusting machine is used.

Explosives and Blasting

1. The use of permissible explosives should be continued, but they should be charged and fired in a permissible manner, as follows:

a. That the explosive is in all respects similar to the sample submitted by the manufacturer for test.

b. That electric detonators (not fuse and detonators) are used of not less efficiency than No. 6, the detonating charge of which shall be 1 gram of a mixture consisting by weight of 80 parts of mercury fulminate and 20 parts of potassium chlorate (or their equivalents), and that the required electric firing must be done by means of a permissible-type blasting unit.

c. That the explosive, if frozen, shall be thawed thoroughly in a safe and suitable manner before use.

d. That the quantity used for a shot does not exceed 680 grams (1-1/2 pounds), and that it is properly confined with clay or other incombustible stemming (from the explosive to the collar of the hole).

e. That the diameter of the cartridge used must be not less than that designated in the column "Smallest permissible diameter".

f. That the shot is not fired in the presence of a dangerous percentage of firedamp.

g. That the shot is not a dependent shot, is not bored into the solid, and does not have a burden so heavy that the shot obviously is liable to blow out.

h. That the explosive be stored under proper conditions so that it does not undergo change in character.

2. The unit foremen, who also serve as shot firers, should be required to examine all places for explosive gas and other dangers before and after firing each shot, and no shot should be fired in any place if gas is present in sufficient quantities to be detected with a flame safety lamp.

3. Because of the large amount of explosives required for one day's supply, it is recommended that the explosives and detonators be stored in separate crosscuts.

4. Rigid boxes made of wood or some other rigid dielectric material should be used for carrying explosives to the working places.

5. Detonators and explosives should not be carried to the face by the same man at the same time.

6. Each hole should be charged and fired separately; the practice of charging several holes before firing a shot is definitely hazardous and should be discontinued.

7. Shunts or short circuits of detonator leg wires should not be removed until just before the blasting cable is attached.

8. Holes should not be drilled deeper than the cut, nor should they be drilled before the place is undercut.

General

1. A mine rescue station containing at least 10 sets of oxygen breathing apparatus, gas masks, and gas-detecting devices, supplies, and accessories should be provided at the mine to be readily available for emergency use.

2. A number of selected employees 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 monthly, and all employees should be given a course in first-aid.

3. The check-in-and-out system now in use should be continued.

4. A periodic systematic search for smoking material, matches, patent lighters, etc., should be made at frequent intervals.

ACKNOWLEDGMENT

The writers wish to acknowledge the courtesies extended and the help given by the officials of the Nelms mine of the Ohio & Pennsylvania Coal Company, particularly J. C. Nelms, vice president; H. J. Nelms, general superintendent; John Mullen, mining engineer; and William Ramsay, safety inspector. All information requested from these company officials in connection with this investigation was given without reservation. The cooperation of the Division of Mines of the Ohio Department of Industrial Relations, particularly Marcus Kerr, Chief, and all of his inspectors, is also hereby gratefully acknowledged.

Complete cooperation existed between the operating company, the Ohio Division of Mines, the United Mine Workers of America, and the Department of the Interior, Bureau of Mines, throughout the recovery operations and the investigation of this disaster.

Respectfully submitted,

J. J. FORBES
Supervising Engineer
Safety Division

G. W. GROVE
District Engineer

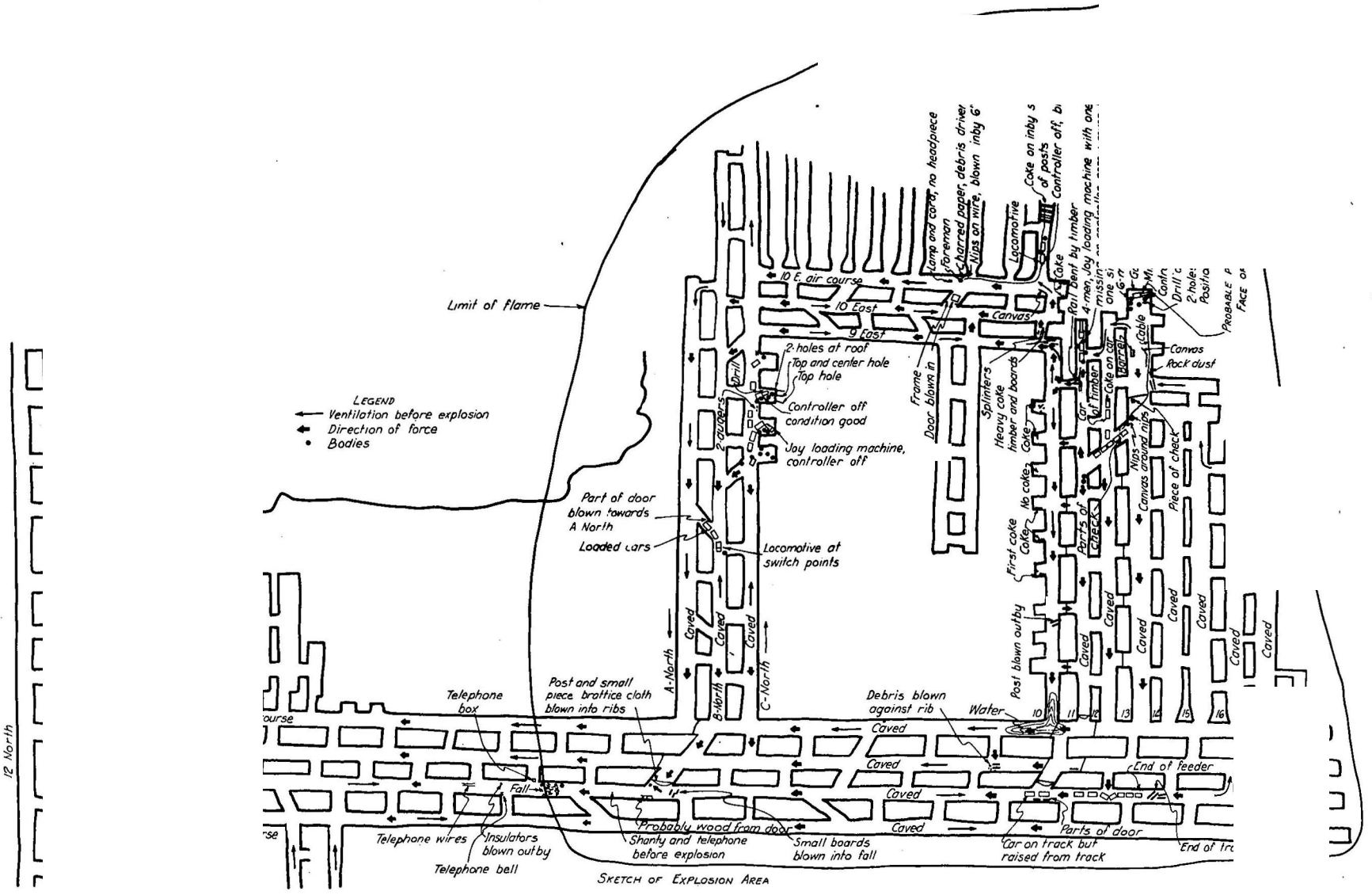
C. W. OWINGS
Mining Engineer

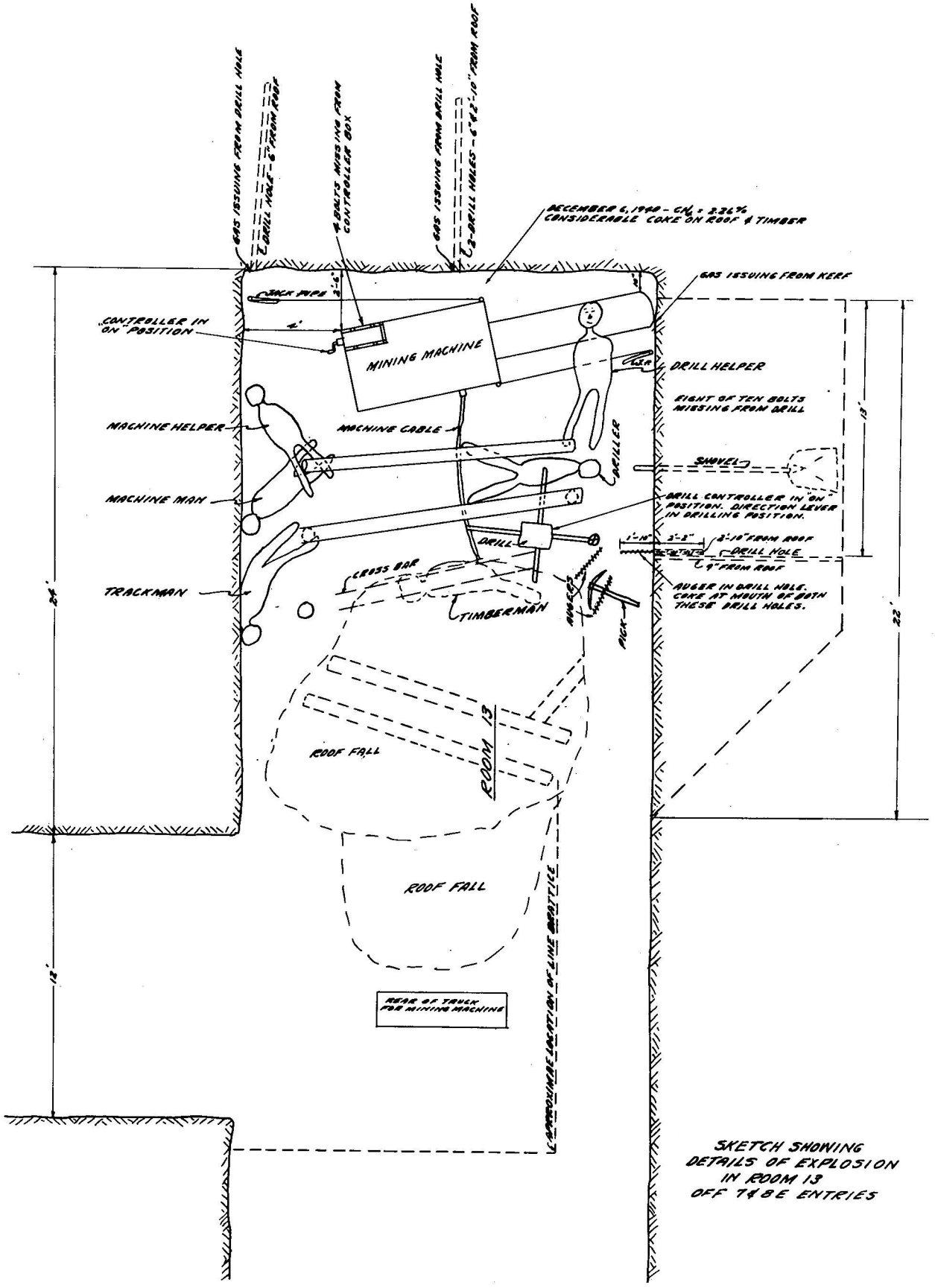
JAMES WESTFIELD, JR.
Assistant Mining Engineer

Approved:

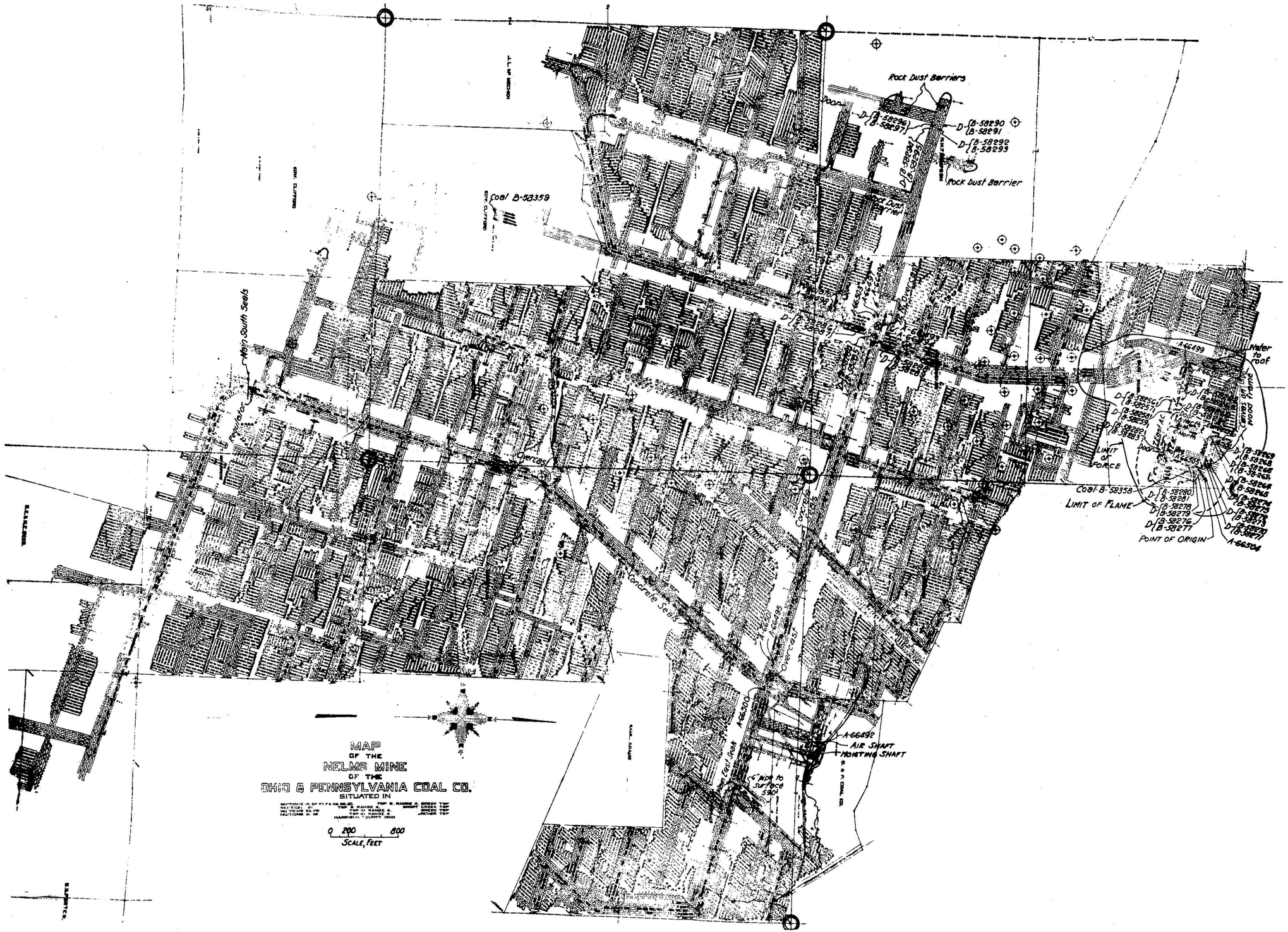
D. HARRINGTON
Chief, Health and Safety Branch

A P P E N D I X


LEGEND
Ventilation before explosion
Direction of force
Bodies
Limit of flame
10 E. air course
10 East
9 East
2 holes at roof
Top and center hole
Top hole
Drill
2 augers
Controller off condition good
Joy loading machine, controller off
Part of door blown towards A North
Loaded cars
Locomotive at switch points
Frame — Door blown in
Lamp and cord, no headpiece
Foreman
Charred paper, debris driver
Nips on wire, blown inby 6'
Locomotive
Coke on inby s
of posts
controller off, b
Coke
Rail bent by timber
4 men, Joy loading machine with one
Canvas
Splinters
Heavy coke
timber and boards
Car
of timber
Coke on car
Barrels
Cable
Canvas
Rock dust
Nips
Canvas
Piece of check
No coke
Coke
First coke
Coke
Parts of
Checks
Post blown outby
Caved
A-North
B-North
C-North
Telephone box
Post and small piece brattice cloth blown into ribs
Debris blown against rib
Water
End of feeder
Fall
Telephone wires
Insulators blown out by
Telephone bell
Probably wood from door
Shanty and telephone before explosion
Small boards blown into fall
Car on track but raised from track
Parts of door
End of tr
SKETCH OF EXPLOSION AREA
12 North



SKETCH SHOWING DETAILS OF EXPLOSION IN ROOM 13 OFF 7 & 8 E ENTRIES


Rock Dust Barriers
Rock Dust Barrier
Coal B-58359
Main South Seals
Overcast
Concrete Seals
Water to roof
Coal B-58358
LIMIT OF FLAME
POINT OF ORIGIN
A-66504
A-66499
A-66000
A-66492
AIR SHAFT
HOISTING SHAFT
Short East Rock
MAP
OF THE
NELMS MINE
OF THE
OHIO & PENNSYLVANIA COAL CO.
SITUATED IN
0 200 800
SCALE, FEET

PRELIMINARY REPORT ON AN EXPLOSION IN THE NELMS MINE OF THE OHIO & PENNSYLVANIA COAL COMPANY AT NELMS, HARRISON COUNTY, OHIO, NOVEMBER 29, 1940

By

J. J. Forbes
Supervising Engineer
Safety Division

G. W. Grove
District Engineer

C. W. Owings
Mining Engineer

and

James Westfield, Jr.
Assistant Mining Engineer

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

PRELIMINARY REPORT ON AN EXPLOSION IN THE HELMS MINE OF THE OHIO & PENNSYLVANIA COAL COMPANY AT HELMS, HARRISON COUNTY, OHIO, NOVEMBER 20, 1940

By J. J. Forbes, G. W. Grove, C. W. Owings, and James Westfield, Jr.

A gas and dust explosion occurred about 1:20 p.m., November 20, 1940, in the Helms mine of the Ohio & Pennsylvania Coal Company, Helms, Harrison County, Ohio. At the time of the explosion 136 men were in the mine, of which number 81 were in the workings driven from the 8 east air course and all of these men lost their lives. The remaining 104 men escaped unassisted and uninjured from other sections of the mine. No barricades were erected.

DESCRIPTION OF MINE

The Helms mine is opened by two shafts, about 488 feet deep, driven to intersect the Lower Kittanning coal bed, which in the vicinity of Cadiz, Ohio, is said to be high-volatile bituminous coal. Samples of the coal have been taken for analytical determination of constituents. The description of the mine, for brevity, is listed in summary form. (a) The bed dips gently, generally in favor of loaded trips. (b) Development is on a room-and-pillar method of mining. (c) With an employment of 481 persons, an average daily production of 5,000 tons is obtained, the total production for 1939 being 667,892 tons. (d) The mine is rated as gassy by the Division of Mines of Ohio. (e) Miners wear permissible electric cap lamps and officials also carry permissible [illegible] fuse is explosive and, in rooms and [illegible] (g) The coal is undercut by mining [illegible] mible type. (h) Coal

and rock are blasted with permissible explosives. (i) Unit foremen load and fire all shots at any time on the shift. (j) Cars are hauled with trolley and cable-reel locomotives. (k) Rock dust is used to a limited extent and rock-dust barriers are said to be used at some strategic locations. (l) Small portable steel tanks, approximately 4 by 18 by 30 inches, are placed on mining machines to hold water for wetting the coal dust during undercutting. A water sprinkler is also used to wet the top of loaded cars before they are hauled to the shaft bottom. (m) Air is conducted throughout the mine on four splits. (n) Coal is drilled with electric drills, originally permissible. (o) The explosion was local in extent, being restricted to two sections of the mine. It is not yet possible to determine what stopped the explosion but it is thought that the large area for expansion, water in a low area running across the lower ends of rooms 10 to 16, and the extensive falls in trackless entries contributed to stopping the flame. (p) Considerable damage was done by the explosion forces, knocking out numerous stoppings and timber, causing extensive caves, and wrecking several mine cars. A brattice cloth stopping, about a mile from the apparent point of origin, was blown down.

STORY OF EXPLOSION AND RESCUE OPERATIONS

About 1:30 p.m., November 28, 1940, an explosion occurred in the 8 east section off 12 north. Two men working on 12 north near the main west overcast felt a concussion while working on the return air from the explosion area. They ran to a small door and crawled through to the haulage road which is on the main intake. The safety inspector for the company, William Hennen, was in 1 east, about 1,700

feet outby the 7 and 8 east entries. He felt the force of the explosion and observed that the direction of the air flow reversed, but in a short returned to its normal direction of flow. He went to the dispatcher's shanty at 12 north and main west junction, where he learned that the general superintendent had been notified that an explosion had occurred and that the men working in main west had been ordered out of the mine. Accompanied by several men he proceeded to 7 and 8 east, where he observed stoppings blown out and other evidence of an explosion. He was unable to penetrate into the area because of afterdamp. The men on the surface in the meantime had notified the Division of Mines of Ohio that an explosion had occurred.

The Associated Press notified the Bureau of Mines at Pittsburgh, Pa., about an explosion that had occurred at the Holmes mine near Cadiz, Ohio. Mr. Forbes called the mine to verify the information and to offer the services of the Safety Division. H. J. Anthony, J. W. Pore, and F. S. Anderson left for the mine in the rescue truck at 3:45 p.m., arriving about 7:00 p.m. J. J. Forbes, S. W. Grove, and six other members of the Safety Division followed and assisted in the rescue and recovery operations.

Recovery operations were conducted by advancing ventilation, mostly in fresh air, gas masks being used only occasionally. The entries were practically one continuous series of falls, causing hazardous roof conditions. On the morning of November 20 a Joy loading machine started to load out part of these falls, but the progress was slow and finally that night the loading was discontinued. One body was recovered on the

morning of November 30. During that night and the next day ventilation was carried forward and the entire section where men had been working was ventilated by men working in fresh air, as tests indicated the air free of harmful percentages of carbon monoxide gas. During this day 22 bodies were recovered and 6 other bodies were located. In order to recover these last 6 bodies it was necessary to timber extensively. The falls in the A, B, and C north entries were extensive and it was necessary to remove considerable rock before 2 more bodies were found and sent to the surface on the morning of December 3. The 30th body was recovered on the afternoon of that day and the last body was recovered about 3:00 p.m. the next day, December 4. All of the mine inspectors of the Ohio Division of Mines were present at the scene of the disaster and helped direct and assist in the recovery operations. They worked under the direction of Mr. Marcus Kerr, chief of the Division of Mines.

An official inspection and investigation of the explosion area was made on December 6, 1940, in which J. J. Forbes, G. W. Grove, C. W. Owings, and James Westfield, Jr., of the Bureau of Mines participated. The State of Ohio was represented by Marcus Kerr, Thomas G. Reese, David J. Cunningham, Alfredo Nardo, John Ryan, Elmer Bagle, Thomas A. Richards, Isaac Vaughn, Joshua McHenry, Stephen Williams, John H. Price, L. L. Ledwick, Gerald Martin, and Thomas McFarlane. The United Mine Workers of America assigned Ford Simpson and William Kennedy to assist in the investigation. Among the representatives of the Ohio & Pennsylvania Coal Company present were John Lee, John Mullen, William Ramsey, and several fire bosses and section foremen. The

coroner of Harrison County, Ohio, was represented by Sergeant Sowers
durance of opinion of the State inspectors is that the ignition occurred
at or near the face of room 15, turned from 8 east air course.

The Bureau of Mines investigators cannot state positively the point of origin nor the cause of ignition until analyses of gas and dust samples collected have been received and until evidence now being given at the State hearing has been concluded; however, it is believed, from evidence now at hand, from observations made, and from data collected that the most likely point of origin of the explosion was at or near the face of room 15, 8 east air course. The most probable cause was ignition of an explosive mixture of methane and air by an electric arc or spark given off by a mining machine or an electric drill, and of these two sources the electric drill is believed to be the more likely. The mining machine and the electric drill were originally permissible but were found in nonpermissible condition. Apparently dust from the undercutting of the coal was still in the air and dust from drilling was being made at the time of ignition; this dust undoubtedly added to the initiation of the explosion. Evidence of coke in this and in other rooms and entries indicates that dust assisted in the propagation of the explosion.

During the investigation two boxes of permissible explosives and a box [illegible]re were found in section 4, but no explosives were

found at the regular storage location in section 2. It appears unlikely, however, that explosives assisted in the initiation of the explosion, but if the explosives detonated in section 2, they probably helped propagate the explosion.

RECOMMENDATIONS

Recommendations will not be made until all data have been correlated and evaluated.

Respectfully submitted

J. J. FORBES
Supervising Engineer
Safety Division

G. W. GROVE
District Engineer

C. W. OWINGS
Mining Engineer

JAMES WESTFIELD, JR.
Assistant Mining Engineer

Approved:

D. HARRINGTON
Chief, Health and Safety Branch

Correspondence

December 18, 1940 GWO:MT

Mr. George A. Strain, Director
Department of Industrial Relations
Ohio State Office Building
Columbus, Ohio

Dear Mr. Strain:

Attached to this letter are analyses of gas and dust samples collected in the Helms mine of the Ohio and Pennsylvania Coal Co., Cadiz, Ohio, on December 6, 1940. After these analyses have served your purpose, will you please give them to Mr. Marvel Herr to whom I have promised to send a set of all analyses.

Every air sample collected contained methane, even the intake on 7 east entry near 11 north. I wish to call your attention to the main return from the mine which contained 1.46 percent methane in 168,348 cubic feet of air per minute indicating a liberation of 2,264,144 cubic feet of methane in 24 hours. The return from main west contained 1.37 percent methane; however, it was not possible to take a velocity reading at this point. The returns from 4 west entry contained 1.20 and 1.07 percent methane, and the average liberation of methane in 24 hours based on these two samples was practically 800,000 cubic feet.

In the explosion area the intake air contained .14 percent methane, equivalent to nearly 7,000 cubic feet of methane in 24 hours. The return from section 2 contained 1.08 percent methane in a current of air with a velocity too slow to measure. At the face of 13 room where line brattice cloth had been restored after the explosion, and in which room it appears most probable the explosion initiated, 2.26 percent methane was found. Inasmuch as this sample was collected one week after the explosion occurred, and in view of the fact that it seems probable the line brattice had been taken down to permit cutting and drilling on rib just before the explosion occurred, it seems reasonable to assume that an explosive mixture of methane was in the room at the time of the explosion.

The

explosive limit and an entry with a cross-sectional area of 60

cc-G.W.Owings
D.Harrington
Files

square feet, enough methane is liberated in one hour in this tion to fill an entry 2,976 feet long with an explosive mixt

You asked me at the hearing at Cadiz, Ohio, the ex in explosibility of methane in air mixtures. At that time I cited the figures of 5 and 15 percent as the lower and upper limits, respectively. You also asked me whether or not a mixture of 4.75 percent methane in air could explode.

I have looked into the matter further and find that my assumptions were correct; in fact, the Bureau of Mines in its Bulletin 279, "Limits of Inflammability of Gases and Vapors," states that in a wide space the lower limit of methane is 5.3 percent, and if the flame travels upward from a closed to an open end of a vessel in gas the flame in motion may travel at least 6 feet when the proportion of methane is not less than 5 percent. In a glass tube 7 feet long and 10 inches in diameter, the upper explosive limit is 13.87 percent methane. In a vessel with a paper release at the top, equivalent to an open end, the higher limit was 13.2 percent. Where propagation of flame is down the explosive ranges are between 5.75 and 13.4 percent in a quiescent mixture, and when a down motion is imparted to the flame the lower explosive limit is 5.45 percent. With horizontal propagation, limits are 5.62 to 14.03 percent. When a limited degree of turbulence is imparted to the gas mixture the lower limit of methane is 5 percent. The final published figures in this bulletin show methane with explosive limits from 5.3 to 14 percent; and with a turbulent mixture, from 5.0 to 13 percent. These figures then show that 4.75 percent methane in air cannot be considered as an explosive mixture.

A number of samples of roof and rib dust were collected in the explosion area and outside of the explosion area. The analyses and their locations are shown in the analysis reports. Your attention is called to the fact that in the explosion area the total combustible, that is volatile matter plus fixed carbon, ranges from 23.5 to 76.8 percent. The moisture content ranges from a low of 1.4 to a high of 2.9 percent, and the moisture plus ash ranges from 31.9 to 94.5 percent. In other words, the average combustible content is 61.6 percent; moisture, 1.4 percent; ash, 35 percent; and total incombustible, 38.4 percent. The 200-mesh dust averages 30.8 percent.

Your attention is also directed to the fact that traces of coke were found on 7 and 8 east entries and air courses entry A, B, and C north, indicating that flame propagated this far. The rib dust samples collected at the same point in the explosion area show an average combustible content of 69.7 percent; moisture, 1.4 percent; and total incombustible of 30.3 percent.

---

the samples contained this amount of incombustible. On the other

hand, the samples on the entry entry 3 north contained from 33 to 40 percent incombustible in the rib dust samples, and 40.34 percent in the roof dust samples. Tests at the Bureau's Experimental mine show that with an explosion of medium speed 65 to 68 percent incombustible is required to prevent propagation of an explosion. On the other hand with a weak explosion under some conditions 40 to 50 percent incombustible may prevent propagation of an explosion. Therefore, it is believed that the inert material in the dust within the explosion area consisted in stopping the explosion; however, apparently there was a chain of circumstances that entered into arresting of the flame. It is believed that the room for expansion within the area prevented development of high pressures and speeds. The cant in the roof dust in rooms 10 and 11 and along 7 cant entry had a retarding effect on the flame. Dampness of dust, and water apparently lying in the low area covering the foot of rooms 10 to 11 and crossing 7 and 8 cant entries and air courses inby 6 North helped extinguish the explosion flame. The pressuring wave preceding the explosion apparently was violent enough to knock out timbers and to allow roof rock to fall, throwing into suspension clouds of natural rock dust. At the same time the falls apparently covered most of the combustible dust on the roof bed. This combination of events probably was sufficient to allow the relatively high inert content in the dust to assist in stopping the explosion.

Yours very truly

J. J. FORBES
Supervising Engineer
Safety Division

Encl.

Pittsburgh, Pa.
December 20, 1940

MEMORANDUM TO MR. J. J. FORBES.

Subject: Nelms mine explosion,
Cadiz, Ohio

Dear Mr. Forbes:

I left Pittsburgh for the scene of the explosion at 3:45 p.m., Friday, November 29, with J. W. Pero and M. J. Ankeny in rescue truck No. 147 and we arrived at 7:00 p.m. F. E. Griffith was already in the mine, and Mr. Ankeny went in immediately. I took over the keys to the truck and stayed outside, ready to be of any assistance necessary. We had no touble getting into the mine yard as the State police were on the scene and had established order, keeping spectators out of the area.

My first trip in the mine was on Saturday morning, accompanied by Mr. Griffith. We got up to the first roof falls in 7 east entry. One crew of men was tightening up brattices and another was setting up a mechanical loader for cleaning the rock from the entry. Griffith and I were relieved within one hour by J. Westfield and C. W. Owings before the loader had been put into operation.

By the time Griffith and I went on shift Sunday morning, the loading operation had been discontinued and a passageway had been cleared and timbered and air brought up to the head of No. 11 room through the main east entries, 7 east and 7 east air course. All of the short-circuiting crosscuts had been covered with brattice cloth and some of them had been boarded up. A searching party had been up to the faces in the main east entries and No. 14, 15, 16, 17, and 18 rooms, so on our shift an exploration party was organized to search for the men in section 4 in rooms 10, 11, 12, and 13, from east air course.

We started up 11 room and located one body along the east rib just south of the chute to room 12. This body was removed during our shift, and in uncovering it another body was located. These were identified by the crew as George Dondal and Benny Mezeresky, trackmen, on the strength of a track wrench in the hip pocket of one. These identifications later proved to be erroneous. These bodies were burned, and from the positions they were found in it appeared as though the men had died in their tracks. We passed through the chute into 12 room and went up to the face and found nothing. Crossing over into room 11 we found the section motor with the body of the motorman lying on top of it covered by a fall of roof. In at

cc-F.G.Anderson
D.Harrington
Files

the face of room 11 the bodies of three more men were found around a loading machine. As the methane concentration was high in here no attempt was made to investigate the scene in detail at this time. The party then crossed over into room 13 and found 6 more bodies in the area of the butt faces opposite the last breakthrough to room 12. The methane concentration was high in this area also. We went down 10 room and went up 9 east entry about 100 feet. As the methane concentration was high here it was decided not to proceed any further into the area until the gas had cleared out. During all of this time we had found no evidence of CO. There was still a smoky smell in the air.

When Griffith and I came on shift Tuesday morning, 9 east entry, 10 east entry, 10 east air course, and A, B, and C north entries had been explored and all of the located bodies removed except those in room 1 off from C north entry. These were the bodies of Doudal, Mezeresky, Marcus, and James, and they were removed during the shift. One of the four still missing men was Griffith whose section motor was found opposite room 1. The crew on this shift was put to work around the motor trying to locate him. About 20 feet south of the motor where it seemed Griffith should be the body of Smith was found. The body of Rayl was also found and removed during this shift. He was found lying under a fall of ground in C north entry at the corner of chute opposite room 1.

On the Wednesday morning shift Griffith and I spent most of our time searching in the rooms from 10 east air course in the hope of locating Dinger and Griffith, the two still missing men. All this time a crew was continuing a thorough search in the area around section 2. I returned to Pittsburgh after this shift.

As this was my first experience in a coal mine, this gave me a chance to observe many new things and served as a very serious concrete object lesson.

Respectfully submitted

Floyd G. Anderson

FLOYD G. ANDERSON

December 21, 1940. RRS/[illegible]/gd

Mr. H. J. Helms,
The Ohio and Pennsylvania Coal Co.,
Helms Mine,
Cadiz, Ohio.

Dear Mr. Helms:

Referring to your letter of December 16, we appreciate very much the nice statements which you make about Messrs. Forbes and Grove, and other Bureau of Mines men who have participated in the rescue and recovery work in the recent explosion in your mine.

All of us are sorry that you have had to undergo the recent sad experience and it is hoped that lessons will be learned from your disaster as well as from others which have occurred this year, and that these lessons will enable the coal mines of the United States for at least several years to avoid mine explosions.

As desired by you, I have turned over to Mr. Harrington the map which you sent, and he indicates that it gives us some information of value.

I thank you for the information you have given us, and wish you a [illegible]ful New Year.

[illegible] sincerely,

R. R. SAYERS

R. R. SAYERS,
Director.

cc Safety Division

Files

Mr. Forbes, Pittsburgh

ADDRESS ALL COMMUNICATIONS TO
THE DIRECTOR, U. S. BUREAU OF MINES
WASHINGTON, D. C.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

WASHINGTON December 31, 1940.

Mr. J. J. Forbes,
U. S. Bureau of Mines,
Pittsburgh, Pa.

Dear Mr. Forbes:

I am returning herewith the final report on the Nelms disaster and have made some alterations in it which should be placed on the other copies of the report.

In this mine, particularly in the region in which the disaster occurred, it strikes me that here, above all, the conditions which I have observed on maps of mines or in the mines themselves, would be an ideal location for the use of methane indicating alarms, if any are available. Up to the present time we have none known but one ~~which~~ should by all means be perfected by someone, either within or out of the Bureau of Mines.

I wish to call your attention to the fact that the report does not indicate the extreme hazard of having trolley locomotives or non-permissible equipment of this type in use where blasting is done in mines where the gases from blasting can be taken by ventilation and drawn over this open or non-permissible devices. It seems to me that the report is missing one of its most important points in not calling attention to this matter of the probable release of considerable collections of gas from blasting where this gas can accumulate or can be drawn to the working places on the return side of the regions in which the blasting occurred, and if open or defective electrical equipment is in use in these places, gas ignition is almost certain to occur. This is of especial importance in a mine or section of a mine as gassy as is the explosion region in the case.

On page 36, line 5 from the bottom, as well as on page 37, is a reference to a radius track. I presume what is meant is the curve in the track leading out of the room to the haulage entry. In any event the expression is a new one to me and in view of the fact that I have had 40 years experience in and around mines, it strikes me that an expression that is new to me is likely to be new to others who read this report, and I do not think that in our reports we should use mining terms that are of local use only, or of such a nature as not to be understood by persons reading our reports or publications.

In recommendation #1 on page 49 where it is stated that the use of permissible explosives should be continued and should be charged and fired in a permissible manner, it seems to me that by all means what is meant by a "permissible manner" should be indicated right here. I realize that in subsequent recommendations some of the requirements of permissible ~~equipment~~ explosives are included but in such a sweeping statement as in recommendation #1, we should certainly define what we mean right there.

In connection with the maps, I have had a considerable amount of difficulty in following out the ventilation on the main sketch which you submitted covering the explosion area. At least on the eight typed copies of the report I wish you would have placed in red on the maps the ventilation currents. That will give a much better opportunity of trying to follow the ventilation than is afforded by the maps as they stand.

In connection with maps it strikes me that as you have arrived at a definite conclusion that the explosion originated in Room 13 and apparently this conclusion is approved by others who have given a judgment including the State inspection force, I am of the opinion that the inclusion of the sketches of the other parts of the mine is not necessary, and I wish to call your attention to the fact that such inclusion will greatly increase the cost of publication of this report later on. I am not insisting that the additional sketches be eliminated but I am of the opinion that their inclusion serves no useful purpose. It is desirable that the report be placed in final form and forwarded as soon as possible as there have been numerous requests for it.

Yours truly,

D. HARRINGTON,
Chief, Health and Safety Branch.

Enclosure 2083522

January 8, 1941 JJF:CWO:MS

Mr. D. Harrington
Bureau of Mines
Washington, D. C.

Dear Mr. Harrington:

The copy of the final report on the explosion in the Helms mine and your letter of December 31, 1940, suggesting changes have been received. The corrections made by you have been incorporated in all the copies, with several exceptions.

The change on page 26 from "swale" to "swamp" was not made as, according to the dictionary, "swale" is a depression or low place, and "swamp" is a "low spongy" place, which is not the condition in the Helms mine.

On page 42, next to the last line, you had made a correction to read "it is improbable that the explosion would not have propagated" etc. The "not" was eliminated.

On page 43 at the end of the second paragraph you added part of a sentence regarding liberation of gas by blasting which has not been included, as it is contrary to conditions found and gives an inaccurate interpretation. While this condition may and probably does exist in this mine at times, there is no evidence to show that it existed at the time of the explosion. The air travels from room 13 to room 11; hence, gas liberated in room 11 would not be carried into room 13.

uggested addition of "at or near the face" has not be leaves the thought that the explosion may have i re in the room, which is not the case.

"Explosives and Blasting" the requirements of p ve been added and recommendation 6 has been omitted.

I agree with you that a methane-indicating alarm would be desirable and when practical permissible ones are available, their use should be recommended.

cc Files

A description of the system of ventilation has been added on page 6 and a discussion of the hazard of trolley locomotives, where there is liability of liberation of considerable gas by blasting, has been added on page 7.

The words "radius track" are becoming a common term where mechanized mining is used, but the word "curved" has been substituted for "radius" in the report.

The ventilation in the explosion area has been indicated by red arrows on the enlarged map of this section. The only maps included in the reports are the main mine map, the sketch of the explosion area, and the enlarged sketch of room 15. Several sets of the details of other parts of the explosion area are being sent to you, in case there are requests for them.

Very truly yours

J. J. FORBES
Supervising Engineer
Safety Division

Encl.

COPY

April 2, 1941 JJF:WJF: RS

Mr. Albert D. Caddell, Secretary
Industrial Commission of Ohio
Columbus, Ohio

Dear Mr. Caddell:

It will be appreciated if you will furnish me information concerning the number of widows and orphans that were left as a result of the following explosions:

Willow Grove No. 10 Mine, Hanna Coal Company,
Neffs, Ohio, March 16, 1940
Nelms Mine, Ohio & Pennsylvania Coal Company,
Nelms, Ohio, November 21, 1940

This information is desired in connection with some statistics we are compiling, and your prompt reply will be appreciated.

Very truly yours

J.J. FORBES
Supervising Engineer
Safety Division

Original
Under D-2110

cc. D. Harrington
W.J. Fene
Files

COPY

APRIL 3, 1941

Mr. J.J. Forbes,
Supervising Engineer,
Safety Division,
United States Department of The Interior,
Bureau of Mines
4800 Forbes St.
Pittsburgh, Pa.

Dear Sir:

In reply to your request of April 2nd for the number of widows and orphans that were left as a result of explosions at Willow Grove No.10 Mine, Hanna Coal Company, and at the Nelms Mine of the Ohio & Pennsylvania Coal Company, We wish to advise as follows:

The mine disaster at the Nelms Mine happened on November 29, 1940. Thirty-one men were killed, leaving 27 widows and 62 children between ages of 0 and 20 years. Also 4 dependent parents and 2 brothers and sisters.

The mine disaster at the Willow Grove Mine of the Hanna Coal Company on March 16, 1940 caused the death of 72 men, leaving 59 widows, 92 children under 16 years of age and 25 children over 16 years of age. also 9 dependent parents, 4 brothers and 2 sisters.

Yours very truly

(signed) Don W. Wiper

Secretary.

HM

Rescue Car 3
Johnstown, Pennsylvania
December 11, 1940

Memorandum to Mr. J.J.Forbes

Subject: Report on explosion Ohio-Pennsylvania Coal Company, Nelms Mine, Cadiz, Ohio

Dear Mr. Forbes:

At 9:00 a.m. Saturday November 30, I received a telephone message from the Pittsburgh office informing me to proceed to Cadiz, Ohio and assist with rescue and recovery work, in progress, following explosion of the Ohio-Pennsylvania Coal Company, Nelms Shaft Mine, November 29.

I left Johnstown, Pennsylvania 9:15 a.m. in Govt. auto US 141 arriving at the mine 3:05 p.m. Following instructions, I immediately prepared to enter the mine on the afternoon shift. In company with Mr. E.E.Quenon, two Ohio State Inspectors, Company Officials and a crew of twenty-five men we left the surface at 5:45 p.m. informed that the previous shift were engaged in loading rock with a Joy loading machine on the 7 East Entry off the 12 North Entry. Numerous caves, blown out stoppings, necessary timbering, percentages of CH4 and CO greatly hampered recovery and exploration work. Several of the crew on our shift were detailed to operate the loading machine, others were instructed to timber and scale the roof, others were instructed to erect board stoppings in the breakthrus between 7 and 8 East Entries in order to restore ventilation at the explosion area of the 2 and 4 Sections of the mine. Mr. Quenon, the State Inspectors, and myself explored the region to the 11 Room, 2 Section, off 7 and 8 East Entries. We deemed it useless to explore farther due to the fact that a low percentage of CO was encountered in that locality. Nothing of interest was noted except the location of four empty mine cars at this point showed plainly that the forces of the explosion evidently came down the 2 Section toward the 12 North Entry. No indication of flame or coke was detected. We were relieved at 1:30 a.m. by Messrs. Pero and Ankeny.

A change of work scedules was arranged there-for the next entrance to the mine was made at 7:15 p.m. December 1. In company with Mr. Quenon, State Mine Inspectors, Company Officials, and a crew of 20 men we relieved Messrs. Owings and Westfield at the face of operations on the 7 East Entry, off 12 North Entry. Operation of the loading machine had been discontinued there for the work done on this shift consisted of erecting board stoppings at the breakthrus between 7 and 8 East Entries, timbering, scaling rock, and erecting board stoppings on 8 East Entry Air-Course at B North Entry at 4 Section. Explorations were made to 4 Room on B and C North Entries. Tests at the return air course of this section showed a 2.0 % CH4 content at 9:00 p.m. and a gradual increase throughout the night to 3.5 % CH4 at 1:00 a.m. December 2. A change in atmospheric pressure was attributed to the change in percentages of CH4. No CO present at this point. The shift was relieved at 1:30 a.m. by Messrs. Pero and Ankeny.

On Monday December 2, in company with Mr. E.E.Quenon, Ohio State Inspectors, Company Officials, and a crew of thirty men we left the surface at 6:00 p.m. to relieve Messrs. Owings and Westfield at the 12 North Entry. The crews were instructed to timber the B and C North Entries on 4 Section up to 4 Room off C North Entry. Accurate check of the CH4 content at this section was maintained through out the shift at 15 minute intervals. The average for the shift was approximately 2.15 % A crew of five men were engaged in cleaning the auxilliary air course off the 11 North Entry Air Course to the 7 East Entry Air Course. Several large caves were leveled with the hope of inducing more air to the explosion area. The crews at the C North Entry were engaged in turning over rock and exploring the region for bodies. Four dinner buckets were discovered, one hundred fifty blasting caps, two boxes blasting powder (450 sticks), outby # 2 Room, C North Entry. A section of cap lamp cord,about sixteen inches long, was found out by # 4 Room, C North Entry. On 12 North Entry out by 7 East Entry the trolley wire fell on a mine car causing a small fire. Contact was made for a period of thirty seconds, yet the circuit breaker was not effected. (11:30 p.m.Dec.2) The shift was relieved by Messrs. Pero and Ankeny at 1:30 a.m.

We were prepared to enter the mine at 6:00 p.m. but certain changes were being made in the ventilation and all crews were retained on the surface, except a few men required to alter the air current. The CH4 content had increased in the return entry off the 4 Section and orders were issued to attempt introduction of more air in that Section. In company with Mr. E.E.Quenon, three Ohio State Inspectors, three Company Officials, and a crew of eight men the shift entered the mine at approximately 8:30 p.m. December 3. The crews were directed to take a part of the air in the 7 West Entry and place it in the 12 North Entry thence to the 7 East and 7 East Air course to the 2 and 4 Section of the mine. Anemometer readings at the 12 North Entry showed 37,000 cu. ft. of air entering that section, yet no appreciatable difference was detected on the return entry of the # 4 section. Tests for CH4 at the return of this section showed an average of 1.6 % taken with the M.S.A. W-8 type detector. No further exploration was made on this shift.

On the afternoon of December 4 we were notified that the last body had been brought to surface. Preparations were then made to leave Cadiz immediately. Mr. James Westfield accompanied me to Pittsburgh, Penna., leaving Cadiz, Ohio at 5:50 p.m. via Govt. auto US 141. arriving at Pittsburgh, Penna. at 9:15 p.m. I then continued to Johnstown, Penna., arriving at that place 12:30 a.m. December 5.

Respectfully submitted,

E.L. Christensen

E.L.Christensen

c/o D. Harrington
Car 3 Files

Pittsburgh, Pa.
December 20, 1940

MEMORANDUM TO MR. J. J. FORBES.

Subject: Mine disaster, Nelms mine, Ohio and Pennsylvania Coal Co., Cadiz, Ohio.

Dear Mr. Forbes:

In accordance with your instructions I left Pittsburgh, Pa., at 3:45 p.m. in mine-rescue truck US-147 in company with J. W. Pero and F. G. Anderson, arriving at the mine at 7:00 p.m. Mr. F. E. Griffith was in the mine at the time of my arrival. After obtaining whatever information was available on the surface I entered the mine at 8:15 p.m. with the intention of relieving Mr. Griffith at 11:00 p.m. Upon my arrival at the dispatcher's office underground I was asked by Jack Lee, who was in charge at this point, to check the main returns for methane and CO at half-hour intervals until time for the mantrip to leave, which I did. Shortly before 11 o'clock I was joined by J. W. Pero who advised that you had arrived and had come into the mine. With the relief shift, and accompanied by J. W. Pero, I arrived at the fresh air base at about 11:30 p.m., where I contacted you. Advance work had stopped at the fresh air base because of insufficient air.

After arrangements were made to reinforce the temporary stoppings along 7 east an attempt was made to advance, but progress was slow due to bad roof and considerable time was lost in scaling and timbering. Toward the end of the shift we succeeded in getting into the 7 east air course and found that the falls were not as bad as they had been in 7 east; however, at the close of the shift a decision had been made to stop the advance ventilation work and start a Joy loader to load out rock in 7 east heading. One body, that of the mechanic, was found on 7 east just outby the chute leading to B north during the shift. The body was under a fall.

At the beginning of my next shift, starting at 11:00 p.m., Saturday night, a decision was made to continue advancing the ventilation, so this work was started where it had been left off at the end of my previous shift. During this shift the air was advanced to the faces of the 7 east entries and was conducted up No. 15 room to the point where No. 15 room intersected with No. 1 room off No. 13 room off 7 east. This advance was made in about five hours but was discontinued because a heavy fall occurred on 7 east where the Joy machine was operating. This fall covered up the Joy loader and broke down a stopping which could not be replaced immediately due to bad roof, making it necessary for the ventilation crews to retreat.

cc-M.J.Ankeny
D.Harrington
Files

5. I did not have the opportunity to visit the face of No. 13 room and therefore have formed no conclusions of my own regarding the exact cause of the ignition. From my own observations I do not believe that the explosion originated in B north, but from what I have been told by the other members of the Bureau I think the explosion originated at the face of No. 13 room off 7 east and that the ignition was caused by an arc or spark from a drill or mining machine.

Yours very truly

M. J. Ankeny

M. J. ANKENY

Newspaper Accounts

The Pittsburgh Press
Saturday, Nov. 30, 1940

RESCUERS FIND BODY IN OHIO PIT EXPLOSION

Five Overcome as Sound Device Records No Trace of Victims

Pictures on Page 5.

Special to The Pittsburgh Press

CADIZ, O., Nov. 30—Hope that any of the 30 other men trapped by a mine explosion near here late yesterday still might be alive faded today as weary rescue workers reported the recovery of the first body.

A rescue squad toiling through debris-filled passages of the Ohio-Pennsylvania Coal Company's Nelms mine far below the surface informed mine officials that the body of Pete Speicher, 38, had been found.

Although the first victim was reached hours before it previously had been thought possible, officials doubted that any of the men could be alive.

Believe All Are Dead

Most observers believed that those who had not been killed outright by the explosion had been suffocated.

This was borne out by the failure to pick up signals from the trapped men through sound detection equipment, indicating that if any still lived they already were unconscious.

The man whose body was recovered was a resident of Cadiz and a brother of Matthew Speicher, personnel director for the company.

Fear They Died Instantly

The body had been nearly decapitated. This led to the belief that many if not all the buried miners had been killed instantly.

Mine experts believe it would be late today or tomorrow before all victims could be reached through the tons of earth and coal which choked the passages.

The explosion occurred in a part of the mine known as Section 12, North. Its cause was not known but officials theorized that a slate fall had broken electric cables, creating a short circuit that set off a pocket of gas.

Near Phone Shanty

The exact place where the first body was recovered was not known immediately at the mine entrance. Earlier, however, a rescue squad was reported to have reached a point within 400 feet of a telephone shanty where four of the entombed men were working at the time of the explosion.

Frank St. Clair, chief clerk at the mine company office, expressed the belief that a large mass of debris still had to be removed before other victims would be reached.

Rescue squads were forced to delay operations at several points long enough to timber the walls of the shaft to prevent further collapse and to instal air locks to fend off bad air.

The lives of rescue workers themselves were in some peril. One group narrowly escaped being caught in a fall of rock loosened by the blast. Five others were carried out unconscious from the effects of gas but were quickly revived.

Huddled about the mine entrance in the eerie glow from a burning slag pile and miners' lamps were the wives and families of the trapped men hoping that word would come from the searchers below that some of the trapped men would be found alive.

Two full mine crews evidently were trapped about 500 feet below the surface and approximately two miles from the mine entrance. They were believed to have been caught about 2000 feet off the main shaft.

Rescue workers had no means of determining how much of the spur had collapsed.

The mine is about a quarter of a mile off a main highway deep in the hills of Harrison County in Southeastern Ohio.

J. J. Forbes, head of the U. S. Bureau of Mines in Pittsburgh, immediately sent three mining experts to the scene. Arriving here a few hours after the explosion were M. J. Ankeny, mining engineer; J. W. Pero, senior safety instructor, and F. G. Anderson, assistant mining engineer.

Franklin E. Griffith, who had been conducting a safety program at the Hannah Coal Co. mines at Willow Grove, O., where 72 men died last March, also arrived here last night to assist in the rescue work.

Third Disaster This Year

The disaster was the third in the Ohio-West Virginia area this year. Before the Willow Grove tragedy, 92 men perished in a mine of the Pocahontas Coal Corp. at Bartley, W. Va.

Neighboring communities sent blankets, stretchers, first aid materials and food. Physicians and nurses from Cadiz Hospital were at the scene to help first aid staffs at the mine.

The Nelms mine, which has some of the deepest shafts in the state, has been in use 15 years. Officials said there had been no previous major accidents.

J. P. Nelms, vice president of the company, arrived from Cleveland and went immediately into the mine with other company officers.

Gov. Bricker Sends Agent

Gov. John W. Bricker sent an agent of the State Industrial Commission from Columbus to make arrangements for prompt settlement of workmen's compensation, death or injury claims.

The company employs over 400 men in three shifts. Approximately 150 men were at work in the mine when the explosion occurred, but those working in other sections escaped and were among the first to begin rescue operations.

Harvey Nelms, mine superintendent, was in direct charge of the workers. He reported that there was no evidence of fire following the explosion.

The Herald Star
Steubenville, Ohio
December 10, 1940

MINE EXPERTS OFFER THEORY IN CADIZ BLAST

Drilling Machine Spark Believed to Have Ignited Gas in Pit

WELLS DOT AREA

By JOHN H. COLBURN
Associated Press Staff Writer

CADIZ, O., Dec. 10.—Testimony today in the state investigation of an explosion at the Nelms mine indicated that a drilling machine possibly set off the blast that killed 31 coal miners on Nov. 29.

J. J. Forbes, supervising engineer for the federal bureau of mine's safety division, said at the the second day of a public hearing that his inspection showed the drill in room 13 apparently was being operated and that no machinery was functioning in the nearby rooms when the explosion occurred.

Previous testimony had shown that explosive methane gas was generated in large quantities in room 13, where Forbes said the heaviest damage appeared to be.

Forbes had not been questioned regarding what ignited the gas when the hearing recessed at noon. Other mine experts have been unable to explain the ignition factor positively, but said that a spark from a drill could have been responsible.

Men at Drills

John Mullen, engineer for the Ohio and Pennsylvania Coal company, the mine owners, also testified that men appeared to be working at the drill when the blast hit them without warning.

John C. Wilson of Columbus, chief inspector of gas wells for the state, related that a large number of abandoned gas wells dotted the mine property.

State mine inspectors appearing at the fact-finding investigation yesterday reported that inadequate ventilation allowed the gas to accumulate in room 13.

Nelson Hovey, Ohio assistant director of industrial relations and counsel in charge of the inquiry, indicated that officials of the Ohio and Pennsylvania Coal company, the mine owners, might not be heard until Wednesday.

Marcus Kerr, chief of the Ohio division of mines, testified that "the fact that there did accumulate quantities of gas in an explosive mixture is evidence that the ventilation was faulty."

Kerr and two of his district inspectors, Richard McGee and Alfred Nardo, were unable to learn what ignited the methane gas, which they said was generated in large quantities in Room 13 because of clay deposits.

Amid Gas Deposits

Company officials, who have declared that their ventilation system met all requirements, observed previously that the deep mine is located amid large gas deposits.

Nardo said perhaps five loaded coal cars which were found between Rooms 12 and 13 had caused an air leak in a partition, allowing gas to accumulate. A broken door also was considered as a possible cause for short circuiting the flow of air.

Kerr testified before an audience of miners who packed the Harrison county court room that William Ramsey, mine safety foreman, had told him that a broken door was discovered a half hour before the blast and that a man had been assigned to repair it. That man died in the blast.

Two days before the explosion, four state mine inspectors discovered gas in explosive quantities

(Turn to MINE EXPERTS on 3)

MINE EXPERTS

(Continued from Page 1)

in Room 13, Kerr said in making their report public for the first time. The inspectors had ordered the condition remedied at once.

"It is my opinion that the explosion originated in Room 13 of Section 2" said Kerr. "That was not necessarily the point of ignition, but Room 13 was the place with the largest quantity of explosive mixture."

George A. Strain, state director of industrial relations, presided at the hearing which he described as a fact finding investigation. Company Mine Superintendent Harvey Nelms, who was to be called later, and representatives of the United Mine Workers of America were in attendance.

Company spokesmen have declared that the air supply met all requirements and while not speculating on the cause of the blast they have pointed out that the mine four miles east of here, deepest shaft mine in the state, is located in the vicinity of gas deposits.

Two of the four inspectors who made the Nov. 27 inspection, Richard McGee and Alfred Nardo, also testified in the hearing which was expected to last three days. McGee said that adequate rock dusting at the Nelms mine had prevented a greater explosion such as that at the Willow Grove mine where 72 were killed last March 16.

Kerr declared that the explosion was localized "and that the force was not sufficient to develop the theory that dust started the explosion or was instrumental in spreading it."

Meanwhile, the Federal Bureau of Mines in Washington said that because of "the past year's black record as regards coal mine explosions" special attention would be devoted to making working conditions safe and hygienic.

"Accident prevention must be stressed if the mining industries are to retain the improvement they have shown during the 30 years of the Bureau of Mines," the report said.

Secretary of the Interior Harold L. Ickes announced that legislation to require federal inspection of coal mines had received the endorsement of Mark W. Potter, president of the Pennsylvania Coal and Coke Corp.

The Times Recorder
Zanesville, Ohio
December 11, 1940

Electrical Equipment Ignited Gas in Mine

CADIZ, O., Dec. 10—(AP)—Ignition of a gas explosion that killed 31 coal miners in the Nelms mine Nov. 29 was traced today by federal engineers to electrical equipment, which one of them said did not meet federal requirements because bolts were missing from vital control boxes.

C. W. Owings federal mine engineer from Pittsburgh, testified at a public hearing into the disaster that eight of ten bolts were missing from an electric drill control box and that four of eight were missing from the box on a mining machine.

"Then the involvement of some human element on the drill and mining machine made them nonpermissible and not approved by the U. S. division of mines?" asked Nelson Hovey, counsel in charge of the investigation being made by the state department of industrial relations.

"Yes, an explosion inside the control boxes might have transmitted flames outside, igniting any gas there," replied Owings, who said the bolts left on the box covers were insufficient to hold them in place. Permissible mining equipment is not required under Ohio law.

Faulty Equipment

Before Owings took the stand, two other federal engineers, J. J. Forbes and George W. Grove, expressed the opinion that either the electric drill or the mining machine in room 13 ignited the gas explosion in the 460-foot deep mine of the Ohio and Pennsylvania Coal Co. four miles east of here.

While nothing was brought out at the hearing to show why bolts were missing from the control

(Turn to Page 14, Please)

Electrical

(Continued from Page 1)

boxes, mining men explained that bolts often were lost in making equipment repairs.

Human Element

Hovey stressed that the "human element" was something over which the federal bureau of mines and the state department of industrial relations had no control.

Engineer Owings asserted that "it appears that the force of the explosion more or less radiated from the hole being drilled" in room 13.

George A. Strain, state industrial relations director, rejected at the afternoon session of the hearing's second day a request by Attorney John Cinque for permission to question and cross-examine witnesses. Cinque represented district 6 of the United Mine Workers of America.

Strain, explaining that if the request were granted he would have to grant similar rights to other organizations, said that "we are motivated by one desire—to ascertain and determine what caused this catastrophe."

THE HERALD STAR
Steubenville, Ohio
December 11, 1940

Inspector Says New Air Shaft Needed At Mine

Recommends Delay In Resuming Work At Cadiz Until Improvement Is Completed

By JOHN H. COLBURN
Associated Press Staff Writer

CADIZ, O., Dec. 11.—State Mine Inspector John W. Harris asserted today that the Nelms mine, scene of the disastrous gas explosion Nov. 29, should not be reopened until a second air shaft is installed.

Reiterating at a public hearing testimony that an inadequate ventilating system permitted explosive gas to accumulate and cause a blast that killed 31 coal miners, Harris disclosed that he previously had recommended a new shaft in the interest of mine safety.

The recommendation, he said, was made to John Mullen, Ohio and Pennsylvania Coal Co., engineer and Walter Smith, former chief of the state division of mines.

Harris quoted Mullen as saying a new shaft was contemplated. The inspector said that Smith, only man who could order a new shaft, promised to look into the matter but never did.

"I do not believe that the mine should be reopened until another shaft is sunk," Harris said.

Examiner Inspects Mine

Marcus Kerr, present head of the mining department, declined immediate comment on whether reopening would be halted until a new shaft was dug. State mine inspectors today examined the mine to determine whether it was safe to reopen. It has been employing about 500 men.

Before Harris' testimony, Federal Mine Engineer C. W. Owings disclosed definitely for the first time in the three-day hearing that ignition of the gas probably was due to an electric drill in room 13.

Representatives of the United Mine Workers of America, refused permission to participate directly in the state's investigation of the Nelms mine disaster, today voiced new determination to seek through the legislature the right for miners' and operators' counsel to examine witnesses.

"We want the privilege for spokesmen of the miners and operators, as well as the state, to question and cross examine witnesses in a full and open investigation," said John Cinque, attorney for the mine workers union.

George A. Strain, state director of industrial relations, who is conducting a public hearing here to determine the cause of the gas explosion which killed 31 coal miners Nov. 29, yesterday rejected Cinque's request to examine state and federal mine inspectors.

Says Probe "One-Sided"

Cinque commented that "the state is interested in cleaning its own skirts" and added that "we can't do a thing about the one-sided investigations until the legislature revises the mine code."

Cinque's request would force him to oblige other organizations similarly and emphasize that "we are motivated by only one desire—to ascertain and determine what caused the catastrophe."

Cinque said that Strain presu-

(Turn to INSPECTOR on Page 2)

INSPECTOR SAYS SHAFT NEEDED

Recommends Mine Be Kept Closed Until Done

(Continued from Page 1)

ises to call William Kennedy, district UMW board member, and Ford Sampson, district representative, at tomorrow session of the hearing which opened Monday.

Federal Mine Engineers J. J. Forbes and George W. Grove testified yesterday that ignition of the gas came from electrical equipment in room 13 and Engineer C. W. Owings asserted that because bolts were missing from vital control boxes of this equipment it did not meet federal requirements.

An electric drill and mining machine were being operated in room 13 when methane gas exploded. None of the engineers could say definitely from which machine the ignition came, but Owings observed that "it appears that the force of the explosion more or less radiated from a hole being drilled."

Forbes, who has been associated for 2 years in the safety division of the U. S. bureau of mines, after qualifying as an expert stated that he had formerly served as safety inspector of the Provident Coal company at St. Clairsville, and prior to that with the Carnegie Steel company at Bellaire. He went to Unionvale, location of the Nelms mine, immediately after being appraised of the accident and with his assistant and Harvey Nelms, went down into the mine on an inspection

He said that he and Mr. Nelms walked to the explosion area where he was primarily interested in the condition of the return air so that rescue work could be speeded. He said at that time the return air contained less than three-tenths of 1 per cent gas and no smoke, giving assurance there was no fire in the area.

However, on the day following the explosion, he said that it became necessary to halt rescue operations in the stricken section temporarily due to gaseous conditions. He said that at that time, the air showed a content of about four and one-half per cent of methane gas, which, according to bureau standards, approached the explosion point. He explained that the explosion point was between five and 15 per cent.

Under questioning of Nelson Hovey, Forbes told of his tour of inspection of the area.

Locate Bodies

Mr. Forbes told of finding the bodies in the mine. He at first stated that room 13 showed "little violence" but later changed his testimony that "considerable violence was found."

He told of inspecting room 11 where there was a Joy loader, with two or three cars and a gasoline motor. He said that the evidence showed none of these machines were in operation at the time of the blast. The trucks on one of the cars was off the tracks he said, and in all probability, the men who were found dead in that section had been engaged in getting the truck wheels back on the track.

In room 10, he said, there was a motor which obviously had been engaged in cleaning the room of trackage and posts. A cable from the motor was fastened to a post, but the cable was not taut, and the motor control was on the "off" giving indication that the only machinery in operation in the area was in room 13.

Describing the machinery in room 13, which, according to early testimony will be picked as the room in which the blast originated, he said that the undercutting machine was a "permissable" machine, given the stamp of approval of the United States bureau of mines.

Bolts Missing

He testified, however, that three bolts were missing from the plate which sealed the machine and make it flame proof and permissible. Witness stated he did not examine the drill.

"Why," demanded Hovey, "did you pay so much detailed attention to the mining machine and not inspect the drill?"

Forbes indicated that in all probability one of his assistants had inspected the drill.

Preceding Forbes on the stand was John C. Wilson, oil and gas well inspector for the state.

Wilson said that following the blast, he had checked through state records and found four abandoned gas wells that were not charted on the company map of the mine.

Three of the wells were on the Robb farm and one on the Thompson farm. A fifth well, possibly located over the coal bearing strata of the Nelms operation was thought to be on the Barkner farm. Wilson said he had no positive information about this well, however, as it was located on a very old map of the Ohio Fuel Gas Co. that might not be reliable.

John Mullen, mine engineer, employed by the Nelms mine, also testified, indicating that the only actual mining activity at the time of the explosion in the blast area was confined to room 13.

Mullen was presented with a large number of maps showing the interior of the mine, particularly those sections which were wrecked by the explosion. The maps covered every part of the interior and Mullen was questioned at great length relative to air and gas formations would have on the explosion.

THE HERALD STAR
Steubenville, Ohio
December 11, 1940

THE TIMES RECORDER
Zanesville, Ohio
December 12, 1940

Ohio's Mine Laws Lack Teeth

CADIZ, O., Dec. 11—(AP)—Ohio's mining laws lack "teeth" to aid state inspectors enforce safety practices, Inspector John W. Harris asserted today at a public investigation of the Nov. 29 Nelms mine catastrophe.

Harris pointed out at a hearing conducted by the state department of industrial relations that the law does not empower inspectors to close mines if they find unsafe conditions or to inspect machinery to determine if it is faulty.

"We are continually rebuffed by an inadequate law," he said.

Harris disclosed that he had recommended a new air shaft for the Nelms mine of the Ohio-Pennsylvania Coal Co. where a gas explosion killed 31 miners, and that in his opinion the mine should not be reopened until a second shaft is installed.

The inspector later qualified his remark by saying that if "12 north" section, where the explosion was concentrated, were sealed the ventilation system would be adequate for the remainder of the mine.

Because of some disruption which short circuited the air flow methane gas accumulated to explosive proportions in room 13, Harris and other mine experts have testified in the three-day old fact finding inquiry.

Harris related that after one inspection he recommended the additional shaft in talking with John Mullen, company engineer, but Mullen said he did not recall such a conversation.

Company officials have taken the position that the ventilating system is adequate. This was supported, in part, by Harris who said that an explosion would have occurred on Nov. 28 had the system not "cleared" quantities of explosive gases which he found in room 13 on an inspection Nov. 27.

THE WHEELING INTELLIGENCER
December 12, 1940

LACK POWER TO CLOSE UP NELMS MINE

Inspector Harris Says Second Air Shaft Needed

Important witness yesterday at the Harrison county court house at Cadiz, in the investigation of the fatal Nelms mine disaster of November 29, when 31 miners lost their lives, was John W. Harris, of Adena, O. Mr. Harris is a state district deputy mine inspector, and declared that Ohio's mining laws lack "teeth" to aid state inspectors in enforcing safety practices.

Mr. Harris testified yesterday at the third day of the hearing being conducted by the Ohio department of industrial relations. Other witnesses yesterday were Ford Sampson of Cadiz, a district representative of the United Mine Workers of America; William Kennedy of Bellaire, also a district representative of the miners and Harvey J. Nelms, mine superintendent at the workings, and C. W. Owings of Pittsburgh, federal mine safety engineer. Mr. Nelms was the last witness to testify yesterday and when the hearing reopens this morning will again take the stand.

When Mr. Harris took the stand Wednesday morning, his examination was begun by Nelson Hovey, assistant director of the industrial relations department of Ohio. Witness stated that the Ohio law does not empower inspectors to close mines if they find unsafe conditions or to inspect machinery to determine if it is faulty.

Continually Handicapped.

"We are continually rebuffed by an inadequate law," he said. Mr. Harris added that he had recommended a new air shaft for the Nelms mine, owned by the Ohio & Pennsylvania Coal company, and in his opinion the mine should not be reopened until a second shaft is installed.

Elaborating on his testimony Mr. Harris stated that he was employed at the Nelms mine from 1934 to 1937 and a year ago suggested sinking of a shaft to the 12 north section of the mine. He discussed the plan with John Mullen, chief engineer at the mine, and Inspectors Nardo and M'Gee. Mullen had told him that an air shaft was being considered.

The deputy inspector detailed his visit and inspection of the mine two days before the explosion. He had found gas from a low of one per cent to an explosive mixture in room 13, believed to have been the point of ignition of the explosition, and all over sections 2 and 4, also in the blast area. He "dangered off" that section and also ordered the entire mine rock dusted, guard boards replaced and other safety steps taken.

Sealing Section.

The inspector later qualified his remark by saying that if "12 north" section, where the explosion was concentrated, were sealed the ventilation system would be adequate for the remainder of the mine.

Because of some disruption

(Turn to Page 6, Column 7.)

LACK POWER TO CLOSE NELMS MINE

(Continued from Page One.)

which short circuited the air flow methane gas accumulated to explosive proportions in room 13, Harris and other mine experts have testified in the three-day old fact finding inquiry.

Federal Engineer C. W. Owings said his investigation showed that probably an electric arch or spark from a drill in room 13 set off the explosion.

Marcus Kerr, state mine chief, had scheduled an inspection yesterday to determine if the mine was safe to reopen, but deferred it until today after Harris' testimony. J. C. Nelms, company vice president, also is due today and may decide whether "12 north" section will be sealed.

Sampson Testifies.

Ford Sampson, district representative of the United Mine Workers, corroborated earlier testimony concerning the place and time of the explosion and that it probably was caused by an electric spark from a drill.

Harvey J. Nelms, mine superintendent, was the last witness of the day. He said that he and his own fire boss, William Ramsey, went through the mine after Harris' examination and that Ramsey reported no indication of gas.

Nelms said that Ramsey's examination was made on Thursday, the day before the explosion.

Pittsburgh Press
March 13, 1941

Mine Opening Awaits Further Inspection

By The United Press

CADIZ, O., Dec. 13—State officials today planned a further inspection before permitting resumption of operations at the Nelms Mine of the Ohio and Pennsylvania Coal Co. where 31 men were killed by an explosion two weeks ago.

The inspection will be made tomorrow and if investigators approve the company may be permitted to reopen the mine Monday.

Shortly before conclusion of a public hearing conducted by the State Industrial Relations Department, William Ramsey, the mine safety director, testified that he had made an inspection less than an hour before the explosion occurred and had found no gas.

He suggested that a cutting machine may have released a gas pocket.

An official report on results of the state inquiry will be issued in Columbus next week.

Telegraph

STANDARD FORM No. 14A
APPROVED BY THE PRESIDENT
MARCH 10, 1926

TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

GOVERNMENT PRINTING OFFICE 6—7134

FROM INTERIOR DEPARTMENT

BUREAU of Mines, J. J. Forbes, Supervising Engineer, Safety Division

CHG. APPROPRIATION Collect telegram--Charge Bureau of Mines, Washington, D. C.

JJF:FF

Pittsburgh, Pa., Nov. 29, 1940

TELEGRAM

D. Harrington
Bureau of Mines
Interior Building
Washington, D. C.

Griffith just telephoned from Helms mine latest information available 22 to 24 men unaccounted for and that he was then starting underground. Expect Ankeny, Pero, and Anderson to arrive with truck between 5:30 and 6:00 this evening. According to directory mine produces about four thousand tons daily, mobile loaders are used, and from gas analysis records here taken several years ago main return contained approximately 1 percent methane in 170,000 cubic feet of air returning. Main haulage this mine according to Griffith is on intake air. This should facilitate recovery operations.

Forbes

Phoned W.U., 4:40 p.m., 11/29/40 by FF

Confirmation

Files

STANDARD TIME INDICATED

RECEIVED AT

TELEPHONE YOUR TELEGRAMS TO POSTAL TELEGRAPH

Postal Telegraph

Mackay Radio · Commercial Cables · All America Cables · Canadian Pacific Telegraphs

THIS IS A FULL RATE TELEGRAM, CABLEGRAM OR RADIOGRAM UNLESS OTHERWISE INDICATED BY SYMBOL IN THE PREAMBLE OR IN THE ADDRESS OF THE MESSAGE. SYMBOLS DESIGNATING SERVICE SELECTED ARE OUTLINED IN THE COMPANY'S TARIFFS ON HAND AT EACH OFFICE AND ON FILE WITH REGULATORY AUTHORITIES.

Form 16

G.NB183 N.WC85 5 GOVT=G WASHINGTON DC 26 332P 1940 DEC 26 PM 4 03

J J FORBES=

BUREAU OF MINES 4800 FORBES ST PGH=

RUSH FINAL REPORT NELMS DISASTER=

D HARRINGTON..

NELMS..

Ma 4500 Ha
Eb 420 med
Dec 26

STANDARD FORM No. 14A
APPROVED BY THE PRESIDENT
MARCH 10, 1926

TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

6—7134

FROM INTERIOR DEPARTMENT

BUREAU of Mines, J.J.Forbes, Supervising ~~Engineer, Safety Division~~

CHG. APPROPRIATION Fast Day Message
Charge U. S. Bureau of Mines, Pittsburgh Pa.

Pittsburgh, Pa. December 27, 1940

Mr. D. Harrington
U. S. Bureau of Mines
Interior Building
Washington, D. C.

Nelms disaster report will be in your hands not later than Tuesday of next week, and probably Monday. Have considerable number of sketches, analytical reports, and there is some delay in obtaining map of mine.

Forbes

CONFIRMATION
Phoned to W.U. 12/27/40 4:20 P.M. by hca

cc-Files ✓

STANDARD FORM No. 14A
APPROVED BY THE PRESIDENT
MARCH 10, 1926

TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

GOVERNMENT PRINTING OFFICE 6—7134

FROM INTERIOR DEPARTMENT

BUREAU of Mines, J. J. Forbes, Supervising Engineer, Safety Division

CHG. APPROPRIATION Collect telegram--Charge Bureau of Mines, Washington, D. C.

Pittsburgh, Pa., Nov. 29, 1940

TELEGRAM

D. Harrington
Bureau of Mines
Interior Building
Washington, D. C.

Grove and Forbes enroute Helms mine at request of company, expect to arrive about ten tonight.

Forbes

Phoned W.U., 7:45 p.m., 11/29/40 by watchman

Confirmation

cc-Files ✓

STANDARD FORM No. 14A
APPROVED BY THE PRESIDENT
MARCH 10, 1926

TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

GOVERNMENT PRINTING OFFICE 6—7134

FROM INTERIOR DEPARTMENT

BUREAU of Mines, J. J. Forbes, Supervising Engineer, Safety Division

CHG. APPROPRIATION Telegram

Send Collect

Pittsburgh, Pa., December 1, 1940

D. Harrington
Bureau of Mines
Interior Building
Washington, D. C.

Twenty-three bodies recovered Helms mine by eight tonight. Latest count eight still missing. Recovery work progressing satisfactorily. Affected area ventilated. Remaining bodies probably buried under extensive falls. Will be in Washington tomorrow morning.

Forbes

Phoned.W.U., 10:30 p.m., 12/1/40 by FF

Confirmation

Files

CLASS OF SERVICE

This is a full-rate Telegram or Cablegram unless its deferred character is indicated by a suitable symbol above or preceding the address.

Files

WESTERN UNION

1201

SYMBOLS

DL = Day Letter
NL = Night Letter
LC = Deferred Cable
NLT = Cable Night Letter
Ship Radiogram

R. B. WHITE, PRESIDENT
NEWCOMB CARLTON, CHAIRMAN OF THE BOARD
J. C. WILLEVER, FIRST VICE-PRESIDENT

The filing time shown in the date line on telegrams and day letters is STANDARD TIME at point of origin. Time of receipt is STANDARD TIME at point of destination

33Z PG31 COLLECT GOVT

CADIZ OHIO 405P DEC 2 1940

BUREAU OF MINES

211

4800 FORBES ST PITTSBURGH PENN

TWO MORE BODIES RECOVERED NELMS MINE TODAY MAKING TOTAL OF TWENTY NINE. TWO MORE STILL MISSING BUT ONE OF THESE BELIEVED LOCATED UNDER A FALL. RECOVERY WORK CONTINUING WASHINGTON NOTIFIED

GROVE

420P

DEC - 3 1940

Rec'd 4:45 PM 12/2

WA. 12/3/40 11:30 am

4:32 P

THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

STANDARD FORM No. 14A
APPROVED BY THE PRESIDENT
MARCH 10, 1926

TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

GOVERNMENT PRINTING OFFICE 6—7134

FROM INTERIOR DEPARTMENT

BUREAU of Mines, G. W. Grove, Mining Engineer

CHG. APPROPRIATION Fast Day Message

Charge Bureau of Mines, Washington, D. C.

Pittsburgh, Pa., December 2, 1940

D. Harrington
Bureau of Mines
Interior Building
Washington, D. C.

Ankeny reports four additional bodies recovered during night. Four believed still missing.

Grove

Phoned W.U., 10:05 a.m., 12/2/40 by FF

Confirmation

Files ✓

Fdl

1207-A

CLASS OF SERVICE DESIRED			
DOMESTIC		CABLE	
TELEGRAM		FULL RATE	
DAY LETTER		DEFERRED	
NIGHT MESSAGE		NIGHT LETTER	
NIGHT LETTER		SHIP RADIOGRAM	

Patrons should check class of service desired; otherwise message will be transmitted as a full-rate communication.

WESTERN UNION

CHECK
ACCT'G INFMN.
TIME FILED

R. B. WHITE, PRESIDENT — NEWCOMB CARLTON, CHAIRMAN OF THE BOARD — J. C. WILLEVER, FIRST VICE-PRESIDENT

Send the following message, subject to the terms on back hereof, which are hereby agreed to

Dec. 3 19 46

To D. Harrington

Street and No. Bureau of Mines

Place Washington, D.C.

One body recovered Nelson's mine today. One still missing. Efforts to locate last body continuing. Pittsburgh advised

Grove

Official Business
Govt rate Collect

Thurmond Grove Supt

Sender's address for reference

THE QUICKEST, SUREST AND SAFEST WAY TO SEND MONEY IS BY TELEGRAPH OR CABLE

Sender's telephone number

File

1207-A

CLASS OF SERVICE DESIRED			
DOMESTIC		CABLE	
TELEGRAM		FULL RATE	
DAY LETTER		DEFERRED	
NIGHT MESSAGE		NIGHT LETTER	
NIGHT LETTER		SHIP RADIOGRAM	

Patrons should check class of service desired; otherwise message will be transmitted as a full-rate communication.

WESTERN UNION

R. B. WHITE, PRESIDENT — NEWCOMB CARLTON, CHAIRMAN OF THE BOARD — J. C. WILLEVER, FIRST VICE-PRESIDENT

CHECK
ACCT'G INFMN.
TIME FILED

Send the following message, subject to the terms on back hereof, which are hereby agreed to

Dec 2 1940

To D. Harrington

Street and No. Bureau of Mines

Place Washington, D.C.

Two more bodies recovered Nelms mine today making total of twenty nine. Two more still missing but one of these believed located under a fall. Recovery work continuing Pittsburgh notified - Duplicate to Wash. Saying Pgh notified. Crews

Govt Rate collect

GWH

Sender's address for reference

THE QUICKEST, SUREST AND SAFEST WAY TO SEND MONEY IS BY TELEGRAPH OR CABLE

Sender's telephone number

CLASS OF SERVICE

This is a full-rate Telegram or Cablegram unless its deferred character is indicated by a suitable symbol above or preceding the address.

WESTERN UNION

1201

SYMBOLS

DL = Day Letter
NL = Night Letter
LC = Deferred Cable
NLT = Cable Night Letter
Ship Radiogram

R. B. WHITE, PRESIDENT
NEWCOMB CARLTON, CHAIRMAN OF THE BOARD
J. C. WILLEVER, FIRST VICE-PRESIDENT

The filing time shown in the date line on telegrams and day letters is STANDARD TIME at point of origin. Time of receipt is STANDARD TIME at point of destination

14Z 0G 18 COLLECT GOVT

278

CADIZ OHIO 503P DEC 3 1940

J J FORBES

BUREAU OF MINES 4800 FORBES ST PITTSBURGH PENN

ONE BODY NELMS MINE RECOVERED TODAY, ONE STILL MISSING EFFORTS TO LOCATE LAST BODY CONTINUING WASHINGTON ADVISED

GROVE

618P

BUREAU OF MINES PITTSBURGH, PA. DEC - 4 1940 RECEIVED

Rec'd 7:25 PM 12/3

THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

STANDARD FORM No. 14A
APPROVED BY THE PRESIDENT
MARCH 10, 1926

TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

GOVERNMENT PRINTING OFFICE 6—7134

FROM INTERIOR DEPARTMENT

BUREAU J. J. Forbes, Supervising Engineer, Safety Division

CHG. APPROPRIATION Night Letter

Send Collect GWG:FF

Pittsburgh, Pa., December 10, 1940

D. Harrington
Bureau of Mines
Interior Building
Washington, D. C.

Forbes, Grove, Owings, at request of Director, Ohio Department Industrial Relations, testified at hearings Cadiz today. Owings will continue testimony tomorrow and Westfield will also probably be called. We placed most likely point of origin of explosion which killed 31 men as result of explosion in Nelms mine, Ohio and Pennsylvania Coal Co., on November 29, 1940, in face of 13 room off 8 east off 12 north. We also stated that the explosion was initiated by an ignition of gas by an electric arc or spark from a drill or mining machine which apparently were in operation at time of explosion. Mining machine was a permissible type but due to 4 bolts out of 8 missing from controller case it was not in permissible condition. The drill is also believed to be a permissible type but 8 out of 10 bolts missing from case it was also in nonpermissible condition. Our opinion is based on observations made during recovery operations and a subsequent investigation conducted jointly by Ohio Division of Mines, company officials, representatives of United Mine Workers of America, a representative of the coroner's office of Harrison County, and representatives of the Bureau of Mines. All Bureau investigators agree on this statement. Preliminary report delayed account hearing being held immediately after completion of investigation. Will try our utmost to have report in your hands by end of week.

FORBES

Phoned W.U., 9:45 p.m., 12/10/40 by GWG
Confirmation Files ✓