UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
REGION VIII

FINAL REPORT ON MAJOR EXPLOSION DISASTER
CARPENTERTOWN MINE
CARPENTERTOWN COAL & COKE COMPANY
CARPENTERTOWN, WESTMORELAND COUNTY, PENNSYLVANIA
(Near Mt. Pleasant, Westmoreland County, Pennsylvania)

February 2, 1952

By

W. Dan Walker, Jr.
Chief, Pittsburgh Branch, Accident Prevention and Health Division

G. M. Smith
F. E. Riley
J. H. Dumire
Coal-Mine Inspectors

Originating Office - Bureau of Mines
4800 Forbes Street, Pittsburgh 13, Pa.
W. Dan Walker, Jr., Chief, Pittsburgh Branch
Accident Prevention and Health Division

CONTENTS

FINAL REPORT ON MAJOR EXPLOSION DISASTER
CARPENTERTOWN MINE
CARPENTERTOWN COAL & COKE COMPANY
CARPENTERTOWN, WESTMORELAND COUNTY, PENNSYLVANIA
(Near Mt. Pleasant, Westmoreland County, Pennsylvania)

February 2, 1952

By

W. Dan Walker, Jr.
Chief, Pittsburgh Branch, Accident Prevention and Health Division

G. M. Smith
F. E. Riley
J. H. Dumire
Coal-Mine Inspectors

INTRODUCTION

A gas explosion occurred in the Carpentertown mine, Carpentertown Coal & Coke Company, at Carpentertown, Westmoreland County, Pennsylvania, about 1:45 a.m., Saturday, February 2, 1952, causing the death of six men, five of whom were killed outright and one of whom was found alive but died before reaching the surface. Seventy-nine men were in the mine at the time. Sixty-nine men escaped uninjured; four of these were directed to the surface through the air course by the pumper in the 6 butt section. Four men were rescued and were hospitalized. The names of the men killed, their ages, marital status, number of dependents, mining experience, and Social Security numbers are shown in Appendix A of this report. The explosion originated in the haulage entry near the junction of the borehole entry and 20 room in the 6 butt 1 right section when an accumulation of methane was ignited by an electric arc or spark from a trolley locomotive. It was confined to a comparatively small area in the vicinity of No. 20 room. The area affected by the explosion is shown on a map, Appendix B.

GENERAL INFORMATION

The Carpentertown mine is about 2 miles east of Route 981 at Carpentertown, near Mt. Pleasant, Westmoreland County, Pennsylvania. The coal was trucked about 2-1/2 miles to a cleaning plant near Carpentertown, Pennsylvania, and later to coke ovens in this area. The coke yards are served by the Pennsylvania Railroad.

The mine was opened in 1907 and operated by the Mt. Pleasant Connellsville Coke Company until 1929 when it was obtained by the Carpentertown Coal and Coke Company. In 1947, the Sharon Steel Corporation acquired the mine and by agreement continued to use the same name.

The Baton Coal Company serves as the operating company for the Carpentertown Coal & Coke Company.

The main office of the Carpentertown Coal & Coke Company is in Pittsburgh, Pennsylvania, and the officials of the company are as follows:

Henry Rhomer, Jr.	President	1100 Union Trust Bldg. Pittsburgh, Pa.
Charles B. Baton	Operating Vice President	1100 Union Trust Bldg. Pittsburgh, Pa.

The main office of the Baton Coal Company is in Pittsburgh, Pennsylvania, and the officials are as follows:

Charles B. Baton	President	1100 Union Trust Bldg. Pittsburgh, Pa.
C. C. Cornelius	General Superintendent	Bridgeville, Pa.
Wm. A. Morris	Safety Director	McKeesport, Pa.
L. O. Lougee	Chief Engineer	1100 Union Trust Bldg. Pittsburgh, Pa.
Harry Mathias	Superintendent, Carpentertown Mine	Mt. Pleasant, Pa.
J. J. Hunter	Mine Foreman	Mt. Pleasant, Pa.

About 459 men were employed; 171 worked on the surface and 288 worked underground, 3 shifts a day, 5 days a week, and produced an average of 1,050 tons of coal daily, all hand-loaded. The mine produced 289,658 tons of coal in 1951.

The mine is opened by five drifts, classed as slopes because of the inclination of the coal bed, and two 290-foot shafts. A deep-well pump was installed in the No. 1 shaft, and the other shaft had caved and was not being used.

Mining operations are in the high-volatile Pittsburgh coal bed which, in this mine, averages 84 inches in thickness and dips an average of 3 percent to the northwest. The coal bed is overlain with draw slate up to 12 inches in thickness, which is under laminated coal and shale up to 8 feet in thickness. The main roof is massive shale and sandstone. The floor is soft clay and shale.

An analysis of the coal, furnished by the company, is as follows:

Moisture	1.44 percent
Volatile matter	28.36 percent
Fixed carbon	61.24 percent
Ash	8.96 percent
	100.00 percent
Sulfur	1.31 percent
B.t.u.	13,900

Numerous tests by the U. S. Bureau of Mines have shown that coal having a volatile ratio of 0.12 is explosive and that the explosibility increases with any increase in the volatile ratio. The volatile ratio of the coal in this mine, as determined by the foregoing analysis, is 0.32, indicating that dust from this coal is highly explosive.

MINING METHODS, CONDITIONS, AND EQUIPMENT

Mining Methods

The development of the mine was completed, and mining operations were confined to the extraction of pillars. Squeeze conditions had often occurred in the mine to the extent that subsidence was caused on the surface, and in some instances, the coal pillars had been pushed into the floor. Rooms 12 to 17 feet wide were driven in room and entry pillars to the gob areas, and the pillars were then recovered on full retreat, except that in the section where the explosion occurred, pillar recovery was confined to splitting some of the pillars in order to leave sufficient support to prevent excessive subsidence of the surface.

The timbering system required cross bars to be set on 3-foot centers where the draw slate and laminated strata were supported, and safety posts were set at the faces of working places. Along the haulage roads and in the face regions where the immediate roof and the laminated strata were taken down or had fallen, the main roof was supported with cross bars set on cribs or on cribs without cross bars.

Blasting was done on shift with permissible explosives and No. 6 electric detonators fired with permissible blasting units by the miners. Tests for methane were not made before or after firing. Shots were not fired off the solid. The coal faces were cut about 4 feet deep at the roof with picks before blasting in pillar places where necessary. Hand augers were used to bore the holes.

Ventilation and Mine Gases

Ventilation was induced by a 4- by 8-foot centrifugal fan installed on the surface in line with a mine opening, but a weak wall was provided in an adjoining opening. The fan was operated blowing continuously. About 126,000 cubic feet of air a minute was circulated, and from 7,000 to 20,700 cubic feet of air a minute was entering the intake ends of the pillar lines during the last Federal inspection, which was completed August 28, 1951. Three splits of air were used to ventilate the mine workings, and nearly all the haulage roads and trolley wire were in air returning from pillar workings and abandoned places. Air from abandoned workings and pillar lines was used to ventilate active workings. Permanent stoppings and overcasts were constructed of incombustible material, and main doors were installed in pairs to form air locks.

The mine was classed nongassy by the Pennsylvania Department of Mines, but a mine-air sample collected at the face of the line water entry in No. 12 left section during a previous Federal inspection, June 1951, contained 0.25 percent methane. Records at the mine indicated that preshift, onshift, and weekly examinations for methane and other hazards were made. As far as could be determined, gas or oil wells do not penetrate this mine, and underground restorage of gas had not been practiced in this area.

Dust

The mine was wet and had never been rock-dusted. At the time of the last Federal inspection, rock-dusting was not considered necessary because of the wet condition. Coal-dust accumulations were not observed, and the amount of dust raised into suspension during mining operations was negligible.

Transportation

Mine cars were gathered from the working places by horses. Trolley locomotives were used to transport coal and rock in drop-bottom cars from the sidetracks in the face regions to sidetracks at the slope junction. From this point to the tipple, rope haulage was used.

Electric Equipment

Electric power, as 2,200, 440, and 220 volts alternating current, was used on the surface, and 550-volt direct-current power was used underground. Power was transmitted underground by means of the trolley wire on the slope and haulage entries. Power wires were installed on insulators and provided with cut-out switches. The only electrical equipment used in the mine was pumps and trolley locomotives.

Illumination and Smoking

All employees used permissible electric cap lamps for portable illumination underground. Smoking was not permitted or practiced in the mine, and there was no evidence to indicate that smokers' articles were being carried into the mine.

Mine Rescue

Three universal gas masks were available at the mine. None of the mine personnel had been trained in mine rescue work in recent years. Trained teams and adequate mine rescue apparatus were available at several nearby mines. Two teams from the United States Steel Company, Coal Division, directed by Mr. J. A. Boyle, participated in recovery operations and worked tirelessly and relentlessly in the hope that lives could be saved. In addition, the State Department of Mines, which has three completely equipped mobile rescue units, had one unit at the mine. The Westmoreland Coal Company and the Greensburg-Connellsville Coal and Coke Company also had rescue teams at the mine.

Fire extinguishers and rock dust were standard equipment at pumps, and each locomotive was provided with a fire extinguisher.

Two travelable passageways were available as escapeways from each working section to the surface. A check-in and check-out system was in effect, and each employee carried an identification check on his person while in the mine.

PREVIOUS EXPLOSIONS AT THIS OR NEARBY MINES

This is the first explosion at this mine, but the mine workings border on the property of the Mammoth mine where there was a widespread explosion on January 27, 1891, in which 109 men were killed.

MINE CONDITIONS IMMEDIATELY PRIOR TO THE DISASTER

On February 1, 1952, the mean temperature was 48° F., and mist fell all day. On February 2, 1952, the mean temperature was 49° F., and rain started to fall at 12:30 a.m., and stopped at 7 a.m.; 0.23 inch of rain fell.

The barometer readings taken by the United States Weather Bureau at the Allegheny County Airport from Friday, February 1, 12:30 a.m., to 12:30 p.m., Saturday, February 2, are as follows:

	Inches of mercury
12:30 a.m.	28.94
1:30 a.m.	28.93
2:30 a.m.	28.93
3:30 a.m.	28.93
4:30 a.m.	28.93
5:30 a.m.	28.93
6:30 a.m.	28.93
7:30 a.m.	28.92
8:30 a.m.	28.92
9:30 a.m.	28.91
10:30 a.m.	28.91
11:30 a.m.	28.89
12:30 p.m.	28.86
1:30 p.m.	28.82
2:30 p.m.	28.79
3:30 p.m.	28.78
4:30 p.m.	28.77
5:30 p.m.	28.77
6:30 p.m.	28.78
7:30 p.m.	28.78
8:30 p.m.	28.78
9:30 p.m.	28.76
10:30 p.m.	28.74
11:30 p.m.	28.73

	Inches of mercury
12:30 a.m.	28.71
1:30 a.m.	28.70
2:30 a.m.	28.69
3:30 a.m.	28.69
4:30 a.m.	28.69
5:30 a.m.	28.68
6:30 a.m.	28.69
7:30 a.m.	28.70
8:30 a.m.	28.69
9:30 a.m.	28.73
10:30 a.m.	28.74
11:30 a.m.	28.74
12:30 p.m.	28.72

The barometric pressure decreased steadily from 28.93 at 6:30 a.m., February 1, to 28.68 at 5:30 a.m., February 2, indicating that atmospheric pressure was not an important factor in the cause of the explosion.

The mine was operating normally; no unusual conditions, as far as could be ascertained, had been reported prior to the time of the explosion, and interruptions had not occurred to the ventilating system. The fan chart, showing the water-gage pressure at the time of the explosion, is given in figure 1. This chart indicates excessive pressure at about 1:45 a.m. caused by the explosion. It was reported that tests for gas were made at least twice on each shift. Each section foreman made an onshift examination and a preshift examination for the oncoming shift. Each foreman informed the oncoming foreman of the condition of his section by telephone, but he did not make a written record of his examination until he reached the surface. Although the foremen reached the surface before the oncoming shift entered the mine, fire-boss records were not always completed before the men entered the mine.

Nelson Nedrow, section foreman in the 6 butt 1right section on the second shift, had completed an onshift examination between 3 p.m. and 6 p.m. and a preshift examination for the following shift between 7 p.m. and 10 p.m. on the day preceding the explosion without finding any gas. Ray R. Bell, section foreman in the section on the third shift, had completed an examination of his section between midnight and 1:30 a.m. on the day of the explosion without finding any gas, according to the record in the fire-boss book.

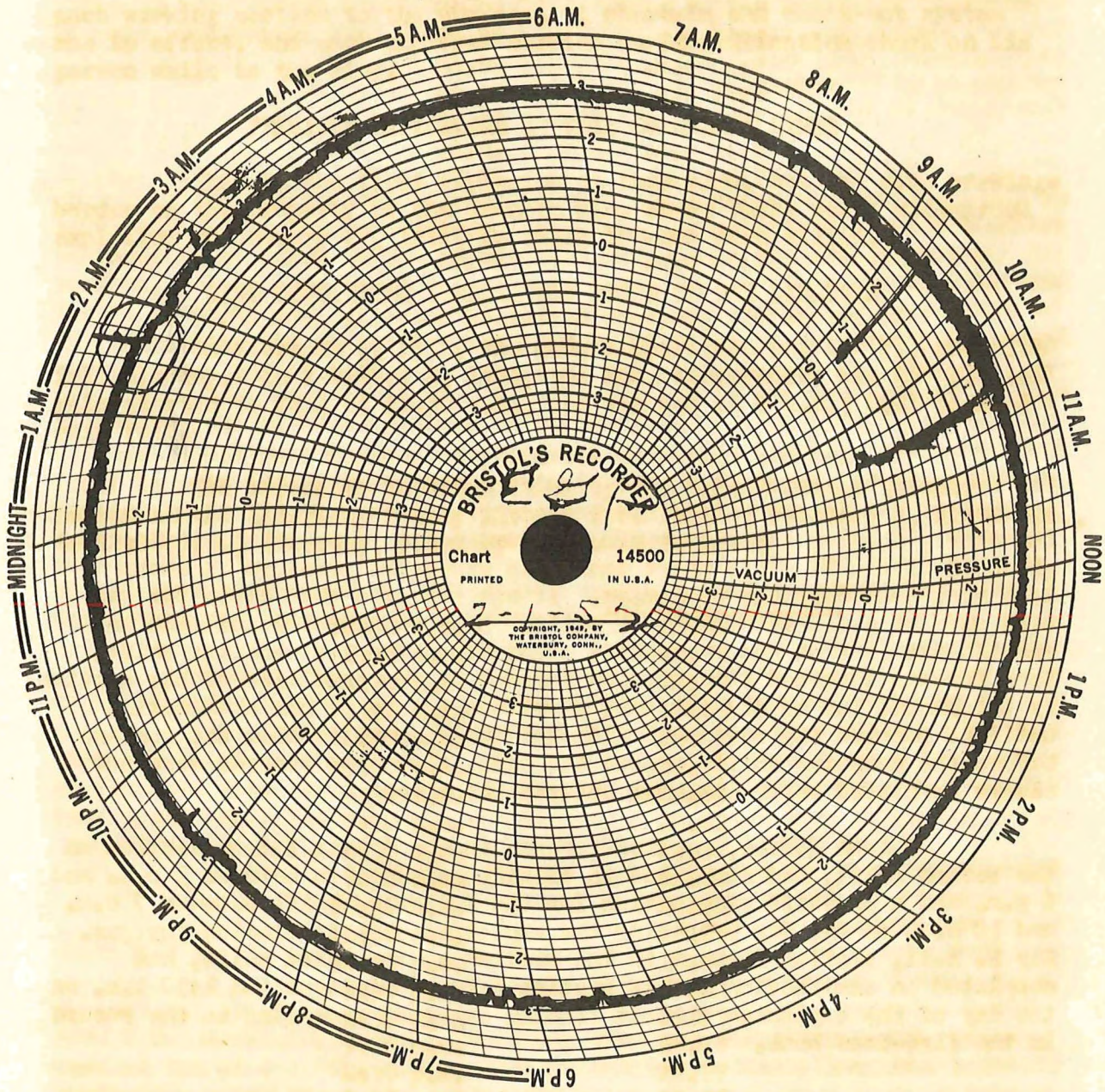


Figure 1. - Fan Chart for 24-Hour Period Starting 9:15 a.m., February 1, 1952, Carpentertown Mine, Carpentertown Coal & Coke Company.

ACTIVITIES OF BUREAU OF MINES PERSONNEL

The Pittsburgh office of the Bureau of Mines first learned of the explosion about 5:55 a.m., February 2, 1952, when E. C. Dydo, coal-mine inspector at Greensburg, Pennsylvania, telephoned James Westfield, Chief, Accident Prevention and Health Division, Region VIII, Bureau of Mines, at his home, Pittsburgh, Pennsylvania. Dydo had been notified about 5:45 a.m. by Harry Mathias, superintendent, that there had been an explosion in the Carpentertown mine. Westfield instructed Dydo to contact F. E. Riley, coal-mine inspector, and then both should proceed to the mine. Dydo and Riley arrived at the mine at 7:20 a.m. and went underground at about 7:45 a.m. and assisted with the recovery operations. Westfield telephoned Mr. J. J. Forbes, Director, Bureau of Mines, Washington, D. C., at 6:30 a.m. Inspectors G. M. Smith and J. H. Dumire were instructed to proceed to the mine, and they arrived there about 10:15 a.m. and assisted on the surface. Westfield and Inspector H. R. Burdelsky arrived at the mine about 11:30 a.m. Westfield took charge of the activities of Bureau of Mines personnel and assigned inspectors to work on the different shifts. He also held conferences with officials of the Carpentertown Coal & Coke Company and representatives of the Pennsylvania Department of Mines regarding details of the explosion and the rescue and recovery operations and entered into the preliminary investigation and selected Bureau personnel who were to take part in the official investigation. W. Dan Walker, Jr., Chief, Pittsburgh Branch, Accident Prevention and Health Division, arrived at the mine about 4:30 p.m. the day of the explosion, held conferences, and made arrangements to start the official investigation at 10 a.m., Sunday, February 3, 1952.

Mr. J. J. Forbes, Director, Bureau of Mines, arrived at the mine about 2:30 p.m., Sunday, February 3. He attended a conference of State inspectors, company officials, United Mine Workers of America representatives, and Bureau of Mines personnel, which was held soon after the investigation of the explosion area on Sunday.

STORY OF EXPLOSION AND RECOVERY OPERATIONS

The third-shift workmen boarded the man-trip at the slope portal at 10:30 p.m., February 1, 1952, and the crew in the affected area arrived in the section about 11:00 p.m. A fire-boss examination had been made before these men entered the mine, and the records indicate that methane was not detected in the 6 butt 1 right section. Twenty men went to their assigned working places in this section.

The locations of the men working in the area affected by the explosion are shown on the map in Appendix B by an open circle (O) with a number for identification. The pumper is indicated in Appendix B as No. 19.

Ray Bell, the section foreman, stated that he began an examination of the section, visiting all working places and making the usual tests and examinations, but he did not detect any methane. He then visited 3 and 4 butt off No. 26 room, where a squeeze condition existed and two men had recovered some rails on the previous shift. Examinations for gas were made in this area about 12:45 a.m., but methane was not detected. After completing the examinations, the section foreman came back to No. 20 room and continued out to the No. 12 room telephone. He also stated that about 11:40 p.m., February 1, 1952, the trolley locomotive had brought an empty trip into the section and pulled the loaded cars that had been left from the previous shift. The trolley locomotive made a second trip into the section about 1:15 a.m., February 2, and placed the empty cars on the sidetrack. The locomotive was coupled to a loaded trip, consisting of 10 cars of rock and 1 car of coal, and was traveling outby when the explosion occurred. The section foreman (20) was traveling along the 6 butt haulage road near 14 room when he felt a big wind that raised a great amount of dust, but he saw no flame. He immediately went back to the telephone at No. 12 room, called the outside, and instructed the night watchman to send in gas masks and inform the superintendent and mine foreman that an explosion had taken place in 6 butt 1 right section.

The pumper (19) stated that he had just finished cleaning a strainer in the suction line of a pump near a crosscut in No. 20 room, when the explosion occurred. The forces from the explosion knocked him into a ditch, where he remained for a short while. Before getting up, he put a little water on his face and heard one of the men yelling and asking if this was an explosion. The pumper then went out to the No. 20 room door and, finding the air bad, decided to go back. Visibility was very bad, and it was difficult, if not impossible, for the men to see each other, so the only way to keep contact was by yelling. The pumper and four other men (3, 4, 5, and 6) were able to travel by way of the intake air course to the No. 12 room telephone.

R. H. Moser, section foreman in charge of 12 left and 7 butt section, first learned of the explosion when he intercepted the call made to the night watchman, and immediately ordered all men in his section to go to the surface. On arriving at the telephone at No. 12 room, the pumper and the four other men had just arrived from 20 room. Accompanied by the pumper and another man, he made his way through the intake air course to No. 20 room, where they located the driver (18) who was injured severely. The driver was made as comfortable as possible; his horse was tied to a crib.

John Hunter, mine foreman, arrived at the mine about 2:15 a.m., February 2, went underground immediately, and arrived at the No. 12 room telephone just as the pumper and a section foreman came back from the trip to No. 20 room through the intake airway. Hunter took charge of recovery operations at this time. The pumper and another man were ordered to work their way back to No. 20 room through the intake air course. Hunter with two other men, equipped with All-Service gas masks, started for No. 20 room by way of the haulageway, which was in return air. About

65 feet outby No. 17 room curve on the 6 butt haulageway, two men (1 and 2) were found alive, one of whom was unconscious and was given artificial respiration. One man was assisted and the other man was placed on a stretcher and taken to the 12 room telephone at about 3:05 a.m. Two other men (8 and 9) were found alive on the haulage road a short distance outby 20 room and were carried on stretchers to the 12 room telephone. These four men, who had been affected by carbon monoxide, and the driver were then sent to the surface, but the driver died about 4:30 a.m. on the way out.

A miner (7) was discovered unconscious about 50 feet outby the locomotive. He was given artificial respiration for about 25 minutes, but he did not revive. The motorman (16) was found dead partly under the outby end of the locomotive, and the brakeman's body (17) was at the rear end of the trip near the telephone. The body of another miner (11) was discovered in the borehole heading about 160 feet from the locomotive. At this time, all but one of the workmen in the explosion area had been located.

The rescue party was then joined by C. C. Cornelius, general superintendent, William Morris, safety director, and C. B. Lozaw, State inspector. Federal Inspectors E. C. Dydo and F. E. Riley and State Inspector George S. Struble entered the mine soon after. At this time, a decision was made to await the arrival of the rescue teams to remove the bodies already located and locate the body not yet found.

Mr. J. A. Boyle, chief mine inspector, United States Steel Company, Coal Division, arrived in the mine at 10:05 a.m., with two rescue teams equipped with self-contained oxygen breathing apparatus. It was then decided to advance as far as No. 20 room before using oxygen. Immediately, all bodies that had been located were recovered, placed on stretchers, and sent out to No. 12 room telephone. A team was making a short exploration trip into No. 20 room, when the last body (10) was located in the back switch off No. 20 room at 11:20 a.m. All bodies were removed to the surface by 12:30 p.m., and all men then left the mine. Two miners (7 and 10) traveled 800 to 900 feet from their working places to the positions where their bodies were located before being overcome by carbon monoxide, and four injured men were sent to a hospital because of breathing carbon monoxide.

Four men (12, 13, 14, and 15) working outby the flame area in 6 butt off 1 right section escaped unassisted.

INVESTIGATION OF CAUSE OF EXPLOSION

The investigation of the disaster was started about 10:20 a.m., Sunday, February 3, 1952, by representatives of the U. S. Bureau of Mines, Pennsylvania Department of Mines, United Mine Workers of America, Carpentertown Coal & Coke Company, Coal Operators Casualty Corporation, and the U. S. Senate Committee on Labor and Public Welfare. The investigation was continued through February 8, 1952. The names of the persons in the investigating party on February 3 are as follows:

U. S. Bureau of Mines

James Westfield	Chief, Accident Prevention and Health Division, Region VIII
W. Dan Walker, Jr.	Chief, Pittsburgh Branch, Accident Prevention and Health Division
G. M. Smith	Coal-Mine Inspector
F. E. Riley	Coal-Mine Inspector
J. H. Dumire	Coal-Mine Inspector
E. C. Dydo	Coal-Mine Inspector

Pennsylvania Department of Mines

G. J. Steinheiser	Inspector
G. S. Struble	Inspector
C. H. Curry	Inspector
C. B. Lozaw	Inspector

United Mine Workers of America

Charles Ferguson	Acting Director, Safety Division
Justin McCarthy	Representative, Safety Division
James Mark, Jr.	Representative, Safety Division
James Kelly	Representative, District 3
Bruno Olimizzi	Representative, District 3
Ben Malesky	President, Local Union No. 7750
Stephen Lipko, Jr.	Safety Committeeman
George Forejt	Safety Committeeman
Jacob Obrocto	Safety Committeeman

U. S. Senate Committee on Labor and Public Welfare

Curtis Johnson	Special Investigator

Company Officials

Charles Baton	Operating Vice President
C. C. Cornelius	General Superintendent
William Morris	Safety Director
Harry Mathias	Mine Superintendent
John Hunter	Mine Foreman

Coal Operators Casualty Corporation

John Moore

Federal inspectors, State inspectors, representatives of the Carpentertown Coal & Coke Company, and the mine safety committeemen took part in the investigations conducted on February 4-8, 1952.

On the first day of the investigation, methane was detected over a fall about 200 feet outby the locomotive. The investigating party stopped at that point while the area ahead was examined by Federal and State inspectors. When large accumulations of methane were found at the locomotive and in the surrounding area, it was decided that most of the party should remain outby the point where gas was first detected and that explorations deeper into the mine would be conducted by Federal and State inspectors and a representative of each interested group. This party determined that methane was present throughout the affected area, and it was decided that the investigating party should return to the surface. A conference was then held on the surface with representatives of the U. S. Bureau of Mines, headed by Director J. J. Forbes, the company, the State Department of Mines, and the United Mine Workers of America attending. It was decided that, to clear the methane concentrations from the affected area to the extent that further explorations could be made, the fan would be reversed, and, after the fan had been operated 3 hours, workmen would be taken into the mine to replace a blown-out stopping. This work was done Sunday night, February 3, under the direction of Federal and State inspectors, and the investigation was continued on Monday, February 4.

DETAILS OF EVIDENCE

Appendix C shows the map of the mine, location of the haulage roads, and coursing of the ventilation currents previous to the explosion. This map also shows the probable origin of the explosion.

The sketch, Appendix B, shows the approximate area traversed by the flame, approximate area affected by violence, and a portion of the squeezed area believed to be the source of the methane liberation. In addition, it shows the locations of the bodies of the victims of the disaster and the locationsof the men in the affected area who escaped after the explosion.

Appendix D shows the location of the trolley locomotive and the trip of 11 cars near the junction of No. 20 room and the borehole heading. This sketch also shows the locations of the bodies of the victims of the disaster and the direction of forces.

Appendix E is a cross section on the haulage entry at the junction of No. 20 room and the borehole entry showing the relation of the roof to the trolley wire and the locomotive.

Squeeze Conditions

It was immediately apparent to the investigators that the most difficult part of the investigation would be to determine the source of methane liberation. The search for the source of gas liberation was made difficult by squeeze conditions and falling roof in the affected area. On Tuesday, February 5, the area was explored by two parties of State and Federal inspectors, and evidence gathered seemed to point to a squeeze area northwest of 20 room haulage road as being the source of gas liberation. From testimony of mine officials and miners, it was established that this area had been squeezing for several days and that rails were

being removed from the area on the second shift, February 1. On February 6, this squeeze area was explored by Federal and State inspectors to the extent that conditions would permit. Tests were made with a W-8 methane detector at many points throughout the area, and methane was detected in amounts ranging from 0.2 to 2.5 percent. The standing pillars in this area were being pushed into the floor at many places, and the floor was heaving and breaking. Since the amounts of methane in the air lessened at points away from this squeeze area, this area was believed to be the probable source of methane liberation.

Flame

The area traversed by the flame of the explosion was determined by visual examinations in the explosion area, burns on the bodies of some of the victims, and the presence of coke particles in the explosion area.

Mine-dust samples were collected from the area involved during the investigation, and the results of the tests for coke are shown in table 1. A sample taken from a cross bar over the locomotive at the mouth of 20 room haulage road did not contain any coke, but five other samples from the explosion area had coke ranging from small to very large amounts.

The flames extended down the borehole heading to the water line, a distance of about 550 feet from the locomotive, and extended undetermined distances left and right from the borehole heading. Testimony of men working in the inby part of 20 room section indicates that flames did not reach the working places. The outby extent of the flames was just beyond the intersection of 17 room and the fourth angle chute on the main haulage road, a distance of about 750 feet outby the locomotive.

Forces

The forces of the explosion radiated in all directions from the locomotive. The last evidence of violent forces in an outby direction on the main haulage road was the timbers blown out on the curve at 17 room. Except that a door was blown through the frame at the outby end of the 12 room haulage road, there was no destruction beyond 17 room. The platform at the deep-well pump in the No. 1 shaft was moved, indicating that the forces extended to the surface at that point. Blown-out stoppings, doors, and timbers indicated that forces were great in 20 room and in the area to the right and left of the borehole heading.

Physical damage to the mine as a result of the explosion was not great. A few doors and stoppings were destroyed and timbers were dislodged. However, the enforced idleness of the mine has resulted in considerable flooding of the mine workings, caving of roof along haulageways, and excessive weight on pillars in the working section. It has not been determined when operations will be resumed.

Table 1--Results of Alcohol Coke Tests of Dust Samples Collected, Carpentertown Mine, Carpentertown Coal & Coke Company, February 1952

Can No.	Sample of dust from	Location in mine	Amount of coke
C-345	Inby side cribs	At second switch to left off 12 room 6 butt.	None
J-75	Ribs, bottom	On haulage road between Nos. 17 and 20 rooms.	Small
V-117	On cross bar top of locomotive	On haulage road No. 20 room.	None
Q-445	Off cribs & cross bar	On haulage road from Nos. 20 to 25 rooms (75 ft. outby standing water)	Very Large
J-991	Off coal ribs	At fourth break through (right side) inby the haulage road between Nos. 17 and 20 rooms.	Small
P-166	Off coal ribs	Fourth angle off 12 room on haulage road.	None
F-476	On crib	No. 17 room off fourth angle of haulage road.	Large
V-998	On timber	In No. 22 room left side haulage road.	Small

Methane as a Factor in the Explosion

This mine was classed nongassy by the Pennsylvania Department of Mines, but it was considered gassy by the Bureau of Mines under the provisions of the Federal Mine Safety Code on the basis of 0.25 percent methane in an air sample collected during a Federal inspection in June 1951. The mine has been inspected 14 times by Federal inspectors and was subjected to a special gas survey at the request of the company, September 21 and 24, 1951. During the Federal inspections and the gas survey, 63 air samples were collected for analysis by the U. S. Bureau of Mines gas laboratory at Pittsburgh, Pennsylvania. Methane was present in quantities less than 0.20 percent in 18 samples and in quantities of 0.20 percent or more in 3 samples, the maximum being 0.25 percent. Following the detection of 0.25 percent methane in the mine air in June 1951, the provisions of the Code applicable to gassy mines were applied, and recommendations were made for correction of hazards observed pertaining to the possibility of gas accumulations.

The last two Federal inspection reports cited the following violations of the Federal Mine Safety Code: Examinations for gas were not made before and after blasting on shift. Air that had passed through abandoned workings was reused to ventilate live workings. With the exception of 3 flat, the trolley wire was in air returning from pillar-recovery work.

The analyses of air samples collected after the explosion are shown in table 2. An air sample taken over the locomotive that caused the ignition contained 4.25 percent methane. Other samples from the explosion area contained 1.17 to 5.35 percent methane. A sample of the air returning from the explosion area, collected in the pump house on the surface at No. 1 shaft, contained 1.00 percent methane.

It is believed that the gas involved in this explosion was liberated from a squeeze area. Although much of this area could not be explored, the extent of this squeeze condition was indicated by subsidence on the surface near the No. 1 shaft, which was about 600 feet from the squeeze area explored underground; a brick garage and some coke ovens had broken and subsided in line with the squeeze area underground. This area was ventilated in such a manner that air returning from it could carry any methane liberated into the borehole heading, into a part of 20 room, and onto the main haulage road. Appendix E is a cross section showing the relationship of the trolley wire to the roof over the locomotive and trip and illustrates how methane could accumulate in the void caused by the irregular roof line in this area and be ignited by an arc from the trolley pole of the locomotive. That methane was being liberated rapidly is indicated by the fact that at about 11 a.m., February 2, after the explosion occurred, methane was detected by a State inspector and a member of a mine rescue team with a flame safety lamp over the locomotive. The amount of methane encountered during the investigation is further evidence that it was liberated rapidly. Men had been working in the squeeze area on the shift preceding the one on which the explosion occurred, and the foreman had visited these men and made tests for gas, but methane was not detected. The foreman on the third shift stated that he had been in the squeeze area just prior to the explosion and had made tests for gas at several locations, but methane was not detected.

Forces radiating in all directions from the locomotive indicate that the point of ignition was at the locomotive. Mining machines or electric drills were not used at the faces, and, although electrically operated pumps were being operated near the faces in 20 room, it is known that these

Table 2--Results of Analyses of Air Samples Collected, Carpentertown Mine, Carpentertown Coal & Coke Company, February 1952

Bottle No.	Date	Time	Location in mine	Air quantity	Percent				
					Carbon dioxide	Oxygen	Carbon monoxide	Methane	Nitrogen
572	2-3-52	11:40 a.m.	On top locomotive, 20 room 6 butt	Still	1.13	18.36	Trace	4.25	76.26
573	2-3-52	2:45 p.m.	In 25 room left side of borehole heading	Still	0.63	19.42	Trace	1.17	78.78
A-3097	2-3-52	4:30 p.m.	Return, alongside pump at 1 shaft		0.52	19.53	Trace	1.00	78.95
C-4493	2-3-52	2:50 p.m.	25 room right side borehole heading		0.82	19.06	Trace	2.09	78.03
C-5144	2-3-52	3:00 p.m.	21 room	Still	1.39	17.66	Trace	5.35	75.60
C-5145	2-3-52	11:20 a.m.	On fall 3 ft. from roof, between 18 and 19 room on haulage road	Still	0.61	19.57	Trace	1.53	78.29
A-6877	2-3-52	5:00 p.m.	Return, manway portal	22,000	0.13	20.59	0.00	0.05	79.23
A-6878	2-3-52	5:05 p.m.	Return, haulage portal	66,900	0.10	20.46	Trace	0.03	79.41
C-5212	2-5-52	1:10 p.m.	Return, 1 right 6 butt overcast	20,750	0.21	20.53	-	0.24	79.02
B-9813	2-6-52	9:30 a.m.	Return, 6 butt 1 right	36,500	0.20	20.68	Trace	0.19	78.93

Table 2--Results of Analyses of Air Samples Collected, Carpentertown Mine, Carpentertown Coal & Coke Company, February 1952 (Contd.)

Bottle No.	Date	Time	Location in mine	Air quantity	Percent				
					Carbon dioxide	Oxygen	Carbon monoxide	Methane	Nitrogen
B-9817	2-6-52	3:15 p.m.	On overcast, 6 butt 1 right	37,000	0.23	20.44	Trace	0.21	79.12
A-2033	2-8-52	12:35 p.m.	On fall, 21 room 3d opening left side haulage road	Still	0.16	20.62	-	0.20	79.02
7531	2-8-52	10:20 a.m.	Return, overcast 6 butt 1 right	37,000	0.23	20.58	-	0.18	79.01

pumps did not ignite the gas, because they were not in the flame area of the explosion. The body of the motorman was found under the locomotive indicating that the locomotive was being operated at the time of the explosion, and he was forced from the deck of the locomotive in front of the moving trip. In addition, two miners testified that they heard the trip moving just prior to the explosion. When found, the controller of the locomotive was in the off position, the reverse lever was set for forward motion toward the outside, the track sanders were open, and the trolley pole was off the wire.

Factors That Prevented the Spread of the Explosion

The mine was wet and was not rock-dusted. The flames of the explosion dried portions of the area to the extent that some coal dust did enter into and propagate the explosion; however, it is the opinion of the Federal investigators that the wet condition and the numerous openings from the explosion area into abandoned workings, providing a very large area for expansion, were factors that prevented the explosion from spreading into other working sections.

SUMMARY OF EVIDENCE

The evidence leading to the conclusions concerning the probable cause, origin, and propagation of the explosion is obtained from previous Federal coal-mine inspection and investigation reports, observations of Federal investigators and State and company officials, and information in the company's fire-boss and foremen record books. It is summarized as follows to support the conclusions of the Federal investigators:

1. All the working sections, except one, and haulage entries were ventilated by air returning from pillar workings or air that had passed through or by abandoned areas.

2. Barometric pressures were dropping, but the changes were slight for 24 hours before the explosion.

3. The mine atmosphere was sampled 63 times during 14 Federal inspections and 1 special survey for methane; 18 samples contained methane in quantities less than 0.20 percent, and 3 samples contained 0.20 percent or more, the maximum being 0.25 percent.

4. The mine was considered gassy under the provisions of the Federal Mine Safety Code on the basis of an air sample containing 0.25 percent methane that was collected in June 1951, but the Pennsylvania Department of Mines classed the mine nongassy.

5. Oil and gas wells have not been drilled within the boundaries of this mine so far as could be determined. The restorage of natural gas in depleted sands was not practiced in this immediate area.

6. The pressure chart at the fan shows a sudden rise in pressure at about 1:45 a.m., indicating the approximate time of the explosion.

7. The record books of the mine indicate that onshift and preshift examinations for gas and other hazards were made. Testimony given by the foreman on the shift when the explosion occurred and the foreman on the preceding shift shows that tests for gas had been made adjacent to and in the squeeze area northwest of 20 room, and methane was not found.

8. This rapid liberation of methane was unusual for this mine, inasmuch as past history did not indicate any undue liberations, men had been working in the area on the preceding shift, and the locomotive was making its second trip from No. 20 room on this shift at the time of the explosion. In addition, methane was detected with a flame safety lamp over the locomotive about 9 hours after the explosion, and accumulations of methane within the affected area during the investigation were so extensive that it was difficult to remove them with the amount of air available.

9. Forces radiating in all directions from the locomotive indicated that the explosion was initiated by the trolley locomotive near the junction of the No. 20 room and the borehole heading.

10. The gas liberation was traced to a squeeze area northwest of No. 20 room. A roof movement in this portion of the mine had been in progress for several days prior to the explosion. Subsidence was indicated on the surface above the area, and some pillars underground had been pushed into the bottom, which had been heaved and broken, and extensive caves were present. During the investigation, methane was detected along the southeast edge of the squeeze and in smaller quantities at points away from this area.

11. The squeeze area was ventilated in such a manner that methane liberated in the area would be carried in the return air current into the borehole heading and onto the main haulage road.

12. The electric pumps in operation at the time of the explosion were not in the flame area.

13. The void caused by the irregular roof line in the area where the trip was passing at the time of the explosion presented a large pocket for an accumulation of gas that could be ignited by an arc or spark from the trolley of the locomotive.

14. Shots were not being fired at the time of the explosion.

15. The mine was wet and had not been rock-dusted. Coal dust entered into the explosion only to a limited extent.

16. The explosion was limited to a small area because of the wet condition of the mine and the large number of openings which afforded space for expansion.

CAUSE OF THE DISASTER

Representatives of the U. S. Bureau of Mines who investigated the disaster are of the opinion that the explosion originated on the haulage road in 20 room near its junction with the borehole heading. Methane was liberated from a squeeze area northwest of No. 20 room and was carried by the ventilating current to the haulage road, where it was ignited by an electric spark or arc from the trolley locomotive which was transporting a loaded trip out of 20 room toward the outside. The explosion was primarily a gas explosion, although coal dust entered into the propagation to a limited extent. The explosion was limited by the volume of gas accumulated, the wet condition of the mine, and the many openings which provided space for rapid expansion of forces.

CONDITIONS CONSIDERED RESPONSIBLE FOR THE DISASTER

1. The operating company considered this a nongassy mine and provided an inadequate ventilation system in which air that had ventilated abandoned workings and pillar workings was coursed therefrom to active workings and haulage roads on which trolley locomotives were operated.

2. Open-type pumps and locomotives were operated in air returning from abandoned workings and pillar workings where gas might be liberated and accumulate in unusual amounts.

RECOMMENDATIONS

Recommendations concerning the safe operation of this mine were made in reports on previous Federal inspections, the last inspection having been made August 23-24 and 27-28, 1951. Recommendations in this report, therefore, are limited to conditions as related to this disaster.

Ventilation

1. The main intake air currents should be split to ventilate effectively each working section with a separate split, and air that has passed through or by abandoned areas and pillar workings should not be reused to ventilate live workings.

2. Abandoned workings which are not or cannot be thoroughly examined should be sealed or ventilated with air which returns to the outside without passing through active workings or over electrical equipment.

3. Sufficient air should be directed to all parts of the mine to prevent accumulations of gas.

4. The fire bosses should make a written record of their preshift examinations, either on the surface or underground, before the next shift enters the mine.

Coal and Rock Dust

5. Should the mine or any portion thereof become dry as the result of ventilation changes or otherwise, the mine or portions of the mine so affected should be rock-dusted to the extent that the incombustible content of the mine dust will be at least 65 percent plus 1 percent for each 0.10 percent methane present in any ventilating current. The rock-dust applications should extend to within 40 feet of the faces and up to and including the last open breakthrough.

Ignition Sources

6. The installation of trolley wire and all other power wires should be confined to pure intake air.*

7. Electrical equipment used in other than pure intake air should be of a type approved by the U. S. Bureau of Mines and be maintained in permissible condition.

Miscellaneous

8. A self-rescuer should be provided for each person underground, and all underground personnel should be instructed in its maintenance, use, and limitations.

*"Pure intake air" is defined as air which has not passed through any active working places in face regions and has not passed through any worked-out abandoned areas or through or by the unsealed entrances to any abandoned or worked-out areas.

ACKNOWLEDGMENT AND COMMENDATIONS

The writers acknowledge the courtesies extended and the help given by officials of the operating company, members of the United Mine Workers of America, and representatives of the Pennsylvania Department of Mines, who gave all information requested in connection with this investigation.

The Bureau of Mines commends the United States Steel Company, Coal Division, mine rescue teams; the Pennsylvania State Police; the Salvation Army; the American Red Cross; and the management of the Penn-Francis Hotel in Mt. Pleasant, Pennsylvania, for the humanitarian services rendered.

Respectfully submitted,

W. Dan Walker Jr

W. Dan Walker, Jr., Chief
Pittsburgh Branch, Accident
Prevention and Health Division

G. M. Smith

G. M. Smith
Coal-Mine Inspector

F. E. Riley

F. E. Riley
Coal-Mine Inspector

J. H. Dumire

J. H. Dumire
Coal-Mine Inspector

Approved by:

James Westfield

James Westfield, Chief
Accident Prevention and
Health Division, Region VIII

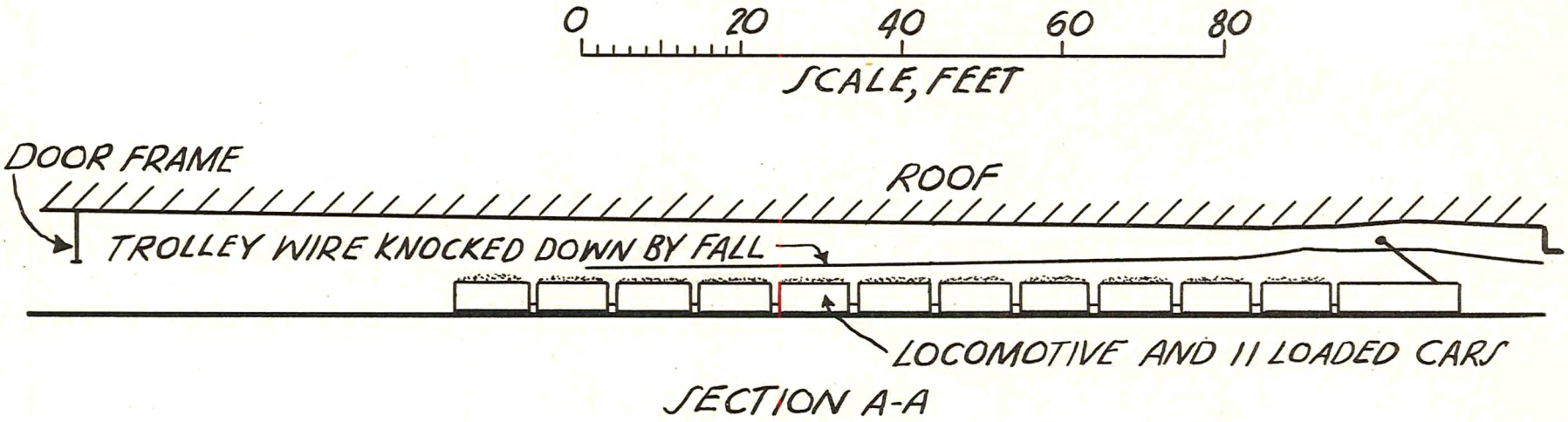
Int. - Bu. of Mines, Pgh., Pa.

APPENDIX A

VICTIMS OF EXPLOSION, CARPENTERTOWN MINE
CARPENTERTOWN COAL & COKE COMPANY

February 2, 1952

Name	Age	Marital status	Dependents	Estimated years experience	Social-Security Number
Fred Yothers	48	M	2	25	[redacted]
Charles Hamborsky	56	M	1	35	
John Magrey	55	M	1	35	
Joseph Smartnick	56	M	1	35	
Michael Klementic	40	M	4	20	
Lawrence Bollinger	54	M	1	35	



APPENDIX E

SKETCH SHOWING RELATIONSHIP OF TROLLEY WIRE TO ROOF