Reports

Pocahontas Fuel #34

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

DISTRICT C

FINAL REPORT OF MAJOR MINE EXPLOSION DISASTER
NO. 34 MINE
POCAHONTAS FUEL COMPANY, INCORPORATED
McDOWELL COUNTY, WEST VIRGINIA
(NEAR BISHOP, TAZEWELL COUNTY, VIRGINIA)

February 4, 1957

By

W. R. Park
District Supervisor

E. M. Lewis
Health and Safety Engineer

and

W. M. Cordray
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Originating Office - Bureau of Mines
Mount Hope, West Virginia
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INTRODUCTION

An explosion occurred in the No. 34 mine of the Pocahontas Fuel Company, Incorporated, near Bishop, Tazewell County, Virginia, about 1:55 a.m., Monday, February 4, 1957. Thirty-seven men were killed by the explosion; 24 of them died from burns and/or forces and 13 were killed by afterdamp. None of the other employees in the mine at the time of the explosion was injured, imprisoned, or made an attempt to erect a barricade; these men, 141, escaped unassisted.

The names of the victims, their ages, marital status, occupations, and the number of their dependents are listed in Appendix A of this report.

Bureau of Mines investigators believe that the explosion originated at or near the faces of working places being driven in or off the Day Headings when an explosive mixture of methane-air was ignited by an electric arc or spark from the face electric equipment or a power conductor. Forces of the explosion extended throughout the Day Headings, Shaft Headings, and Little Horse Pen entries, into the Bleeder entries, and to the surface through the man shaft.

GENERAL INFORMATION

The No. 34 mine of the Pocahontas Fuel Company, Incorporated, is in McDowell County, West Virginia, about a mile south of Bishop, Virginia,

and it is served by the Norfolk and Western Railway Company. The operating officials of the Pocahontas Fuel Company, Incorporated, on February 4, 1957, were:

A. R. Matthews	President	Pocahontas, Virginia
A. V. Sproles	Vice President	Pocahontas, Virginia
P. P. Ferretti	General Superintendent	Pocahontas, Virginia
W. J. Skewes	Chief Engineer	Pocahontas, Virginia
J. W. Pero	Director of Safety and Mine Inspection	Pocahontas, Virginia
M. E. Hall	Division Superintendent	Pocahontas, Virginia
Charles T. Stephenson	Superintendent	Bishop, Virginia
Howard Clark	Assistant Superintendent	Bishop, Virginia
Louis Roncaglione	Mine Inspector	Bishop, Virginia
John F. Meade	Mine Foreman	Bishop, Virginia

A total of 825 men was employed; 675 of them worked underground, 3 shifts a day, 5 days a week and produced an average of 9,500 tons of coal daily. One hundred and fifty men were employed on the surface. Production for the year of 1956 was 2,083,751 tons of coal. The last Federal inspection of this mine prior to the disaster was made October 29-31 and November 5-9, 1956.

Access into the mine is by seven drifts and two concrete-lined air shafts into the Pocahontas Nos. 3, 4, and 5 coal beds; the shafts are 315 and 320 feet in depth, respectively. At the time of the explosion, mining was being done only in the No. 3 coal bed, which averaged 72 inches in thickness in the areas being mined and dipped to the north about 4 percent. The intervals between the Nos. 3, 4, and 5 coal beds are 120 and from 2 to 15 feet, respectively. The Nos. 3, 4, and 5 coal beds have been interconnected at several locations by open passageways.

The immediate roof was unconsolidated shale, from 8 to 20 inches in thickness. The main roof was laminated shale and sandstone beddings, from 20 to 40 feet in thickness. Kettle bottoms, slips, and slickenside formations were prevalent in the immediate roof. Cover over the coal bed ranges from a few feet to 1,000 feet in thickness. The floor is either sandstone or shale. The analysis of a coal sample from the Pocahontas No. 3 coal bed in this mine, as provided by the company, is as follows:

	Percent
Moisture	2.5
Volatile Matter	21.0
Fixed Carbon	70.5
Ash	6.0
	100.0

Numerous tests by the Bureau of Mines have shown that coal dust having a volatile ratio of 0.12 is explosive and that the explosibility increases with an increase in the volatile ratio. The volatile ratio of the coal in this mine as determined from the above-mentioned analysis is 0.23, indicating that the dust from this coal is explosive.

The mine records indicate that three gas explosions occurred in the Nos. 4 and 5 coal beds of this mine in 1937 and 1951; three persons were killed in the first explosion, and one in each of the others. Other major mine explosions that have occurred in nearby mines include:

Mine	Date	Location	Lives Lost
Algoma No. 7	September 15, 1902	Algoma, W. Va.	17
Grapevine	February 26, 1905	Wilcoe, W. Va.	7
Tidewater	July 5, 1905	Vivian, W. Va.	5
Tidewater	November 4, 1905	Vivian, W. Va.	7
Standard	August 1, 1911	Welch, W. Va.	6
Bottom Creek	November 18, 1911	Vivian, W. Va.	18
King	March 28, 1916	Kimball, W. Va.	10
Yukon No. 1	December 15, 1917	Yukon, W. Va.	18
Carswell	July 18, 1919	Kimball, W. Va.	7
Yukon No. 2	March 28, 1924	Yukon, W. Va.	24
Shannon Branch No. 3	May 13, 1927	Capels, W. Va.	8
Keystone No. 2	April 2, 1928	Keystone, W. Va.	8
No. 1	May 22, 1928	Yukon, W. Va.	17
No. 1	January 10, 1940	Bartley, W. Va.	91
Carswell	January 22, 1941	Carswell, W. Va.	6
Havaco No. 9	January 15, 1946	Havaco, W. Va.	15

MINING METHODS, CONDITIONS, AND EQUIPMENT

Mining Methods. An entry-and-block system of mining was followed. Multiple entries in sets of 3 to 12, turned at various intervals, were driven 16 feet wide on 75- or 90-foot centers, and crosscuts were about 80 feet apart. Pillars were recovered by an open-end method. Pillar lifts were 18 to 20 feet in width. A high percentage of the coal was recovered in this mine.

Bolts were used for roof support in all areas of the mine, except in pillar lifts where the draw rock was more than 5 feet in thickness or where the draw rock fell when the coal was cut or blasted. Where roof conditions in pillar lifts would not permit bolting, posts were set on 4-foot centers and two rows of posts were set on the open side of all lifts. Breaker posts were set in the pillar sections, and the roof support plan required that additional supports be provided where needed. Coal was top cut and sheared with rubber-tired Universal mining machines and loaded into rubber-tired shuttle cars with tractor-mounted loading machines.

Explosives and Blasting. Permissible explosives were used for blasting, and the blasting supplies were transported underground in specially constructed explosives cars and stored temporarily in suitable section boxes. The coal was top cut to an average depth of 9-1/2 feet and sheared vertically near the middle of the cuts, then blasted on shift by trained shot firers. Two shot holes were drilled, one above the other, near the rib on each side of the cut in solid places. In such places, all shot holes were charged, the two shot holes on each side of the shear cut were wired together, and each set of shots fired separately. In pillar work, the two shot holes on the pillar side of a cut were loaded, wired together, and fired simultaneously, and then the two shot holes on the open side of the cut were fired. Six to eight cartridges of explosive were used in each shot hole. Incombustible material was used for stemming, and permissible multiple-shot blasting units were used for firing the shots. During the last Federal inspection, suitable examinations for methane were made before and after blasting.

Ventilation and Gases. Ventilation was induced by four electrically driven axial-flow fans, operated exhausting and circulating through the mine approximately 941,300 cubic feet of air a minute. The fans were operated continuously. Each fan was installed in a fireproof structure on the surface, offset from its mine opening, and provided with explosion doors, a recording pressure gage, and a device to give alarm should the fan slow or stop. Overcasts and permanent stoppings were constructed of incombustible material. Temporary stoppings were constructed of lumber and/or brattice cloth. Check curtains and line brattice were used to conduct air in the face regions; part of the line brattice at a few places in sections unaffected by the explosion sagged from the roof or was torn, and the area between the line brattice and rib at several places was somewhat restricted. Perceptible movement of air was discernible at the ends of all line brattice. Only five ventilation doors were in use in the mine on the day of the explosion. Three of these doors were installed to form a single air lock in the Day Headings; two of them were on the haulageway and the third was across a spur track in the adjacent parallel entry. A single door in the Bleeder entries was used in conjunction with wooden stoppings to direct intake air through the No. 6 entry and to the other entry faces. Another single door was used in a pillar section. The space between the air-lock doors on the haulageway in the Day Headings was approximately 80 feet and, reportedly, a trip to this section usually consisted of 10 mine cars and the locomotive. Each mine car has an overall length of 14 feet; consequently, 10 cars and a locomotive could not clear in the space between the doors, and both doors on the haulageway had to be open at the same time while a trip was passing through the air lock. Inasmuch as permanent or temporary stoppings were installed on both sides of entries from the air-lock doors to the faces of Day Headings, a complete short-circuiting of intake air to the return airways would not occur when these air-lock doors were opened. However, the excessive number of brattice-cloth stoppings in the Day Headings would likely permit sufficient leakage, when the air-lock doors were open, to interfere seriously with face ventilation in the Shaft Headings and Day Headings.

Ventilation in the area affected by the explosion was induced by the Horse Pen fan; three additional working sections were also ventilated by means of this fan. Each working section, except the Day Headings and Shaft Headings, was ventilated with a separate split of intake air. The quantities of air reaching the last open entry crosscuts and the intake ends of pillar lines during the November 1956 Federal inspection ranged from 15,000 to 40,000 cubic feet a minute. In several working sections, intake air was coursed through the center entries of each set, split right and left near the faces, and returned by way of the outside entries. In other working sections, a single row of stoppings was used to separate the intake airways from the single return. On February 1, the Day Headings and Shaft Headings were ventilated with a single split of air, coursed first through the Shaft Headings and Little Horse Pen entries and thence to the Day Headings. This air current was controlled by the air-lock doors in the Day Headings (see Appendix B).

The following air measurements and methane determinations were made during the November 1956 inspection:

Location	Volume of air, c.f.m.	Methane, percent	Cubic Feet of Methane in 24 hours
Immediate return, pillar split 3 panel 3 left section	19,000	0.08	21,888
Immediate return, 4 left tunnel section	15,000	0.25	54,000
Immediate return, pillar split 2 panel 3 left section	24,000	0.13	44,928
Immediate return, 6 panel 5 left section	15,000	0.27	58,320
Immediate return, Bleeder entries	40,000	0.48	276,480
Immediate return Jenkinjones section	34,000	0.55	269,280
Immediate return Daniel mains, left side	33,000	0.45	213,840
Immediate return, Daniel mains, right side	23,000	0.46	152,352

Location	Volume of air, c.f.m.	Methane, percent	Cubic Feet of Methane in 24 hours
Immediate return, Shaft entries	38,000	0.24	131,328
Main return, Horse Pen Shaft, No. 1 airway - Daniel Mains	102,000	0.54	793,152
Main return, Horse Pen Shaft, No. 3 airway - Bleeder entries	172,000	0.39	965,952
Main return, Horse Pen Shaft, No. 2 airway - Jenkinjones	109,000	0.41	643,536
Main return, Big Creek Fan	331,000	0.14	667,296

According to measurements made by the general assistant mine foreman about noon, Saturday, February 2, the quantity of air passing through the regulator controlling the air split for the Day Headings and Shaft Headings was 91,000 cubic feet a minute. The quantity of air passing through this regulator on January 24, was 83,811 cubic feet a minute, indicating that "holing through" of the Little Horse Pen entries to the Bleeder entries had little effect on ventilation other than to increase slightly the volume of air in the split ventilating the Day Headings and Shaft Headings.

The mine is classed gassy by the West Virginia Department of Mines and by the Bureau of Mines. Fire bosses made preshift examinations for gas and other hazards for the 12:00 to 8:00 a.m., shifts; other preshift examinations for succeeding shifts were made on shift by the section foremen during their regular tour of duty. Fire bosses and assistant foremen stated that the finding of gas during preshift examinations, which occurred quite frequently, was not included in the fire-boss record book if the gas was removed while the examiner was present. Although the aforementioned policy was followed by the fire boss who examined the Day Headings, his record of preshift examinations shows that he found gas in and "dangered off" the following places in the Day Headings during the period January 4 to February 3, 1957:

Date	Working Places Dangered Off	Date	Working Places Dangered Off
1-4	Nos. 2 and 4	1-16	No. 3 and crosscut
1-6	Nos. 1, 3, and 4	1-17	No. 1
1-7	Nos. 1 and 4	1-18	Nos. 1, 2, 4, and 5
1-8	No. 4	1-21	Nos. 2 and 4
1-10	No. 1	1-22	Nos. 2, 4, and 5
1-11	Nos. 2 and 3	1-25	No. 2
1-14	Nos. 1 and 2	1-27	No. 5
1-15	No. 3	2-1	No. 11

On-shift examinations for gas and other hazards were made by fire bosses, section foremen, assistant foremen, and the general mine foreman, but records of such on-shift examinations were not made. Also, records were not made to show how hazards reported by the preshift examiners were corrected.

Operators of electrical face equipment were instructed to make suitable tests for gas before electrical equipment was taken to the working faces and frequently while the equipment was being operated at the faces. However, during the November 1956 Federal inspection, more than 3 percent of methane was detected with a permissible flame safety lamp at a point not less than 12 inches from the roof, face, and ribs in a roof cavity 18 inches deep, 7 feet wide, and 8 feet in length at the face of No. 1 entry of the Shaft Headings and the mining machine was being operated at this face. The line brattice was repaired and the methane was removed promptly.

The section foreman and four workmen in the Day Headings had flame safety lamps at the time of the explosion; the lamp used by the roof bolters was destroyed by forces. The other four lamps were sent to the Bureau of Mines laboratories in Pittsburgh, Pennsylvania, for testing and examination. These tests showed that the four lamps were in permissible condition, and they did not ignite methane in any of the tests performed.

Coal and Rock Dust. The following information was obtained from the November 1956 Federal inspection report: The mine surfaces ranged from wet to dry. Dangerous accumulations of loose coal and coal dust were not present, and excessive coal dust was not raised into the air during normal mining operations. Water was used in the working places to allay the dust produced during mining operations and along the shuttle-car roadways. The working places were well rock-dusted to within 40 feet of the faces, including all open crosscuts, and the dry haulageways and parallel and back entries were rock-dusted adequately. The incombustible content of the 11 dust samples collected during the inspection ranged from 87.0 to 97.0 percent.

According to the superintendent, the loading-machine operators' helpers were required to shovel any loose coal and dust from along the ribs to the middle of the places so that the material could be loaded by machines. If loading operations were delayed or interrupted, all the men available on the section were required to clean up loose coal and dust. Five 50-pound bags of rock dust, or more if needed, was distributed by hand in the area for each cut of coal removed. Generalized rock-dusting was done by machines on week-ends and in some cases by portable rock-dusting machines between shifts. Company officials stated that the section foreman and three men from the 4:00 p.m. to 12:00 midnight shift in the Day Headings worked their regular shift February 1, and then worked the next shift cleaning and rock-dusting the working places in the Day Headings. Company records showed that 8,320 tons of rock dust was applied, and 2,083,751 tons of coal was produced in 1956; this amounts to about 8 pounds of rock dust used per ton of coal produced.

After the explosion, examination of the Day and Shaft Headings revealed that the sections were covered with a thin layer of dust and/or soot. Evidence that the areas had been rock-dusted was apparent throughout the sections, and excessive accumulations of coal dust were observed only near the loading points and in the areas between the loading points and the working faces.

Examination of the face areas of three working sections not affected by the explosion (Bleeder entries, Daniel mains, and Pine Ridge entries) during the underground investigation revealed that dangerous accumulations of coal dust were present at one or more locations near the working faces in each section, and small to excessive amounts of fine coal dust were present on the roof and ribs, particularly on ledges and offsets in the ribs, in these areas between the loading points and the faces. The floor material in the face regions of each section ranged from damp to wet. All openings inby the loading points had been rock-dusted by hand, but visual observation indicated that these locations generally were not rock-dusted adequately. Dust samples were collected in the face areas of the three sections and at regular intervals along the entire length of the back entries, parallel entries, and haulageways. Only 1 of the 12 dust samples collected within 350 feet of the faces of the Bleeder entries contained more than 65 percent incombustible material; the other 11 samples contained incombustible material ranging from 26.7 to 61.7 percent. The incombustible content of the 16 dust samples collected within 300 feet of the faces of Pine Ridge entries ranged from 24.3 to 95.7 percent, and only 5 of the 16 samples containing more than 65 percent incombustible. One of the samples collected near the faces of Daniel main entries contained 97.4 percent incombustibles; the other 5 samples contained incombustibles ranging from 28.4 to 43.3 percent (see Appendix B).

If rock-dusting in the face regions of the Day Headings at the time of the explosion was similar to rock-dusting in the face regions of the Bleeder entries, Pine Ridge entries, and Daniel mains, it must be assumed that sufficient incombustible material was not present and therefore, some of the coal dust that entered into propagation of the explosion came from the face regions of the Day Headings.

Transportation. Permissible-type cable-reel shuttle cars were used for face haulage; they discharged the coal directly into 5-ton capacity steel mine cars, which were hauled by trolley locomotives to the surface. The rolling equipment was maintained in reasonably good repair. The tracks were well maintained and the clearance space along the haulageways was free of obstructions. Shelter holes were provided at 80-foot intervals, and shelter holes or more than 6 feet of clearance was provided at switch throws. Men were transported in special section man-trip cars, and suitable man-trip waiting stations were provided. In some instances when only a few men were transported, they were hauled in a mine jeep.