FINAL REPORT OF MINE EXPLOSION AND FIRE
BELVA NO. 1 MINE
KENTUCKY STRAIGHT CREEK COAL COMPANY
FOURMILE, BELL COUNTY, KENTUCKY

DECEMBER 26, 1945

BY

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

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INTRODUCTION

An explosion occurred in the Belva No. 1 mine of the Kentucky Straight Creek Coal Company at Fourmile, Bell County, Kentucky about 8:20 a.m., December 26, 1945. Thirty one men, including 2 from another of the company's mines, were in the mine at the time of the explosion. Of this number, 18 were killed almost immediately by flame, violence or afterdamp; 4 died about 7 hours after the explosion from afterdamp; 1 died about 50 hours after the explosion while awaiting rescue; 1 was rescued about 54 hours after the explosion and died in a hospital the second day following his rescue and 1 man died several months after he was rescued. Six men rescued about 54 hours after the explosion, survived.

The 6 survivors, the 2 men who later died, and the man who was with them and was found dead erected an ineffective barricade consisting principally of an old mine door in the entrance to a place that was relatively free from strong concentrations of afterdamp.

The disaster was caused by the ignition of an accumulation of methane which in turn ignited coal-dust, resulting in the propagation of flame throughout the greater portion of the mine. Coal dust was not allayed nor was the mine rock-dusted.

First notification of the disaster received by the Bureau of Mines was about 9:00 a.m., when Mr. A. A. Fish, company engineer, called Wilbur Stiles at Barbourville, Kentucky; and Robert Smith, a representative of the Mine Safety Appliances Company, at Harlan, Kentucky, phoned the Norton, Virginia, Bureau of Mines office. M. L. Davis, in charge of the Norton office during the absence of the Engineer-in-Charge, learned by a telephone call to one of the company officials at Fourmile, Kentucky, that a cloud of dust and smoke had issued from the mine portal about 8:20 a.m. and that he thought 40 to 50 men were in the mine. Mr. Davis instructed Wilbur Stiles to proceed to the mine; and W. R. Park, M. L. Davis, J. E. Bradburn, and William Holt left the Norton office for the mine about 10:00 a.m. Bureau of Mines personnel continued to arrive at the mine from 10:10 a.m., December 26 until 4:00 p.m., December 30.

Bureau of Mines representatives cooperated with the Chief and inspectors of the Kentucky Department of Mines and Minerals and with officials of various mining companies in directing the recovery operations, serving as shift leaders in the reestablishment of ventilation, and leading exploratory parties. Breathing apparatus and other mine rescue equipment from the Bureau of Mines rescue truck were used in the mine.

GENERAL INFORMATION

Location and Operating Officials

The Belva No. 1 mine, owned and operated by the Kentucky Straight Creek Coal Company, is at Fourmile, Bell County, Kentucky, about 6 miles northwest of Pineville, Kentucky, on a branch of the Louisville and Nashville Railroad.

The names and addresses of the operating officials were:

W. E. Lewis, Sr.	President	Fourmile, Kentucky
A. A. Fish	Mining Engineer	Pineville, Kentucky
W. E. Lewis, Jr.	Superintendent	Fourmile, Kentucky
Nath Centers (Deceased)	Mine Foreman	Fourmile, Kentucky

Employees and Production

Of the 85 men employed at the mine, 80 worked underground on two shifts. The average daily production was 300 tons of coal.

Openings

The mine was opened by three drifts, one of which is the haulage road; another, connected to the fan, is the intake airway. The third drift, driven parallel to the fan drift, was closed with a fireproof stopping. An additional opening that was driven from the underground workings to the outcrop was caved shut at the surface. Workings of the mine were cut through to the worked-out caved areas of the adjoining old No. 1 mine which was abandoned. This adjoining mine had four drift openings to the surface, all of which were caved. The superintedent stated that the mine was also connected, by large cracks in the 90-foot intervening strata, to an abandoned mine in the overlying coal bed.

Nature of the Coal Bed

The mine is operated in the Straight Creek coal bed, which averages 34 inches in thickness and is nearly level except for local undulations. There are no noticeable partings in the coal bed; the roof is reasonably hard, sandy, gray shale; and the floor is smooth, hard fire clay. Greatest overburden, at the present active workings, is 1,000 feet in thickness The coal is high-volatile bituminous; and the ratio of the volatile matter to total combustible matter of the coal, which is an index to the explosibility of the coal dust is 0.40.

Approximate analysis of 2-inch nut-and-slack coal from the Belva No. 1 mine, as taken from "Analyses of Kentucky Coals", Technical Paper 652, published by the Bureau of Mines, is as follows:

	Percent
Moisture	2.7
Volatile matter	37.2
Fixed Carbon	56.0
Ash	4.1
	100.0

MINING METHODS, CONDITIONS, AND EQUIPMENT

Method of Mining

The mine was developed by a two-main-entry system with side entries driven to the right and left in pairs at intervals of from 300 to 400 feet, except that the interval between 5 left and 6 left off 9 right is about 800 feet. At the junction of 9 right and the straight mains, the straight mains turn slightly to the left and 9 right turns slightly to the right off the straight mains forming a "Y". Side entries were driven to the right and left, in pairs, off the straight mains inby 9 right and to the right and left in pairs off 9 right at irregular intervals and at various angles. The side entries driven to the right off the straight mains and those driven to the left off 9 right intersect at several places in the intervening territory. Entries were generally driven 22 to 35 feet wide, leaving pillars 35 feet wide, and rooms were driven 45 feet wide, leaving 10-foot pillars. Rooms were driven off headings and air courses of side entries. Pillars were not extracted.

Recent development has not followed any definite mining plan and workings off 5 and 6 left were driven in various directions, often without sights, and without regard to width or proper distance between crosscuts.

The coal was undercut by shortwall mining machines and loaded into cars by hand in some working places; however, one set of shaker conveyors was in use in 5 left and another in 6 left at the time of the explosion.

Ventilation and Gas

A 6-foot Aerodyne fan, operated blowing, was used to force air into the mine. This fan, installed in a wooden structure on the surface, was offset 25 feet from the airway opening by means of a wooden air duct. It was operated continuously except that it was usually stopped when the mine was to be idle for a period of several days. The fan was reversible. The fan was driven by an independent source of power. It was not equipped with a pressure-recording gage or water gage, and provision has not been made to give warning in the event the fan slows or stops. The fan was not constantly attended. At the time of the last Federal inspection in August 1945 the fan was circulating 35,000 cubic feet of air a minute.

A map of the mine, included in this report as appendix "A", has indicated on it, by arrows, the direction of the air flow through the mine.

air was circulated through the old workings to the left of the straight main and through the left parallel entry of the straight main to the junction of 9 right. From this point, both entries of the straight main were used as intakes. The air from the straight mains inby 9 right junction traveled through old, abandoned, caved areas to the right of the straight mains into 5 left off 9 right. A booster fan was located near the mouth of 5 left. The intended function of this fan was to collect the air coming through the old workings into 5 left and force it through an entry parallel to 9 right and from there through or by the workings off 6 left. The air, returned from 6 left through the 9 right haulage road, passed the entrance to 5 left and returned to the 9 right junction with the straight mains through the 9 right haulage road. From the 9 right junction, the return air traveled the haulage road to the outside.

The amount of air that was being recirculated by the booster fan cannot be estimated; however, it is the belief of the investigators that a large portion of the air reaching 6 left was recirculated air. Air leaking through the door at 5 left and air leaking through the stoppings between the 9 right haulage road and its parallel entry would be drawn to the booster fan and recirculated.

The booster fan received its power from the trolley circuit and was connected by means of a bare nip. It was customary to operate the substation, located on the surface, only while the mine was in operation; therefore, the booster fan would be idle during the off shift each day and during idle periods such as Sundays and holidays. It was also customary to start the substation about an hour before the first shift entered the mine following an idle period.

Blower fans were used in conjunction with the conveyor units in 5 left and 6 left. The blower fan in 5 left was installed in a room with a conveyor unit and did not have tubing attached to it. The blower fan in 6 left was installed in a crosscut, and tubing from it extended to a point near the face of the entry. See Appendix C. The Federal inspection report on this mine of August 13-14, 1945 is quoted as follows:

> "The volume of air measured at the intake opening was 35,000 cubic feet a minute, which was adequate for the needs of the mine if directed properly to the working faces. Because of excessive leakage through wooden stoppings between the main intake and return airways, air courses partly blocked by roof falls, and doors being hung singly in the working sections, insufficient amounts of air were reaching the working sections. Room crosscuts were not closed, line brattices were not used, and the 285 stoppings built to replace defective stoppings since the last inspection were made of wood."

Doors used to control the air current were constructed of wood and installed singly and did not form air locks. Stoppings between the intake and return airways throughout the mine were constructed of wood. Overcasts or air bridges have not been constructed.

The mine was rated as nongassy by the Kentucky Department of Mines and Minerals. Enough methane was discovered, however, during each of four Federal inspections to warrant rating the mine as gassy in accordance with standards promulgated by the United States Bureau of Mines. During the Federal inspection of December 28, 1943, to January 4, 1944, methane was detected with a flame safety lamp in Nos. 1 and 2 rooms off 7 left. Methane content in air samples collected at the faces of working places ranged from 0.00 to 0.35 percent. Methane was not indicated in a sample collected in the main return; however, during the May 11-13, 1944, Federal inspection, methane in air samples collected at the faces ranged from 0.09 to 0.14 percent, and a sample collected in recirculated air from a booster fan contained 0.52 percent methane. In the December 20-30, 1944, Federal inspection report, the methane content of face samples ranged from 0.09 to 0.61 percent, and 0.03 per ent methane was found in the main return. In the August 13-14, 1945, Federal inspection report, face samples contained methane from 0.08 percent to 0.32 percent, but methane was not indicated in the main return. As cited elsewhere in this report, methane was detected with a flame safety lamp and with a permissible methane indicator during recovery operations.

Three sets of air samples, in duplicate, were collected during recovery operations. The results of analyses of these samples are shown on page 6 of this report. The absence of methane in the analyses of these samples is explained by the fact that any methane coming from the interior of the mine was being diluted by leakage of fresh air through stoppings into the return.

Fire bosses were not employed to make examinations of the mine before the working shifts entered, and mine officials or other employees did not carry flame safety lamps, except infrequently, or other devices capable of detecting methane.

In the four Federal inspections referred to, recommendations were made in the reports thereof that the mine be rated and operated as a gassy mine and that fire bosses be employed to make examinations of the mine for gas and other hazards before the men entered, such examinations to be made not more than 3 hours before time for the men to begin work.

Drainage

The mine was naturally dry except for a local spring about 1,000 feet from the drift portal. The water from this spring drains naturally to the surface through the main haulage road, and the use of pumps was not required anywhere in the mine for drainage purposes.

Dust

The mine was excessively dusty, and no means were employed to allay coal dust during mining operations. Accumulations of coal dust were present along the conveyor lines, at the unloading points of conveyors, and along the haulageways. Heavy deposits of fine coal dust existed on the floor and on the gobbed rock along all haulage roads. The incombustible content of four dust samples collected during the Federal inspection of December 28, 1943, to January 4, 1944, ranged from 28.7 to 48.5 percent. Screening tests on these samples revealed that from 79.1 percent

Analyses of Air Samples Collected During Recovery Operations
Belva No. 1 Mine, Kentucky Straight Creek Coal Company
Fourmile, Bell County, Kentucky

Bottle Number	Location in Mine	Cubic Feet of Air per Minute	Date	Time Collected	Percent CO_2	O_2	CO	CH_4	N_2
131-U	Main return at fan	49,650	12-31-45	11:00 a.m.	0.30	20.64	0.03	0.00	79.03
924	Main return at fan	49,650	12-31-45	11:00 a.m.	0.27	20.61	0.03	0.00	79.09
519-R	Main return at fan	43,200	1-3-46	12:10 p.m.	0.51	20.33	0.04	0.00	79.12
520-R	Main return at fan	43,200	1-3-46	12:10 p.m.	0.50	20.37	0.04	0.00	79.09
395	Return at 9 right 10 feet inby old booster fan	—	12-30-45	4:40 p.m.	0.36	20.58	0.03	0.00	79.03
396	Do	—	12-30-45	4:40 p.m.	0.31	20.65	0.02	0.00	79.02

Analyses of Air Samples Collected During Recovery Operations
Belva No. 1 Mine, Kentucky Straight Creek Coal Company
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Bottle Number	Location in Mine	Cubic Feet of Air Per Minute	Date	Time Collected	Percent CO_2	O_2	CO	CH_4	N_2
8918	6 left at 2 left	Movement	10-7-48	11:00 a.m.	1.15	19.32	0.00	0.37	79.16
8898	1 left off 6 left	Movement	10-5-48	9:00 a.m.	1.64	18.53	0.00	0.64	79.19
9839	Just inby 6 left 9 right	Still	9-21-48	10:00 a.m.	3.82	14.57	0.00	1.88	79.73
7297	Return inby fan	33,000	8-10-48	11:30 a.m.	0.40	20.32	0.00	0.05	79.23
7247	Return inby fan	33,000	8-6-48	2:30 p.m.	1.71	17.64	0.00	0.68	79.97
7180	At seals inby 5 right	Still	7-23-48	11:10 a.m.	9.30	5.00	0.00	1.20	84.50
8728	At seals inby 5 right	Still	2-3-48	10:15 a.m.	1.79	17.93	0.04	0.17	80.07
398	At seals inby 5 right	Still	10-2-46	2:30 p.m.	9.20	1.20	0.002	2.2	87.4
6304	At seals inby 5 right	Still	4-22-46	9:30 a.m.	2.60	16.45	0.00	0.00	80.95
6090	At seals inby Portal	Still	4-1-46	11:00 a.m.	0.50	20.03	0.00	0.00	79.47

to 94.9 percent passed through a 20-mesh screen. No changes of practices or conditions have occurred since the inspection referred to that would alter the characteristics of the dust deposits in the mine. Any bituminous dust that contains less than 65 percent incombustible material and that will pass through a standard 20-mesh screen will enter into and support the propagation of a dust explosion. Rock dust was not used in this mine to render the coal dust nonexplosive.

Haulage

Trolley locomotives were used for main and secondary haulage; a combination cable-reel and trolley locomotive was used in the face regions of 6 left section; and a trolley locomotive with a "stinger" attachment was used to handle cars at the conveyor unloading point in 6 left.

All haulage was conducted either in return air or in air that had passed through old workings.

Lighting

Connections for the few fixed electric lights installed at intersections were made by wrapping the ends of the positive service wires around the trolley lines. All the underground employees used permissible portable electric cap lamps for illumination.

The superintendent stated that the foreman sometimes carried a permissible flame safety lamp; however, this statement is not borne out by any of the previous coal-mine inspection reports, and two survivors of the explosion stated that they had never seen the foreman carry a flame safety lamp.

Smoking was permitted in the mine.

Electrical Equipment Underground

Electric power, as 250 volts direct current, to operate the underground machinery was transmitted from the surface substation by means of two 4/0 trolley wires connected at frequent intervals and supported, one above the other, by the same hangars. The lower of the two trolley lines being continuous inby old 1 main, the sectionalizing switches in the original line were rendered useless. Cut-out switches were in the single 4/0 branch lines. All of the power lines were poorly alined and in return air. Bonding of tracks had not been kept up to date.

All the electrical equipment, including mining machines, nand-held drills, conveyor motors, fan motors, and locomotives, used underground was of the open type. Electric circuits and equipment were not protected against sustained overload, and open-type switches were used in the circuits where deemed necessary. Trailing-cable splices, made in the mine, were insulated only with friction tape.

Examinations for methane were not made before or while machinery was operated in the face regions.

Explosives

It must be assumed that blasting practices just prior to the explosion were virtually the same as reported during the August 1945 Federal inspection.

Permissible explosives and instantaneous electric detonators, fired by means of permissible attachments on the electric cap lamps, were used for all blasting in the active sections. Part of a box of deteriorated 40-percent dynamite found in old workings during recovery operations indicates that this explosive had been used for blasting rock falls in attempting to clear old airways. Explosives and detonators for use in the hand-loading places were stored, unconfined or in carrying containers, on the mine floor in proximinty to each other and too close to the working faces. About 2 days' supply of explosives and detonators for use in the conveyor places was stored in their original containers along the ribs or in crosscuts. Explosives supplies unused at the end of the shift were left in the mine.

Shot holes in the coal, properly placed and not more than 5 feet in depth, were charged usually with two cartridges of explosive, stemmed with fine coal cuttings by means of either a wooden or copper-tipped iron tamping bar, and fired any time during the shift by the miners. Roof was brushed by firing a single shot hole, not more than 6 feet in depth, having 1-1/2 to 2 feet of burden, and charged with two to three cartridges of explosive, in the roof over the center of the roadway.

Tests for methane were not made before or after blasting.

Mine Rescue

None of the employees had been trained in mine rescue procedure. Neither self-contained oxygen breathing apparatus nor gas masks were maintained by the company; and the nearest available mine rescue equipment, owned by the Pioneer Coal Company, is at Kettle Island, Kentucky, about 14 mines from the Belva No. 1 mine.

Fire Fighting

Neither surface nor underground fire-fighting organizations were maintained, and there were no means of combating fire on the surface or in the mine.

PREVIOUS EXPLOSIONS IN NEARBY MINES

This was the first explosion and the first fire, as far as could be ascertained, that had occurred in the Belva No. 1 mine; however, explosions have occurred in nearby mines worked in the same coal bed. Five men were burned severely by an explosion of gas, ignited by a spark from an electric motor, in the Little Creek mine of the Bell Coal Company, Rolla, Kentucky, on January 18, 1943. On March 29, 1930, a gas-and-dust explosion, ignited by an open light, in the Kettle Island mine of the Pioneer Coal Company at

Kettle Island, Kentucky, resulted in the death of 16 men. An explosion of gas, ignited by an open light, caused the death of 1 man in the same mine on March 14, 1927. A duet explosion, started by a blown-out shot, in the Laymond Mine at Pineville, Kentucky, on January 30, 1922, killed 6 men.

MINE CONDITIONS IMMEDIATELY PRIOR TO EXPLOSION

The morning of December 26 was cloudy; barometric readings for the vicinity were not available.

No one had been in the Belva No. 1 mine from about 2:00 a.m. Sunday, December 23, 1945, until the man-trip entered at 7:02 a.m., Wednesday, December 26. Only part of the normal complement of men reported for work at the Belva No. 1 mine on Wednesday; the number of men who reported at the company's other two (small) mines was insufficient to operate these mines; and an effort was made to have these latter men work in the Belva No. 1 mine, thereby delaying the man-trip for about 17 minutes. Contrary to custom, as stated by the mine electrician, the main fan had been shut down from about 2:00 a.m., December 23, to 6:00 p.m., December 25. The underground booster fan, usually idle when all men were out of the mine, had been shut down from about 2:00 a.m., December 23, to 6:00 a.m., December 26. Otherwise, the mine was being operated normally.

STORY OF EXPLOSION AND RECOVERY OPERATIONS

According to statements of two of the survivors, the motorman and brakeman on the last locomotive to enter the mine, the power failed for a few minutes (a not unusual occurrence) about 7:10 a.m., very soon after they entered the portal; and the man-trip was further delayed while small roof falls along the haulageway were removed. Upon reaching 5 left (off 9 right) junction, the locomotive crew took six cars from the man-trip, and had placed them in the three working places off 5 left when they felt the explosion. After gathering the other seven men in 5 left together, they started out 5 left toward 9 right entry but were stopped by a dense cloud of smoke just inby 1 left off 5 left.

The assistant mine electrician, when going to the substation to reclose the circuit breaker for the second time, at 8:20 a.m., saw a cloud of smoke and dust rolling out of the haulage portal. He reported this immediately to the superintendent at the mine office, and then attempted to reclose the circuit breaker; it would not stay closed. The superintendent notified the State mine inspectors at Harlan, Kentucky, a Federal mine inspector at Barbourville, Kentucky, and the officials of other mines in the vicinity.

Although the operation of the main fan was not interrupted by the explosion, the fan casing was moved inward about 3 inches by the retonation wave. Two company officials entered the mine at the fan opening and attempted unsuccessfully to travel through caved old workings used as the intake airway. After a superficial examination of the first 1,000 feet of the haulageway (normal return airway), and noting that stoppings between the intake and return were destroyed or damaged, Frank Rhodes (superintendent of the Three Point Coal Company) and State Mine Inspectors Earl Acuff and Henry Hamblin agreed to reverse the air flow. This was accomplished and the fan operated exhausting at 12:30 p.m. A few men available were put to work gathering tools and materials, then to rebuilding stoppings.

An exploratory party of Bureau representatives and State mine inspectors entered the mine at 1:10 p.m., traveled about 2,000 feet of the main haulageway, and extinguished several small fires. A gas-mask crew led by a Bureau man tried to explore old workings to the right and left of the haulageway, but could penetrate for only short distances because of extensive falls. With approximately 50,000 cubic feet of air a minute entering the mine, it was decided to reestablish ventilation as far as possible by closing all crosscuts with brattice-cloth stoppings. This work, seriously hampered by badly caved crosscuts, roof falls, and the necessity for extinguishing fires (some of them in the caved return airway), was continued until nearly midnight, reaching a point about 150 feet outby 7 left entry. At this point the velocity of the air was not great enough to move the dense smoke, and all available labor was directed toward building tight wooden stoppings in the 50-odd crosscuts outby.

Meanwhile, men stationed at the fan reported occasional increases in carbon monoxide but no methane. About 4:00 a.m., December 27, a telephone line, with two magnetic telephones, was laid and the haulage road was opened as far as ventilation had been restored; the telephone line was extended as the exploration advanced.

Installation of wooden stoppings increased the volume of air to such extent that three crosscuts just outby 7 left entry could be closed; and a coal fire in 7 left turn-out, reached at 6:15 a.m., was partly extinguished and covered with rock dust by a gas-mask crew by 7:10 a.m., December 27. The first stopping inby 7 left turn-out was almost intact, and no smoke could be seen from this point; however, the atmosphere contained much afterdamp. Continuing the installation of wooden stoppings in outby crosscuts, and using brattice cloth to close crosscuts on the advance, ventilation was restored to 9 right junction with the straight main, 7 left off the main was explored as far as possible (about 250 feet), five fires were extinguished in 7 left, and an exploratory party had penetrated a short distance into 9 right haulageway by 5:00 p.m. the same day.

Dense smoke was encountered in the straight main just inby 9 right junction, but 9 right haulageway was clear of smoke. In order to ventilate the working sections, it would have been necessary to utilize 9 right haulageway as the intake airway and the straight main entries inby 9 right junction as the return airway, since both 9 right parallel airways were caved beyond hope of passing air through them. However, this was not considered safe procedure until the fires in the proposed return were located and controlled. It was, therefore, decided to recover the straight main haulageway before attempting to deflect much air into 9 right entry. Progress in establishing ventilation in the straight main was slowed by the dense smoke and the caved crosscuts, and wooden stoppings had to be erected in order to move the smoke.

Meanwhile, an exploratory party proceeded about 1,000 feet up the 9 right haulageway, encountered roof falls, and was stopped by heavy concentrations of afterdamp. This exploratory trip was made possible by the clearing of 9 right due to leakage of intake air through caved workings to the right of the straight main.

About 11,000 cubic feet of air a minute was entering the return just inby 11 left entry about 6:00 a.m., and at 8:00 a.m., December 28, ventilation of the straight main had been restored as far as 12 right entry. A small quantity of clear air returning from 9 right was noted at 12 right junction, but an attempt to explore 12 right workings was stopped by rock falls. The next shift established ventilation of the straight main to 13 right entry, but at this point, due principally to the caved condition of the return airway, there was not enough air-velocity available to continue clearing the smoke.

In the meantime, another exploratory party going into 9 right entry encountered two small fires and had them extinguished. Later, the same party, led by J. E. Bradburn, Harry Thomas, Louis Huber, and Arthur Guthrie, started into 9 right entry, found several sets of footprints advancing to near 4 left and retreating, noted a chalk-marked board indicating that nine men were in 5 left entry, and walked into 5 left. Another marker showed that the nine men were in the first active working place (1 left) off 5 left. When a poorly constructed barricade was opened, a lighted cap lamp could be seen ahead. The party then proceeded through afterdamp, without respiratory protection, and reached the men, who were all unconscious, about 1:30 p.m., December 28.

While this advance party was examining the survivors, they became distressed because of increasing afterdamp and started to retreat toward 9 right. Three of them were unable to walk and were forced to creep on their hands and knees because of the effect of the afterdamp. One of the party, John Bradburn of the Bureau of Mines, succeeded in getting back to where men were engaged in clearing falls along the haulageway in 9 right. He sent these men ahead to assist those of his party who were in distress. Realizing that the continued erection of stoppings in the straight main had finally cut off the return from 5 left, Bradburn ordered the last two stoppings, erected in the straight main, taken down so that fresh air would again circulate through 9 right to 5 left and relieve those who were in distress and at the same time provide more air for the survivors in 5 left.

It was then decided to take a calculated risk and deflect most of the available air into 9 right in order to save the survivors of the explosion. A temporary stopping was erected across the straight main inby 9 right junction and additional stoppings between the straight main and its parallel airway inby the cross stopping were opened to improve the return. Rescue men and apparatus were brought into the mine, but apparatus was not used because 5 left had cleared sufficiently by this time to make it possible to reach the survivors without the use of respiratory protection. Inhalators and fresh crews were brought into 9 right as far as 5 left, and two physicians and inhalators were brought to 9 right junction with the main.

Stretcher crews were sent into 5 left, one crew at a time, to remove the survivors. Inhalators were placed at the junction of 1 left and 5 left, at the 5 left junction, at 3 left off 9 right, and at the 9 right junction, and the survivors were given oxygen at each of those places as the stretcher bearers paused for rest. The stretcher bearers who carried the men from 5 left to 9 right junction, a distance of more than half a mile, experienced great difficulty in traveling under low roof over rock falls, and under hastily timbered roof. At least four of the stretcher bearers were in distress during the rescue operations and were given inhalator treatment.

After the survivors were treated by the physicians, they were hauled to the surface, given further treatment, then taken to a hospital. All of the survivors were out of the mine at 8:30 p.m., December 28.

Discovery of these live men revived hopes of finding others in 6 left section, and it was determined to advance positive ventilation to 6 left, despite the known existence of fires in the return and the presence of methane in 5 left and in 9 right inby 5 left. The door in 5 left entry was closed, crews of men were put to work reinforcing and repairing stoppings along 9 right, and additional brattice-cloth stoppings were erected in an attempt to force air into 6 left. Using 5 left junction as a fresh-air base, an apparatus crew traversed 9 right to 6 left and about 50 feet of 6 left entry (a distance of about 850 feet), discovered the badly burned body of the wireman, just inby 6 left curve, and retreated when the last man of the crew suffered distress. This man, in his hurry to retreat, tore the exhalation tube from his machine; therefore, it was decided that the limited traveling height rendered further use of apparatus crew impracticable for long trips. Two gas-mask crews, in attempting to enter 6 left, could not advance as far as the apparatus crew had, because of high carbon monoxide concentrations.

All available men except rescue crews were put to work plastering the tar-paper-covered wooden stoppings along the straight main and tightening the brattice-cloth stoppings along 9 right. As the ventilation in 9 right improved, temporary stoppings were advanced until, at 8:00 a.m., December 29, a movement of air was noticeable inby 5 left. About 8:45 a.m., during the change of shifts, a fire that had gained considerable headway before discovery destroyed the wooden stopping in a crosscut about 2,000 feet from the portal. The first stopping outby was knocked out to short-circuit the air, and all men except those necessary to control the fire and rebuild the stoppings were withdrawn from the mine.

After the fire was extinguished and the burned-out stopping replaced, crews were again engaged at building wooden stoppings, reinforcing brattice-cloth stoppings and cleaning up falls along 9 right. Nine crosscuts immediately inby 9 right junction were closed with tar-paper-covered wooden stoppings. About 8:06 p.m., December 29, an advance party of three Bureau men explored 6 left to 1 left entry, at which turn-out another badly burned body (mine foreman) was found. There was no smoke, but high concentrations of afterdamp, in 6 left, were found. Soot streamers and evidence of violence along 6 left and along 9 right between 5 and 6 lefts revealed that, unquestionably, the explosion originated in the workings inby 6 left curve.

During the night, 9 right haulageway was opened to the extent that narrow trucks could be hauled to 5 left by locomotive, and the rails and trolley wire were cut outby 5 right. At 2:10 a.m., December 30, a party of Bureau and State officials upon entering 6 left found high concentrations of afterdamp about 125 feet outby 1 left entry. Five men, including two Federal inspectors, put on gas masks and proceeded until the flame of a safety lamp was extinguished by methane in a roof cavity just outby 1 left curve. After obtaining another safety lamp, this party entered 1 left entry for a distance of about 100 feet. High concentrations of afterdamp precluded further advance, and no other attempt was made to explore 6 left section during these operations. After closing the last two inby crosscuts along 9 right and the first two crosscuts in 6 left, there was very little movement of air inby; in fact, the advance man was rendered unconscious while helping to close the second crosscut along 6 left. Nevertheless, the bodies of two men in 6 left, discovered on previous shifts, were recovered at 7:30 a.m. and sent out of the mine.

While an effort was being made to improve circulation of air in 6 left on December 30, men who had been stationed constantly in the immediate return from 6 left (at the booster fan) detected 0.1 to 0.4 percent methane in the ventilating current. Frank Rhodes and another man who were making tests in the return just inby 9 right junction reported steady increases in methane content until 1:15 p.m. when 1.0 percent methane and very dense smoke were reported. It was then decided to withdraw all men working inby 9 right junction to 9 right junction. Subsequent tests in the return with a flame safety lamp and an electrical methane tester revealed fluctuating methane content ranging from 0.0 to 2.0 percent. In view of the imminent hazard of a second explosion, and after all the shift leaders present agreed that the explosion originated in 6 left section and that there was not a possible chance of any of the victims still being alive, it was resolved to withdraw all men from the mine. A man-trip carrying the last man to come out of the mine arrived on the surface about 6:30 p.m., December 30. While this trip was coming out of the mine, it was discovered that a fire at 7 left off the straight main had rekindled. This fire was again brought under control by the application of rock dust before all of the men came out of the mine.

At 8:30 p.m., December 30, a conference of State mine inspectors, Bureau of Mines representatives, and other shift leaders, together with a representative of the United Mine Workers of America, was called by Harry Thomas, Chief of the Kentucky Department of Mines and Minerals. At this meeting, every leader that had been underground voiced the opinions that there could be no survivors in the mine and that the situation had become too dangerous for further recovery work; moreover, that the mine should be sealed at the drift mouths. To conclude the meeting, Mr. Thomas stated that he would announce his decision the next morning. Accordingly, about 11:00 a.m., December 31, Mr. Thomas ordered the mine to be sealed at the portals, designating Wednesday, January 2, as the date of sealing, and stipulating that the fan be operated until the mine was sealed.

At noon of January 1, two State mine inspectors and four Federal mine inspectors met with A. A. Fish (company mining engineer) and, after examining maps of the Belva No. 1 mine, the adjoining old No. 1 mine, and the overlying abandoned mine with regard to surface openings, went to the mine to locate these openings. Inspection of the terrain revealed that all but three surface openings, these in the Belva No. 1 mine, were closed by falls and slides; and that one of these three, adjacent to the fan portal, was closed with a stopping that would require little repair. Arrangements were made with the mine superintendent to provide labor and materials in order to begin sealing at 8:00 a.m., January 2.

Very little labor was available on January 2; at times one or two or as many as six men would work for a short period, then wander off the job. At 5:00 p.m., all the men had left the job and little had been done toward erecting the first seal.

Virtually the same labor conditions prevailed on January 3, and an apparatus crew of the Black Star Coal Company was called in to help build the seal inby the fan. Both seals, of 1-1/8- inch boards plastered with wood fiber, were completed at 4:30 p.m., January 3. State and Federal mine inspectors arranged to collect air samples periodically at the seals.

Movements of the survivors were recounted by Joe Hatfield and Hugh Miller, motorman and brakeman, respectively, on the locomotive used in 5 left. As stated previously, they walked out 5 left immediately after the explosion until stopped by dense smoke just inby 1 left off 5 left. After returning into 5 left, they walked around to select a suitable place to stay, then entered 1 left, where they remained until 4:00 p.m., December 26. At that time they entered 1 left entry by crawling through the smoke and along the rail until they reached clear air. For about 2 hours thereafter they tried to find an opening connected to 4 left workings, but all the known openings were caved tightly. The men again returned, with difficulty, to 1 left off 5 left and remained there until 9:00 a.m., December 27. At that time, they started out 5 left, entered 9 right, and walked nearly to 4 left, where the leader, Mr. Hatfield, "went down". He was dragged back by Mr. Miller and another man, and soon recovered sufficiently to crawl back toward 5 left. On their way back to 1 left off 5 left, they marked the boards later found by the rescue men, entered 1 left for the last time about 11:30 a.m., December 27, and erected an old mine door for a barricade. All the men except Thomas McQueen, who died later in the hospital, laid on the mine floor with their faces as close to the floor as possible; McQueen reclined on a board laid against an upright prop until he fell from it, presumably unconscious. Some time after, he regained consciousness and crawled back on the leaning board against the advice of the others. In the meantime, Albert Bennett laid on the board for only a short time before he rolled to the floor. Both Mr. Hatfield and Mr. Miller are of the opinion that all the men in 5 left were conscious at 9:00 a.m., December 28, and that, one by one, they lost consciousness thereafter.

Successive air samples taken at the seals showed only a limited drop in the oxygen content and on April 17-18, 1947 these seals were replaced by seals in the haulageway and return air course about 3,200 feet inby the portals. The latter seals were constructed of wood and plaster faced.

Air samples, collected at the new seals regularly, showed a steady decline in the oxygen content. The analyses of air samples collected July 22, 1948 showed an oxygen content of 0.7 to 1.2 percent, carbon dioxide 9.3 to 9.8 percent, methane 4.6 to 5.0 percent, and carbon monoxide 0.0 percent.

On August 5, the fan was started and representatives of the Kentucky Department of Mines and Minerals and U. S. Bureau of Mines removed the seals. Ventilation was established inby. Samples of the return air, 33,000 cubic feet a minute, taken inby the fan on August 6, showed 0.68 percent methane, 1.7 percent carbon dioxide, and 17.6 percent oxygen; on August 9 the return air contained only 0.28 percent methane and 0.03 percent carbon dioxide.

On August 19, exploration crews comprised of State and Federal inspectors, checked the ventilation and roof along the haulageway to 5 left 9 right, and a determination of the necessary stopping repairs and loose roof and falls to be removed was made. During the period ensuing to September 8 many of the stoppings were repaired or replaced and slate removed from many points, Federal inspectors cooperating in accomplishing this work.

On September 10 the haulageway stoppings and roof were again officially inspected to 6 left by a party of State and Federal inspectors. On September 11, 6 left was penetrated to 2 left switch by a crew wearing oxygen-generating apparatus because of the afterdamp inby 6 left 9 right switch. Seven bodies were observed just outby 2 left switch on 6 left, but were not moved due to the intervening heavy falls and distance to traverse in irrespirable air.

Work of repairing and replacing stoppings was resumed. Improvement in the ventilation permitted exploring 1 and 2 left off 6 left and discovery of eight more bodies in this area. On October 18 and 19, fifteen bodies were removed from 1 and 2 left and 6 left outby 2 left. Extending of the ventilation finally permitted removal of two bodies on October 20 and the last three on October 21.

INVESTIGATION OF THE EXPLOSION

The investigation of the disaster was made for the Federal Bureau of Mines by M. C. McCall, Supervising Engineer of District D, C. H. Dodge, Engineer-in-Charge of the Jellico office and Federal Mine Inspectors Wilbur Stiles, Brooks Blackwood, M. L. Davis, William Demkowicz, W. R. Park and M. J. Ankeny, Chief of the Coal Mine Inspection Branch of the Federal Bureau of Mines, who was present during the recovery operations in 1945-46 and who collaborated in the writing of the report. The Federal investigation consisted of observations of conditions and questioning of witnesses during the recovery operations immediately following the explosion in 1945-46, observations of conditions and questioning of witnesses during the final stages of the recovery operations in September and October 1948 and detailed study of conditions in the mine during an inspection trip on October 22, 1948, the day following completion of recovery operations.

Investigation for the State of Kentucky was made by A. D. Sisk, Chief of the Kentucky Department of Mines and Minerals, Noah L. Jackson and Pearl Elkins, Inspectors at Large of the State of Kentucky, and Kentucky Electrical Inspector Frank Forsyth.

Investigation for the United Mine Workers of America was made by Taylor Maddox, Safety Director, District 19, United Mine Workers of America.

Investigation for the operators was made by Earl Lewis, Superintendent of the mine, and Ira Inman, Safety Director of the Cumberland Valley Mining Institute.

All persons concerned with this investigation cooperated in obtaining the information, but the Bureau of Mines in accordance with established practice rendered a separate report.

Property Damage

The explosion was not violent nor highly destructive except in the 9 right aircourse working place and the vicinity of the entrance thereto. At this location heavy equipment such as the blower fan, the conveyor drive unit, the conveyor loading head and the wiring and controls connected thereto were moved violently and damaged by the forces of the explosion. The trolley wire was disturbed at only a few locations throughout the mine, and some timbers that were dislodged along the haulageways resulted in falls and bad roof conditions in relatively few places. All of the stoppings, except three, between the main intake and return airways were destroyed, and several doors were smashed. The most serious loss that occurred as a result of the explosion, other than the loss of human life, was the loss of production from the mine for a period of nearly three years and the loss of the use of a considerable quantity of mine equipment during this same period. While the mine equipment was recovered following the completion of recovery operations it will be extremely difficult to put the mine into such condition that it can safely resume operations through the present openings, not because of the damage done to the mine by the explosion, but because of the cost of correcting the unsafe conditions that were allowed to develop during the lifetime of the mine.

Forces

Appendices "A" and "B" show the direction of forces developed by the explosion as determined by the movement of heavy equipment, dislodgment of timbers, destruction of stoppings and movement of debris. The investigators found little conflicting evidence of force with the great preponderance of evidence indicating that the explosion originated in the working area of the right air course of 6 left and the forces moved generally outby to the mine portals. The sketch appendix "B" shows how the forces coming from the right air course of 6 left increased in intensity and dislodged all posts beginning about 120 feet from the face, destroyed the canvas tubing along this air course working place and last open crosscut, threw the fan into the empty car, swept the flight conveyors and drive motors at the crosscut transfer point and along the crosscut into twisted heaps along the outby ribs, and then spread through the three openings outby, dislodging posts for a radius of several hundred feet. The forces expanding through the open workings, diminished rapidly and did not penetrate more than 100 feet into 1 and 2 left off 6 left. The forces concentrated at the bottom of 6 left and created considerable destruction before moving out by 9 right. The pressure of the explosion diminished as it approached 5 left, as evidenced by the undisturbed door and (booster) fan casing in 5 left and the slightly damaged stopping in the first crosscut along 9 right inby 5 left. Violence increased after the explosion passed the entrance to 5 left and the explosion spread into old workings to the left of 9 right. From 9 right junction and the straight main, the explosion traveled both in and out the straight main and created a serious fire inby 12 right which could not be reached during recovery operations. In traveling outby 9 right, violence again diminished in the vicinity of 7 left, (as indicated by the slightly damaged stopping in 7 left parallel) gradually increased for about 1,000 feet, then slowly decreased as the explosion expanded into old workings to the left of the straight main and traveled toward the portals where it vented to the surface.

Evidence of Heat or Flame

As far as could be determined, flame traversed the entire mine with the exception of the Nos. 1 and 2 left entries off 6 left and the workings thereof, and the 5 left entries off 9 right and the active and abandoned workings thereof. Appendices "A" and "B" indicate the areas traversed by flame.

An unusual aspect of this explosion was the large number of fires scattered throughout the mine which hampered recovery operations and several of which forced the abandonment of recovery operations before the remaining twenty bodies were recovered. At least 22 fires at widely scattered locations throughout the mine were discovered and controlled by advancing rescue parties during the recovery operations following the explosion. The large number of fires is attributed to the relatively slow propagation of the explosion throughout the mine.

Factors Involved in the Explosion

Explosive Gas and Ventilation

The Belva No. 1 mine was not classed gassy by the Kentucky Department of Mines and Minerals; however, methane was found with a flame safety lamp by Federal inspectors on several occasions and air samples collected during each inspection of the mine contained methane up to 0.61 percent. Although the main fan delivered 15,000 cubic feet of air a minute at its discharge, only a negligible part of this air was delivered to the inby working sections despite the fact that the ventilating current was continuous rather than split. This loss of air was caused by leaking wooden stoppings between the main intake and main return entries; by doors erected singly instead of in pairs to form air-locks; by badly caved intake air courses: and by the absence of stoppings in some crosscuts.

The blower fan, from which tubing was extended to near the face of the right air course of 6 left entries, was installed in the open crosscut outby the face and in such position that it would recirculate air. This fan was not operated continuously, but was started when the working crew arrived at its location each shift and operated during the shift only. An open-type knife switch was used to start and stop this fan.

Preshift examinations of the mine for methane and other hazards were not made and on-shift examinations for methane were made infrequently.

Men who were at the face of the right air course of 6 left entry during the last shift the place was worked prior to the explosion have stated that methane was heard issuing from a gas feeder early in the evening and after the face was undercut. The supervisor cautioned the men, and had them clean up and load out the fine coal and coal-dust from the face outby for a distance of about 50 feet before the 2 center holes in the face were blasted. The men left the mine after the coal blasted by these 2 center holes had been loaded out. This place was not inspected since the end of the last shift worked, prior to the explosion.

Possible Sources of Ignition

Consideration was given to every possible source of ignition during this investigation. The conditions found in the face region of 6 left air course and vicinity as shown in Appendices "C" and "D" suggest arcs or sparks from electric equipment or cables and the practice of smoking as possible ignition sources. It was definitely established that blasting was not being done at the time the explosion occurred.

The only electric equipment at the face of 6 left air course was a non-permissible shortwall mining machine and a non-permissible hand-held electric drill. The insulation on the mining machine cable was notched, exposing both conductors, close to the entrance of the mining machine to provide power connections for the drill cable. The drill and coiled cable were about 10 feet from the mining machine and could not have been connected at the time of the ignition; therefore, the drill is eliminated as a possible source of ignition. The mining machine had cut across the face and the two center shots of the cut had been fired and the coal loaded out leaving

undrilled, unblasted, undercut corners of coal at each side of the face. The cutter bar of the machine was in the kerf in the left rib of the place and the controller was in the "off" position. The mining-machine cable received its power from a power cable by means of bare hook connections immediately outby the conveyor loading point at the same place where power connections were made for the conveyor drive units, the car hoist and the blower fan. Since this power-distribution center was completely demolished by the forces of the explosion it could not be determined with certainty that there was power on the machine cable, but from the location of the body of the machine man who was found in the crosscut near the mouth of the air course it is assumed that he had started toward the face of the working place and therefore had probably attached the nips of the cable to the power source when he passed the power distribution center in the crosscut. It is only remotely possible, however, that any sparking could have occurred at the mining machine at the face with the controller in the "off" position.

A break was found in one of the two conductors of the mining machine cable at a splice about 150 feet from the face and consideration was given to the possibility of an arc or spark igniting gas at this point due to a possible blow-out. The cable was examined carefully and it was evident that one of the conductors was pulled apart at the splice by the forces of the explosion. The other conductor was intact at the splice and the splice was fully insulated by friction tape precluding the possibility of a short-circuit at this point. Since the controller of the mining machine was in the "off" position it is unlikely that there could have been sufficient load on the circuit due to possible electrical leakage within the machine to have caused an electrical rupture.

The non-permissible motor drive for the entry conveyor and its controller were located in line with the entrance to 6 left air course as shown in Appendix "C". This unit was normally connected to the power distribution center near the loading head by nips but it could not be determined whether or not the unit was in operation at the time of the explosion. Since there was no coal prepared at the face and the conveyor was empty it is presumed that the conveyor was not in operation. Likewise there was no reason for the cross conveyor and loading head to be in operation.

The blower fan, driven by an open type electric motor, was located in the crosscut outby 6 left air course on the intake side. This fan motor also obtained its power through nips at the power distribution center which was destroyed by the explosion and therefore its operation was in doubt; however, since one loader had reached the face area and the other loader and machine man had evidently started toward the face it seems reasonable to assume that the blower fan was started by one of the workmen as he walked past the fan and that the fan was in operation at the time of the explosion. It is believed that the fan may have been started before the man, whose body was found at the face, proceeded toward the face, therefore, it could have been operating several minutes before the explosion occurred. A locomotive was shifting 13 loaded cars in 2 left when the explosion occurred. This trip had the 2 left door blocked open creating a direct short circuit of the ventilation at the junction of 2 left and 6 left. At the instant of the explosion and for at least a few minutes previous the regular ventilation current was completely cut off from the workings in 6 left resulting in compete recirculation of air through the blower fan. The air emerging from the ventilation tubing in the face area of 6 left air course was returning through the 6 left air course and the last open crosscut to the intake orifice of the fan. It is believed that this air may have been laden

with an explosive mixture of gas and that it may have come in contact with an arc or spark at the commutator of the fan motor resulting in the ignition.

The evidence points strongly toward the ignition of explosive gas by the electric motor of the blower fan, however, this cannot be proven conclusively. Although this mine was considered to be gassy by the Federal Bureau of Mines because of the detection of methane with a flame safety lamp on several occasions and the presence of methane in air samples collected during such inspection, the mine was operated as a nongassy mine and precautions against the accumulation and ignition of explosive gas were not taken. Smoking in the mine was a common practice despite the fact that recommendations had been made in Federal inspection reports that smoking be prohibited and steps be taken to prevent the carrying of matches and smokers articles underground. The man, whose body was found about 30 feet from the face of the right air course at 6 left, had proceeded into the working place in advance of the two other members of the face crew. It is not known why he proceeded into the working place so far in advance of the other loader and the machine man but it is thought that he was on his way to the face to start to prepare coal for loading. There is no evidence that he had started to work at the face and it is logical to believe that he may have attempted to light a cigarette with a match and in doing so he may have ignited the gas. A match-stem was found near the body of this loader during the investigation by a member of the investigating party. The finding of this match-stem however is considered to be of little significance because, as has been stated previously, smoking was a common practice in this mine and matches were used without restriction. In this connection the investigators desire to point out that if the loader was attempting to smoke he was not violating any company rule, or State mining law, but on the contrary was a victim of the mining conditions and practices which were allowed to exist in this mine. Although the ignition of gas by the loader near the face of 6 left air course is considered to be a possibility, no specific evidence was found that he was smoking or attempting to light a cigarette when the explosion occurred.

Coal Dust Hazard

An approximate analysis of coal from the Belva No. 1 mine, as taken from "Analyses of Kentucky Coals", Technical Paper 652, published by the Bureau of Mines, showed the coal to contain 37.2 percent volatile matter, and 56.0 percent fixed carbon. The calculated volatile ratio of the coal is 0.40. Experiments have shown that bituminous coal with a volatile ratio of more than 0.12 is explosive when suspended in a dense cloud in air, and that the explosibility increases as the volatile ratio increases.

The mine was generally dry and dusty, but means were not provided to allay the coal dust at its origin and the mine was not rock-dusted. Analysis of dust samples collected at representative places in the mine during the investigation is shown in table No. 1. Roof and rib samples varied from 51.8 to 9.8 percent incombustible matter with a mean of 34.7 percent and road samples varied from 54.2 to 11.3 percent with a mean of 37.1 percent. Protection against the propagation of flame by coal dust could have been obtained by maintaining the incombustible content of the mine dust above 65 percent by generalized rock dusting. It is the opinion that the proper use of rock-dust would have confined the explosion to a small area and would probably have confined the loss of life to the immediate area of the 6 left air course where 4 men were killed.

Lab. Nos. D-3700 to D-3707 incl.

TABLE ____. ANALYSES OF DUST SAMPLES. COLLECTED October 1948

MINE Belva No. 1 COMPANY Kentucky Straight Creek Coal Co. Collected by Wilbur Stiles

Can No.	Sample of Dust From	Location in Mine	As-Received Basis, Percent				Percent Through 20-Mesh
			Moist.	Ash	Comb.	Incomb.	
Q-155	Roof & Rib	30 feet outby face of 6 left air course.	2.4	7.4	90.2	9.8	43.7
J-810	Road	Do.	2.4	8.9	88.7	11.3	62.0
U-192	Roof & Rib	20 feet outby 1 left off 6 left.	2.0	37.7	60.3	39.7	85.2
F-22	Road	Do.	1.4	52.8	45.8	54.2	80.8
T-508	Roof & Rib	100 feet inby 5 left off 9 right entry.	1.6	50.2	48.2	51.8	53.3
W-993	Road	Do.	1.5	47.0	51.5	48.5	80.8
G-429	Roof & Rib	Main haulageway at 7 left	2.6	35.0	62.4	37.6	84.5
B-325	Road	Do.	2.4	32.1	65.5	34.5	82.1

Activities in the Working Sections Immediately Preceding the Explosion

According to statements of survivors, and observations in the mine, the main fan was started about 6:00 p.m., Tuesday, December 25, having been shut down for 64 hours. The booster fan was started at 6:00 a.m. on the 26th when the surface substation main switch was closed. No one had been in the mine during the idle period nor was any examination made of the mine prior to the entrance of the locomotives and man trips.

The two gathering locomotives and the tram motor with the man-trip entered the mine shortly after 7:00 a.m. being delayed waiting on additional workmen from the company's adjoining mines. Further delay was entailed by locomotive trouble and removal of small falls along the main haulage roads.

The tram motor crew pulled the 25-car empty trip past 5 left, cut off 6 empties, and continued to 6 left with a 4-man conveyor crew, and 8 loaders for 1 left and 2 left. One gathering crew pushed a car of timbers, stored in 5 left, up 5 left and unloaded them in 2 left off 5 left. The second motor crew pushed the 6 empties up 5 left, cut off 3 empties at 2 left and proceeded to 6 left. Both crews were shifting cars in the working places when the explosion occurred. The positions of locomotives and cars in 6 left are shown in Appendix "B". It will be observed that a locomotive and a long string of empty cars was found in the 6 left haulage entry immediately inby 2 left turnout. Another locomotive with thirteen empty cars was found in 2 left entry immediately inby the turnout in such position that the ventilation door would have to be open. Seven bodies were found on 6 left haulage entry immediately outby the locomotive on 6 left, one body was found near the locomotive in 2 left and three bodies were found in the left air course of 6 left near the 2 left haulage entry. It was evident that the workmen of 2 left had not entered their section when the explosion occurred.

Four loaders proceeded to their working places in 1 left off 6 left. After the explosion occurred they assembled and found they could not get out 6 left because of the smoke and heat. Some then returned toward the faces of 1 left off 6 left and several hours later wrote the time, as late as 2:00 p.m. on the rails, then assembled in 4 room left off 1 left where others had written notes dated 10:30 a.m. on boards. These four men were asphyxiated.

Possible Points of Origin

The only working face area in the mine where any evidence whatsoever of force and flame was present was the right air course of 6 left off 9 right. This working place had been driven a distance of 320 feet ahead of the last crosscut and was being worked with a chain conveyor as shown in Appendix "C". The face area of this place contained heavy deposits of coke which diminished gradually toward the open crosscut. Timbers outby the face for a distance of 120 feet were intact but from this point outward all of the timbers in the place were dislodged by the force of the explosion. (See Appendix "D") The fan line in the working place was not disturbed but was broken at the entrance to the place and the transfer mechanism drive motor and control box were thrown violently outby for a distance of about 15 feet. These conditions together with a consideration of the possible ignition sources

lead to the conclusion that the explosion originated at the blower fan in the crosscut immediately outby 6 left air course or at a point near the face of 6 left air course.

SUMMARY OF EVIDENCE

1. Forces originated in the working area of 6 left air course and traveled consistently in an outby direction to the drift portals.

2. The face area of 6 left air course contained evidence of extreme heat and flame but no evidence of violence.

3. Evidence of heat and flame was not present in any other face areas in the mine.

4. The 6 left air course was advanced 320 feet beyond the last crosscut. The ventilation in this place had been interrupted for a period of approximately 68 hours immediately preceding the explosion.

5. Testimony was given to the effect that a gas feeder was heard in the kerf in the face of 6 left air course during the last shift the mine worked prior to the explosion but devices were not available for the detection of methane at that time.

6. Methane was not detected before the men entered the mine because preshift examinations were not made.

7. Electrical equipment was not being operated at the face of 6 left air course at the time of the explosion but the blower fan was probably in operation for a short time and the power probably was on the mining machine cable.

8. The main air current was short-circuited at the junction of 6 left and 2 left off 6 left.

9. The ventilating arrangements were such that the blower fan recirculated air.

10. The body of a loader was found near the face of 6 left air course and the bodies of a loader and a machine man were found outby the entrance to the place more than 320 feet away from the face.

11. Smoking was not prohibited in the mine and therefore it was a common practice for employees to carry and use matches and smokers' articles underground.

12. The explosion was propagated by coal dust because the mine was not rock dusted.

13. Most of the fatalities in this disaster were caused by the propagation of the explosion by coal dust.

CAUSE OF THE DISASTER

This disaster was caused by the ignition of an accumulation of methane which in turn ignited coal dust, resulting in the propagation of flame throughout the greater portion of the mine. The accumulation of gas was caused by defective ventilation and unsafe mining practices; the propagation of flame by coal dust over a wide area was caused by failure to rock-dust the mine; and the ignition of methane was caused by failure to eliminate sources of open arcs, sparks, and flames from face regions.

RECOMMENDATIONS

The following recommendations are made in the belief that their adoption is necessary to reduce the chances of an explosion occurring in this mine in the future.

Ventilation and Gas

1. The mine should be rated and operated as a gassy mine.

2. No effort should be made to operate the mine until a safe, travelable escapeway has been provided from each active section of the mine; this in addition to the haulageway.

3. The mine should be examined for gas and other hazards by a competent mine official within 4 hours before each shift enters, and additional tests should be made for methane by mine officials during their visits to the working places.

4. Tests should be made for methane by a competent person before and after firing each shot, and shots should not be fired if methane is present in such quantity that it can be detected with a flame safety lamp.

5. Tests should be made for methane by a competent person immediately before any electrical equipment is taken beyond the last open crosscut in any working place or before any stationary electrical equipment is operated beyond the last open crosscut. Tests for methane should also be made at intervals not to exceed 30 minutes while such equipment is being operated in face regions. Electrical equipment should not be operated in any place where methane is present in such quantity that it can be detected with a flame safety lamp.

6. Provision should be made for an adequate number of intake and return airways so that fresh air can be circulated to the working faces.

7. Booster fans should not be used as a substitute for adequate airways.

8. Blower fans with tubing should not be used as a substitute for regular crosscuts and line brattice to conduct the air to the working faces.

9. Not less than 6,000 cubic feet of air a minute should be made to circulate through the last open crosscuts.

10. A separate split of air should be provided for each working section of the mine.

11. Air should not be coursed through abandoned workings or by the unsealed entrances to abandoned workings before reaching the active working sections.

12. Trolley and other bare power wires should be installed only in intake air.

13. The fan should be operated exhausting so that the main and intermediate haulage operations are in intake air.

14. The main fan should be operated continuously except when the mine is shut down for an extended period, in which case the mine should be examined thoroughly for methane within 4 hours before the workmen enter.

15. The air duct leading to the fan should be of fireproof construction and equipped with pressure-relief doors.

16. The fan should be provided with a device that will give visual and audible warning in case the fan slows or stops.

17. Stoppings between intake and return of all main haulageways and branch haulageways should be as air-tight as possible. Stoppings in main haulageways should be constructed of incombustible material and those of branch haulageways should at least be fire-resistant.

18. Doors used to control the air currents should be installed in pairs to form air locks.

Dust

1. Accumulations of dust along the haulage roads should be cleaned up and hauled out of the mine.

2. Water or a wetting solution should be sprayed on the coal as it emerges from the kerf during undercutting, on the coal at the unloading heads of the conveyors, and on loaded and empty trips.

3. The mine should be rock-dusted thoroughly in all open places to within 80 feet of the working faces, and to the extent that representative samples of the mixed dusts will contain at least 65 percent incombustible material, plus 1 percent for each 0.1 percent of methane present in the ventilating current.

Electrical Equipment

1. All electrical equipment used in the face regions should be of the permissible type. Until such equipment can be obtained more than ordinary precautions should be taken in the use of present equipment.

Smoking

1. Smoking should not be permitted in the mine, and a search of employees should be made periodically to prevent them from taking matches, lighters, or smokers' articles underground.

General

1. An accurate map of the mine should be provided and kept up to date and recent developments should be added to the map covering periods not to exceed 6 months.

2. A fire-fighting organization should be maintained and employees should be instructed as to methods of procedure in fighting mine fires.

ACKNOWLEDGMENT

The writers acknowledge the courtesies extended and the help given by representatives of the Kentucky Department of Mines and Minerals; United Mine Workers of America; and officials and employees of the Kentucky Straight Creek Coal Company. Information was supplied and exchanged without reservation.

Respectfully submitted,

M. J. ANKENY
Chief, Coal Mine Inspection Branch

M. C. McCall
Supervising Engineer

C. H. Dodge
Engineer-in-Charge

APPENDIX E

CASUALTY LIST

1. Reed Lawson, Flat Lick, Knox County, Kentucky. Age 35. Dependents 6. Occupation motorman. Removed from the mine dead.

2. Delbert Lockard, Fourmile, Bell County, Kentucky. Age 33. Dependents 8. Occupation motorman. Removed from the mine dead.

3. Robert Sulfridge, Fourmile, Bell County, Kentucky. Age 44. Dependents 6. Occupation wireman and bonder. Removed from the mine dead.

4. Cary Frank Mills, Pineville, Bell County, Kentucky. Age 57. Dependents 6. Occupation face boss. Removed from the mine dead.

5. Bud Partin, Straight Creek, Bell County, Kentucky. Age 27. Dependents 4. Occupation conveyorman. Removed from the mine dead.

6. Bill Carroll, Straight Creek, Bell County, Kentucky. Age 29. Dependents 8. Occupation machineman. Removed from the mine dead.

7. Hugh Westerfield, Flat Lick, Knox County, Kentucky. Age 52. Dependents 2. Occupation coal loader. Removed from the mine dead.

8. James Collins, Pineville, Bell County, Kentucky. Age 39. Dependents 4. Occupation motorman. Removed from the mine dead.

9. George Matthews, Pineville, Bell County, Kentucky. Age 50. Dependents 3. Occupation coal loader. Removed from the mine dead.

10. Bill Brook, Fourmile, Bell County, Kentucky. Age 40. Dependents 2. Occupation coal loader. Removed from the mine dead.

11. Harmon Lovell, Jr., Fourmile, Bell County, Kentucky. Age 19. Dependents 6. Occupation coal loader. Removed from the mine dead.

12. James Bain, Fourmile, Bell County, Kentucky. Age 51. Dependents 3. Occupation trackman. Removed from the mine dead.

13. John Brock, Fourmile, Bell County, Kentucky. Age 48. Dependents 1. Occupation coal loader. Removed from the mine dead.

14. James Emory, Pineville, Bell County, Kentucky. Age 32. Dependents 4. Occupation coal loader. Removed from the mine dead.

15. Dave Sharpe, Pineville, Bell County, Kentucky. Age 49. Dependents 2. Occupation coal loader. Removed from the mine dead.

Casualty List- Continued

16. Henry Honeycutt, Fourmile, Bell County, Kentucky. Age 40. Dependents 7. Occupation coal loader. Removed from the mine dead.

17. Nate Centers, Fourmile, Bell County, Kentucky. Age 62. Dependents 2. Occupation mine foreman. Removed from the mine dead.

18. Tom Fisher, Fourmile, Bell County, Kentucky. Age 53. Dependents 4. Occupation coal loader. Removed from the mine dead.

19. Albert Bennett, Fourmile, Bell County, Kentucky. Age 64. Dependents 1. Occupation coal loader. Removed from the mine dead.

20. Champ Patterson, Fourmile, Bell County, Kentucky. Age 46. Dependents 4. Occupation conveyor loading point man. Removed from the mine dead.

21. H. J. Branstutter, Fourmile, Bell County, Kentucky. Age 44. Dependents 3. Occupation trackman. Removed from the mine dead.

22. J. T. Gambrell, Fourmile, Bell County, Kentucky. Age 52. Dependents 4. Occupation coal loader. Removed from the mine dead.

23. Floyd Gambrell, Fourmile, Bell County, Kentucky. Age 24. Dependents 3. Occupation coal loader. Removed from the mine dead.

Rescued but Died Later

1. Bud Towns, Pineville, Bell County, Kentucky. Age 52. Dependents 3. Occupation coal loader. Died after removed from the mine.

2. Thomas McQueen, Tinsley, Bell County, Kentucky. Age 30. Dependents 1. Occupation coal loader. Removed from the mine alive, but died in hospital.

Rescued

1. McKinley Leath, Fourmile, Bell County, Kentucky. Age 45. Dependents 5. Occupation conveyorman.

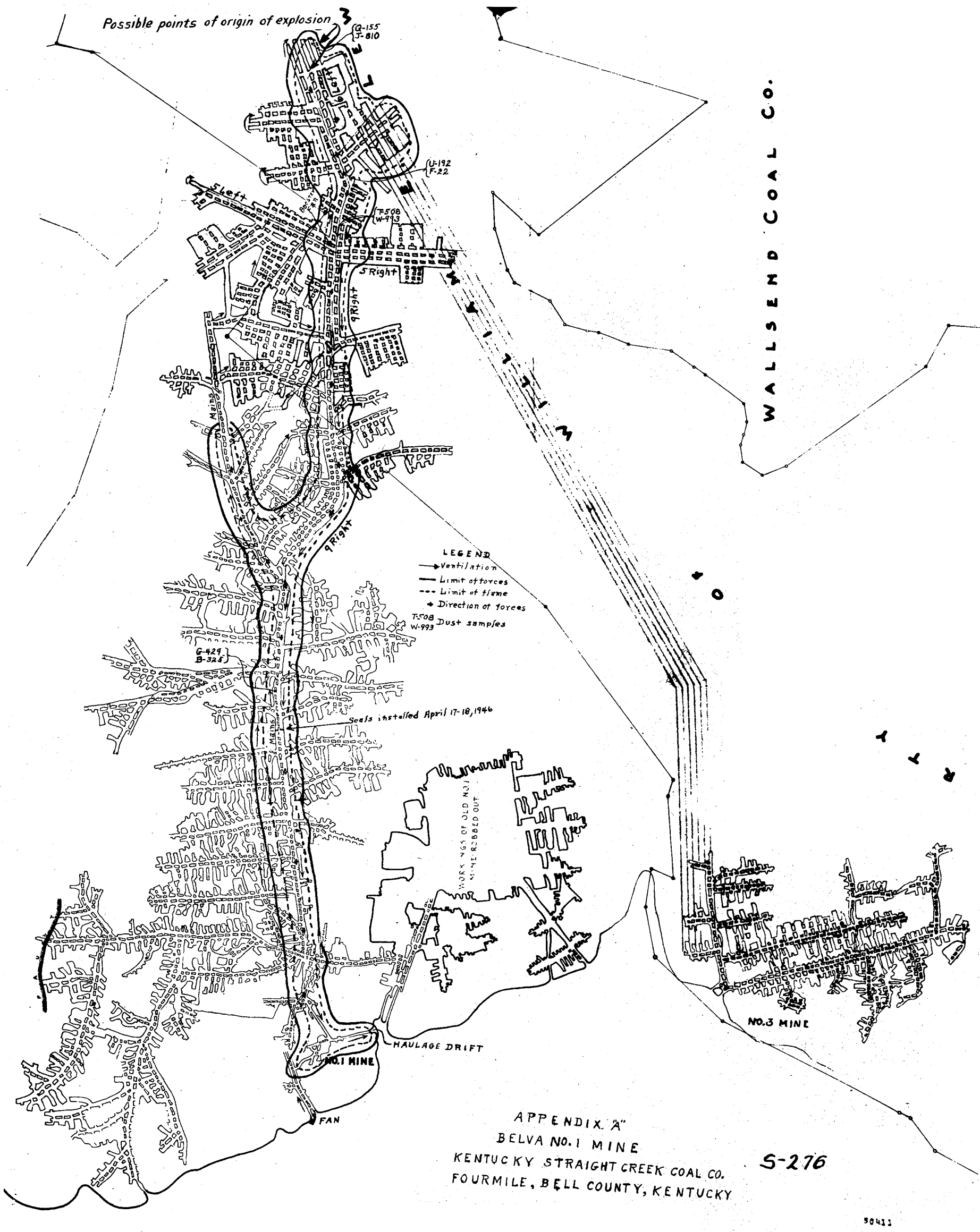
2. Ivan Philpot, Pineville, Bell County. Kentucky. Age 51. Dependents 5. Occupation coal loader.

3. Charles Lingar, Fourmile, Bell County, Kentucky, Age 30. Dependents 5. Occupation coupler.

4. Bill Branstutter, Fourmile, Bell County, Kentucky. Age 41. Dependents 8. Occupation motorman.

5. Joe Hatfield, Pineville, Bell County, Kentucky. Age 40. Dependents 6. Occupation motorman.

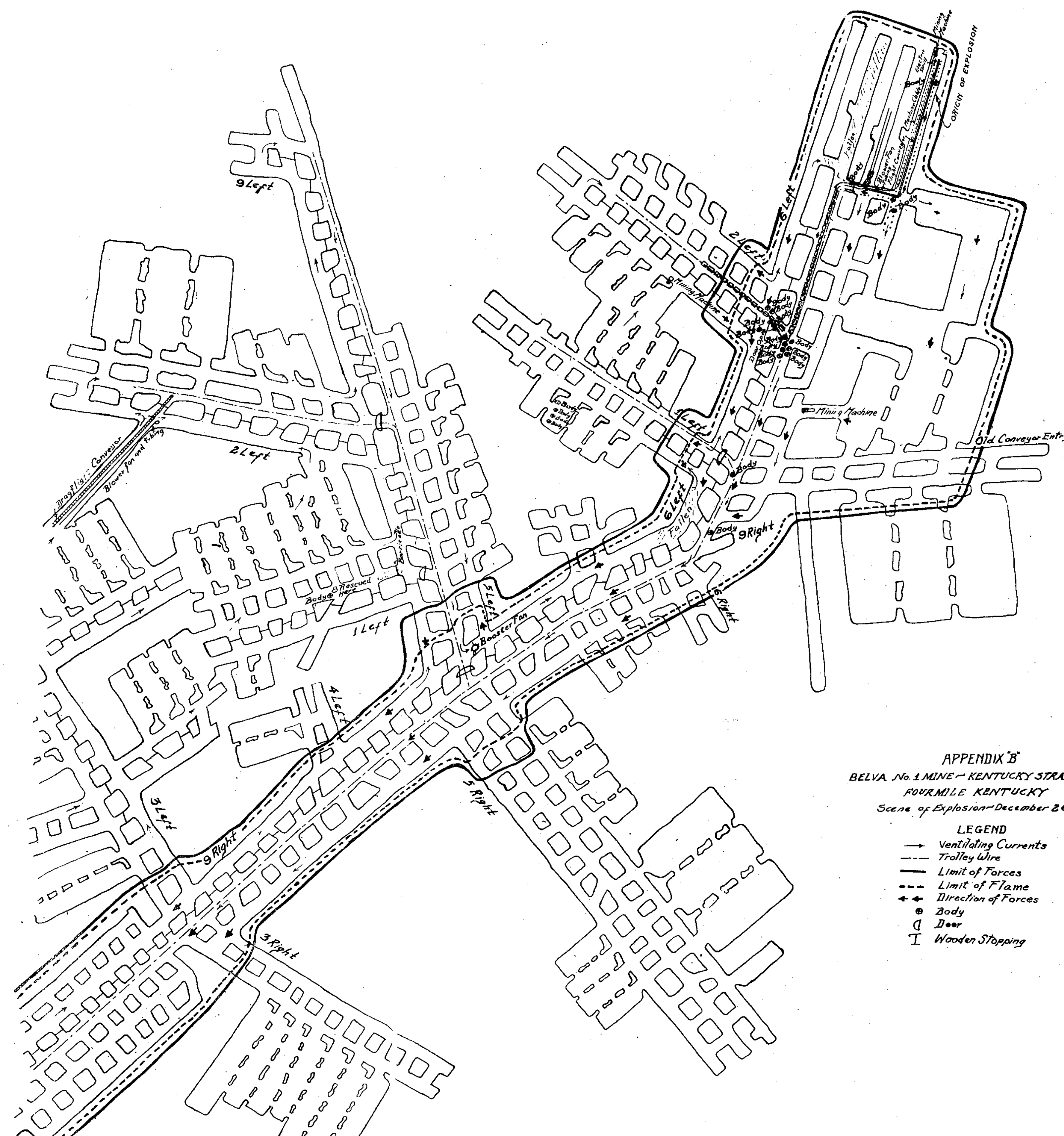
6. Huey Miller, Fourmile, Bell County, Kentucky. Age 31. Dependents 7, Occupation coupler.



APPENDIX "A"
BELVA NO. 1 MINE
KENTUCKY STRAIGHT CREEK COAL CO.
FOURMILE, BELL COUNTY, KENTUCKY

S-276

50411



APPENDIX "B"

BELVA No. 1 MINE – KENTUCKY STRAIGHT CREEK COAL COMPANY

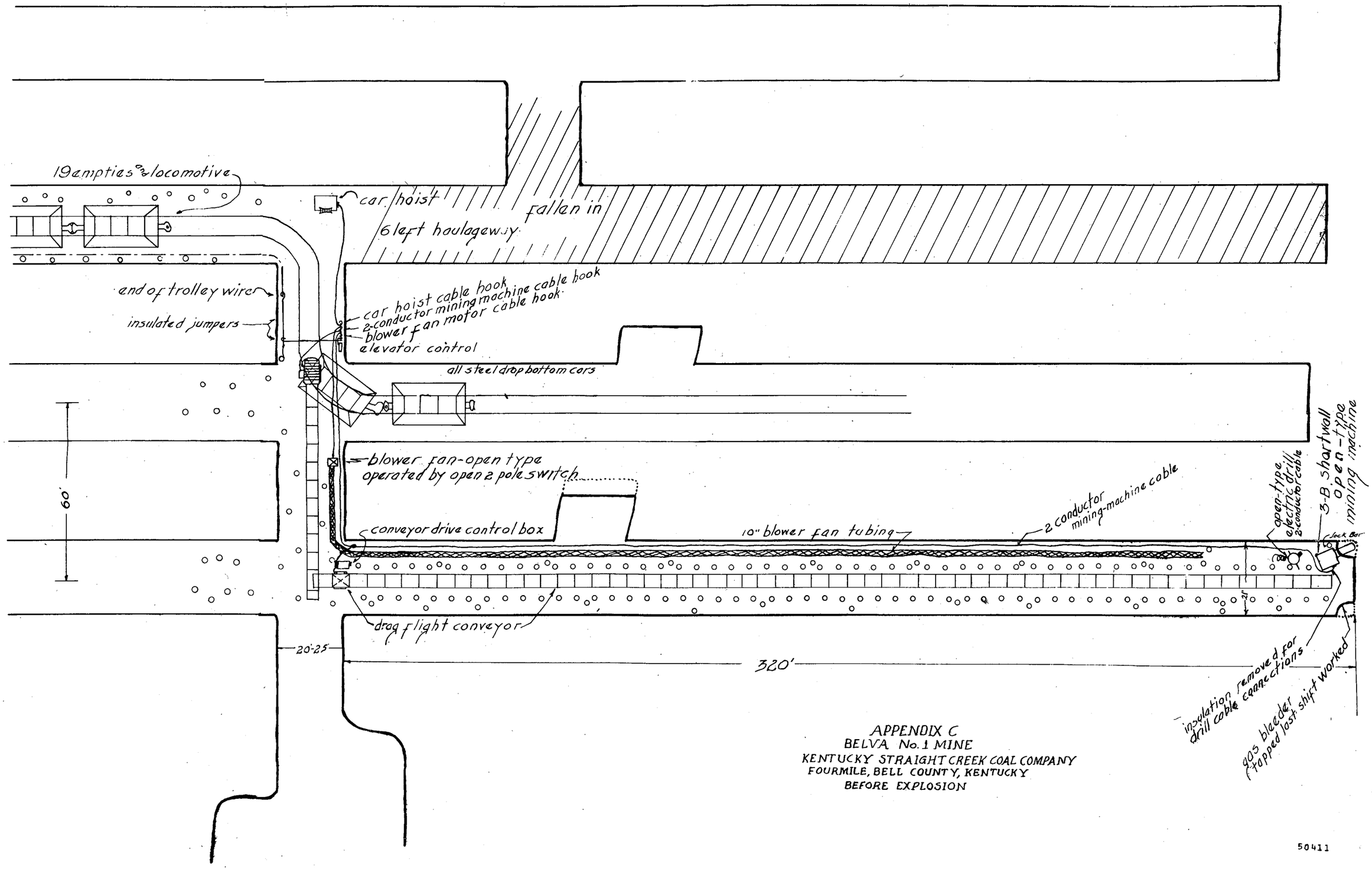
FOURMILE KENTUCKY

Scene of Explosion – December 26, 1945

LEGEND

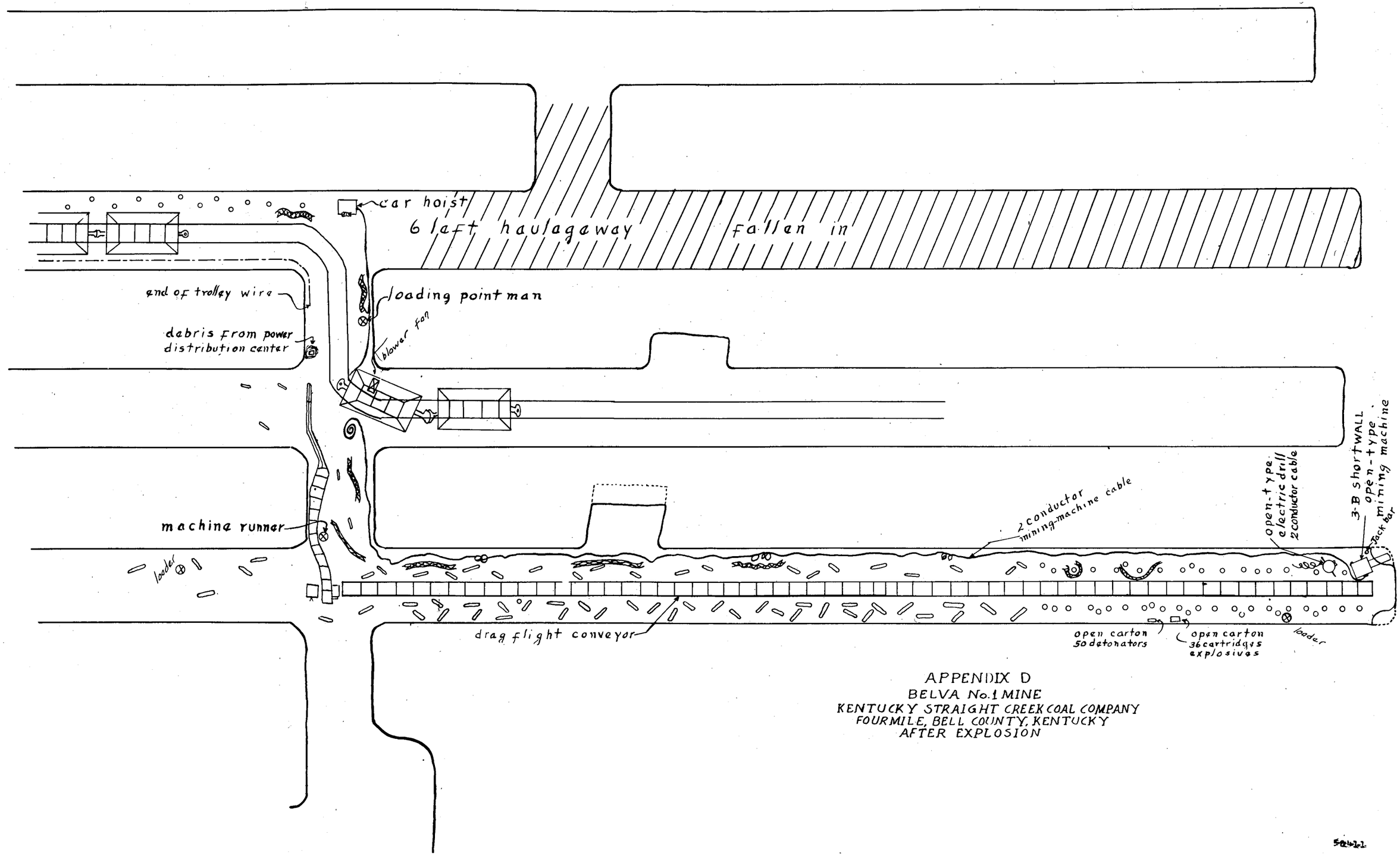
- → Ventilating Currents
- --- Trolley Wire
- ── Limit of Forces
- - - - Limit of Flame
- ◄◄ Direction of Forces
- ⊕ Body
- ᑕ Door
- I Wooden Stopping

50411



APPENDIX C
BELVA No. 1 MINE
KENTUCKY STRAIGHT CREEK COAL COMPANY
FOURMILE, BELL COUNTY, KENTUCKY
BEFORE EXPLOSION

50411



APPENDIX D
BELVA No. 1 MINE
KENTUCKY STRAIGHT CREEK COAL COMPANY
FOURMILE, BELL COUNTY, KENTUCKY
AFTER EXPLOSION

502621

STANDARD FORM NO. 64

Office Memorandum • UNITED STATES GOVERNMENT

TO : Files

DATE: 4/3/46

FROM : E.E. Quenon

SUBJECT: Mine Explosion - Kentucky Straight Creek Coal Co

Hope Flickers For 50 Caught In Mine Blast

The Charleston Gazette

Dec 26, 1945

Blazing Inferno Faces Rescuers

Force of Explosion Said Probably Fatal

PINEVILLE, Ky., Dec. 26.—(AP)—Rescue workers ran into an inferno of burning debris and coal less than half-way from the area where 30 to 50 miners were entombed by a coal mine explosion here today.

Highway Patrolman Austin Hall said the flames were encountered 3,100 feet from the mine entrance tonight. He said the miners were believed to be trapped at the dead-end of the two and one-half mile deep mine.

Hall said this development, coupled with other handicaps which have slowed work to a snail pace, had caused most workers, miners and families of the trapped men to abandon hope that any would be brought out alive.

All available means were being employed to combat the fire, which apparently had been burning since the explosion occurred about 8:30 a. m.

Rescuemen had been in the mine seven hours, digging through piled framing, dislodged coal, smoke and gas fumes, when they came upon the fire.

Little Hope Held

Hall said it appeared unlikely that the explosion area could be reached short of "two or three days," and that there appeared little hope for this reason that the men could be reached in time.

Mine operator W. E. Lewis said he believed there were "not less than 30 nor more than 50" men in the mine.

At Washington, Daniel Harrington, of the bureau of mines, said indications were the explosion was a violent one and that it was probable that all the trapped men were killed.

The explosion, which Mine Operator W. E. Lewis said occurred about 8:30 a. m. (CST) today, was so far back from the mine entrance it was not heard above ground.

Rescue crews, trained for such work, were summoned from several mines in the southeastern Kentucky Coal fields. First squads entered the mine's lone exit shortly before noon, Lewis said, while clouds of smoke still boiled from the pit opening.

The source of the smoke was not determined immediately and there were no indications what caused the explosion. Lewis said the mine ranged back from two to two and one-half miles from the pit entrance.

ranged back from one and one half to two miles from the pit entrance.

Crew Smaller Than Usual

The number of day shift men was smaller than usual, company officials said, because full production had not been resumed since yesterday's Christmas Day holiday.

Scores of persons, many of them relatives of miners, began to gather near the mine soon after word spread of the explosion. Officials roped off an area around the pit to protect rescue workers and calls were sent out to adjoining Harlan county for additional crews.

Miners from other shifts, familiar with the tunnel, said unless the trapped men were able to follow the fresh air course to its source their chances for rescue would be small.

One other hope, these miners said, would be for the trapped men to brattice themselves with brattice cloth into a room inside the pit and seal off the foul air.

Falls Block Crew

The first rescue crew to attempt to reach the men entered from an air shaft, about two miles from the mine mouth, but had to turn back when its path was barred by a slate fall.

The rescue squads were provided

(Please Turn to Page 12 Col. 4)

Blazing Inferno

(Continued From Page 1)

with gas masks for protection against gas formations.

Derb Harris, an employe of the mine, said he was walking toward the mine entrance when the black smoke started pouring out of the pit. Harris said the explosion blocked the only entrance and that smoke soon filled the small valley around the mine.

Veteran miners said this might be the worst disaster of its kind in Bell county history. The worst previous explosion occurred about 15 years ago when 14 men were trapped and killed at another mine near here and several others were rescued.

Lester Morris, mine employe, said today he issued lamps to at least 28 workers before the explosion that trapped an undetermined number of miners in a mine near here.

He said he could not be sure that all who received lamps entered the mine, adding, however, that possibly several more than that number reported for duty.

He recalled the names of 26 white men and two Negroes, including a father and son, J. T. Gambrell and his son, Floyd Gambrell, and two brothers, John H. and William Branstutter. The others were:

Reed Lawson, Hobert Sulfridge, Delbert Lockard, McKinley Leach, Ivan Philpot, Frank Mills, Bud Partin, William Carroll, Bud Townes, Negro; Hugh Westerfield, Negro; James Collins, George Matthews, Bill Brock, Harmon Lovell, jr., Charles Lingar, Jim Baine, John Brock, Jim Emory, Joe Hatfield, Dave Sharpe, Henry Honeycutt, Nath Centers (mine foreman), Tom Fisher and Tom McQueen.

Among those in the mine, Morris said, were three or four from a second operation of the Kentucky Straight Creek Coal Co., transferred for the day when a shortage of miners reported for work after a Christmas holiday.

STANDARD FORM NO. 64

Office Memorandum • UNITED STATES GOVERNMENT

TO : Files

DATE:

FROM : E.E. Quenon

SUBJECT: Mine Explosion – Kentucky Straight Creek Coal Co

Charleston Gazette Dec 27 1945

31 Men Caught In Mine Blast Believed Dead

Fire, Gas Retard Efforts at Rescue

Superintendent Holds No Hope Any Still Alive

PINEVILLE, Ky., Dec. 27.—(AP)—Rescue workers trying to reach 31 trapped miners here are at least 7,000 feet from the area where the men are believed to be entombed, Earl Lewis superintendent of the No. 1 mine of the Kentucky Straight Creek Coal Co., said tonight.

Previous estimates had placed the rescue teams within 2,000 feet of the trapped men.

Lewis, son of owner W. E. Lewis, had just emerged after 26 hours in the mine with a rescue crew.

"It would be a miracle if they found even one of those men alive," Lewis told the Associated Press in an exclusive interview. "There is not even a mouse alive in there."

Believed at Farthest Point

The mine superintendent was the first man to enter the mine yesterday after the explosion and officials and workers were agreed that he knows every foot of the mine better than anyone else on the scene.

Lewis said the mine is almost exactly two and one-fourth miles long, and expressed the belief that the miners' bodies would be found at the far end of the tunnel.

The superintendent said he was convinced that the 31 names on the list of men to whom lamps were issued yesterday morning were all in the mine and added that there might be "one or two others," but he doubted it.

Rescuers are encountering worse conditions as they go along, Lewis reported. Larger piles of rocks and other debris are being found.

Fires Caused by Timbers

Lewis said that crews still were fighting their 19th fire when he left the farthest underground penetration of the workers to come to the surface for a rest.

The fires are caused by the burning of timbers and not by ignited coal, Lewis explained, and therefore the flames are not proving very difficult to extinguish.

"Of course, we may run into more fires before we get through," he added.

He estimated that it would be late tomorrow, at the earliest, before the entombed men—or bodies—would be reached.

The workers put in 5,000 feet of telephone line to establish communication and 35 to 40 men in crews battled in shifts through gas, fire and debris toward the sealed off miners.

R. R. Sayers, director of the bureau of mines at Washington, estimated it would take two or three days to reach the miners.

Black Damp Present

The rescue crews, assembled from various sections of southeastern Kentucky reported considerable "black damp," a poisonous gas usually found in mines after a fire or explosion. The crews were equipped with gas masks.

Few of the veteran miners here held out any hope for the rescue of any of the trapped men alive. During the first 40 hours of rescue

STANDARD FORM NO. 64

Office Memorandum • UNITED STATES GOVERNMENT

TO : Files

FROM : E.E. Quenon

DATE:

SUBJECT: Mine Explosion
Kentucky Straight Creek Coal Co
Charleston Daily Mail
Dec 30, 1945

Hope for 22 In Mine Dies

Raging Fire Hides Coal Miners' Fate

PINEVILLE, Ky., (UP).—Rescue workers beat down one fire within 400 feet of the entrance Saturday night, then threw their efforts against another roaring blaze less than 200 feet from the shaft where 22 miners are believed trapped deep within the Kentucky Straight creek coal mine.

Harlan county safety superintendent James Bryson said fresh crews had been sent in to fight the new blaze which was raging in approximately the area where the Wednesday morning explosion that trapped the miners originated.

Denies Body Found

Bryson said he could "hold out mighty little hope" for the remainder of the crew that went into the mine the day after Christmas. Of the 31 known men in that crew, one was said dead and eight others were in Pineville community hospital, two of them in a serious condition.

"There's nothing to a story that we've found a burned body down there," Bryson told the United Press.

Veteran miners shook their heads over the prospects for finding their companions alive after the crashing explosion which apparently bloomed in their midst, some 300 feet from the other nine-man party which took refuge in "room 5" and were rescued yesterday.

Bad air, cold, smoke and carbon monoxide gas were combining to stack the deck against their chances, miners said. The air was bad in room 5 more than 24 hours earlier.

No Inkling of Cause

Neither Bryson nor Mine Operator William E. Lewis would attempt to say what might have caused the vast explosion that entombed the miners. It was acknowledged to have been one of the most powerful ever to strike in this part of the coal fields.

The eight known survivors of the explosion that tore though the mine tunnel at 8:30 a. m. Wednesday, were recoving in Pineville Memorial hospital. They still were too weak for doctors to permit them to be interviewed formally. But they agreed that their 22 comrades had seemed to be in the center of the explosion. The rescued indicated they believed the others must have been killed outright by the blast.

Nevertheless, the 100-odd trained mine disaster workers, directed by officials of the state mine department, worked at top speed despite

See HOPE FOR 22 (Page 3, Column 1)

Hope for 22

(Continued from Page One)

exhaustion. They were determined to get the 22 out, dead or alive.

Shoring Takes Fire

After dealing with the new fire near the entrance in piles of shattered shoring, they struggled against smouldering piles of slate and burning coal veins to get beyond the walled-off room where they had found nine of the men at 1:30 p. m. yesterday. One of the nine died soon afterward and the eight survivors said their comrades had been 300 feet farther along the tunnel when the explosion occurred.

The hope of the rescue workers was that the 22 had barricaded themselves in a side room as the nine had. But even if they had, their chance of having survived diminished steadily as the hours passed. When the rescuers reached the prison of the nine, the air was all but exhausted.

Figures in Kentucky Death Drama

The family of miner Hughey Miller (top picture), some of whom heard the explosion and saw debris blown from the mine entrance just an hour after he went to work in the shaft, stands watch at the entrance of Straight Creek mine No. 1, near Pineville, Ky. Below, two members of rescue squad, near exhaustion after nearly 24 hours of constant work, sleep in a miner's home.

STANDARD FORM NO. 64

Office Memorandum • UNITED STATES GOVERNMENT

TO : Files

FROM : E.E. Quenon

SUBJECT: Mine Explosion
Kentucky Straight Creek
Coal Co
Charleston Daily ~~Mail~~
Mail

Crews Enter Burning Mine For Gas Test

Chas Daily Mail
DEC 30, 1945

Results May Cause Rescuers to Abandon Search for 20 Men

Combined From AP and UP Wires

PINEVILLE, Ky. — Rescue officials sent crews into the Kentucky Straight Creek mine today for conclusive tests of the air and gas concentration to determine whether or not the work of digging out the remaining bodies would be continued or be given up.

Workers already had been driven out of the workings by gas, bad air and fire and the men remaining in the mine after Wednesday's explosion were given up as dead. At least 20 were believed buried in the caved-in area around room six-left some two and a half miles inside the mine.

United Mine Workers representatives urged that the work be continued, but mine officials believed that it would be dangerous to send workers back into the shaft if the gas concentration remained high. Some crew members already had been made ill by inhaling fumes.

In the event the search is given up, the mine probably will be sealed to extinguish the coal fire which had broken out.

Sealing off the mine would halt rescue operations. Veteran miners said hope had been abandoned for the survival of any of the trapped men.

This action would leave only seven survivors out of 31 miners trapped by an underground explosion of unexplained origin in the Kentucky Straight Creek Coal Co.'s No. 1 mine.

Meanwhile, another of the mine men brought out of the mine has died. He was Tom McQueen, 30, of Magnet, Ky., who succumbed in the Pineville community hospital without regaining consciousness.

McQueen was one of the nine miners found alive in the fire-ravaged pit more than 53 hours after the explosion sealed in the men. Another, Albert Bennett, 64, of Pineville, died before he could be brought to the surface.

Bodies of Mine Foreman Nath Centers, 62, and Hobart Sulfridge, 44, were brought from the mine yesterday.