

FINAL REPORT OF MINE EXPLOSION  
THREE POINT MINE  
THREE POINT COAL CORPORATION  
THREE POINT, HARLAND COUNTY, KENTUCKY

September 16, 1943

By

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UNITED STATES  
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BUREAU OF MINES

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INTRODUCTION

A gas explosion causing the death of 12 men occurred about 9:00 a.m. on September 16, 1943, in the Three Point mine of the Three Point Coal Corporation, Three Point, Kentucky.

At the time of the ignition, approximately 50 men were in the workings contiguous to the No. 1 opening, wherein the explosion occurred. The explosion was local in character, and all men working outby the point of origin, and in other outlying sections of this part of the mine, escaped unaided.

Twelve men working in new 1 right off 12 left, 3 right main, in the immediate vicinity of the explosion, were killed by violence, burns, and after-damp, but six men working in the face of 12 left entry, about 3,300 feet inby the mouth of new 1 right entry were rescued approximately 14 hours after the explosion. The rescued men had built a barricade of mine ties, covered on the outer side with several thicknesses of vent tubing, at the mouth of a dead-end opening about 100 feet deep and 500 feet from the face of 12 left entry; the vent tubing was slit lengthwise and opened out to hang flat against the barricade. The men reported that the air behind the barricade was to be used if any discomfort was experienced in breathing the air outby this point. Fortunately, however, it was not necessary for the men to resort to this protection, since the gases from the explosion were short-circuited through an angle crosscut some distance outby the barricade, where a door had been broken by the blast, and the air in 12 left entry, inby this angle crosscut, was still comparatively good at the time of rescue.

All evidence indicates that the explosion resulted when the assistant foreman struck a match in an attempt to relight a nonpermissible flame safety lamp in an explosive mixture of methane and air.

The Norton office of the Bureau of Mines was notified of the explosion at 12:30 p.m., September 16, 1943. A crew of Bureau men from the Norton office, under the direction of Mr. W. H. Tomlinson, engineer-in-charge, left immediately for the scene of the disaster, taking the Bureau truck and a full complement of mine rescue equipment. Messrs. W. H. Tomlinson, J. E. Bradburn, M. L. Davis, W. S. Eltringham, and the writer arrived at the Three Point mine about 3:15 p.m., and the latter four men proceeded directly underground. Messrs. W. R. Park and G. T. Powell arrived about 4:30 p.m., and Mr. M. C. McCall, district engineer, at 8:30 p.m.

The Bureau men took an active part in the underground rescue and recovery operations, and cooperated with the representatives of the State Department of Mines and Minerals and the Harlan County Coal Operators Association, until all the bodies were removed from the mine. Mr. J. E. Bradburn and the writer assisted in exploring the accessible openings and restoring the ventilation in the affected area until September 21, when it was considered safe to operate the pumps to dewater the place wherein the ignition occurred.

#### GENERAL INFORMATION

##### Location and operating officials

The Three Point mine, owned and operated by the Three Point Coal Corporation, is situated along a branch of the Louisville and Nashville Railroad at Three Point, Harlan County, Kentucky, about 14 miles southeast of the town of Harlan. This company does not operate any other mine.

The officials of the company are:

Elmer D. Hall,	President,	Harlan, Kentucky
B. F. Gross,	General Manager,	Three Point, Ky.
W. J. Simonton,	Chief Engineer,	Grays Knob, Ky.
J. C. Dawson,	Superintendent and Mine Foreman,	Grays Knob, Ky.

##### Employees and production

Approximately 114 men are normally employed underground at this operation, divided as follows: 71 men on the day shift in the No. 1 opening; 37 on the day shift in the No. 2 opening; and 6 men on the second shift who work part time in both areas. The average daily production is 600 tons of coal, and the mine produced 239,577 tons during 1942.

##### Openings

The mine is developed through two sets of drift openings; various other drift openings have been driven to the surface at widely separated points, and at three of these the fans are installed.

##### Coal bed and analysis of coal

The workings are in the Harlan bituminous coal bed, which ranges from 44 to 78 inches in thickness, and lies practically flat, except for local undulations. The bed outcrops in ravines, caused by surface erosion, indenting the surface area at many places on the property. In some areas of the mine, the coal bed contains a dirt or shale seam 1/4 inch to 21 inches thick, about 12 to 18 inches above the floor, and is overlain by a "draw slate", 1 to 40 inches in thickness, which is taken down as the coal is removed. In other sections, particularly the involved area, only the top bench of the coal bed, which contains few impurities, is mined, and the immediate roof is a firm hard shale that is easily controlled. The thickness of the overburden ranges from zero at the outcrop to a maximum of 800 feet.

A proximate analysis of samples of coal from the Harlan bed, as given in "Typical Analyses Bituminous Coals", published by the Consumers' Counsel Division, United States Department of the Interior, is as follows:

<u>As received</u>		
Moisture	2.5	Percent
Volatile matter	37.1	"
Fixed carbon	55.8	"
Ash	4.6	"
	100.0	

It will be noted from the above figures that the ratio of volatile matter to total combustible matter ( $\frac{V.M.}{V.M. + F.C.}$ ) of the coal in this bed, which is an index of the explosibility of the coal dust, is 0.40.

Tests by the Bureau of Mines have proved that for coals having a volatile ratio in excess of 0.12 the minus-20-mesh dust is highly explosive, and the likelihood of an explosion increases as this ratio increases, and the size of the dust particles decreases. It is obvious, therefore, that the coal dust from the Harlan bed is highly explosive.

#### UNDERGROUND MINING METHODS, CONDITIONS, AND EQUIPMENT

##### Method of mining

The mine is worked by the room-and-pillar method, and the pillars are being recovered in the older sections of the mine; but more recent development is by the wide-room system, and the narrow pillars are being left in place. Main entries are driven double and triple at intervals of 1,200 feet; butt, or cross, entries are driven double, 300 and 600 feet apart. Entries are driven 14 feet in width on 50-foot centers, and the entry crosscuts are at variable intervals up to 300 feet apart. Rooms have been driven 24 feet in width on 50-foot centers and 300 feet in length, but the present conveyor rooms, locally called "walls," are 65 to 75 feet in width on 90-foot centers. At present, room crosscuts are not driven. Good roof breaks are experienced where the pillars are extracted, but only local falls were noted where the pillars are left in place.

All coal is undercut, and the coal holes are drilled with electric hand-held drills. Permissible explosives, detonated electrically, are used exclusively.

In the wide-room development, chain conveyors are used to transport the coal from the faces to the cars on the haulage entries, and face conveyors carry the coal to the room or entry conveyors. All coal is loaded by hand onto the conveyors. Hand-loading into cars is still the practice in some parts of this mine, but the area involved in this explosion is all conveyor development.

The entries are well timbered where necessary, and the roof in the rooms, or "walls," is exceptionally well secured; posts are used on 18- to 24-inch centers, and small cogs of square timbers, 30 inches long, are interspersed along the conveyors, about 12 to 15 feet apart.

Clearance and shelter holes are generally provided along the haulage tracks, but in some places the clearance is obstructed by road cleanings and rock falls. Work of cleaning up the haulage tracks is now in progress.

### Ventilation and gas

The No. 1 opening area is ventilated by an 8-foot-diameter disk-type fan, situated at Bobs Creek opening and exhausting 49,500 cubic feet of air a minute, and an underground 6-foot-diameter booster fan set in a concrete housing near the beginning of 12 left, 3 right main air course. This booster fan was torn from its base by the force of the explosion, but the Bobs Creek fan was unaffected. Two other smaller disk-type fans operated independently, to ventilate the workings in the No. 2 opening area, which was not in any way involved in this explosion. The Bobs Creek fan is installed in an incombustible housing in the mouth of the Bobs Creek drift, and it is not provided with adequate safety devices, or properly guarded. Previous to the explosion, it had been the practice to stop the fans at night after all men were out of the mine, and start them about 2 hours before the men reentered. On September 16, the night before the explosion, it is reported that the Bobs Creek fan was stopped at 12:10 a.m. and started at 5:00 a.m. The mine is not examined before the men enter.

Each fan induces a separate air current, which is conducted in a continuous circuit through an individual area of the mine, and the air travels through abandoned and worked-out areas before entering the active workings.

The air currents were not measured in the working areas, because ventilating conditions had not been restored to normal at the time of this investigation. The report on the coal mine inspection by C. J. Thomas, April 6 to 16, 1943, indicates that adequate air currents were being conducted to the working areas at that time, but, at places, the return air current coursed the main haulage roads.

One automatic door is installed on 3 right main haulage; the others are manually operated, and all are installed singly. Latches are generally provided to hold the doors open, but trappers are employed at two of the main haulage doors.

Stoppings between the main entries are constructed of brick, gob-wall, or wood, and those along the butt entries are of wood. Room crosscuts, where provided, are closed with brattice cloth. Abandoned parts of the mine are not sealed or inspected regularly. The faces of the conveyor rooms are ventilated by blower fans and tubing, and line brattices are not used.

The mine is rated nongassy by the Kentucky Department of Mines and Minerals. Small percentages of explosive gas were indicated by an electrical methane tester in various parts of the affected area during the recovery operations, but large accumulations were not found. The officials do not carry flame safety lamps when making routine inspections of the working places, but it is reported that they make periodic inspections for gas with a nonpermissible, key-lock, flame safety lamp, which is kept in the superintendent's office.

During the investigation four air samples were collected in the affected area, the analyses of which are shown in table 1.

TABLE 1 ANALYSIS OF AIR SAMPLES COLLECTED IN Three Point (Mine)

(Company) Three Point Coal Corporation

(Location) Three Point, Kentucky

(Date) 9/21-24/43

Bottle No.	Location in Mine	Percent					Cubic Feet Air Per Minute
		Carbon Dioxide	Oxygen	Carbon Monoxide	Methane	Nitrogen	
135	Face 13 left entry, 3 right main.	1.00	19.10	0.04	1.01	78.85	Still
136	Face new 1 right entry crosscut	0.93	19.51	0.02	0.62	78.92	"
393	Drill hole, face 2 room, new 1 right entry, 12 left	0.82	19.78	0.00	0.09	79.31	"
906	Return, 30 feet inby Bobs Creek fan	0.15	20.62	0.00	0.00	79.23	49,500

The results of the analyses of the foregoing air samples are not representative of the normal atmosphere in this mine, since normal ventilation had not been restored following the explosion, but it will be noted that methane is being generally liberated in the 12 and 13 left areas of the mine. This fact is also substantiated by referring to G. J. Thomas' report on the routine coal mine inspection at this mine, April 6-16, 1943, which indicated that the methane content of the air samples collected in the return at 4 room, 9 right, 3 right main, in the return 900 feet inby Bobs Creek fan, and at the face of 12 left, 3 main wall, 200 feet inby last crosscut were 0.17, 0.07, and 0.10 percent respectively; these return air samples were taken in air that had passed through 12 and 13 left workings.

### Dust

The mine is normally quite dry, although considerable water had been impounded in 13 left, 3 right main entry, and in 3 right main entry inby 12 left entry; some of this water is pumped out periodically, but it is reported that the areas has not been entirely dewatered for some time. The haulage roads in this mine are not excessively dusty, but much dust is produced, and heavy deposits were present, in the vicinity of the working faces and the conveyor loading heads. Water is not used to allay the dust at its source.

Rock dust has been applied on the main haulage roads and side entries, but other parts of the mine are not rock-dusted. It is reported that the mine dusts are not sampled and analyzed to determine whether redusting is needed, but the management's plans call for a general cleanup of the mine and thorough rock dusting of the haulage roads at least every 6 months.

The Bureau has determined by tests and experiments that bituminous coal dusts must contain at least 65 percent incombustible material to give complete protection against the propagation of flame.

It is highly probable that the coal dust in the non-rock-dusted area in new 1 right entry entered into, and added force to, the explosion where the victims were working, but undoubtedly the rock-dust applications along 12 left entry served to confine the flame to new 1 right, and prevented extensive propagation of flame beyond the new 1 right loading head.

Four dust samples, collected in the vicinity of the conveyors in 12 left entry and new 1 right entry, were analyzed at the Bureau of Mines coal laboratory at Pittsburgh, Pennsylvania; the results of these analyses are shown in table 2.

TABLE 2 ANALYSIS OF DUST SAMPLES COLLECTED IN THREE POINT MINE

COMPANY Three Point Coal Corporation

LOCATION Three Point, Kentucky

DATE September 20-24, 1943

Can No.	Location in Mine	Kind of Sample	Percent			Remarks
			Combustible V.+F.C.	Incombustible moisture + ash	Through 20-mesh	
T-19	At conveyor head, 12 left entry 32 plus 77	Floor	65.5	34.5	99.3	Rock dust
T-52	Do	Rib	45.5	54.5	91.3	Do
T-544	At conveyor head, new 1 right entry	Floor	83.4	16.6	80.7	No rock dust
T-926	On new 1 right slant entry at 2 plus 50	Floor	87.7	12.3	62.5	Do

Samples were collected after mine explosion.

It will be noted from the foregoing that the incombustible content of each dust sample collected was less than the 65 percent minimum necessary to give complete protection against the propagation of flame; also, that a very high percentage of the dust particles were minus-20-mesh in size. A combination of these two factors definitely presents an extremely dangerous condition, from the standpoint of dust-ignition possibilities.

### Haulage

The 48-inch-gage tracks are in good condition; 60-pound rails are used on the main line; 30-pound rails are laid in side entries; and in the rooms, 20-pound rails are used. Considerable spilled coal had accumulated along the tracks on the haulage roads and in the vicinity of the loading heads, but the work of cleaning the tracks was in progress at the time of the explosion. The superintendent stated that the semi-annual cleanup had been started, and it would be followed through to completion.

General haulage practices were not observed during the investigation since the mine had not resumed operations.

Wooden end-gate mine cars, having a capacity of 1-1/4 tons, are used. They are equipped with link-and-pin couplings.

Trolley locomotives are used on the main-line haulage, and combination cable-reel-and-trolley units are used for gathering purposes.

Parts of the main haulage roads are on return air, particularly on 3 right main from a point near 4 right to 12 left entries in the No. 1 drift area.

Trolley and transmission lines are well installed, but they are not guarded adequately.

### Lighting

Incandescent electric lamps are installed at some main-line switches, at waiting stations, and at some electrical installations, but they are not provided at all main-line doors, and some unprotected lamps are installed in return air.

In addition to the afore-mentioned nonpermissible flame safety lamp kept in the superintendent's office, the superintendent stated that the company owns a permissible flame safety lamp that had been sent away for repairs, but had not been returned. Although permissible electric cap lamps are used by all underground employees when engaged at their usual occupations, some of the men use open-flame (carbide) lamps when entering or leaving the mine through other than the main openings.

Smoking is permitted underground.

### Machinery underground

All underground electrical equipment is nonpermissible, but it is

generally maintained in good operating condition. The power, purchased from a utility company as 2,300 volts, is transformed and converted to 275 volts direct current for use in the mine; a surface and an underground substation are used to convert the alternating current to direct current. The power cables from the surface substation are taken through the main openings, installed directly above the trolley wires, and suspended from the trolley-wire hangers. An insulated transmission line, carrying alternating current at a potential of 2,300 volts, enters the mine at the 1 right, 3 main drift opening. It is well installed in a covered trench cut in the floor, and the casing is grounded effectively.

The conveyors are well installed, but in two instances the contactor-box covers were blocked open, thus permitting the coal dust to accumulate inside the boxes in the vicinity of the unprotected contactors.

The trailing cables observed were in good condition, and few splices were noted during this investigation; the splices observed were well made with splicing rings and insulated with friction tape. Connections to the power lines are made with wire hooks, and fuse protection is not afforded. The cables to the portable face equipment and conveyors are left lying on the floor; in some cases they were almost completely covered with coal and coal dust.

It is reported that the operators of all electrical equipment are required to examine their machines daily, and all defects are reported to the official in charge. A report, showing the repairs made or needed, is given to the master mechanic by the operators of the equipment. The underground substation is housed in a brick enclosure, but automatic-closing fire doors are not provided.

#### Explosives and blasting practices

The methods of handling, transporting, and using explosives were not observed during this inspection as the mine had not resumed operation, but it was stated that these practices were the same as described in the report on the Federal inspection by C. J. Thomas, April 6-16, 1943. However, it was noted that in 2 room, near the face of new 1 left entry, 12 left, the cutting machine was in operating position about 10 feet from the left rib, and 6 holes had been drilled in the face, while a shovel containing 13 cartridges of permissible explosives and 6 electric detonators was on the floor at the face near the right rib. This evidence gives the impression that it was the practice to start to charge the drill holes in the face before the cutting operations were completed. In some cases the explosive- and the detonator-storage boxes were placed too close together in the working places.

#### GENERAL SAFETY CONDITIONS

##### First aid and mine rescue

All the employees were trained in first aid in 1939, but additional training has not been sponsored. It is reported that none of the men has been trained in mine rescue work, but methods of, and reasons for, barricading after an explosion were discussed in the first-aid classes conducted by Bureau of Mines representatives, which probably accounts for the commendable and life-saving procedures taken by the rescued men.

First-aid materials are kept underground at strategic places, and additional supplies are maintained in the first-aid room on the surface.

A rescue station is not maintained, but five all-service gas masks are kept in the mine foreman's office, and the company has access to the Harlan County Coal Operators Association's equipment at Harlan, Kentucky, 14 miles away. Trained mine rescue teams are maintained at several mines in this part of the State, many of which volunteered their services and assisted materially in the recovery operations.

#### Safety organization

A safety organization is not maintained at this mine, but weekly safety meetings of the officials are held. A safety inspector, employed by the company, makes periodic inspections of the mine.

The accident records of the Three Point mine, as given in the coal mine inspection report, indicate that 49 men were injured during the year 1942 while the mine produced 239,577 tons of coal, or 4,889 tons of coal for each lost-time injury. During the first 3 months of 1943, 9 injuries were incurred while producing 52,592 tons of coal, or 5,848 tons for each lost-time injury. The tons of coal produced per injury in both cases is far below the 11,894-tons-per-injury average of all mines in the State of Kentucky for the year 1942. It is reported that, previous to this explosion, the Three Point mine had not experienced a fatal injury in approximately 7 years.

#### Supervision and discipline

It is apparent that the officials have a high regard for the safety of the men under their supervision, and the general condition of the mine bears out this assumption, but, it is reported that the superintendent, who also acts as mine foreman, is required to make a daily supervisory inspection of a part of the mine to which no other supervisory official has been assigned. This necessarily takes up considerable time every day that should be devoted to general supervision over other officials and the mine in general.

#### FIRE PROTECTION

Suitable fire extinguishers, and rock dust, are placed at the sub-station and at conveyor loading heads, and bags of rock dust are placed at other strategic locations underground. Two 50-gallon Carboloid tanks, mounted on trucks and kept on the surface, can be taken underground, if necessary. A rock-dusting machine, canvas, lumber, and tools are available in case of fire, but a fire-fighting organization is not maintained.

#### PREVIOUS EXPLOSIONS IN THIS OR NEARBY MINES

There is no record of any other explosions having occurred in the Three Point mine, but an explosion in the adjoining Zero mine, Harlan Fuel Company, at Yancey, Kentucky, killed 23 men on December 9, 1932.

## MINE CONDITIONS IMMEDIATELY PRIOR TO EXPLOSION

The mine was apparently working in normal operating condition on September 16, prior to the explosion. In the vicinity of the point of ignition, a single entry, 13 left, 3 right main, had been driven about 600 feet from 3 right main, and another narrow place had been driven, singly, from 13 left entry about midway between 3 right main and 13 left face, for a distance of 250 feet parallel to 3 right main. These places had not been worked since 1941, and were inaccessible, because the area was recently used as a sump to hold water for the pump along 3 right main. A slant entry was driven off new 1 right, 12 left entry to make a connection with the face of 13 left entry. A crosscut had been started about 50 feet outby the slant-entry face to make the connection with 13 left face. On the afternoon of September 15, the day before the explosion, a hole, about 4 feet in depth, was drilled through from the face of the crosscut to the face of 13 left entry, and that evening this intervening coal was undercut. The superintendent stated that he was present when the hole was drilled through, and his flame safety lamp was extinguished when placed near the drill hole. After clearing the gases from the flame safety lamp by holding the lamp at the end of the vent tubing, used to ventilate the slant entry, he relit the safety lamp and proceeded to test for gas in the immediate area. He stated that the safety lamp did not indicate the presence of methane at that time; and he assumed it was lack of oxygen that had extinguished the lamp. The next morning, Thursday, September 16, the assistant foreman, Albert Bonza, took the safety lamp to the slant entry off new 1 right, to supervise opening the connection to 13 left entry. At about 9:00 a.m. an explosion occurred in the vicinity of new 1 right entry.

## STORY OF THE EXPLOSION AND RECOVERY OPERATIONS

The main-line locomotive crew was waiting on 3 right main, near the mouth of 10 left entry, for the gathering locomotive to bring a trip of loaded cars from 12 left entry, when the explosion occurred. The locomotive operator stated that he jumped into a nearby crosscut to protect himself from the concussion, and then called the surface from the telephone at 9 left entry, before making his way outside. All men outby the explosion area, and those working in outlying sections, made their way to the surface unaided, but the fate of the men inby the mouth of 12 left entry was not known.

The State Department of Mines and Minerals and the office of the Harlan County Coal Operators Association were notified promptly by the company officials.

When the first Bureau of Mines men went underground, Mr. James Bryson, safety engineer for the Harlan County Coal Operators Association, Messrs. Henry Hamblin and Rufus Bailey, State mine inspectors, and Mr. J. C. Dawson, superintendent, had already made a superficial exploration of the area outby the devastated section, and supplies were being delivered underground. These men reported that they had been able to advance to a point a short distance inby the mouth of 12 left entry, where a dense cloud of smoke was encountered, and further exploration was impossible.

Due to the fact that the 3 right main air course on the right, or return, side of the entry had not been driven for a distance of 275 feet between 10 and 11 left turn-outs, it was necessary to use the main haulage road at this point as a return air course from the affected area. However, a door near the mouth of 12 left entry had been demolished by the explosion, and the intake air was short-circuiting at this point to 3 right main, and providing comparatively good air to a point on 12 left entry at the junction of the intake airway. Since the intake air course in this area was too low to permit free travel of men, and the efficient handling of the necessary supplies, it was decided to provide an adequate supply of men and material on 12 left entry by way of 3 right main before attempting to restore ventilation in the affected area, which would result in the pollution of the air where 3 right main entry was serving as the return air course. This done, the door at the mouth of 12 left entry was repaired and closed, and a stopping was built across 3 right main in the vicinity of 10 left to deflect the return air to the parallel air course and thence through 9 right to the fan. A Bureau man was stationed on 3 right main, outby the stopping, to make tests of the air, and to provide for the safety of the workmen building stoppings outby this point. He was also to prevent any person from traveling 3 right main between 10 and 12 left turn-outs; emergency travel was to be by way of the intake air course only.

A rescue party, organized and directed by Mr. G. M. Patterson, chief of the Kentucky Department of Mines and Minerals, and Mr. Bryson, and accompanied by the writer, proceeded to advance into 12 left entry as it restored ventilation by constructing temporary canvas stoppings to replace those demolished. When the party reached the conveyor head in 12 left air course at the mouth of new 1 right entry, the bodies of three men, the conveyor-head attendant and the gathering-locomotive crew, were found. Their heads, hands, and clothing were burned, and cuts and lacerations gave mute testimony of violence and flame at this point. Other evidences of violence and the direction of the forces, as revealed by the demolished stoppings and the derailed empty cars on the entry, indicated that the explosion had occurred in new 1 right. Slight hopes were held for the men in that area, so it was decided to bypass new 1 right, and continue toward the face of 12 left, about 3,300 feet away, in hopes that the six men working in this area might be alive. The dead-end entries, off the left side of 12 left, were sealed when tests indicated small percentages of carbon monoxide and methane present; explosive mixtures of methane and air were not found. At about 10:00 p.m., when the party reached a point 1,580 feet in 12 left entry, footprints leading out the entry and retracking toward the face were detected in the freshly settled dust, and, about 5 minutes later, the lights of the missing men were sighted approximately 1,300 feet away.

The crosscut stoppings, inby the turn in 12 left entry, were found to be intact and needed only to be patched up to seal the leaks, but the doors in the slant crosscuts were broken and dislodged. When the slant crosscut at 21 plus 0 was reached, a gas-mask crew was sent ahead to demolish the next crosscut stopping before the slant crosscut was sealed, as a precaution against forcing the polluted air onto the imprisoned men, since it was not known whether the victims had provided for short-circuiting the air current outby their place of refuge. This procedure was continued until the gas-mask crew contacted the imprisoned men at about 11:00 p.m., and found the air sufficiently pure to permit the men to walk out without respiratory protection. All except one of the

rescued men were in good physical condition and needed little help to get to the surface. One, who showed signs of weakness and was carried out on a stretcher, responded quickly to treatment at the hospital, and fully recovered. Safe exit from the affected area, through that part of 3 right main entry serving as a return air course, was afforded by opening the door at the mouth of 12 left entry, and allowing the intake air to short-circuit over 3 right main to the return for a few minutes before the rescued and rescuers were allowed to proceed.

A subsequent rescue party, in charge of M. C. McCall and W. H. Tomlinson of the Bureau of Mines, and F. Rhodes, State mine inspector, and including L. Huber, Mine Safety Appliance Company, W. R. Park of the Bureau of Mines, and J. H. Mosgrove, State mine inspector, then proceeded to restore ventilation in the new 1 right entry. A canvas curtain was installed across 12 left air course between new 1 right entry and the air course, and the party, advancing with the fresh air, installed canvas stoppings in the crosscuts to replace those demolished. At about 3:30 a.m., September 17, two bodies were found on the left side of the entry conveyor about 320 feet from 12 left air course, and at 3:45 a.m. three other bodies were found a short distance inby the others on the right side of the conveyor. These men were apparently overcome by the gases when attempting to escape, since they were approximately 300 feet outby their working place. The party then proceeded to the face of new 1 right entry and air course, explored the rooms driven to the left off the entry and to the right off the air course, and continued outby through the air course to the beginning of the slant entry. Considerable carbon monoxide was present in the air, but dangerous percentages of methane were not encountered. The small amounts found were quickly dissipated by the air current. While the workmen were recovering the bodies found in new 1 right, the exploring party searched the slant entry and discovered the remaining four victims, including the assistant foreman, along the right side of the slant entry, 145 to 182 feet from the beginning of the entry. Further exploration toward the face of the slant entry was impossible, since the inflow of water from 13 left had inundated the slant entry from the face to within a few feet of the inby body.

All bodies were recovered and transported to the surface at 9:00 a.m. Friday, September 17.

During the latter part of the rescue and recovery operations, the party was augmented by Inspectors Brock and Buckner of the State Department of Mines and Minerals.

Immediate investigation, as to the cause of the explosion, was not possible, since the inflow of water from 13 left entry had inundated the slant entry, where it was apparent that the blast had originated. As the pumps were installed in the return air courses, dewatering of this area could not proceed until adequate ventilation had been restored, and all accessible openings in the affected area were explored and cleared of noxious gases. J. E. Bradburn and the writer, of the Bureau of Mines, assisted the State inspectors and the company officials in this work, and the pumps were started on Monday, September 20.

#### INVESTIGATION OF CAUSE OF EXPLOSION

On Thursday morning, September 23, Mr. Bryson telephoned the Norton

office of the Bureau of Mines that he and the State inspectors had inspected the slant entry and recovered the dissembled nonpermissible safety lamp, the various parts of which were scattered over an area near the place where the assistant foreman's body was found. J. E. Bradburn and the writer left immediately for Harlan, Kentucky, and viewed the dissembled lamp in Mr. Bryson's office, where the various parts had been carefully kept separate as found. All parts of the lamp were thickly coated with a black smudge, due to their being submerged in water for several days, but the integral pieces were not in any other way damaged and could be readily assembled. This rather definitely proved that the lamp had been opened before the ignition, rather than blown apart by the explosion. A match box, containing several unburned wooden matches, and one match from which the sulphur had burned, found in the same area, were also exhibited. Mr. Bryson stated that the places where the various articles were found had been chalkmarked on the roof of the slant entry for the benefit of the Federal inspectors.

On Friday, September 24, J. C. Dawson, superintendent and mine foreman, and W. J. Simonton, chief engineer, Three Point mine, and J. E. Bradburn and the writer inspected the slant entry.

#### PROPERTY DAMAGE

Extensive property damage was not done, except in new 1 right entry, although the wooden stoppings along 12 left entry within 600 feet of new 1 right were demolished, and doors as far as 2,400 feet away were broken. Posts were dislodged and parts of the conveyors were knocked awry in new 1 right. A blower fan was wedged on top of the room-conveyor driving assembly near the face of 1 right entry, and spare conveyor pans that had been piled along the rib out-by this point were in disorder. The inby end of the first conveyor in 1 right was tipped on its side, and the pan line was buckled. The booster fan, set in a concrete stopping in 12 left air course, was torn loose from its base and moved outward about 6 feet.

The management estimated that the necessary repairs would be completed and the mine ready for operation within 10 days after the investigation.

#### FORCES

The forces of the explosion seemed to radiate from the slant entry off new 1 right, and all destroyed stoppings were blown outward toward the entry. The wood from the door frames inby the curve on 12 left was blown outward, but the broken doors were lying inby, or on the air-course side of, the door frames; these doors, apparently blown open by the blast, were broken when they were slammed shut by the retonation wave. A trip of 29 empty cars, coupled to the locomotive, was standing on 12 left entry directly inby the turn-out to the new 1 right loading head. The sixth and seventh, and the twelfth, thirteenth, and fourteenth cars in the trip were derailed to the side of the track away from the air course; these cars were directly in front of the crosscuts which were nearest in line with the new 1 right air course and entry, respectively. The locomotive trolley pole was still in contact with the trolley wire, but the top covers on the locomotive were disarranged, and two sections were lying on the floor of the entry.

## EVIDENCE OF HEAT OR FLAME

Evidence of extreme heat was limited outby the mouth of new 1 right, although some coking was noted in the intake air course between 11 and 12 left, and in the vicinity of the door near the beginning of 12 left entry. The three bodies found near the new 1 right loading head and the four bodies in the slant entry were burned, but the five men in new 1 right entry were probably suffocated when trying to escape.

It is thought that some coal dust was involved and assisted in the terrific force of the explosion in new 1 right entry and near the loading head but apparently the rock-dust applications on 12 left entry limited further propagation.

### PROBABLE CAUSE OF THE EXPLOSION AND SUMMARY OF EVIDENCE

The dissembled nonpermissible flame safety lamp and the matches found near the body of the assistant foreman prove, almost conclusively, that gas was ignited when a match was struck to relight the flame safety lamp.

Since only small percentages of methane were found at any place in the affected area with an electric methane tester, it can be assumed that gas, which had accumulated in the face of the idle 13 left entry, had seeped into the slant entry through either the drill hole or the undercut connection that had been made between the face of the crosscut from the slant entry and the face of 13 left entry. It is highly probable that the flame safety lamp had been extinguished by the mixture of methane and air in the vicinity of the crosscut, and, from the location of the bodies, the official had taken the men with him to a point about 50 feet outby the crosscut to relight the safety lamp. Other sources of ignition were not discernible.

The cutting machine had apparently undercut the coal from the right rib of the crosscut a distance of 6 feet, 7 inches, and then had been moved about 250 feet to a point near the beginning of the slant entry on the previous night; it was found undamaged at this location after the explosion. The hole that was drilled through to the face of 13 left entry, from the middle of the crosscut face, and about midway between the roof and floor, was still undamaged, and showed no indications of having been charged or blasted. The electric drill and cable were lying in the conveyor pan, near a shovel and wrench, about 10 feet outby the crosscut corner; the drill cable was wound up, and there was no indication that it was being used.

It is apparent that the men had been opening the connection between the crosscut and 13 left, since the coal above the undercut had been dug out, so that the opening was 18 inches high at the right rib, about 12 inches high at the left side of the opening, 6 feet, 7 inches wide from the right rib, and about 4 feet through to 13 left face.

### CONCLUSIONS OF STATE INSPECTORS AND OTHERS

An official statement by the Kentucky Department of Mines and Minerals as to the cause of the explosion has not been made at the time of writing this

report, but the State district inspectors, the company's officials, and a representative of the Harlan County Coal Operators Association concurred unofficially with the Federal investigators as to the cause and origin.

Coroner's inquests are not usually held in Kentucky when the cause of death is obvious.

#### LESSONS TO BE LEARNED FROM THE CONDITIONS AS THEY RELATE TO THE EXPLOSION

The following outstanding conditions and practices were contributory to this explosion, or hampered rescue and recovery operations following the blast. Elimination of these hazardous conditions and practices in coal mines would greatly reduce the possibility or seriousness of similar disasters:

1. An unlocked nonpermissible, key-lock flame safety lamp, with the key attached to the hook ring, was used to test for gas.
2. A flame safety lamp is an outstanding hazard when misused.
3. Single places were driven as far as 600 feet without a companion air course.
4. Idle places were not ventilated properly or regularly inspected for gas.
5. Blower fans are used to ventilate the working places instead of properly coursing the ventilating current to the faces. The use of blower fans frequently causes recirculation of air, and, where used, the provision of frequent crosscuts is almost invariably neglected.
6. The coursing of return air along the main haulage road definitely retarded recovery operations, and made rescue operations extremely hazardous.
7. Smoking is permitted underground, and matches are carried and used at will by the workmen and officials.
8. Rock dust is used only on the main haulage roads. The heavy accumulations of highly explosive coal dust in the new 1 right conveyor places, undoubtedly, added to the fury of the explosion.

#### RECOMMENDATIONS

It is thought that, if carried out, the following recommendations will materially lessen the explosion hazard at this mine.

#### UNDERGROUND MINING METHODS, CONDITIONS, AND EQUIPMENT

##### Ventilation and gas

1. Booster fans should not be used underground to augment the normal ventilating current.

2. The fans should be operated continuously.
3. If a main fan should stop for 5 minutes or more, the man should be withdrawn from the mine, and not allowed to reenter until the workings have been thoroughly examined and found free of gas.
4. A split system of ventilation, utilizing air crossings, should be established.
5. The air currents should not pass by or through abandoned or worked-out areas before entering the active workings.
6. The haulage roads should be ventilated with intake air.
7. The air course on the right side of 3 right main should be connected between 10 and 11 right to eliminate the necessity of using the haulage road as a return air course.
8. Doors should be constructed in pairs to form air locks, and latches should not be provided to hold the doors open.
9. All entry stoppings should be substantially constructed of incombustible material.
10. Room crosscuts should be closed with gob-wall, dirt, or tight-board stoppings.
11. All abandoned parts of the mine should be substantially sealed, or adequately ventilated, and weekly inspections made of all unsealed places.
12. Blower fans should not be used to ventilate the working faces. Line brattices should be installed to conduct the air from the last open crosscuts to the working faces.
13. No place should be worked more than 80 feet in advance of the last open crosscut.
14. The officials, shot-firers, and cutting-machine operators should carry permissible flame safety lamps, and make inspections for gas in all places visited.
15. Only permissible, magnetically locked flame safety lamps should be used.
16. This mine should be classed as gassy.
17. Pre-shift examinations should be made in all working places within 3 hours of the time the men start to work.
18. Tests for gas should be made before and after blasting.
19. All keymen should be trained in the proper method of assembling, maintaining, and using flame safety lamps.
20. Places should not be driven without a companion place to serve as an air course, and crosscuts should be driven not more than 80 feet apart.

## Dust

1. The surfaces of all accessible openings should be thoroughly rock dusted, so that the incombustible content of the mixed mine dusts will not be less than 65 percent.
2. The mine dusts should be sampled and analyzed periodically to determine when redusting is needed.
3. Water should be used in the face area and at the conveyor-loading heads to allay the coal dust.
4. Spilled coal should be removed and not allowed to accumulate along haulage roads. A continuous road-cleaning program should be adopted.

## Lighting

1. Incandescent electric lamps should not be installed in return air.
2. Open-flame lamps should not be used underground at any time.

## Machinery underground

1. Nonpermissible electrical equipment should not be used in air likely to contain explosive gas.
2. The conveyor contactor-box covers should be kept closed securely.
3. Cables to face equipment should be suspended on posts, and not allowed to lie on the floor.
4. Automatic self-closing fire doors should be installed at the underground substation.

## Explosives and blasting practices

1. Explosives should not be brought to the face when electrical equipment is operating at or near the face.
2. Explosives and detonators should be brought to the working places in separate, tight, well-insulated containers, and kept in these containers until ready for placement in the drill holes.
3. Explosives and detonators should be kept at least 15 feet apart in the working places.
4. Holes for blasting should not be drilled before the coal is cut.

## General

1. All employees should be trained in first aid annually.
2. Keymen should be trained in mine rescue procedure.
3. A safety organization should be effected, and monthly safety meetings of all employees should be held.
4. Fire-fighting crews should be organized and fire drills should be held four times a year.

### ACKNOWLEDGMENT

The writer wishes to acknowledge the courtesies extended, and the assistance given, by the officials of the Three Point Coal Corporation, particularly Mr. Elmer D. Hall, president, Mr. B. F. Gross, general manager, Mr. J. C. Dawson, superintendent and mine foreman, and Mr. W. J. Simonton, chief engineer.

The cooperation of Mr. James Bryson, safety engineer of the Harlan County Coal Operators Association, Mr. G. M. Patterson, chief of the Kentucky Department of Mines and Minerals, and the several district mine inspectors who assisted, is also hereby gratefully acknowledged.

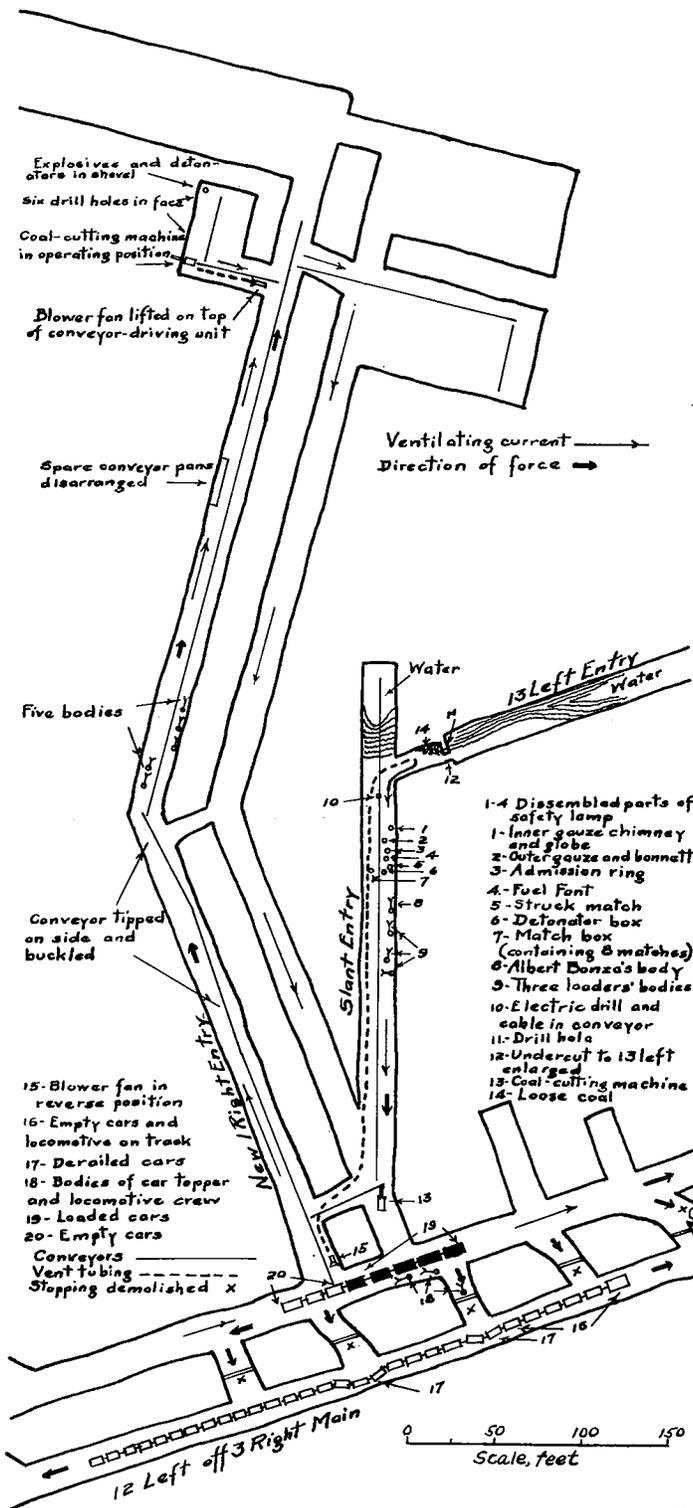
Also greatly appreciated, were the sandwiches and coffee served the rescue workers by the Harlan unit of the Salvation Army, and the exceptional good order maintained in the vicinity of the mine by the members of the State Highway Patrol and the Auxiliary Police Unit of the Harlan City County Civilian Defense Council.

Respectfully submitted,

/s/ Charles M. Keenan

Charles M. Keenan,  
Coal-Mine Inspector

APPENDIX

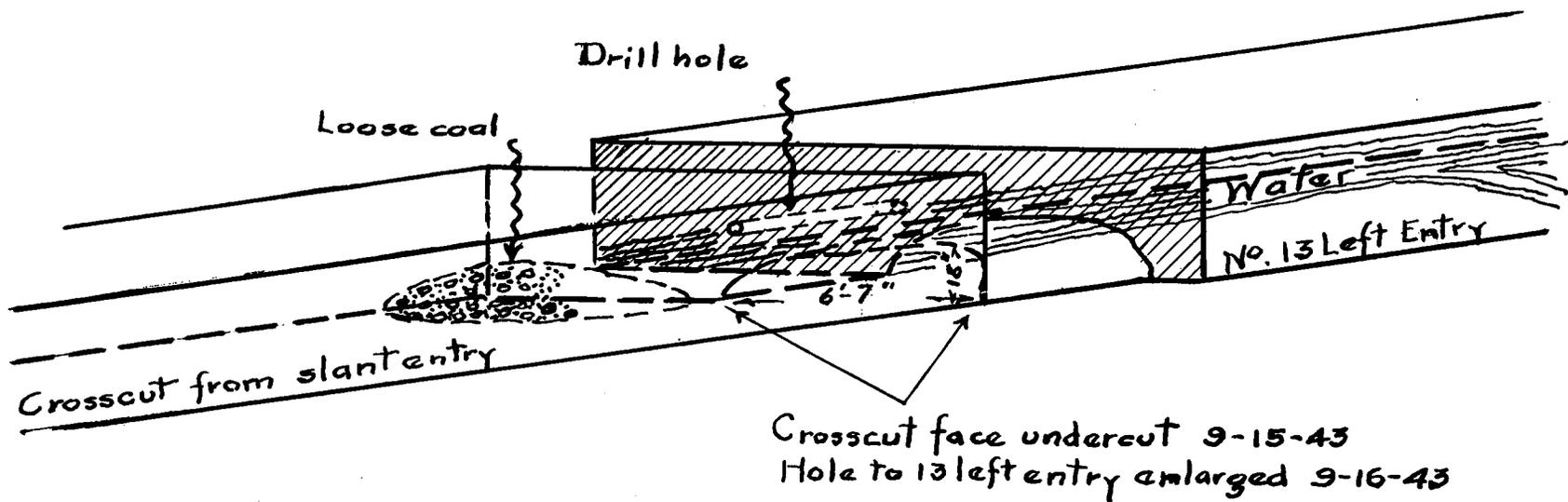


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DETAIL MAP OF EXPLOSION AREA  
 NEW RIGHT ENTRY OFF 12 LEFT 3 NORTH  
 THREE POINT MINE

SCALE 1 INCH = 50 FEET

SEPTEMBER 1943



PERSPECTIVE CROSS SECTION  
OF  
CONNECTION TO 13 LEFT ENTRY  
THREE POINT MINE

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