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FINAL REPORT OF MINE EXPLOSION  
MINE NO. 47, PEABODY COAL COMPANY  
HARCO, SALINE COUNTY, ILLINOIS

12-28-41

By

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UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF MINES

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DECEMBER 28, 1941

By L. H. McGuire

INTRODUCTION

A local mine explosion occurred about 3:30 a.m., December 28, 1941, at Mine No. 47 of the Peabody Coal Company, Harco, Saline County, Illinois. A total of 14 men were underground at the time of the explosion. Eight men were killed by violence and the other six escaped. Two of the six who escaped were in the affected area and suffered from the effects of carbon monoxide gas poisoning.

The cause of the explosion as determined by the Bureau of Mines' investigating party is thought to be an ignition of explosive gas by electricity. The electrical origin could have been either a short-circuit of the trolley wire against the rail due to a roof fall or a spark or sparks from a trolley locomotive operated by the mine examiner.

The explosion was local in nature and was confined principally to one section of the mine, dying out near the mouth of two outby sections. Property damage was slight considering the distance the explosion traveled.

So far as could be observed, the rock-dusting done in the affected portion of the mine was principally along the north main haulageway and around the panel entry mechanical loading heads.

No water is used for wetting and allaying coal dust during the process of mining.

The Bureau of Mines was first informed that a mine explosion had occurred, by a radio news report about 11:30 a.m., December 28, 1941. Mr. C. A. Herbert, Supervising Engineer of the Vincennes Station, verified the news report, and called Messrs. L. H. McGuire, J. C. Reardon, W. O. West, and E. J. Marron to proceed to the disaster as quickly as possible with Bureau of Mines' truck and equipment.

Upon arrival at the mine at 3:15 p.m., L. H. McGuire immediately notified Mr. R. M. Medill, Director, Department of Mines and Minerals, State of Illinois, who was in charge of all rescue work, that the Bureau desired to assist in any way possible with the rescue and recovery work. Mr. Medill informed Mr. McGuire that the work was so far advanced that his services were not needed and that, because the haulageways were on return air, it was not advisable for anyone to go inside until after the rescue work was completed.

The first four bodies were brought to the surface at 4:00 p.m., the next three at 4:45 p.m., and the last, that of the mine examiner, Harold Holden, was found at about 9:15 p.m. and brought to the surface at 10:50 p.m. All crews and men came to the outside when the last body was brought out.

After all bodies were recovered, it was decided to postpone the investigation until ventilation was completely restored.

The investigation by the Bureau of Mines was conducted from January 1 to 7, 1942.

## GENERAL INFORMATION

### Location and Operating Officials

The No. 47 Mine is located at Harco, Saline County, Illinois, on the Big Four and Illinois Central Railroads, and is owned and operated by the Peabody Coal Company. The officials of the company and their addresses are as follows:

President	Stuyvesant Peabody	231 So. LaSalle St. Chicago, Illinois
General Supt.	D. H. Devonald	ditto
Secretary	Joseph Solari	ditto
Treasurer	W. A. Fisher	ditto
Division Eng. (local)	Frank White	Marion, Illinois
Mine Supt.	W. M. Elders	ditto
Mine Manager	Edgar Vaughn	Harrisburg, Illinois
Safety Engineer	D. F. McElhattan	Marion, Illinois

### Employees and Production

The mine is operated two 7-hour shifts per day. Approximately 245 men are employed underground on the day shift and 128 men on the night shift. Coal is hoisted only during the day shift. A total of approximately 150 men are employed on the surface during three 7-hour shifts; 80 men work on the day shift, and 35 men on each of the two night shifts. The mine has a total of approximately 543 men employed.

Approximately 4,500 tons of coal are produced per day.

### Openings

The No. 47 Mine is opened by means of an air shaft and a double-compartment hoisting shaft approximately 500 feet apart. The air shaft also serves as an escapeway. The main hoisting shaft is about 427 feet in depth.

### Coal Bed

The mine is operating in the No. 5 bed of the Illinois series which averages about 56 inches in thickness, and at this mine lies nearly flat. The coal is bituminous; it contains no partings and is fairly uniform in character throughout the field.

The following analyses were made from the composite of face samples collected in nearby mines and obtained from State Geological Survey Reports and Bureau of Mines' Bulletins:

Moisture	Volatile Matter	Fixed Carbon	Ash	Sulphur	B.t.u.
6.90	34.42	48.55	10.13	2.16	12,088
5.75	35.01	52.65	6.59	2.05	12,800
3.72	34.44	52.91	8.93	3.76	13,032
6.65	33.52	52.48	7.35	1.93	12,609
5.75	33.90	53.21	7.14	2.29	12,624
4.71	38.50	46.90	9.89	4.08	12,470
6.08	34.37	51.05	8.47	2.83	12,521

Experiments by the Bureau of Mines have shown that the relative explosibility of bituminous coal dust is indicated by the empirical formula:

$$\frac{\text{Volatile matter}}{\text{Volatile matter} + \text{fixed carbon}} = \text{Combustible ratio}$$

and that when the ratio of volatile matter to volatile matter plus fixed carbon exceeds 0.12 the coal dust is explosive; furthermore, the explosibility of the dust increases with the increase of this ratio.

Substituting the values of 34.37 per cent volatile and 51.05 percent fixed carbon in the foregoing formula, we obtain a ratio of 0.40. This indicates that coal dust from the No. 5 bed at this mine is highly explosive.

The immediate roof at the No. 47 Mine in the explosion area is a strong, stratified, gray, fine-grained sandstone overlain by gray shale. The sandstone roof tends to spall off along the entries after exposure to

the air. The floor is a fairly soft fireclay. The coal being mined at this property lies on each side of a fault which runs in a northwesterly direction.

## UNDERGROUND MINING METHODS; CONDITIONS, AND EQUIPMENT

### Method of Mining

The mine is developed by means of three main entries driven in a north and south direction from near the main hoisting shaft bottom. Cross entries are driven to the right and left of the main entries at irregular intervals. The cross entries consist of two and three entries. Generally, panel or room entries are driven in pairs off the cross entries to the right and left on about 620- to 640-foot centers. The first pair of panel entries is started about 450 feet from the main entries.

Entries are driven 12 to 14 feet wide on 32-foot centers. Rooms are driven 24 feet wide on 42- to 50-foot centers to a depth of from 300 to 500 feet. Connecting crosscuts are usually cut at 60-foot intervals or less in rooms and entries.

The coal is undercut to a depth of about 5 1/2 and 8 feet by Jeffrey shortwall mining machines mounted on caterpillar-treadtrucks. The mining machines are equipped with 6- and 8 1/2-foot cutter bars.

The coal is blasted with "cardox" by shot firers who drill and shoot the coal when all men are out of the mine.

All coal is loaded mechanically by means of Joy permissible-type, 14 BU loaders and Joy "shuttle cars" (storage-battery operated), permissible-type, mounted on rubber-tired wheels. The "shuttle cars" dump the coal into Joy loading conveyors, which in turn deliver the coal into mine cars at the loading points. So far as could be observed, the permissible equipment was largely operated in a nonpermissible manner.

As a rule little timbering is necessary on the entries in the face sections. Some timbering is done in places along the main, cross, and panel entries, but no regular system is followed. It was observed that dangerously large pieces of rock spalled off occasionally along the main entries. For this reason, it would be advisable to inspect the roof at regular intervals. In rooms, from three to four rows of posts are set on 4-foot centers, leaving a 12-foot space in the center for shuttle cars. Timbers are kept to within about 10 feet of the room faces. Wedges are only used between the top of the posts and the roof.

Pillars are not recovered in the course of mining. The general practice is to seal the panel entries near the mouth after the coal has been extracted.

### Ventilation and Gases

The mine is ventilated at the present time by means of a steam-driven Sirocco fan, 5' x 18' reversible type, direct-connected, and run blowing. The fan is offset 20 feet from the downcast shaft and is protected by steel swing-type explosion doors. The fan is equipped with a signal-light warning device in which the light goes out when the fan stops.

Power is furnished by an 18" x 24" Ridgway steam engine operating at 190 revolutions per minute. Auxiliary power is furnished by a General Electric 100-hp., 220-volt belt-driven direct-current motor operating at 570 revolutions per minute. The fan is installed in a concrete building on the surface approximately 500 feet from the hoisting shaft. A new Jeffrey "aerodyne" fan to be operated blowing is now being installed to replace the Sirocco fan. The latter will be left intact to serve as an auxiliary fan.

The present fan was delivering 180,000 cubic feet of air per minute on December 26, 1941, according to readings taken by local mine officials. The fan-pressure gage charts show that the main ventilating fan was operating continuously prior and subsequent to the explosion on about 1.50 inch water-gage pressure.

There are five main air splits in this mine. The coursing of the air throughout the entire mine can be seen on the mine map in the appendix of this report. A brief explanation of the coursing of the air from the air-shaft bottom through the explosion area follows:

From the bottom of the air shaft the air is split, one part flowing inby along the main 2nd east off north mains, ventilating the north entries and old workings as far east as 14 south off main 3rd east north parting. The other part flows outby from the shaft bottom along main 2nd east off north main where it splits again at the mouth of 1st and 2nd north entries. It passes up both of these entries to main 2nd west north where it is split again. The part that continues north up 1st south off main 3rd east north is joined by part of the air on the split flowing inby on 2nd east north. The combined air ventilates the main 3rd and 4th east entries and the old workings on the north side as far east as 5th north off main 4th east north. From the 5th north to 18th north off main 4th east north the entries and old workings are ventilated by the other part of the main 2nd east inby split. The combined part ventilating the entries and old workings from 1st north to 5th north off main 4th east passes through a regulator near the

mouth of a stub entry between main 4th and main 5th east off north mains. It then courses through the right air course of north mains to main 5th and 6th east where it passes inby through both of these entries to 1st and 2nd north off main 6th east; thence north through both of these entries and the worked-out rooms on both sides to main 7th east; thence inby on main 7th east air course, coursing through 3, 4, 5, and 6 south entries progressively to the faces of main 7th, 8th, and 9th east; thence returning along main 8th and 9th east haulageway and air course respectively; thence passing progressively through 6, 5, 4, 3, 2, and 1 north entries off main 9th east and rooms thereof to the mouth of main 9th east off north mains; thence north along the right air course of north mains to the faces of north mains; thence returning along the middle and left north main entries, which are the haulage and air course entries respectively, to main 9th west air course; thence inby along main 9th west air course past the sealed entries of 1st and 2nd north, passing through 3, 4, 5, 6, 7, and 8 north entries and rooms thereof to the faces of main 7th, 8th, and 9th west; thence returning outby along main 7th and 8th west entries, which are air course and haulageway respectively; thence progressively passing through 8, 7, 6, 5, 4, and 3 south entries off main 7th west; thence flowing outby along main 7th and 8th west entries past the seals of 1 and 2 south to the mouth of main 7th and 8th west off north mains; thence returning outby along north mains left air course and haulageway through the hoisting shaft to the outside.

From the above description it can readily be seen that the air passes through worked-out areas before reaching the live workings and the main haulageways are on return air. In fact, the general practice is for the main haulageways to be on return air throughout the entire mine. Overcasts are used to some extent but, generally, dependence is placed on single doors for coursing the air through long and more or less complicated routes entering old workings as well as entries before finally reaching the live workings. The present ventilation practices at this mine are poor and invite trouble.

Stoppings along the main entries are mostly of concrete block and appear to be well built. In the room or panel entries they are built of wood. Doors are of wood, constructed singly and not in pairs to form an air lock. They are of the slam type, set in wood frames with wood wings, and are equipped with latches to hold them open. Doors should not be equipped with latches for holding them open.

Five regular mine examiners are employed to make pre-shift examinations. Two mine examiners are employed on the night shift to examine places where night shift men are working. Two "Safety First" men are employed to examine old workings, return airways, live workings, and to take air measurements throughout the mine.

TABLE 1. - Analyses of air samples collected in Mine No. 47  
Peabody Coal Company, Harco, Illinois, January 1,  
4, and 12, 1942

Laboratory No.	Location in mine	Percent					Cu. Ft. Air per minute	Cu. Ft. Methane in 24 hours
		Carbon dioxide	Oxygen	Carbon monoxide	Methane	Nitrogen		
68480	Mouth of 5th south off 7 west main off 3 north mains. Intake air. (Explosion area.)	0.06	20.92	0.00	0.04	78.98	15,012	8,647
68393	Mouth of 6th south off 7 west main off 3 north mains. Return air. (Explosion area.)	0.07	20.77	0.00	0.61	78.55	16,000	140,544
68394	Ditto.	0.10	20.78	0.00	0.64	78.48	16,000	147,440
68392	8 west main off 3 north mains, opposite mouth of 3rd north. Intake air. (Explosion area.)	0.06	20.92	0.00	0.00	79.02	18,200 air comes down 7 & 8 west mains	None.
68391	9 west main off 3 north mains, outby mouth of 3rd north. Return air. (Explosion area.)	0.11	20.62	0.00	0.48	78.79	18,550	128,218
68478	8 west main off 3 north mains outby 1 north. Intake air. (Explosion area.)	0.06	20.79	0.00	0.00	79.15	20,812 air comes down 7 & 8 west mains	None.
68479	9 west main off 3 north mains outby 1 north. Return air. (Explosion area.)	0.17	20.72	0.00	0.33	78.78	20,600	97,891 5 & 6 south permanently sealed.

See footnote page 8.

TABLE 1. - Analyses of air samples collected in Mine No. 47  
Peabody Coal Company, Harco, Illinois, January 1,  
4, and 12, 1942<sup>1/</sup> (Cont'd.)

Laboratory No.	Location in mine	Percent					Cu. Ft. Air per minute	Cu. Ft. Methane in 24 hours
		Carbon dioxide	Oxygen	Carbon monoxide	Methane	Nitrogen		
68638	At hoisting shaft bottom. Main air return of entire mine.	0.13	20.68	0.00	0.19	79.00	180,000 (Estimated)	492,480 Evidently bottle leaked in shipment.
68639	Ditto.	0.17	20.48	0.00	0.35	79.00	180,000 (Estimated)	907,200
68640	1st main north outby 5 east. Intake air.	0.06	20.90	0.00	0.00	79.04	20,900	None.
68641	Main north at overcast inby 1-2-3 west. Return air.	0.13	20.67	0.00	0.32	78.88	26,130	120,407
68642	5 & 6 east off main south in rock tunnel. Return air.	0.26	20.22	0.00	0.69	78.83	21,060	209,252
68643	1 east 2 south on 2 south. Return air.	0.16	20.70	0.00	0.22	78.92	34,075	107,950
68644	Main south in rock tunnel. Return air.	0.17	20.57	0.00	0.19	79.07	9,650	26,402
68645	1st west south off main south. Return air.	0.23	20.37	0.00	0.42	78.98	23,375	141,372

<sup>1/</sup> The analyses were made in the Gas and Dust Laboratory of the Health Division of the Bureau of Mines at the Central Experiment Station, Pittsburgh, Pennsylvania.

The mine has always been rated as gassy by the Illinois State Department of Mines and Minerals.

During the investigation air samples were collected at points shown on the accompanying map. The analyses of these samples together with other data are shown in Table 1 on the preceding pages.

The first five samples bearing laboratory numbers 68480, 68393, 68394, 68392, and 68391 were taken on January 1, 1942; four days after the explosion occurred. The next two samples bearing laboratory numbers 68478 and 68479 were taken on January 4, 1942, seven days after the explosion occurred. All the above samples were taken during the time the fan was reversed, putting the haulageways on intake air, and during the time the recovery work was taking place in the affected section of the mine. The purpose, however, was to obtain vital information before the panel entries located at 3rd and 4th north off 9th west main 3 north, and 3rd, 4th, 5th, and 6th south off 7th west main 3 north were permanently sealed and the ventilation restored to normal condition. The remaining eight air samples were taken at important splits on January 12, 1942, when the mine was operating normally.

Samples bearing laboratory numbers 68480, 68393, and 68394 were taken at the mouth of 5th and 6th south off 7 west main off 3 north mains to determine the amount of methane being given off. The intake air contained 0.04 per cent methane. The volume of air per minute at this point was 15,012 cubic feet, thus indicating that 8,647 cubic feet of methane in 24 hours is being generated up to this point. The return air samples, containing methane pushed out by the squeeze in 5th and 6th south and rooms thereof, contained 0.61 and 0.64 percent methane respectively. The volume of air per minute at this point was 16,000 cubic feet, indicating that 140,544 and 147,440 cubic feet of methane is being liberated in 24 hours. The average of the above would be 143,992 cubic feet. By taking the difference between the intake and return air we find that 135,345 cubic feet of methane is being liberated in 24 hours from 5th and 6th south entries and rooms thereof. If the outside fan were stopped or the ventilation cut off entirely from these panel entries, this amount of methane would make 1,354,500 cubic feet of a 10 percent mixture of methane and air, which is the highest explosive proportion. This amount of explosive mixture would be sufficient to fill two entries with an average cross-sectional area of 60 square feet for a distance of 11,288 feet or slightly more than two miles. These entries are now permanently sealed with concrete block stoppings.

Samples bearing laboratory numbers 68478 and 68479 were taken on January 4, 1942, to determine the amount of methane being liberated by the 7th, 8th, and 9th main west section off 3 north mains, after 5 and 6 south panel entries had been permanently sealed. All other panel entries were open with the exception of 1st and 2nd north and 1st and 2nd south,  
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which were permanently sealed prior to the explosion. These seals were unaffected by the explosion. The 97,920 cubic feet of methane being liberated in 24 hours from the above section will in all probability be considerably lowered following the permanent sealing of 3rd and 4th north and 3rd and 4th south, and the tightening up of seals at 5th and 6th south.

It will be observed that the entire mine liberates approximately 900,000 cubic feet of methane in 24 hours.

Other parts of the mine indicate that while the amount of methane being liberated is not excessive, gassy mines as a whole being considered, nevertheless dangerous conditions are possible in most instances by interrupted ventilation for a relatively short period of time.

Tests conducted by the Bureau of Mines show that under favorable conditions the ignition of as little as 146 cubic feet of a gas-air mixture is sufficient to initiate a coal-dust explosion.

#### Drainage

Generally, the mine and face workings are quite dry; however, local accumulations of water are encountered at various points throughout the mine. A total of 14 electrically driven, nonpermissible pumps were in operation on January 1, 1942. Water from the wet sections of the mine is pumped to the main sump at the hoisting shaft, from which it is pumped to the surface by means of an 8" x 8" pump through a four-inch pipe line.

#### Dust

Much fine coal dust is made in the mining, loading, transportation, and dumping of coal. Since water is not used for allaying coal dust, a considerable amount of very fine dust is raised into suspension by the cutting, drilling, blasting, and mechanical loading operations at the face. This is picked up by the ventilating air current and deposited along the roof timbers, ribs, gob, and floor of the rooms and entry. In addition, there is considerable spillage of coal from the mechanical loading and "shuttle car" operations in the rooms and entries, as well as around the loading boom points. It was observed that this spilled coal is to a large extent ground to dust by the "shuttle cars" traveling over it. This dust was fairly fine, quite free of impurities, and in excessively large quantities. The "shuttle cars" pick up this dust, the finer particles of which are carried quite a distance by the ventilating air current. The spillage of coal from the mine cars appeared to be excessive, thereby creating a large amount of dust due to the car wheels passing over the coal. Along the main haulage roads a considerable amount of rock and fire clay had become mixed with the spilled coal and road dust. Moreover, considerable

fresh coal spillage was in evidence in most of the producing entries, thus making the combustible content quite high.

From observations made of the dust conditions in this mine the following suggestions are offered to lessen the coal-dust explosion hazard, protect the health of the miners, and decrease the accident hazards by improving visibility:

1. Water should be applied to the cutter bars of mining machines to keep the machine cuttings wet while cutting is being done.
2. The face region should be wetted before and after blasting.
3. Water should be sprayed on the coal pile while the coal is being loaded on the "shuttle cars," and at loading boom points.
4. Each working place should be kept free of dust by the effective use of water for a distance of approximately 40 feet from the face.
5. Coal should be loaded on "shuttle cars" so it will not fall off, and any accumulation of coal and coal dust in the rooms and entries should be wetted and promptly loaded out.
6. To prevent spillage along the haulageways mine cars should be kept tight and not overloaded. Loaded and empty cars should be sprayed to prevent dust from being distributed along haulage roads.

These practices are proposed for wetting coal dust at the point of its formation in working places and elsewhere, thus preventing it from rising into the air and being widely distributed by the air currents. Water can be applied most effectively by having water lines near the face of each working place so that mining machines may be connected readily to an adequate supply of water and the face regions promptly wetted down. The installation of water sprays around the loading booms and haulageways will prevent the formation of dust by dumping and loading operations as well as from the tops of fast-moving, loaded trips. Coal dust in the air materially decreases visibility and thus increases the hazards of the mine worker, because he may not be able to see clearly a dangerous condition. Moreover, the prolonged breathing of dust-laden air undoubtedly impairs the efficiency of workmen and may be a distinct detriment to their health.

TABLE 2. - Analyses of dust samples collected in Mine No. 47  
Peabody Coal Company, Harco, Saline County, Illinois  
January 4 and 12, 1942<sup>1/</sup>

Laboratory No.	Can No.	Location in mine	Kind of sample	Percent				Remarks
				Combustible V.+F.C.	Incombust. Moisture & Ash	On 20-mesh	Through 20-mesh	
B-70312	F-55	100 ft. outby 5 east on main 2nd north (haulageway).	Road	63.8	36.2	31.6	68.4	Near and outside explosion area.
B-70311	F-180	Ditto.	Rib & Roof	45.5	54.5	19.8	80.2	Ditto.
B-70310	F-65	100 ft. outby 7 north on 9th west off main 3rd north.	Road	65.2	34.8	42.3	57.7	Ditto.
B-70309	F-77	Ditto.	Rib & Roof	82.3	17.7	31.6	68.4	Ditto.
B-70308	F-139	100 ft. outby 7 north on 8th west off main 3rd north.	Road	52.9	47.1	24.0	76.0	Ditto.
B-70307	F-232	Ditto.	Rib & Roof	49.5	50.5	28.9	71.1	Ditto.
B-70815	E-883	At mouth of 1st west south near main south.	Road	42.0	58.0		61.4	Outside of explosion area in other part of mine.
B-70814	E-842	Ditto.	Rib & Roof	20.4	79.6		70.6	Ditto.
B-70817	E-882	5 east, 100 ft. outby 1 north.	Road	45.5	54.5		72.2	Ditto.
B-70816	E-847	Ditto.	Rib & Roof	4.7	95.3		93.4	Ditto.

<sup>1/</sup> The analyses were made by the Bureau of Mines, Pittsburgh, Pa.

## Rock Dust

The only evidence of rock-dusting that could be seen in the explosion area was around the loading points, along the north main haulage road, and, to some extent, along the parallel return air course. According to statements of the management, the track-mounted, high-pressure rock-dusting machine is operated at night along the main haulage entries. The parallel return air course is rock-dusted to some extent. No rock-dusting is done on the intake air courses. It is also understood that about eight hundred (800) 50-lb. bags of rock dust are used per month in the mine. About a month previous to the explosion a small portable rock-dusting machine was obtained for rock-dusting the rooms and trackless entries in the active, producing face regions; however, according to reports, this machine had not been put into operation prior to the explosion. No rock-dust barriers are used.

Ten samples of dust were collected at five points outside of the explosion area (at locations shown on the map in the Appendix) in the No. 47 mine during the investigation. Of the ten samples collected, the first six bearing laboratory numbers B-70307 to B-70312, inclusive, are samples collected near and outside of the explosion area; the analyses of all samples collected are shown in Table 2 on the preceding page.

A study of the analyses of the first six samples shows:

1. That all samples collected are sufficiently high in combustible material to propagate a mine explosion.

2. Sizing tests of the dust samples show that an average of 73.2 percent of the rib and roof dust and 57.3 percent of the road dust is less than 20-mesh in size. Experiments have shown that any coal dust (with the exception of anthracite dust) that will pass through a 20-mesh screen may enter into an explosion, and that the finer the dust the greater the ease with which it is able to propagate the explosion. This indicates that, so far as the dust samples are concerned, the dust accumulations along the roadways, air courses, and rooms were sufficiently high in combustible material and of sufficient fineness to have carried the explosion beyond the area affected.

In examining the surrounding conditions, it would appear that the explosion wave preceding the flame had the opportunity of expanding quickly by reason of rooms and entries, and therefore the pressure developed was quite low. During the investigation it was learned from Mr. D. F. McElhattan, Safety Engineer for the Peabody Coal Company, that prior to the explosion a layer of rock dust from four to six inches in thickness had been spread over the top of the steel roof plates of the

motor-generator room, which is located near the mouth of 7th west off 3 north mains. These steel roof plates were clean following the explosion; furthermore, several bags of rock dust located near-by had been picked up by the explosion wave and broken open and scattered along main 2nd north. It would appear that the rock dust already present along main 2nd north entry, in addition to the rock dust picked up from the motor-generator room and bags outby, was sufficient to stop the flame at about the same time the explosion was gaining considerable momentum, thus causing the explosion to die out.

Dust samples bearing laboratory numbers B-70814 to B-70817, inclusive, were taken in other parts of the mine along the main haulage roads for the purpose of formulating some idea as to whether the amount being distributed was sufficient to prevent the propagation of an explosion. Although the average of the rib and roof samples at the two points selected, is sufficiently high to prevent the propagation of an explosion, this is not true for the mine as a whole. To prevent the propagation of mine explosions, all coal mines with the exception of anthracite mines should be rock-dusted in every part, whether in damp or dry condition.

Rock-dusting, to be effective, must be done thoroughly and must be well maintained. The dust used should not contain more than five percent of combustible matter and not more than 25 percent of quartz or free silica; all of the dust should pass through a 20-mesh sieve (20 openings per linear inch), and 60 percent should pass through a 200-mesh sieve (200 openings per linear inch); the dust should not absorb moisture from the air to such an extent as to cake and destroy its effectiveness as a dry dust.

Before rock-dusting is done, all combustible material such as machine cuttings and coal spilled in rooms, entries, and haulage roads should be cleaned up and loaded out. Preferably, all passageways and openings should be washed down before or, possibly, while loading out loose material. Active rooms and producing entries generally should be rock-dusted first. The rock dust should be applied from the faces outby and the rock-dusting advanced as the faces advance. Rock dust should be applied to all surfaces of crosscuts, rooms, entries, and air courses. These should be kept dusted to within at least 40 feet of the working faces. Working places and entries not having track may be dusted by hand or with a portable machine. Air courses or other trackless entries or rooms parallel to haulage roads can be dusted by means of tubing extended from a high-pressure machine on an entry, through doors or holes in stoppings between them and the haulage road.

The amount of rock dust to be applied depends on the composition of the coal, the amount of dust and incombustible matter present, the fineness of the dust, the deposition of dust on ribs, roof, and floor, the practices likely to produce coal dust, and the amount of dust formed or deposited from day to day.

The ratio of volatile matter to the total combustible matter in coal dust largely determines the explosibility of the dust. The average analysis of composite face samples collected from near-by mines of the No. 5 coal bed, in which the No. 47 Mine operates, indicates the volatile combustible ratio to be 0.40. Although the volatile combustible ratio varies to some extent with the composition of the coal, the Bureau of Mines recommends that at least 65 percent of incombustible matter be present to prevent propagation of a coal-dust explosion. Moreover, if explosive gas is present, the incombustible matter should be increased one percent for each 1/10 percent of gas present.

### Haulage

Main line haulage from the shaft bottom to the active working sections is by trolley locomotives. Secondary haulage is accomplished by means of six and eight-ton trolley and combination-type locomotives. The six-ton locomotives are of the combination trolley and cable-reel type. Gathering is done by means of 16 Joy "shuttle cars." The cars, which are of composite wood construction with lift end gates, have a capacity of approximately 6,500 pounds when fully loaded. The track appears to be well laid and has a gage of 42 inches. On main entries 60-pound rail is used and on panel entries 40-pound rail. Roadways appeared to have a considerable amount of spilled coal and gob material, and, in general, the clearance appeared to be fairly good. Since the entries are driven wide enough, better clearance could be maintained if these entries were straight and the tracks were laid in line with the sights.

The trolley wire and feeder lines appeared to be well hung but inadequately guarded. It is stated by the management that some split-hose, trolley-wire guards are used in other parts of the mine at points where men are obliged to pass under it; however, none was observed by the writer at any point from the shaft bottom in by to any part of the explosion area. It was observed during the investigation that men were allowed to ride on both sides of the cars, and that the power was not cut off by a sectional trolley-wire, cut-out switch while the man-trip was being loaded or unloaded. The Bureau of Mines recommends that men ride on the side of the car opposite the trolley wire and that trolley wire be adequately guarded and that power be cut off at man-trip stations during loading and unloading of men.

Flying switches or coupling of cars while cars are in motion were not observed. The mine officials state that the above hazardous practices are not permitted.

Unused crosscuts serve as refuge holes. Essentially, all haulage is on return air. The Bureau of Mines recommends that where nonpermissible equipment is operated all underground haulage be performed on pure intake air.

### Lighting

Lighting consists of 60- and 100-watt electric lights from the trolley circuit at partings, switches, doors, yards, around loading booms, and at other necessary points along the haulage roads. All underground workmen wear Edison Model P permissible cap lamps. Permissible trip lights are used for underground haulage. Permissible flame safety lamps are used for gas testing.

### Machinery and Electricity Underground

All underground machinery is electrically operated. It is of the permissible and nonpermissible type and consists of the following:

Jeffrey nonpermissible shortwall cutting machines with 6- and 8 1/2 foot cutter bars. The machines are mounted on caterpillar-tread trucks.

- 3 - 14-ton Jeffrey main haulage locomotives.
- 1 - 10-ton Jeffrey main haulage locomotives.
- 8-ton Jeffrey trolley-type secondary haulage locomotives.
- 6-ton Goodman combination-type secondary haulage locomotives.
- 16 - Joy "shuttle cars," permissible type, for gathering purposes.
- 14 - BU Joy loaders, permissible type.
- Electric drills, nonpermissible type, post-mounted.
- 14 - Pumps, gathering and lift, nonpermissible type.

Portable air compressors of the nonpermissible type are used for inflating the shuttle car tires, and large track-mounted air compressors for operating rock drills.

Joy loading conveyors, nonpermissible type.

1 - High-pressure, track-mounted, rock-dusting machine, nonpermissible.

1 - Portable-type rock-dusting machine.

Sectional automatic circuit breakers are provided.

With the exception of "shuttle cars" which are operated by storage-battery power, all equipment used in face regions, as well as locomotives, pumps, compressors, etc., operate on 250 volts direct current. Motor-

generator sets operate on a potential of 2300 volts alternating current. The power is conducted through bore holes from the surface to the underground motor-generator sets. This is a commendable practice. The feeder lines are insulated and apparently well supported on independent hangers from the trolley circuit. One million circular-mil cable is used on the main entries, and 500,000 on the panel entries. The trolley wire is No. 000,000 throughout and apparently well hung. The telephone lines are hung on insulators, usually on the opposite side from the power lines. Main power lines are extended into areas ventilated by return air currents. Power reaches the mechanical equipment through rubber-covered cable which seemingly is kept in good condition. Very few temporary taped splices were observed on any of the cables in the explosion area. It is recommended that permanent cable splices be made on the surface, preferably of the vulcanized type.

Decision 13 of the Mine Safety Board, U. S. Bureau of Mines, states:<sup>1/</sup>

“The United States Bureau of Mines recommends that when electricity is used in coal mines rated as gassy or whenever in any mine the atmosphere may become gassy:

1. “Electrical equipment shall be permissible.<sup>2/</sup>
2. “Nonpermissible equipment shall be used only in pure intake air.
3. “Electrical power shall be cut off whenever air in the workings is in a dangerous condition due to inflammable gas.”

It was observed that motor-cover plates were missing from the Joy loader at 5th south off main 7 west off main 3rd north, and that there was an absence of permissible junction boxes throughout the mine. A piece of equipment to be called “permissible” must be operated and maintained in a permissible condition at all times. Where power cables are used, they must be plugged into permissible-type junction boxes, as part of the permissible requirements. The trolley-wire cut-out switches at the mouths of all working panel entries off main 8 west off main 3rd north in the explosion area were in the “on” position at the time of the explosion. This was also true of the trolley-wire cut-out switch located on main 8 west at 5 south, even in view of the fact that a squeeze was in progress along 5 and 6 south panel entries and rooms thereof, creating the possibility of an inrush of inflammable gas momentarily. Power should be kept disconnected from all main entries, cross entries, and panel entries by means of sectional trolley and power feeder cable cut-out switches while

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<sup>1/</sup> Information Circular No. 6946, Department of the Interior, U. S. Bureau of Mines, “Recommendations of the United States Bureau of Mines on Certain Questions of Safety as of October 1, 1936.”

<sup>2/</sup> Any equipment that has successfully passed scheduled tests and is officially approved by the U. S. Bureau of Mines is termed “permissible.”

the mine or a portion of it is idle. There is always the possibility of a mine fire resulting from a short circuit, caused by a fall of roof on the trolley or power feeder cable carrying the live conductor down and against the rail. When the mine is working, the fire is usually soon discovered, and immediate steps can be taken to pull the power cut-out switch and to extinguish the fire before it has gained sufficient headway to make it difficult to control. Under certain conditions, as, for instance, doors being left open to short-circuit the air or from other causes, dangerous, undiscovered accumulations of inflammable gas might occur during the time the mine or portions of the mine are idle, and these could be ignited from the same source as previously related for mine fires if the power is left on. This is especially true where the power lines are on return air, as in this mine.

It was observed that some of the permanent pump stations were in the open. It is recommended that all permanent pump stations be housed in an incombustible structure equipped with iron doors.

The underground substation room located near the mouth of 7th west main 3rd north, containing a 300-kilowatt motor-generator set, was housed in a structure composed of concrete walls and heavy steel-plate roof supported on 6-inch steel I-beams. Iron doors were located at each end of the substation room. Dry sand and gravel are used in place of rubber mats in front of underground substation switchboards. An attendant is in charge of the underground substation while it is in operation.

The underground electrical equipment used is well maintained in other respects, and a safety inspection of all electrical equipment is made once each week by electrical and mechanical crews. Sufficient spare parts and equipment are kept available so that the operation of defective electrical equipment is not required.

### Explosives

Only permissible blasting devices and explosives are used underground. Cardox permissible blasting devices are used for breaking down coal. Du Pont permissible lump coal "C," 1 3/4 x 6", 7-oz. cartridges are used for blasting rock.

Shot firers are employed to do all drilling and shooting when the men are out of the mine. The general practice in blasting down coal is to drill three or four 3" holes to the back of the cut, which consists of one hole along each rib and one or two holes in the center. The cardox shells are placed within six inches of the back of the hole to prevent flying shells. Where cardox is used the holes are not stemmed. Permissible explosives are said to be stemmed to the collar of the hole with rock dust.

All shots are fired electrically by means of a special hardwood plug-in connection on the Edison Model P cap-lamp storage battery. The shot-firing cables, which are at least 100 feet long, appeared to be in good condition. All shots are fired singly by the shot firer. No tests for inflammable gas are made before or following the firing of the shot. As observed, the battery end of the shot-firing cable is not shunted and the shots are not fired by a permissible blasting unit. No. 6 electric detonators with 8-foot iron leg wires are used for firing permissible explosives.

Explosives are said to be transported by the supply crew into the mine on the night shift. They are brought in by an insulated explosives car and distributed to the working sections. The explosives car as seen at the mine is in a dilapidated condition and could not be considered safe. The car should be kept in good condition, completely enclosed, locked and equipped with an insulated coupling, and separated from the locomotive by two empty cars. Detonators are said to be delivered at night in an insulated car equipped with a wooden draw bar and an insulated coupling. Explosives are supposed to be stored in large, locked, wooden boxes along the ribs in crosscuts and room necks, out of line of fire, and a safe distance from the face. Electric detonators are supposed to be stored in small, locked, wooden boxes a safe distance from the explosives storage box along the rib. As observed, the practices in connection with storage of explosives and detonators underground were lax in the explosion area.

Some examples of the storing of explosives underground are as follows: Approximately 1 3/4 cases of explosives were standing in the open at a crosscut about 30 feet outby the loading boom on main 8 west off main 3rd north near 7 and 8 north. The lid of the upper case was off, leaving the loose explosives in the open. About 20 feet outby from these explosives was a barrel of oil. Another example - 40 electric detonators were lying loose in an unlocked box next to the rib, approximately six feet in front of a Joy loading machine. This machine, which had been used in cleaning up the air course, was located about 100 feet outby 7 north along main 9 west off main 3rd north. The detonators were deteriorated, thus indicating that they had been stored for a considerable length of time. Another example - Located between 5 and 6 north off main 8 west off main 3rd north in a crosscut opposite room No. 1 near the first crossover were four pasteboard cartons containing approximately 200 electric detonators. These were in an unlocked detonator-storage box, which was separated a distance of eight feet from a locked explosives storage box. Eight cartridges of loose permissible explosives were found in No. 6 room neck 5 north off main 8 west off main 3rd north. During the reventilation of 3 and 4 south off main 7 west off main 3rd north and workings thereof, five loose cartridges of badly deteriorated, 40 percent straight dynamite were found lying at the 8th crosscut inby between 3 and 4 south. In the center and near the mouth of No. 16 room neck off 3 south off main

7 west off main 3rd north, a large, wooden, locked explosives storage box apparently containing several cases of explosives was found. Approximately 100 loose, unfired cardox shells, an amount sufficient for several days, were found along 4 south. It is quite evident from the above mentioned examples that the underground storage of explosives is improperly supervised. When more than one day's supply is taken underground and improperly stored, the danger of explosives accidents is always present.

## GENERAL SAFETY CONDITIONS

### First-Aid and Mine Rescue

All employees of this mine received the standard Bureau of Mines' first-aid training course during the month of March, 1938. No first-aid training has been conducted since that date. The company, however, has always been desirous that its men be trained whenever such training was available.

Some mine rescue training has in the past been given to a few selected employees from this mine by the State of Illinois Department of Mines and Minerals.

A fully equipped first-aid receiving room is maintained on the surface in the main office building. This receiving room is located a short distance from the mine entrance. In addition, four complete first-aid units are kept on the surface.

No regular underground first-aid stations are maintained; however, first-aid materials are furnished and kept underground, usually near the "shuttle car" loading booms. There are nine complete first-aid units with blankets and stretchers at various underground locations.

No oxygen-breathing apparatus, all-service gas masks, or self-rescue respirators are maintained at this mine. The State Mine Rescue Station equipped with breathing apparatus, gas masks, and other rescue apparatus, is located at Eldorado, Illinois, about 10 miles distant, and is available in case of emergency. Other fully equipped State Mine Rescue Stations are located at the near-by towns of Benton, Herrin, and DuQuion, Illinois. The State Mine Rescue Stations are in charge of paid superintendents, who are held directly responsible for the condition of the equipment at all times. The station superintendents conduct mine rescue training one day each week for a paid team made up of selected employees from nearby mines. These men are always available in case of trouble.

### Safety Organization

The Peabody Coal Company employs one safety engineer for all its operating mines. Two "safety first" men are employed at mine No. 47. Apparently, the main duties of these men consist of taking air measurements and examining old workings, live workings, and return airways throughout the mine. No regular safety inspector is employed by the company at this mine. No safety meetings of any kind are held at the present time. The local U.M.W.A. union has a safety committee comprising six men. The management will cooperate fully in any safety program that the men desire; however, the men must show an interest or willingness on their part first.

### Supervision and Discipline

According to the management, eight section foremen are employed to supervise the work on the active producing sections and visit each place from two to three times per shift. Enforcement of safety rules is carried out by a "lay-off" or discharge, depending on the seriousness of the offense.

### Fire Fighting

No fire-fighting organization is maintained, nor are fire drills held. Fire-fighting equipment on the surface consists of eight 2-inch fire hydrants, two of which are located at the tipple, and two reels of 2-inch hose, 200 feet long.

The underground fire-fighting equipment consists of 15 soda-acid, 2-gallon fire extinguishers located at the mechanical loading booms, and 10 carbon tetrachloride, 1-quart extinguishers located at substations and around other electrical equipment. In addition, a supply of rock dust in bags is kept around the mechanical loading booms and other strategic points.

### Commendable Safety Practices

Many excellent safety practices are followed at the No. 47 mine of the Peabody Coal Company. The following are commendable practices observed or brought to the attention of the writer:

#### General:

1. All underground employees wear hard hats and hard-toed shoes.
2. Permissible electrical cap lamps are used by all mine employees, and permissible flame safety lamps are used for gas testing.

3. No smoking, smokers' articles, matches, igniters, or open lights are permitted in the mine.

4. Complete first-aid units with blankets and stretchers are kept available at each underground loading point.

#### Haulage:

1. Locomotives are equipped with headlights.
2. Trip lights are used on the rear ends of all trips.
3. Flying switches and coupling of moving cars are prohibited.
4. Good switch throws are provided.
5. Trolley wire is well hung.

#### Mining and Electricity:

1. Permissible blasting devices and explosives, fired electrically, are used.

2. All blasting is done by shot firers who drill and shoot all holes when men are out of the mine.

3. Motor-generator rooms are completely enclosed by incombustible material.

4. Power is conducted from the outside to the underground motor-generator sets through bore holes located at the substation.

5. Power-feeder lines are insulated and well supported on separate hangers from the trolley wire.

6. Sectional automatic circuit breakers are installed.

7. Telephones are well located throughout the mine.

#### Ventilation:

1. Concrete block stoppings well plastered and hitched into the ribs are used extensively along main and cross entries.

2. The main ventilating fan is run continuously and is reversible.

3. The main ventilating fan is provided with auxiliary power, explosion doors, recording gage, and signal-light warning device to show when the fan stops.

4. Pre-shift examination for methane gas is made by certified mine examiners before men are allowed to enter the mine.

5. The rule requiring a permanent stopping to replace the temporary brattice cloth after it has been up one day in the next to the last crosscut of the development entries.

6. A complete system of ventilation and gas reports is in use.

7. The employment of two "safety first" men to examine old workings and return air courses, take air measurements, and check the mine examiners.

#### PREVIOUS EXPLOSIONS IN THIS OR NEAR-BY MINES

A gas explosion occurred in this mine at about 12:30 p.m. on August 31, 1921, resulting in the death of 11 men, all of whom apparently died from carbon monoxide gas poisoning. At that time the mine was known as the Harco mine of the Harrisburg Colliery Company.

The 11th and 12th north entries had been driven up to within about 200 feet of the 3rd east north entry and stopped, and had been standing since about the first of May. A pair of entries had then been started from the 3rd east north towards them, and on August 31 lacked only about five feet of holing through into them. About noon, one of the men working in the entry approaching the 11th north drilled a hole through the intervening block of coal. He stated that after removing the drill from the hole he felt the air coming through. He accidentally brought his open-flame cap lamp in contact with this air, and in so doing, ignited the gas which in turn ignited the gas standing in the 11th and 12th north entries, thus causing the explosion.

#### MINE CONDITIONS IMMEDIATELY PRIOR TO THE DISASTER

The weather was alternately cloudy and clear, and no sudden drop in barometric pressure had occurred prior to the explosion. The barometric pressure reading was 30.10 inches, which is above normal, at the time of the explosion. The mine was operating normally and the main ventilating fan had been running continuously. The mine examiner's report for the day previous showed no standing gas at any point in the section of the mine involved in the explosion.

## STORY OF EXPLOSION AND RECOVERY OPERATIONS

No indication that an explosion had occurred was observed on the outside of the mine. The first evidence that something was wrong with the power inside was discovered by the third engineer, who tried to put the circuit breaker back in at 3:35 a.m., Sunday, December 28, 1941. Mr. Albert Malone, assistant mine foreman, was notified of the trouble, and he in turn notified Mr. H. Dempsey, night boss, who at that time was changing his clothes in the bath house. Mr. Dempsey sent Mr. Malone below to investigate the power trouble. Malone started down in the cage at 3:50 a.m. Upon reaching the shaft bottom, he proceeded to various trolley and power-feed line switches located at different points near the shaft bottom and started pulling them out to locate the trouble. When Malone reached the motor pit, he found Claude M. Phelps and Frank Dietz, shot firers, who had walked from the mouth of 4th south off 8th east off main 1st north. They were in an exhausted condition from the effects of breathing the return air from the mine explosion. Malone assisted Phelps and Dietz to the surface. The air was so bad in the hoisting shaft by then that it was impossible to return without respiratory protection.

There were 14 men underground at the time of the explosion, of whom 8 were killed by violence and 6 escaped. Four of the six who escaped were mine examiners making their examinations in other parts of the mine. The mine examiners were notified by telephone that an explosion had occurred, and they were rescued by short-circuiting the air near the shaft bottom. The other two who escaped were the shot firers.

Company and State Mine Inspection Department officials were notified as soon as possible that a mine explosion had occurred. Edgar Vaughn, mine manager, arrived at the mine at about 4:30 a.m.; George Bagwell, district state mine inspector, arrived at about 4:45 a.m.; W. M. Elders, mine superintendent, arrived at about 5:00 a.m.; the Eldorado, Illinois state mine rescue team under the supervision of John Taylor, station superintendent, arrived at about 6:40 a.m.; D. F. McElhattan, safety engineer, and Frank White, division engineer, arrived at 7:50 a.m.

Following the rescue of the four examiners by short-circuiting the air around the shaft bottom, the air was returned to its normal course of ventilation to dilute the "afterdamp" in main 2nd north, haulage road, as much as possible. After the Eldorado mine rescue team with self-contained oxygen breathing apparatus and equipment arrived, it was decided to proceed up main 2nd north haulage road on return air as far as possible and establish a fresh air base. Mr. George Bagwell, district state mine inspector, took charge of the rescue and recovery work at this time. State officials, Bagwell and Taylor, and company officials, Elders

and Vaughn, and face officials, accompanied by the rescue team proceeded up main 2nd north as far as the mouth of 8th east. They were then forced to return to the mouth of 5th east because of "afterdamp" and no respiratory protection except for the rescue team. Two wood stoppings were blown out at the mouth of 5th and 6th east causing the air to short-circuit at this point. McElhattan and White entered the mine at 8:00 a.m., met the men and rescue team at the mouth of 5th east, and assisted with the recovery work. The two blown-out stoppings were temporarily repaired, causing the intake air to flow as far as the mouth of 8th east off main 1st north. Temporary repairs at this point consisted of erecting one brattice-cloth stopping, covering the manhole door opening, and closing the main door. Following the temporary repairs, the intake air coursed through main 1st north air course to the face, returning down main 2nd and 3rd north entries, short-circuiting at the blown-open trap door located on main 2nd north at 8th west.

The second fresh air base was established at the mouth of 8th east off main 1st north. The Eldorado team equipped with oxygen breathing apparatus explored up main 2nd north to the mouth of 9th west off main 3rd west, locating seven bodies by 11:30 a.m. About this time apparatus teams and station superintendents from Benton and DuQuoin, Illinois, joined in the recovery work.

Mr. R. M. Medill, director, Department of Mines and Minerals, State of Illinois, arrived during the forenoon and assumed charge of recovery operations.

The Bureau of Mines was first informed that a mine explosion had occurred by a radio news report about 11:30 a.m., December 28, 1941, Mr. C. A. Herbert, supervising engineer of the Vincennes Station, verified the news report, and called Messrs. L. H. McGuire, J. C. Reardon, W. O. West, and E. J. Marron of the Safety Division to proceed to the disaster as quickly as possible with the Bureau of Mines' rescue truck and equipment.

Upon arrival at the mine at 3:15 p.m., Mr. McGuire immediately notified Mr. R. M. Medill, who was in charge of all recovery work, that the Bureau of Mines desired to assist in any way possible with the rescue and recovery work. Mr. Medill stated that the work was so far advanced that the services of the Bureau men were not needed and that because the haulageways were on return air it was not advisable for anyone to go inside until after the rescue work was completed. The main activities of the Bureau personnel at this time consisted of obtaining data in regard to the explosion until the rescue work was completed.

The first four bodies were brought to the surface at 4:00 p.m., the next three at 4:45 p.m., and the last, that of the mine examiner, Harold Holden, was found at about 9:15 p.m. and brought to the surface at 10:50 p.m. All crews and men came to the outside when the last body was brought out.

The third fresh air base was established on main 2nd north at the mouth of 9th west. Air was advanced up 9th west to the mouth of 4th north by temporarily repairing blown-out stoppings.

From the mouth of 4th north the apparatus crews explored up 8th west to 5th south where the body of Harold Holden, mine examiner, was located and brought to the outside.

After all bodies were recovered, it was decided to postpone the investigation until ventilation was completely restored.

The investigation by the Bureau of Mines was conducted from January 1 to 7, 1942. Those from the Bureau of Mines conducting the investigation consisted of Messrs. T. H. O'Neal and L. W. Kelly of the Coal Mine Inspection Division, and L. H. McGuire of the Safety Division.

#### INVESTIGATION OF CAUSE OF EXPLOSION

An investigation during the final recovery work to determine the cause of the explosion was conducted by the following investigators: D. F. McElhattan, safety engineer, and Frank White, division engineer, of the Peabody Coal Company; Joseph Marchesi, assistant director, George Bagwell and Robert Weir, district mine inspectors, of the Illinois Department of Mines and Minerals; T. H. O'Neal, L. W. Kelly, and L. H. McGuire, of the Bureau of Mines.

The evidence of force disclosed the fact that the explosion came out of 5th and 6th south off 7th west off main 3rd north and that 5th south showed the greatest amount of violence; moreover, Bureau of Mines' and company investigators agreed that the explosion was due to the ignition, by electricity, of a body of explosive gas liberated from these entries and rooms thereof. The 5th and 6th south panel section was in a "squeeze" prior to the explosion. It is more or less an accepted fact in this field that when the main roof of No. 5 coal bed breaks there is likely to be an inrush of inflammable gas. For this reason, the electrical crew under McCoy Cobb, deceased, had been employed to remove all equipment from this panel section during the night. Because of blasting time they were supposed to have been at the bottom of the shaft at 3:00 a.m., or approximately 25 minutes before the explosion occurred. As it was, they were caught by the explosion on their way out to the shaft bottom from the

mouth of 8th west off main 2nd north entry. After the equipment was removed from 5th and 6th south, the original plan of the company had been to erect permanent seals immediately at the mouth of these entries. This has been done since, prior to resuming mining operations. John Richardson, examiner, was employed to stay with the electrical crew until they came out, according to one statement made by H. Dempsey, night boss. However, according to Richardson's statement he made his last examination round of 5th and 6th south panel section at 2:00 a.m. and left for the outside at 2:15 a.m., or approximately one hour ahead of the electrical crew. Richardson states that no gas could be detected up to the time he left. Joe Green, foreman, who also was working with a crew of men on 5th and 6th south made several tests for inflammable gas during the night down to No. 14 room, and he could not detect any gas. He left with his crew for the outside at the same time as Richardson. The incoming day examiner, Harold Holden, deceased, riding a locomotive, met Green, Richardson, and crew going out at 3 and 4 south at about 2:20 a.m. Holden placed his locomotive on 8 west straight-out track by 3 north switch to allow the crew to pass. Date marks made it evident that Holden had examined 1st and 2nd north and 1st and 2nd south seals. His next examination in 3rd and 4th south panel entries and rooms thereof would have taken at least an hour. Chalk date marks at the faces of these rooms found following the explosion prove this fact. Holden evidently had just got on his locomotive after examining 3rd and 4th south at about the time the electrical crew with locomotives and battery trucks going out passed him, because he was caught on 8th west main 3rd north at 5th south while the electrical crew was caught by the explosion from the mouth of 8th west outby along main 2nd north.

#### Details of Examiner's Locomotive

Harold Holden, examiner, was operating a 6-ton Jeffrey trolley locomotive, No. 5. By the position of the locomotive it is evident that Holden stopped to throw the 5th south track switch before proceeding approximately 25 feet down 8th west straight where the locomotive stopped. The roadway was practically flat. The distance inby the point of the track switch to the trolley-wire frog was six feet. The distance inby the trolley-wire frog to the wheel of the trolley wheel in its running position was about 10 feet, 3 inches. The trolley pole had been placed or had jumped off the trolley wire frog and was against the roof between the trolley wire leading into 5th south and 8th west. The motor controller was in the "off" position. The trolley pole and wheel were not damaged and were set to go west. The locomotive brakes were set. The examiner's permissible flame-safety lamp was hanging on the brake-controller rod. This lamp was not defective. Holden's body was found between the motor and the north rib of 8th west main entry. He was badly burned about the face and hands and also from the waist down. Holden's watch, a Westclox

Pocket Ben, was still running. The sketch in the Appendix shows the details of the locomotive and the surrounding material evidence.

#### Details of Trolley Wire Leading into 5th South Off 8th West and Surrounding Conditions

The knife switch on the trolley wire to 5th south was found partly closed. Therefore, there was power into 5th south at the time of the explosion. Upon questioning various men who worked in this section immediately prior to the explosion, and whose statements appear later in this report, it would appear that the trolley wire was cut between No. 2 and No. 3 room or about 150 to 200 feet inby the mouth of 5th south and the feeder cable was disconnected at the first crossover track from 5th to 6th south or approximately 100 feet inby the mouth of 5th south. There was no cut-out switch for this feeder cable at the mouth of 5th south entry, but, since there were no falls on the cable, this eliminated the cable as an ignition source. At the time of the investigation, January 1, 1942, an explosive mixture of gas existed about 20 feet inby the first crossover track in both 5th and 6th south entries with 16,000 cubic feet of air per minute passing through the first crossover. The quantity of methane being liberated from both 5th and 6th south entries at this time was 94 cubic feet per minute, or 5,640 cubic feet per hour. According to information received from the state mine inspectors and company officials, it is evident that a much greater quantity of inflammable gas was being liberated previous to January 1. It was noted that the trolley wire was against the rail under small falls about 30 feet inby from the first crossover on 5th south, and that heavy rock falls were inby from the smaller falls. From the evidence, it would appear that the smaller falls inby from the first crossover on 5th south occurred after the explosion, and this is probably true also of most of the larger falls farther in. It was inadvisable to explore farther because the roof was working on both entries and explosive gas was present.

#### Forces

The forces produced by the explosion were rather small for an explosion traveling as far as this one. The forces definitely showed that they radiated from 5th and 6th south off 7th west off main 3rd north. The detailed map of the explosion area (in the Appendix) shows the direction and extent of forces, location of bodies, etc.

#### Evidence of Heat and Flame

Evidence of flame was found during the investigation at the following principal points:

8th west at 5th south - burnt clothing of Harold Holden, examiner.

3rd south in the vicinity of the loading boom at the 21st crosscut between 3rd and 4th south - outer layer of paper on bagged rock dust burned, records burned, insulation of feeder cable charred, soot present along the ribs and roof of both entries.

8th west at 1st and 2nd north - post scorched full length and scattered coke on outby side of post.

Main 2nd north at 8th west - charred telephone receiver.

7th west off main 3rd north - commutator blisters on small motor outby motor-generator room.

The exact point that the flame died out along main 2nd north outby 7th west was difficult to determine. By close examination of the ribs and insulation of the power-feeder cable, it would appear that the flame stopped about halfway between 7th west and 9th east. All seven bodies located along 7th north were reported burned. The body of Harold Smith located approximately 150 feet inby from 9th east on main 2nd north, was, according to the statements of the undertaker who handled the body, blistered about the hands and face from the intense heat, but his clothing was not burned. The attached maps of the explosion area show details in regard to coking, extent of flame, etc.

#### Property Damage

The property damage was small. The principal damage to the equipment consisted of a few broken trolley poles, one damaged pit car, steel fire doors of motor-generator room blown off hinges, parts and equipment scattered and damaged to some extent on 7th and 8th west at 3rd, 4th, 5th, and 6th south. Doors and wings and headers of doors and stoppings blown out (shown on map in Appendix) will have to be repaired. The trolley wire, feeder lines, and telephone wires were down in only a few places as shown on the map. The track was not damaged. The damage could be repaired and work resumed in the affected section in a few days.

#### Summary of Evidence as to Cause, Origin, and Propagation

The explosion was probably due to the ignition by electrical arcs or sparks of an inrush of explosive gas in 5th and 6th south entries and rooms thereof, off 7th west off main 3rd north. The origin was probably one of the following two places: A short distance inby past the first cross-over track on 5th south due to an electrical short circuit caused by a roof fall knocking the trolley wire down and against the rail; the other on 8th west at 5th south by arcs or sparks from the mine examiner's trolley locomotive.

### Details of Origin if Due to Short Circuit

According to reports, a watch recovered from the body of one of the men on main 3rd north stopped at 3:23 a.m. C. M. Phelps shot firer, states that he was at 4th south door on 8th east off main 1st north at 3:30 a.m. trying to "ring" the shaft bottom to ascertain whether the electricians were out so that he could shoot. While he was at the telephone the explosion occurred. This would apparently set the time between 3:23 and 3:30 a.m., December 28. The motor-generator set at 7th west off main 3rd north serving the section where the explosion occurred was shut down at about 2:00 a.m. when the attendant left for the outside. The sectional circuit breaker located on 8th west at 4th north off main 3rd north had not been connected; therefore, when a short circuit occurred on this section, the main circuit breaker on the outside of the mine would "kick out." Due to the distance from the outside to 5th south it is very doubtful whether a momentary short circuit caused by a small roof fall knocking the trolley wire against the rail and momentarily releasing it (which could happen under some circumstances) would be sufficient to knock the circuit breaker or show up on the voltmeter chart. The short flash, if 1/10 of a second or longer, would be sufficient to ignite an explosive mixture of gas. It is understood that at 3:35 a.m. the third engineer tried to put back the main circuit breaker, which probably "jumped out" as a result of the explosion and a sustained short circuit.

### Details of Origin if Due to Examiner's Locomotive

The conditions surrounding the trolley locomotive operated by the mine examiner, Harold Holden, located on 8th west at 5th south are as follows; the trolley pole was against the roof and was undamaged; the pole was between the trolley wire leading into 5th south and 8th west, indicating that it was either placed there by the examiner or had jumped off the trolley wire frog and was not moved by the force of the explosion; the hand brake was set; the controller was in the off position, and the permissible flame safety lamp hanging on the brake rod was found to be properly assembled with no defective parts. It is assumed that the ignition took place as the trolley wheel passed through the trolley-wire frog. It would appear at first that the examiner would have insufficient time to remove his trolley pole, turn the controller in the off position, set the hand brakes, and get between the locomotive and rib before the explosion caught him. On the other hand, it is likely that the gas-air mixture was at the lower explosive point and close to the roof, having come out of 5th and 6th south into the 7th and 8th return air entries shortly after the electrical crew left for the outside. Upon ignition the flame probably traveled slowly back into 5th and 6th south, perhaps several seconds before the "back lash" of the explosion coming out of these entries caught the examiner. He probably had his hand brake set when he threw the track switch at 5th

south, and possibly he intended to go only a short distance inby on 8th west track before starting his examination on foot. Upon getting back into his locomotive, he probably released the hand brake turned the controller "on" several points to give the locomotive a quick start, then turned the controller nearly off and started to set the hand brake by spinning the wheel. The distance from the points of the track switch to the trolley-wire frog is six feet. The trolley wheel passing through the frog would pass over two points, probably causing large arcs. At this point the trolley wheel may have jumped off the frog of wire against the roof. If the arcs caused by the trolley wheel passing through the frog ignited explosive gas, the motorman probably would have had time to finish setting his brake, turn the controller off, and jump in the clear between the locomotive and rib. The time of warning would probably have been much longer for the examiner than for the electrical crew on main 2nd north riding out on the four locomotives. The controllers on all of these locomotives were in the "off" position. One of these men was against the rib in a crouched position with his face down and his arms and hands protecting his head and face. In order for the trolley-wire short-circuit arc or sparks to have ignited the explosive gas on 5th south, as previously discussed, this entry would have had to be practically full of an explosive gas mixture as far as No. 2 or No. 3 room where the trolley wire was cut, prior to the explosion. The arcs from the trolley wire against the rail are on the entry floor. The inrush of methane was from the roof, and not from the floor. If enough inflammable gas were present in the vicinity of No. 2 or No. 3 room to have been ignited by a short circuit caused by a roof fall knocking the trolley wire against the rail, it would have been ignited by the locomotives of the electrical crew as they came out of 5th south. The position of the locomotives following the explosion, shows that the incoming examiner, Harold Holden, could not have been more than two or three minutes behind the electrical crew at 5th south. One of the electrical crew closed the door in the first cross-over between 5th and 6th south as the crew came out so that any accumulation of explosive gas prior to or at this time would have come directly out of 5th south and outby along 7th and 8th west. The examiner's locomotive on 8th west at 5th south is the most likely point of origin.

The forces indicate that the explosion came out of 5th and 6th south with considerable velocity but quickly expanded into 5th and 6th north and inby along 7th and 8th west entries where they soon died out. However, the explosion traveled fairly slowly at first outby along 7th and 8th west from 5th south but picking up speed as it approached 3rd and 4th north and south entries where it suddenly expanded into these panel entries. The explosion soon died out in 3rd and 4th north, indicating only expansion; however, 3rd and 4th south indicated both expansion and propagation by the presence of flame, finally dying out inby the 21st crosscut. The explosion after passing the 3rd and 4th panel entries outby, again

picked up momentum traveling along the 7th and 8th west entries. Propagation was due to coal dust as shown by scattered particles of coke on the outby side of the pine post on 8th west at 1st north. Upon reaching main 2nd and 3rd north, expansion inby and outby along main 2nd and 3rd north occurred to some extent, but the presence of a sufficient amount of rock dust and inert matter in suspension ahead of the flame was the principal cause of stopping the explosion.

Statements of survivors and others taken by T. H. O'Neal and J. W. Kelly, Federal coal mine inspectors, are contained in the Appendix of this report.

#### Probable Cause of Explosion in the Judgment of the Bureau Investigators

After carefully considering observations made during part of the recovery operations, evidence and information obtained during the investigation, the results of air and dust samples collected in the mine, direction of forces, and the careful weighing of information and statements of survivors and others, the Bureau investigators are of the opinion that an inrush of explosive gas occurred in 5th and 6th south entries and rooms thereof, off 7th west off main 3rd north during the night of December 27, 1941. This inrush of explosive gas was caused by the main roof over No. 5 coal bed breaking and releasing the gas during a "squeeze" that had been in progress for a considerable length of time prior to the explosion. From statements of the mine examiner, John Richardson, and others, it would appear that this inrush of explosive gas occurred after 2:00 a.m. on the morning of December 28. It is further believed that explosive gas was ignited by electrical arcs or sparks and that this ignition could have occurred from two sources. The first source of ignition could have been a roof fall on the trolley wire inby the first crossover track on 5th south bringing the trolley wire down and against the rail causing a short circuit. The second source could have been the trolley locomotive operated by Harold Holden, mine examiner, found on 8th west at 5th south. In comparing the two sources of ignition and the circumstances surrounding them, it would appear that the mine examiner's trolley locomotive was more likely to have been responsible for the ignition.

#### Lessons to be Learned from this Explosion

In the opinion of the writer there are several outstanding lessons to be learned from this explosion, as follows:

1. A system of mining should be adopted in which more roof support is left to prevent the possibility of a squeeze developing, resulting in a possible inrush of inflammable gas.

2. When unusual conditions such as "squeezes" are encountered and it is a known fact that an outburst of explosive gas can be expected at any time, it is highly important that the examiner and the mine foreman remain on duty as long as it is necessary to leave power on in the vicinity of where men are working.

3. The hazard of leaving power sectional switches "on" in panel and main entries, while the mine or portions of the mine are idle, is shown.

4. The practice of mine examiners and others riding on trolley locomotives in return air into active working air splits is definitely dangerous.

5. A system of ventilation in which all haulageways and power circuits are on intake air instead of return air would have prevented this explosion.

6. Coal dust should be rendered non-explosive by the liberal use of rock dust.

7. The dust at the face should be allayed by the use of water.

8. The practice of using doors along main entries should be eliminated as much as possible by the use of overcasts or undercasts. Where main ventilating doors are used they should be constructed in pairs in order to form an air lock to prevent short-circuiting of the air. Doors should not be equipped with latches so they may be latched open.

### Recommendations

The following recommendations are made with the desire of being helpful and of reducing the explosion hazards at this mine; furthermore, it is believed that these recommendations could be put into effect without undue departure from the present plan of mining and without undue expenditure of money.

### Ventilation

1. The main ventilating fan should run exhausting so as to permit the intake air to follow the main haulageways and traveling ways into the mine.

2. Where a three-entry system is employed the middle or haulage entry should be on intake air and the outside entries on return air.

3. Each set of cross entries or panel headings should be ventilated on a separate air split. All room panels should be worked so that the air current used goes directly into the main return.

4. Ventilating doors should open against the air, and should be tight and so hung as to be self-closing. Where possible, these doors should be hung in pairs to form an air lock, and every effort should be made to prevent their being left open either by the haulage crews or others. Latches and other devices for holding doors open should be eliminated.

5. The intake air should first be coursed to live workings before passing through abandoned and worked-out areas.

6. Abandoned or worked-out sections of the mine that cannot be thoroughly ventilated and inspected should be sealed with tight incombustible stoppings.

7. The working panel should be completely ventilated until it is permanently sealed.

8. The use of masonry stoppings along the main entries is a commendable practice and should be continued.

9. Mining machine operators should be equipped with permissible flame safety lamps to test for gas before entering the place, while cutting, and at the completion of the cut.

10. All men who carry flame safety lamps and are not certified, should be trained in the care and use of flame safety lamps and the detection of gas.

#### Allaying Coal Dust

1. Water should be used on mining machines while cutting, at and near the face region, before and after blasting, at mechanical loading and unloading points, and on empty and loaded cars.

2. The coal faces and working places 40 feet therefrom should be kept free of coal dust by the use of water.

3. The coal cars and "shuttle cars" should be loaded so as to prevent the coal from falling off the cars along haulage roads and in rooms and being ground to dust.

4. Accumulations of spilled coal and coal dust along rooms and trackless entries where the "shuttle cars" operate should be wetted and loaded out.

5. Accumulations of spilled coal and coal dust along haulage roads should be wetted down if possible, and promptly cleaned up and loaded out.

## Rock-Dusting

1. Rock dust should be applied to the surfaces of all mine openings, haulageways, airways, entries, rooms, and crosscuts, to within at least 40 feet of the working faces if water is used. If water is not used at working places, rock dust should be maintained to within one "cut" of the face.

2. The rock dust should be applied in such quantities and at frequent enough intervals to maintain an incombustible content of not less than 65 percent in all dust that will pass through a 20-mesh to the inch sieve.

## Explosives and Blasting

1. The present practice of using permissible explosives, fired electrically by shot firers when all men are out of the mine is commendable.

2. Blasting practices should be improved so as to retain the permissibility of explosives and blasting devices used in this mine. Requirements in addition to those now in effect are:

a. Shots shall be fired with a permissible battery or other permissible firing device.

b. Each charge shall be in a hole properly drilled and stemmed to the collar of the hole with incombustible material.

c. Before and following each shot in gassy and slightly gassy coal mines, examination for gas shall be made with a "permissible" flame safety lamp or permissible equivalent, and

d. If more than 1 1/2 percent of inflammable gas is found, the place shall be considered to be in a hazardous condition, and before another shot is fired the gas shall be properly diluted and rendered harmless by means of proper ventilation.

3. Explosives are hauled into the mine at night and are distributed to the various working sections. The insulated explosives car should be maintained in good condition, completely enclosed, locked, and preferably separated from the locomotive by two empty cars. If explosives are hauled from one part of the mine to another on a mine locomotive by the shot firer, this practice should be stopped.

4. The amount of explosives taken into the mine should be limited so far as possible to one day's supply.

5. Explosives underground should be kept in a strong insulated wood box with lid and padlock. The explosives box should be kept locked at all times. The box should be located in a safe place as far as practicable from power lines or cables. Detonators are taken into the mine at night, according to reports, separately from the explosives in an enclosed insulated car with insulated coupling. This is a commendable practice; however, these detonators should be stored in a separate place, at least 30 feet from the explosives, and preferably in a niche cut in the rib.

6. Explosives should be carried to the face from the storage box in a waterproof insulated container.

7. The detonator should be inserted in the explosives at the face at the time the explosives are inserted in the shot hole. The leg wires should remain shorted until ready to connect with the shooting cable.

8. Shot-firing cables should be at least 100 feet long, and the battery end of the cable should be kept "shorted" at all times except when a shot is being fired.

9. The shot firers should keep a record of all explosives and detonators used, misfires, and the amount of unused explosives. Unused detonators should be returned to the surface at the end of the shift.

### Electricity

1. The Bureau of Mines recommends that all underground electrical equipment not used in strictly fresh intake air be of the permissible type. The use of permissible-type mechanical loaders and "shuttle cars" is to be commended; however, all permissible equipment should at all times be operated and maintained in a permissible manner. It is suggested that any underground electrical equipment purchased in the future be of the permissible type.

2. Trolley wires should be guarded whenever they are less than 6 1/2 feet above the rail, particularly at points where men are required to pass under them.

3. Trolley wires passing through doors should be shielded.

4. All portable and semiportable electrically operated equipment should be properly grounded insofar as possible.

5. Permanent pumping station rooms should be constructed of fireproof material and equipped with an iron door.

6. Underground power substations should be equipped with doors that will close automatically in case of fire.

7. All power lines should be equipped with sectional cut-out switches. All sectional power cut-out switches should be pulled during the time the mine or portions of the mine are idle.

8. Cables of mining machines, drills, and other electrical equipment should be kept off the ground as much as possible.

9. All trailing cables on which temporary splices have been made should be replaced as soon as possible and sent to the outside where a permanent splice should be made and vulcanized.

10. Automatic re-closing sectional switches should be connected as soon as possible for each active section and all equipment should be properly fused.

11. Tracks should be kept well bonded at all times. Cross bonds should also be installed at frequent intervals.

#### General

1. A system of mining should be adopted to eliminate mine squeezes. Shorter rooms and larger pillars combined with crosscuts at standard intervals should be considered.

2. Mine examiners should not be permitted to operate mine locomotives while making pre-shift examinations.

3. The practice of promiscuous use of mine locomotives by officials and men between shifts and on idle days should be reduced to a minimum.

4. Men should not be permitted to sit on the trolley-wire side while riding in cars.

5. Oil should be taken underground in tight, enclosed containers, not more than one day's supply at a time. When one or more drums of oil are stored they should be kept in an enclosed fireproof room.

6. Inflammable material should not be allowed to accumulate.

7. A systematic search for matches, igniters, and smokers' articles should be made at frequent intervals. This search should take place on the surface and should include all miners and officials.

8. It is suggested that regular monthly safety meetings be held, these meetings to include both men and officials. It is believed that meetings of this kind will bring about a closer relationship between men and management in the promotion of safety and accident prevention.

9. All employees should be given a course in first-aid training whenever such training is available.

10. Six All-Service gas masks (or equivalent) with extra canisters should be maintained at the mine. Also a selected crew should be trained in the use of these gas masks and in the use and care of oxygen breathing apparatus whenever such training is available.

This mine was not visited during normal operation and doubtless some of the foregoing recommendations are already in force; if so, commendations on such practices are extended to the management.

#### ACKNOWLEDGMENTS

Acknowledgment is made of the courtesies shown the representatives of the Bureau of Mines by the officials of the Peabody Coal Company, particularly William Elders, mine superintendent of the No. 47 mine, D. F. McElhattan, safety engineer, and Frank White, division engineer, of the Peabody Coal Company. All information requested from these and other company officials in connection with this investigation was given without reservation. The cooperation of the Illinois State Department of Mines and Minerals, particularly of R. M. Medill, director, Joseph Marchesi, assistant director, George Bagwell, mine inspector, Robert Weir, mine inspector, and various rescue station superintendents, is also hereby gratefully acknowledged.

Representatives of the United Mine Workers of America were also very cooperative in furnishing any and all information requested.

Respectfully submitted,

L. H. McGuire  
Associate Mining Engineer

Approved:

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D. Harrington, Chief,  
Health & Safety Branch.  
8731

APPENDIX

## STATEMENTS OF WITNESSES

Questioned by Leon W. Kelly, Federal Coal Mine Inspector

### Statement of:

C. M. Phelps, shot firer - "At 3:30 a.m., December 28th, I was trying to ring the bottom to see if the electricians were out yet so I could shoot. I was at the 4th south telephone when I heard something 'whish' in and the doors banged and smoke and dust came in. My buddy and I started out. We came to the 1st north door and it was closed. We went through to the main haulage door and the smoke was bad. We went through the door and the smoke and dust were so bad that we couldn't see the rail with our lights. We took our buckets from there on account of the water. My buddy fell down over some timbers and I helped him up and we started out. We walked and then crawled and soaked our shirts with water and crawled until we came to the motor pit, where the air was better. We had been there only a minute when Albert Malone came and helped us up to the top. All the lights went down and stayed red at the time of the explosion, but they never did go out. We were both all in when we got to the top."

Orville Stewart, Examiner - "I went to work Saturday, December 27th, at 3:00 p.m., and worked overtime. I worked until 11:20 p.m. in 3rd and 4th south with a crew of workmen. After 11:30 we were called to 5th south to go to the loader head, and stayed there until 2:15 and completed our work. The loader head was at No. 9 or No. 10 room. I was relieved of my duties as examiner when I went to work overtime at 10:30 p.m. My regular work as examiner generally ended at 6:00 p.m., and we got paid for three hours at the examiner's rate, which was \$8.00. They always gave us the other four hours at other work, which was never less than the motorman's rate, \$7.40, and up to \$9.80, the machineman's rate. Richardson was in charge of the lamp. I left at 2:15 a.m. and Richardson left soon after. We had a motor in as far as No. 9 room as late as 1:30 a.m. I didn't hear of any gas in the 5th and 6th south that night."

Clyde Saunders - "We started to clean up rock in the 4th south and went up to 5th south at 11:30 p.m. Went to 5th south to move rock on the passing track from the load head at No. 9 or No. 10 room to the mouth of the entry. A fall had broken the trolley wire, and the wire was left under the fall at No. 5 room." Question - "Did you hear any discussion between Green and the examiners regarding conditions?" Answer - "Green said he heard Dempsey ask Richardson how things were O.K. Richardson told Green at 2:15 a.m. that everything was clear. When we left, we had two motors, and maybe three, and we brought them out. My motor was in the switch of 5th south and we came to the bottom with three motors."

Henry Wade, motorman - "I connected up with the power of No. 3 room 5th south. When I left I heard the boss say to cut the wire at the crossover switch. I didn't hear any conversation regarding the conditions of the place. I brought the loader head out and quit. I left 5th and 6th south at 2:30 a.m. and met Holden at the parting."

Joe Green, assistant mine foreman - "I was in charge of four men working in 3rd and 4th south, and we went to 5th south at 11:45 p.m. I heard Dempsey ask Richardson how everything was and he said O.K. My men left 5th south and were at 3rd north at 2:17 a.m. We met the day examiner at 3rd north with a motor. He said that the power was on the 5th south for 150 feet and the feeder cable was disconnected at the first crossover. There were two motors at 5th south switch and one at 5th south. I passed Ty Cobb at 9th east on the way out. At 2:15 a.m. the examiner in 5th south said that all was clear. There was a fall on 5th south between No. 2 and No. 3 room before the explosion. This fall was on the trolley wire and the wire was broken."

John Richardson, examiner - "I went up at 7:30 p.m. to the 5th and 6th south. I left at 2:15 a.m. Dempsey told me to examine and report to him all night. I made four trips to the face, and was active all night reporting to Dempsey after each inspection. I made the last round at 2:00 a.m. There was no examiner with the men from 2:15 a.m., when I came out, until they left. I met the incoming examiner at 3rd and 4th south. I always considered that in a general squeeze such as this a rush of gas was possible and to be looked for."

H. Dempsey, night boss - "I left 5th and 6th south at 2:00 a.m. and the place was clear. The examiner left probably 10 or 15 minutes after I did and was outside before I was. The examiner was John Richardson. I told Ty Cobb, the electrician foreman, to have all the electricians out of the mine by 3:00 o'clock. I passed the incoming examiner at the outer end of the parting, 1st and 2nd south, as I was going out. As I was taking off my clothes in the wash house, someone told me there was trouble in the mine. I sent Albert Malone down and he found the two men from 9th east in the motor pit in an exhausted condition, and he helped them to the surface."

Questioned by T. H. O'Neal, Federal Coal Mine Inspector

Statement of:

H. Dempsey, night boss - "I left 5th south at 2:00 a.m. and met Harold Holden at outby 4th south side track. I left instructions to John Richardson, mine examiner, to stay with the men until they came out, also instructed Ty Cobb at motor pit to have his men out by 3:00 a.m.

due to shooting time. Also left Cobb's assistant foreman, Joe Green, in 5th south without any instructions. Albert Malone, assistant foreman, notified me in the bath house that something was wrong with the power lines in the mine and he was going back inside to help find it. Malone met two men who had come from 9th east. They were in difficulty and he helped them to get to the top. When they got out the air was so bad in the shaft that it was impossible to return."

C. M. Phelps, shot firer - "I met Joe Green, assistant mine foreman in 9th east at 4th south door at 2:00 a.m. He instructed me to take the compressor to main north switch and leave it. Dietz and I went to 8th west panel heading for powder and came back to 5th north looking for powder. We couldn't find any and came back out. We saw Orval Daugherty and William Strange. They were at the battery station inside 6th north door off 9th west. I don't remember any one at 5th or 6th south going in or out. When I came back to 9th east, I met Harold Holden and Ty Cobb at 9th east switch about 2:30 a.m. Cobb said he was going to the bottom. Holden asked him to swap motors with him. I left them and went to 4th south off 9th east. Went up in 4th south entry. Tamped 10 shots, and came back to the 4th south doors. Had been at the door 15 minutes. Some motors in 5th south off 8th west. Don't know how many."

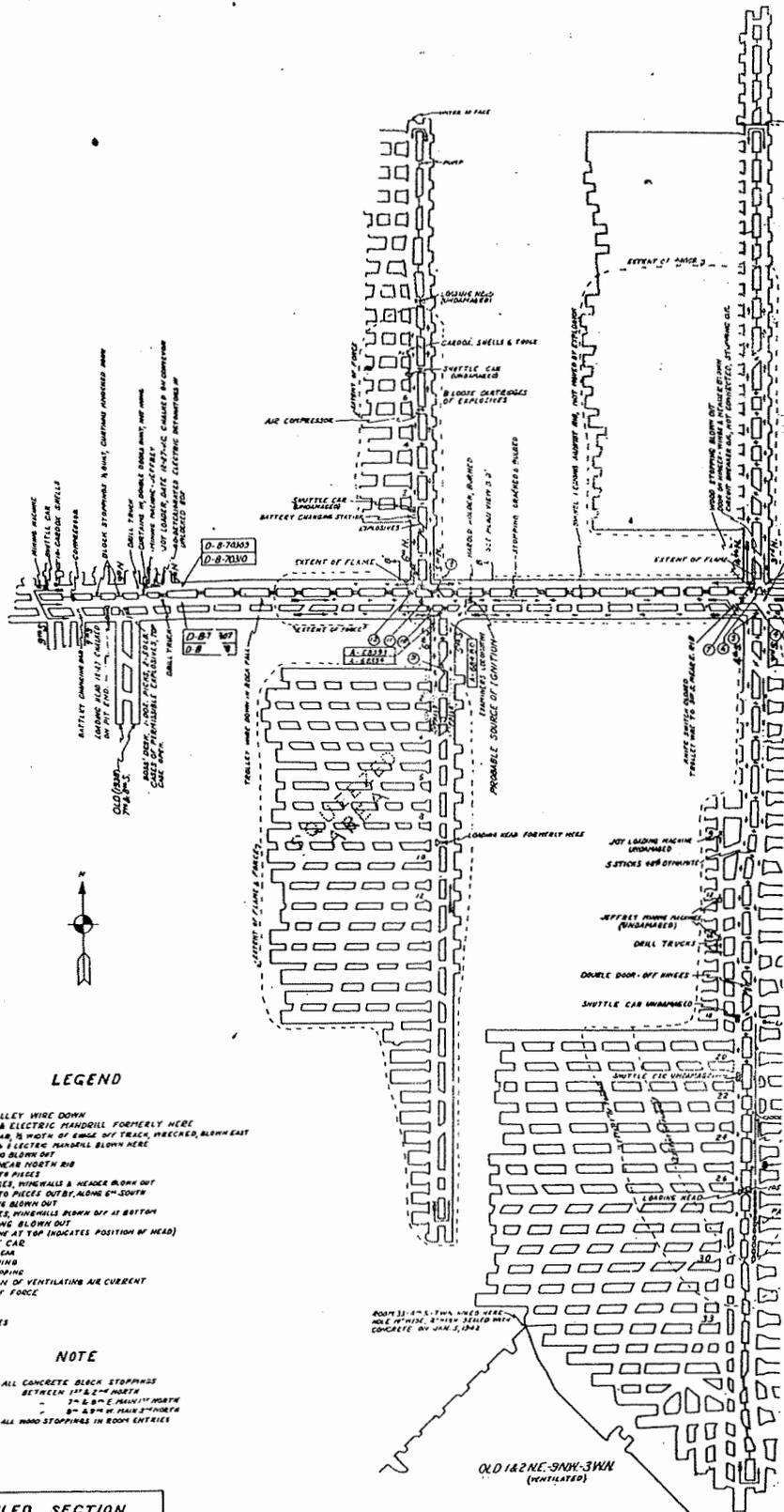
Joe Green, assistant foreman - "I was told by John Richardson, mine examiner, that there was a rock fall in 5th south off 8th west on the passing track. I took four men and went to it at 11:45 p.m. Cleaned it up and pulled the loading head from No. 9 room 5th south to crosscut near No. 1 room, and left it on the crossover track switch to 6th south. I saw Ty Cobb at No. 9 room on 6th south and told him I would leave the cutter head at the crossover track switch. This was about 2:15 a.m. He said he was going to pull the cable. The trolley wire was cut near No. 2 or No. 3 room at 5th south off 8th west at this time. The top was working in 5th south at this time and we decided to bring all the material out. Richardson was up around No. 18 room about this time and when we left 5th south together coming out I asked him before we left 5th south if he found any gas and he said no. Everything was clear. I made several tests in 5th south up to No. 14 room and could not find any gas. I left the 5th south off 8th west about 2:20 a.m. with my crew and Richardson coming to the bottom. We met Holden on the inside end of the 8th west parting. We notified him that everything was O.K. except top working in No. 9 room 5th south. Holden placed his motor on 8th west straight out track by 3rd north track switch to let us get by. I talked to Claude Phelps in 4th south off 9th east at 10:30 p.m. I left the mine about 3:30 a.m. and heard of the explosion about 7:30 a.m. I came out of 4th south off 8th west and went to 5th south and left my motor at the 5th south track switch. There was one motor and two battery cars switched in 5th north and there were four or five motors in by the 5th south track switch to within 20 feet of the 8th west

main door. When I walked into the 5th south I got another reel motor on the inside of 5th south and pulled the loading head out.”

John Richardson, mine examiner - John Richardson's statement was practically the same as Joe Green's except that he said that there was a trolley wire on the rail at No. 3 room 5th south which had caused quite a bit of fire at 11:00 p.m.

#### LIST OF DECEASED MINERS

1. McCoy Cobb	Night Chf. Electrician	Married, one child
2. William Strange	Repairman	Married, one child
3. Orval Daugherty	Repairman	Married, two children
4. Roy Donaldson	Repairman	Married, two children
5. John Fletcher	Repairman	Married, three children
6. Chas. Pemberton	Repairman	Married, one child
7. Harold Holden	Examiner	Married, two children
8. Harold Smith	Repairman	Married



**LEGEND**

- ① DOUBLE TROLLEY WIRE DOWN
- ② WORK BENCH & ELECTRIC HANDDRILL FORMERLY HERE
- ③ EMPTY PIT CAR, 1/2 WIDTH OF EDGE OF TRACK, RECORDED, BURNED EAST
- ④ WORK BENCH & ELECTRIC HANDDRILL BLOWN HERE
- ⑤ WOOD STOPPING BLOWN OUT
- ⑥ TELEPHONE NEAR HOLE IN RIS
- ⑦ DOOR BLOWN TO PIECES
- ⑧ DOOR ON HINGES, MINERALS BLOWN AWAY OUT
- ⑨ DOOR BLOWN TO PIECES OUTSIDE, ALONG 2nd JOINT
- ⑩ WOOD STOPPING BLOWN OUT
- ⑪ DOOR ON HINGES, MINERALS BLOWN OFF IN BITTON
- ⑫ WOOD STOPPING BLOWN OUT
- ⑬ MAN DEAD (LINE AT TOP INDICATES POSITION OF HEAD)
- ⑭ LOADED HIVE CAR
- ⑮ BOARD STOPPING
- ⑯ HONEY STOPPING
- ⑰ ——— DIRECTION OF VENTILATING AIR CURRENT
- ⑱ ——— DIRECTION OF FORCE
- ⑲ AIR SAMPLES
- ⑳ DUST SAMPLES

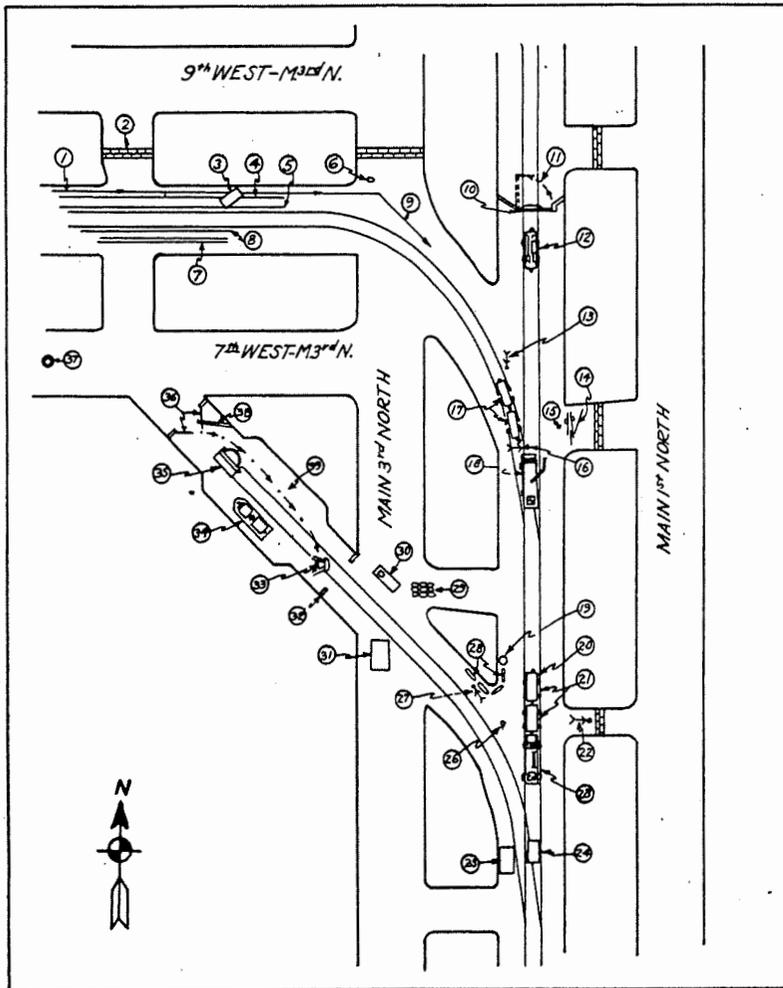
**NOTE**

ALL CONCRETE BLOCK STOPPING BETWEEN 1st & 2nd NORTH 14'-6" WIDE 8" HIGH NORTH 8" & 20" WIDE 8" HIGH 8" HIGH ALL WOOD STOPPING IN ROOM ENTRIES

**DETAILED SECTION OF MINE NO. 47 PEABODY COAL COMPANY HARCO, ILLINOIS DECEMBER 28, 1941 SCALE 1" = 100'**



LEGEND

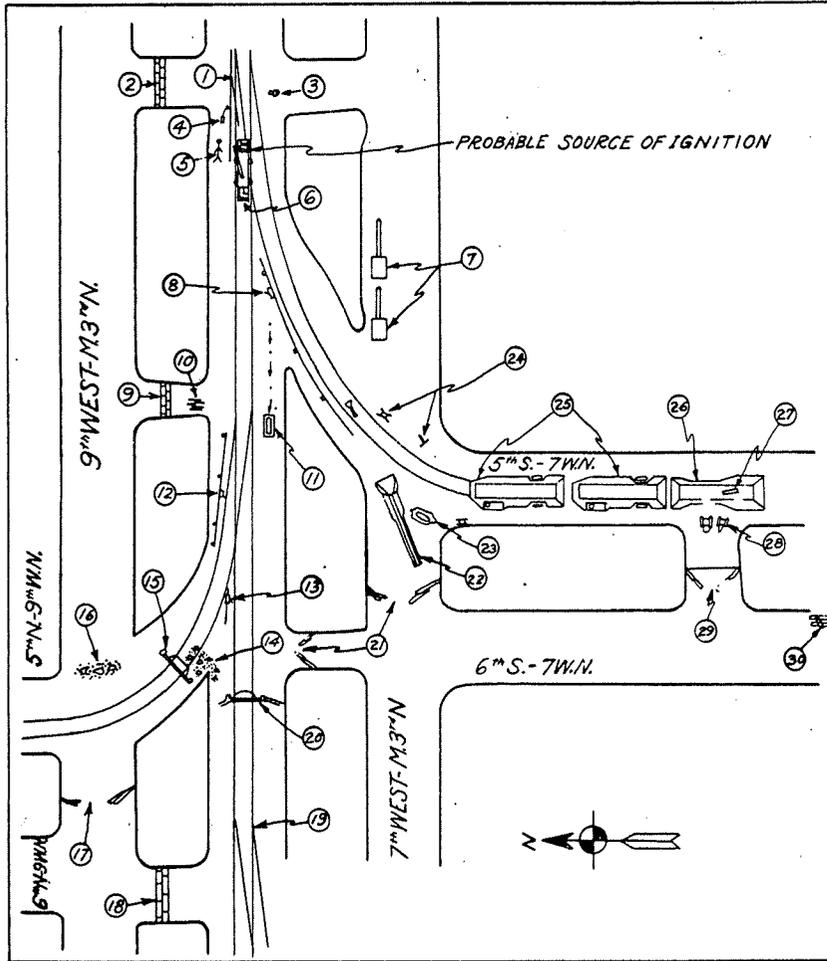


- ① TWO AND ONE HALF INCH WATER DISCHARGE LINE FROM 5N-3WN
- ② CONCRETE BLOCK STOPPING NO.1 ON 8th WEST-INTACT. NO.4 WAS FIRST BLOWN OUT.
- ③ BATTERY TRUCK COVER
- ④ FEEDER CABLE
- ⑤ TROLLEY WIRE
- ⑥ TOP DECK OF ALUMINUM DINNER PAIL
- ⑦ TELEPHONE LINES
- ⑧ RETURN WIRE
- ⑨ TO PUMP AT M.2nd N.
- ⑩ TRAP DOOR TURNED AROUND BY BLAST
- ⑪ NORMAL DIRECTION OF OPENING DOOR
- ⑫ TRACK MOUNTED COMPRESSOR UNDAMAGED.
- ⑬ CHARLES PEMBERTON BURNED
- ⑭ FOUR OLD 30 LB. RAILS, WITH TWO ALUMINUM DINNER PAILS WRAPPED AROUND THEM
- ⑮ TELEPHONE, - CHARRED MOUTH PIECE & RECEIVER
- ⑯ ROY DONALDSON, BURNED & MUTILATED
- ⑰ TWO BATTERY CARS ON TRACK
- ⑱ SIX TON GOODMAN LOCOMOTIVE OFF TRACK, CONTROLLER OFF & TROLLEY POLE BROKEN
- ⑲ NAIL KEG, WITH EMPTY PAPER BOX ON TOP, NOT MOVED BY EXPLOSION
- ⑳ STEEL COVER BLOW OFF TOP OF THIS CAR
- ㉑ TWO BATTERY CARS ON TRACK
- ㉒ ORVAL DAUGHERTY, BURNED
- ㉓ SIX-TON GOODMAN LOCOMOTIVE ON TRACK, CONTROLLER OFF
- ㉔ STEEL COVER, 3'X5', BLOWN OFF BATTERY CAR
- ㉕ GENERATOR ROOM STEEL FIRE DOOR BENT
- ㉖ TELEPHONE RECEIVER BOTTOM BLOWN OFF
- ㉗ WILLIAM STRANGE BURNED
- ㉘ FOUR SPARE TIRES & WHEELS FOR SHUTTLE CARS. NOT MOVED BY BLAST
- ㉙ PILE OF ROCK DUST IN PAPER BAGS
- ㉚ VISE & MOTOR GRINDER BENCH, MOTOR GRINDER MOVED OUTBY
- ㉛ GENERATOR ROOM STEEL FIRE DOOR
- ㉜ STEEL FIRE DOORS BLOWN OUTBY FROM CONCRETE WINGWALLS
- ㉝ 24" BLOWER FAN - BLOWN HERE FROM STEEL FIRE DOORS
- ㉞ MOTOR GENERATOR SET (300K.W.) UNDAMAGED
- ㉟ PORTABLE PANEL BOARD -UNDAMAGED
- ㊱ STEEL FIRE DOORS CONCRETE WINGWALLS
- ㊲ POWER HOLE FROM SURFACE -DEPTH 337'
- ㊳ SIX INCH STEEL I-BEAM RESTING ON TOP OF DOOR
- ㊴ MOTOR GENERATOR ROOM

PLAN VIEW AT SECTION A-A'  
 SHOWING DETAILS OF MINE EXPLOSION  
 MINE NO. 47  
 PEABODY COAL COMPANY  
 HARCO, ILLINOIS  
 SCALE 1" = 20'

## LEGEND

- ① TROLLEY WIRE FROG - TWO FLASH POINTS
- ② CONCRETE BLOCK STOPPINGS O.K.
- ③ EXAMINER'S SAFETY CAP FOUND NEAR RIB LINE
- ④ EXAMINER'S ELECTRIC CAP LAMP & BATTERY NEAR NORTH RAIL
- ⑤ HAROLD HOLDEN, EXAMINER, BODY & CLOTHING BURNED
- ⑥ LOCOMOTIVE; SAFETY LAMP HANGING ON IT; BRAKE SET; ON TRACK; TROLLEY POLE O.K.
- ⑦ 2-JEFFREY MINING MACHINES PULLED OUT & LEFT HERE
- ⑧ KNIFE SWITCH ON TROLLEY WIRE TO 5th SOUTH FOUND PARTLY CLOSED
- ⑨ CONCRETE BLOCK STOPPING O.K.
- ⑩ 65-70 CARDOX SHELLS
- ⑪ SAND BOX BLOWN 19' TO HERE
- ⑫ KNIFE SWITCH ON TROLLEY WIRE TO 5th NORTH FOUND CLOSED
- ⑬ SWITCH ON FEEDER CABLE CLOSED, CABLE KNOCKED DOWN
- ⑭ ROCK FALL - 3 CARS
- ⑮ DOOR ON HINGES, WINGWALLS & HEADER BLOWN OUT
- ⑯ ROCK FALL - 1 CAR
- ⑰ WOOD STOPPING BLOWN OUT
- ⑱ CONCRETE BLOCK STOPPING O.K.
- ⑲ SWITCH IN PROCESS OF CONSTRUCTION
- ⑳ DOOR ON HINGES, WINGWALLS BLOWN OFF AT BOTTOM
- ㉑ WOOD STOPPINGS BLOWN OUT
- ㉒ 14-BU JOY LOADER LEFT HERE - UNDAAGED
- ㉓ AIR COMPRESSOR BLOWN OUTBY
- ㉔ REELS OF CABLE, TROLLEY WIRE, TOOLS ETC.; SWEEP OUTBY FROM TOP OF EQUIPMENT
- ㉕ 2- SHUTTLE CARS UNDAAGED
- ㉖ LOADING HEAD, FRONT WHEELS ONLY OFF TRACK, PAN END SLIGHTLY DAMAGED
- ㉗ 1-PROP IN LOADER
- ㉘ 2- DRILL BUGGIES
- ㉙ ONE HALF OF WOOD STOPPING BLOWN OUT
- ㉚ PIECES OF FIRST CROSS OVER DOOR SCATTERED OUTBY



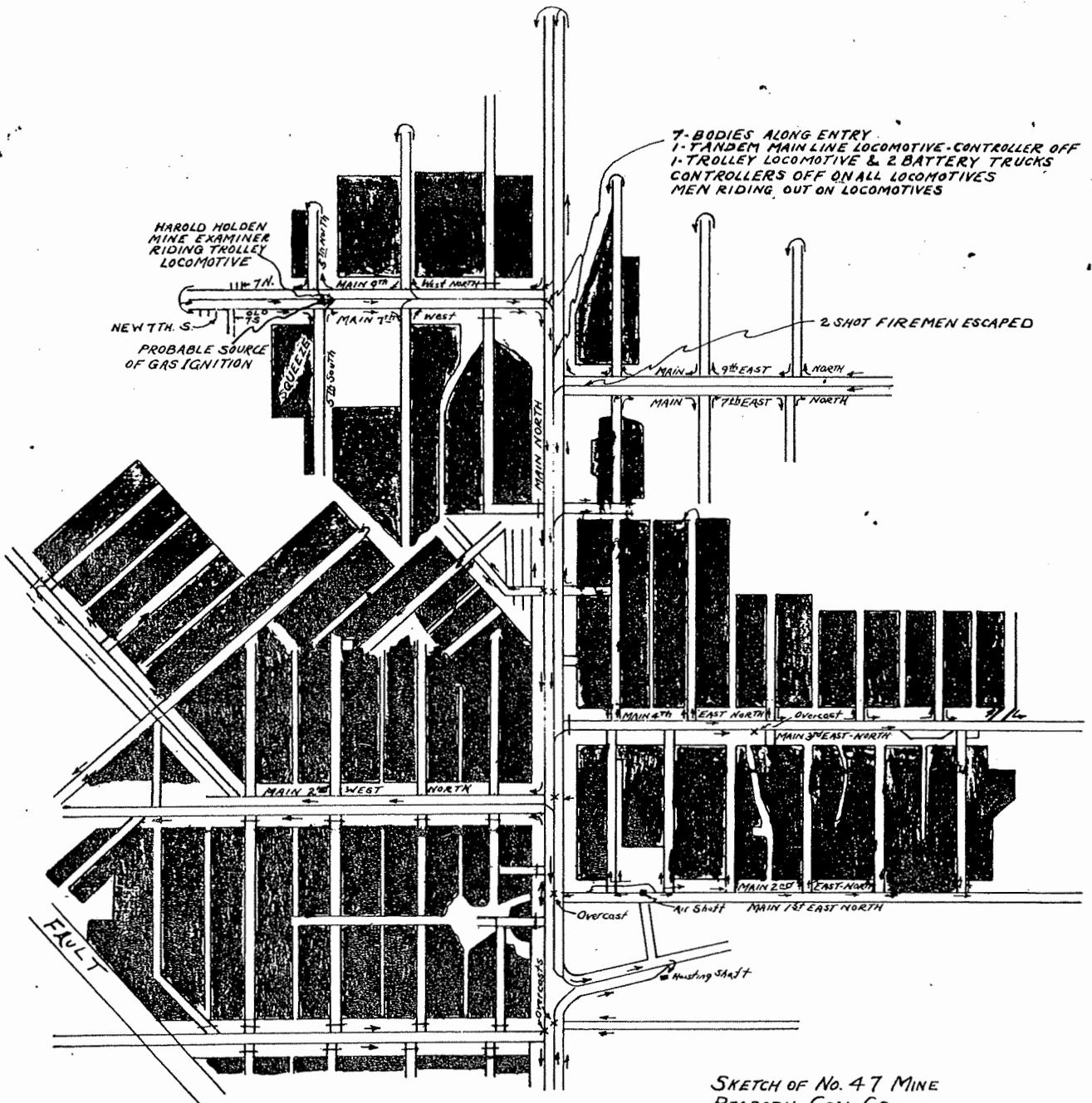
PLAN VIEW AT SECTION B-B'  
SHOWING DETAILS OF MINE EXPLOSION

MINE NO. 47

PEABODY COAL COMPANY

HARCO, ILLINOIS

SCALE 1"=20'



HAROLD HOLDEN  
MINE EXAMINER  
RIDING TROLLEY  
LOCOMOTIVE

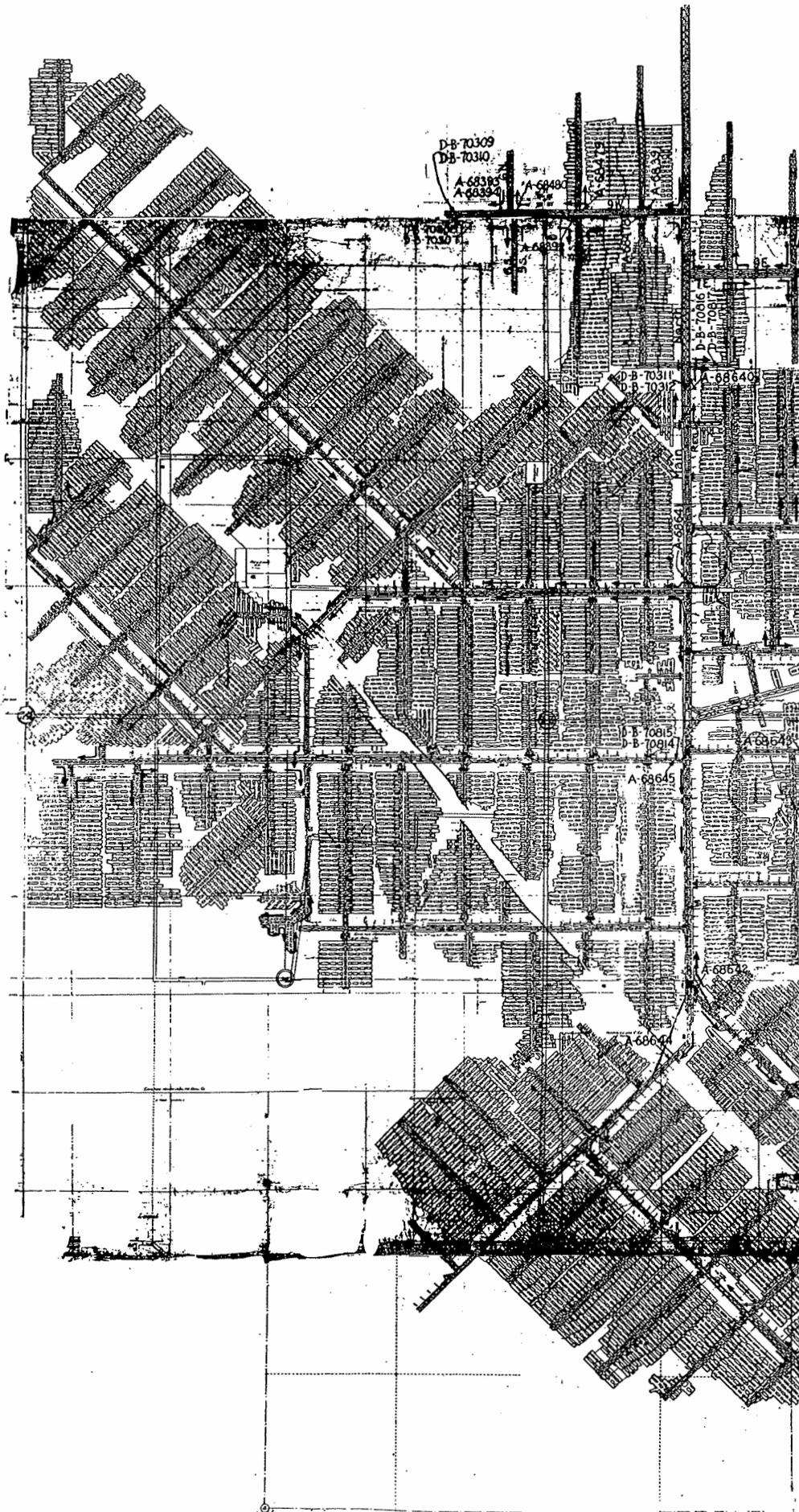
PROBABLE SOURCE  
OF GAS IGNITION

7-BODIES ALONG ENTRY  
1-TANDEM MAIN LINE LOCOMOTIVE-CONTROLLER OFF  
1-TROLLEY LOCOMOTIVE & 2 BATTERY TRUCKS  
CONTROLLERS OFF ON ALL LOCOMOTIVES  
MEN RIDING OUT ON LOCOMOTIVES

2 SHOT FIREMEN ESCAPED

FAULT

SKETCH OF No. 47 MINE  
PEABODY COAL CO.  
HARCO, ILLINOIS  
SCALE 1"=600'



D-B-70309  
D-B-70310

A-68395  
A-68394

A-68480

D-B-70311  
D-B-70312

A-68640

D-B-70313  
D-B-70314

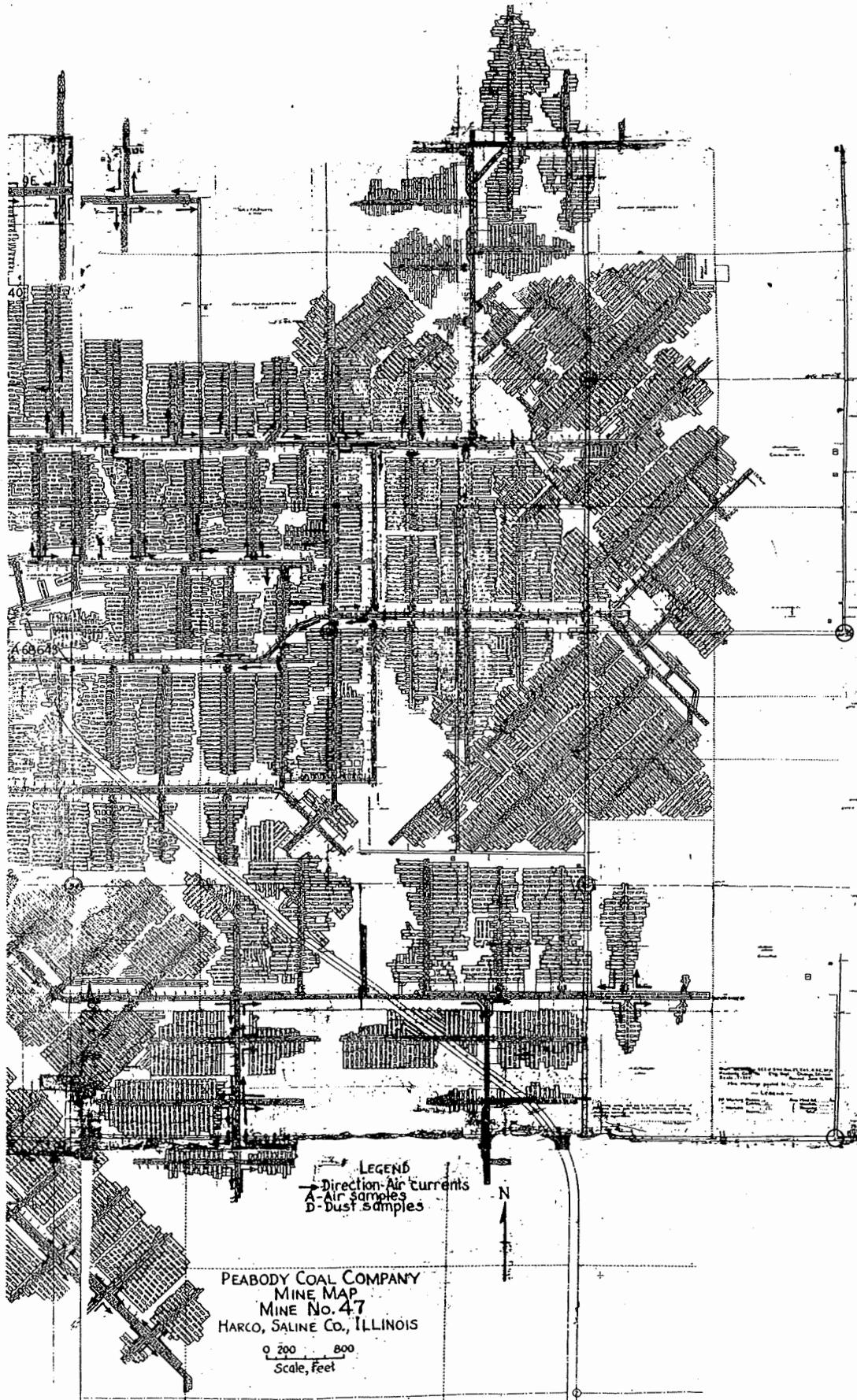
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A-68645

A-68643

A-68642

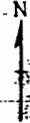
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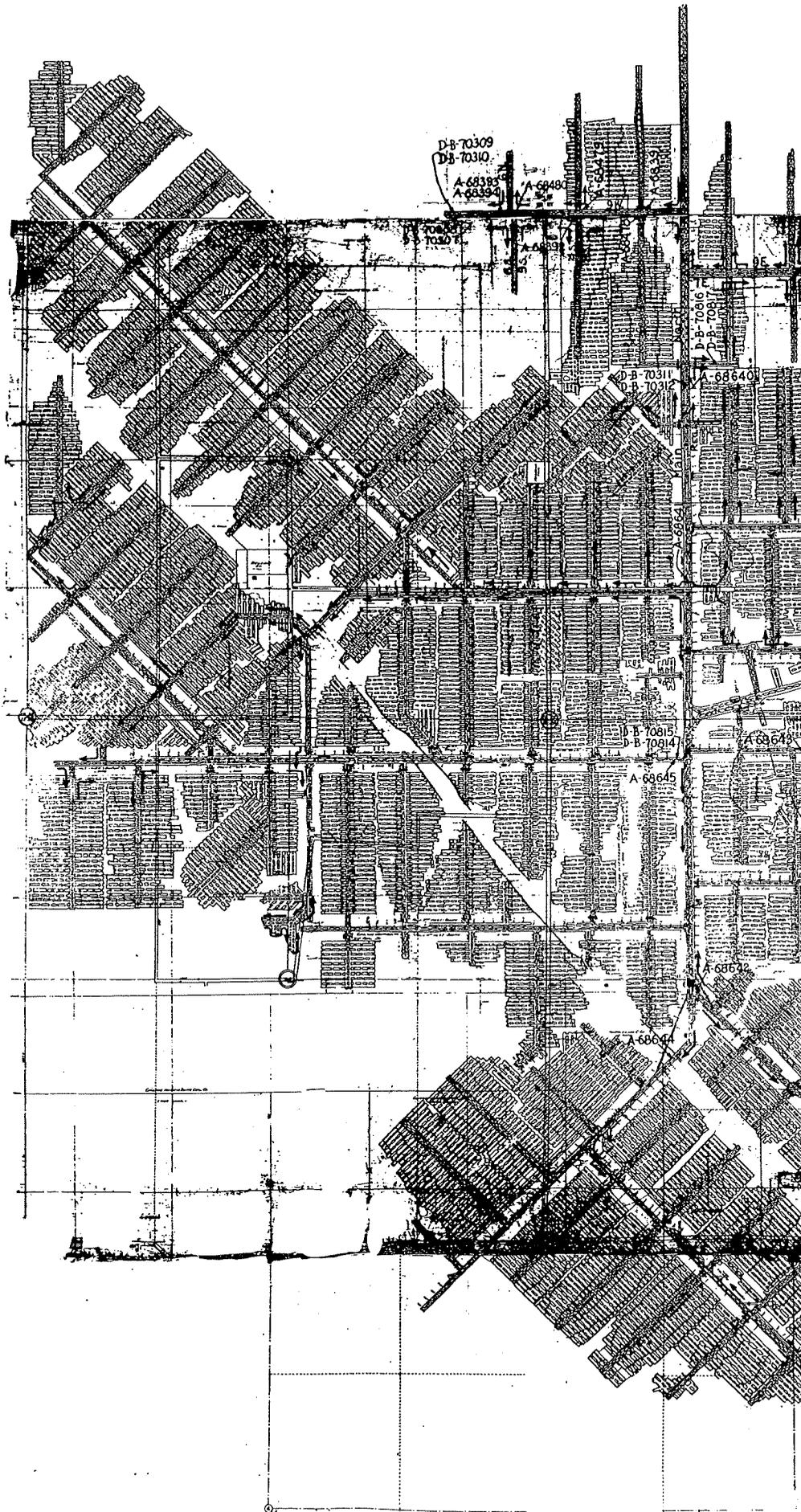


LEGEND  
→ Direction Air currents  
A - Air samples  
D - Dust samples

PEABODY COAL COMPANY  
MINE MAP  
MINE No. 47  
HARCO, SALINE CO., ILLINOIS

0 200 800  
Scale, Feet







LEGEND  
→ Direction-Air currents  
A-Air samples  
D-Dust samples

PEABODY COAL COMPANY  
MINE MAP  
MINE No. 47  
HARCO, SALINE CO., ILLINOIS

0 200 800  
Scale, feet



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