1947-0006

REPORT OF MINE EXPLOSION
KERNS MINE
SPRING HILL COAL COMPANY
TERRE HAUTE, VIGO COUNTY, INDIANA
APRIL 30, 1947

COAL FATAL

8 KILLED

By

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W. A. Gallagher
L. W. Kelly
J. S. Malesky

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

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INTRODUCTION

An explosion occurred in the Kerns mine of the Spring Hill Coal Company about 6 miles southeast of Terre Haute, Vigo County, Indiana, at 2:47 p.m., April 30, 1947, which resulted in the instant death of eight men by burns and violence. Eleven men were in the mine at the time of the explosion. The three survivors, who were near the bottom of the shaft when the explosion occurred, escaped to the surface unaided.

A mine fire in an unknown location, which was caused by the explosion, rendered impossible a detailed study of evidence left by the explosion because it was found necessary by State and Federal authorities to seal the shafts at the surface. Sufficient evidence was obtained, however, by representatives of the Federal Bureau of Mines during recovery operations and by the questioning of witnesses after the explosion to arrive at reasonably definite conclusions as to the cause of the explosion. When the shaft is unsealed after the fire is extinguished and the ventilation of the mine has been re-established, a detailed study of evicence will be made, dust and air samples will be collected and analyzed, and a supplemental report will be issued.

The explosion was caused by coal dust which was probably raised into the air and ignited by black blasting powder, the shots being fired in a dependent sequence by means of fuse. It was a local explosion, although the entire working section of the mine was involved, and relatively strong forces reached the shaft bottom. The point of origin probably was at the face of 1 main south, its parallel 2 main south, or at the face of 2 east off 1 main south.

The mine was damp to dry and dusty throughout, but a small quantity of rock dust had been applied sparingly by hand in haulage entries in recent weeks. Methane has never been detected in the mine in quantities of 0.25 percent or more.

The Vincennes office of the Federal Bureau of Mines was notified of the disaster by telephone from the mine office at 4:05 p.m., and four Federal coal-mine inspectors left immediately for the mine, arriving at 5:25 p.m. Other Federal coal-mine inspectors and Safety Division personnel were subsequently dispatched to the mine. A total of 12 representatives of the Bureau of Mines participated in the recovery operations, the investigation, or both. Sealing of the mine was completed at 5:00 p.m., May 5, 1947.

GENERAL INFORMATION

Location

The Kerns mine of the Spring Hill Coal Company is located on South 25th Street about 6 miles southeast of the center of the city of Terre Haute, Vigo County, Indiana, and coal is transported from the mine exclusively by auto trucks.

Operating Officials

Co-Owner	Harry Kerns	2719 Crawford Street, Terre Haute, Indiana
Operating Manager	Darrell Kerns	2875 Oak Street, Terre Haute, Indiana
Mine Foreman	Calvin Wilson	West Terre Haute, Indiana

The Kerns mine is the only mine owned and operated by the Spring Hill Coal Company.

Employees and Production

During normal mining operations there were 60 men employed at the mine; 3 worked on the surface and 57 underground. The average daily production was 400 tons of coal. At the time of the explosion there were 11 men working underground and 2 on the surface. Of the underground employees, 4 were engaged in coal production, including hauling the coal, and the remainder in installing track in connection with the development of an airway entry through old workings.

Openings and Nature of Coal Bed

The mine is opened by two wood-lined shafts, consisting of a main hoisting shaft 80 feet in depth, through which coal, supplies, refuse, and employees are handled, and a single-compartment downcast air shaft 60 feet in depth and 300 feet from the hoisting shaft, equipped with a steel stairway. The coal-hoisting shaft served as the main air outlet. The shafts were in good condition.

The mine is operated in the Indiana No. 5 coal bed, which averages 6 feet in thickness in the active working areas. The coal bed lies practically flat except for local undulations. The cover over the coal bed ranges from 60 to 100 feet at this property.

The immediate roof overlying the coal bed is a hard black shale ranging from 10 to 12 feet in thickness. The main roof consists of strong limestone approximately 5 feet in thickness. Numerous boulders are present in the immediate roof and coal bed.

The floor underlying the coal bed is smooth, firm fire clay.

Coal Analysis

The following analysis on an "as received" basis of the No. 5 coal bed was obtained from Bulletin 446 "Typical Analyses of Coals of the United States" for Vigo County, Indiana:

	Percent
Moisture	10.4
Ash	10.7
Volatile Matter	37.9
Fixed Carbon	41.0

The ratio of volatile matter to total combustible matter, as given above,

$$\frac{\text{Volatile Matter}}{\text{Volatile Matter + Fixed Carbon}}$$

is 0.48 for the No. 5 coal bed in Vigo County in which this mine is operated.

MINING METHODS, CONDITIONS, AND EQUIPMENT

Mining Methods

The room-and-pillar method of mining was followed, and pillars were not extracted. The main entries were driven two abreast, and room entries were turned right and left off the main entries in pairs. The room entries were turned off the main entries at various intervals; entries were driven 12 feet in width.

Rooms, 24 feet in width, were turned on 35-foot centers off the headings and air courses and were driven to various depths. Room and entry crosscuts were made at 45-foot intervals.

All coal was blasted off the solid.

A systematic method of timbering was followed, but the timbers were generally more than 12 feet from the working faces.

Ventilation and Mine Gases

Ventilation was provided by a 3-1/2 by 8-foot centrifugal fan operated blowing and located on the surface at the intake air shaft. The fan was driven by a 15-horsepower 220-volt alternating-current motor. Auxiliary power was not available in event of failure of the motor or power. The fan was offset 25 feet from the intake air shaft opening and was installed in a metal casing. During the Federal inspection of February 13, 1947, the fan was delivering 25,200 cubic feet of air a minute into the mine. The direction of the air flow was not readily reversible. A water gage or pressure-recording gage, and a warning device to show when the fan slows or stops were not provided. The fan was run continuously.

One continuous air current was used to ventilate the mine. The new air course under construction, the main haulageway, and the hoisting shaft were in return air.

Crosscuts were made at 45-foot intervals and more than one open crosscut was often permitted between the faces of entries and the first outby temporary or permanent stoppings.

Stoppings were constructed of wood, and all doors were erected singly. Check curtains were used near the faces.

The mine was not considered to be gassy by the Federal Bureau of Mines or the Indiana Bureau of Mines and Mining. A preshift examination of the mine for gas and other hazards was made.

During the six Federal inspections from October 1942 to September 1946, the analytical results of the 13 air samples collected near the faces of active workings and from returns of active workings showed methane ranging from 0.00 to 0.06 percent. During the time of the last Federal inspection, February 13, 1947, there were two air samples collected and the analytical results showed methane as follows:

Return at coal shaft	0.00 percent
Face of main south airway	0.12 percent

Drainage

The mine workings and haulage roads were dry, except for accumulations of water in a few small sumps near the hoisting shaft bottom and along the main intake airway. Water from these sumps was pumped to the hoisting shaft sump with three small electrically driven pumps. An electrically driven pump was located at the shaft bottom and was used to pump water out of the hoisting shaft sump to the surface.

Dust

Moisture conditions in the mine ranged from damp to extremely dry, and heavy deposits of coal dust were present along the roadways and air courses on the roof, ribs, and timbers. Rock dust had been applied in the past few weeks to the roof, ribs, and roads in the active working entries to a limited extent, but rock dust was not used in rooms.

Dust samples will be taken when the mine is opened and will be discussed in the supplemental report.

Haulage

Mules and a hoist were used for all haulage purposes. A hoist was used to pull loaded cars up a small grade on the main east haulage road. Mules were used for gathering and all other haulage purposes. About 65 wooden end-gate-type mine cars of 1-1/2-ton capacity each were in use.

The cars were hoisted on two self-dumping cages to the top of the tipple where they were dumped. The coal hoist, which was also used for handling men and materials, was of single-drum design, and was electrically driven. One-inch diameter ropes were used, and the hoist was equipped with a positive indicator to show the positions of the cages. Automatic overwind, overspeed,

and stop controls were not provided, and a second engineer was not on duty while men were being handled. Written records were not kept of the daily inspections of the hoisting equipment and appurtenances.

Lighting

Incandescent electric lights, operated from the mine circuit, were installed at the shaft bottom and at irregular intervals along the main east haulage road. Carbide lamps were used by all underground personnel for individual illumination. Two keylocked flame safety lamps were available at the mine.

Smoking was permitted and practiced freely in the mine.

Electrical Equipment Underground

All power used at the mine was purchased from a utility company. The underground hoist and pumps were operated electrically by 220-volt alternating current. No other electrical equipment was used in the mine.

Insulated 220-volt alternating-current power wires entered the mine at the hoisting shaft. The power wires to the main east hoist were in return air; all other power wires were in the main east intake airway. Cut-out switches were not installed in the mine.

Explosives and Blasting

Granular 1F black blasting powder was used for all blasting purposes. No dynamite or permissible explosives were being used in the mine. The shots were fuse-actuated and fuse was lighted with the flame of carbide lamps.

Prior to the shut-down order of April 3, 1947, by the Coal Mines Administrator, when the mine was operating normally, the miners worked singly. They drilled their own shot holes during the working shift as the work progressed, with manually operated post-mounted drills. Normally, from 2 to 3 holes were drilled in rooms and entries, about 3 inches in diameter, and varied up to 9 feet in depth. The manner of placing and spacing the drill holes was dependent on the conditions of the working faces and was left to the judgment of the miners. Prepared cartridges of black powder were made up at the individual storage boxes and brought to the working faces for insertion into the drill holes. Variable lengths of fuse were used, depending upon the desired order of firing. The fuses varied up to 10 feet in length and were slit near the ends so that they could be ignited readily with carbide lamps. Charges of black powder varied up to as much as 10 pounds, and it was common practice to obtain only 4 shots from 25 pounds of the granular black powder. The shot holes were charged during the working shift. A mixture of coal dust and fire clay was used as stemming, and copper-tipped steel tamping bars were used. At about 3:15 p.m., after all underground employees had come to the surface, the shot firer entered the mine to ignite the shots. It usually required about one hour for the shot firer to light all shots and return to the surface.

Following the closure order of April 3, 1947, and the resumption of operations, to a limited extent, on April 9, 1947, the blasting procedure had been changed. Instead of a shot firer igniting the shots after all underground employees were on the surface, the miners ignited their own shots. A few minutes prior to quitting time, an employee was sent to the faces on the working entries to give the order to fire the shots. Upon ignition of the shots, all miners and other underground employees hurried to the shaft bottom. The firing of the shots was usually heard by the men while they were enroute to the shaft.

Kegs of black powder from the surface explosives-storage magazine were hauled by truck to the hoisting shaft and were placed in regular mine cars. The explosives were transported underground in wooden mine cars drawn by mules during the working shift and placed in the miners' wooden storage boxes located at the entrances to their working places. The miners ordered and received the 25-pound kegs of black powder as needed. A keg generally lasted a miner three working days. The fuse was carried by the miners to their storage boxes.

Mine Rescue and Fire Fighting

None of the men at the mine have had mine rescue training.

There were no gas masks available at the mine. The nearest State-maintained mine rescue station was located at West Terre Haute, Indiana, about 7 miles away, and the nearest mine rescue team was at Bicknell, Indiana, about 50 miles away. There was also a mine rescue station maintained by the coal operators at Bicknell, Indiana. The United States Bureau of Mines rescue truck and apparatus were located at Vincennes, Indiana, about 60 miles from the mine.

Electrical circuits in surface buildings were installed on insulated knobs, and enclosed switches were used. The wash house was heated by means of hot air, and all other surface buildings were heated by means of coal stoves. A water line, hose and connections, and one carbon tetrachloride fire extinguisher were provided for the tipple and surrounding buildings. The fire-fighting equipment was inspected and tested twice a year, but written records were not kept.

The underground fire-fighting equipment consisted of a very small amount of rock dust located at the shaft bottom. A fire-fighting organization was not maintained on the surface or underground, and an outline of the procedure to be followed in case of fire or other emergency was not provided.

Previous Explosions in this Mine

On March 6, 1947, a shot firer was killed in this mine as the result of a dust explosion while blasting off the solid with granular black powder. Statements of employees at the mine revealed that other dust explosions, "windy shots," have occurred at this mine, but loss of life was not involved.

MINE CONDITIONS PRIOR TO DISASTER

The last regular Federal inspection of this mine, previous to this disaster, was made on February 13, 1947, by Federal Coal-Mine Inspector W. B. Dalrymple. A final report on this inspection indicated thirty-seven violations of the Federal Mine Safety Code, among which were the following:

Article IV, Section 5d. All blasting in this mine was done with the use of black blasting powder.

Only permissible explosives or permissible blasting devices should be used for blasting in this mine, and they should be used in a permissible manner.

Article IV, Section 5a6. A mixture of fine coal and fire clay was used as stemming.

Boreholes should be stemmed with at least 24 inches of incombustible material.

Article V, Section 3c. Less than 6,000 cubic feet of air a minute was passing through the last open crosscut of the 6 west, the main south, and the 1 east entries.

At least 6,000 cubic feet of air a minute should be coursed through the last open crosscut of each of the above-mentioned entries.

Article VI, Section 1a. Accumulations of coal dust were observed along sections of the main haulageways.

These accumulations of coal dust should be removed and such accumulations prevented in the future.

Article VI, Sections 2a, 2b, and 2c. The mine had not been rock-dusted and considerable coal dust was observed on the ribs, roof, and floor of the main entries.

The dry and dusty parts of the main haulageways should be rock-dusted. Such rock dusting should be extended to within 80 feet of the entry faces and in back entries for at least 1,000 feet outby the junction with the first active entry. The rock dust should be maintained in such quantity that the incombustible content of the mine dust will be at least 65 percent.

On March 6, 1947, a local coal-dust explosion occurred in the Kerns mine, resulting in the death of the shot firer, who was the only man in the mine at the time of the explosion. The dust was ignited by a blown-out shot of black blasting powder which was being used in violation of Article IV, Sections 7a4, 7a7, 7a8, 7a10, and 7all of the Federal Mine Safety Code.

On March 21, 1947, after the Bureau of Mines report on this explosion had cleared through the proper channels and had reached the office of the Coal Mines Administration, the Coal Mines Administrator ordered the operating manager of the Kerns mine to conform to the Federal Mine Safety Code in its entirety, and requested him to report to the Coal Mines Administration any steps taken to correct the violations of the Code. The operating manager was also advised that "failure to comply with Article IV, Section 7, of the Code will cause this office to take drastic steps to enforce compliance therewith."

On April 3, 1947, an order was issued by the Coal Mines Administration which had the effect of closing down 518 coal mines which were in violation of certain important requirements of the Federal Mine Safety Code and in which explosion hazards were known to exist. The Kerns mine was among this group of mines that was closed by the Coal Mines Administration on April 3.

On April 7, the operating manager of the Kerns mine called the District Supervising Engineer of the Bureau of Mines at Vincennes, Indiana, and advised him that the District office of the United Mine Workers of America would not permit men to enter the mine to perform work in connection with bringing about compliance with the safety Code, including the driving of an air course entry through old workings. The District Supervising Engineer then contacted Louis Austin, president, District 11, United Mine Workers of America, and Mr. Austin stated that the union had no objection to men entering the mine to do whatever work was necessary to comply with the safety Code. The supervising engineer then advised the operating manager by telegram to request permission from the president of District 11, United Mine Workers of America to work the necessary number of men to drive new air course entry in order to comply with the Code on ventilation.

On April 8, a meeting was held at the mine which was attended by Ben Trump, board member, District 11, United Mine Workers of America, Harry Kerns, owner of the mine, Darrell Kerns, operating manager, Calvin Wilson, (deceased), mine foreman, and local union officials. It was decided at this meeting, according to a statement made during the investigation by Ben Trump, that a limited number of men would be permitted to work in the mine, but the complement of men would be confined to those needed to perform the labor necessary to bring about compliance with the Code. Mr. Trump asserted that stipulations were made at the aforementioned meeting to the effect that no development or production work would be permitted other than that necessary for the driving of the air course entries and that any blasting that had to be done in connection with this work must be done by a shot firer after all men, except the shot firer, were out of the mine.

Work was started on the following day, April 9, toward completing the driving of the air course entry and continued up to the day of the explosion. Some rock dust was applied in haulage entries by hand during this period. In addition to doing work necessary to bring about compliance with the Code and eliminate explosion hazards, four loaders and a driver were put to work driving entries and producing coal in 1 and 2 main south entries and 1 and 2 east entries off 2 main south and, instead of following the normal practice of having shots fired by shot firers while all men except the shot firers were out of the mine, shots were being fired by miners at the end of the

shift while the working shift was still in the mine. The driving of these entries was not being done for the purpose of making the mine safe or for the purpose of bringing about compliance with the safety code. The entries were being driven to obtain development for future work and for the purpose of producing coal. This work was being done surreptitiously and in direct violation of the order of the Coal Mines Administrator of April 3, and of the oral agreement of April 8, between the operating manager and the officials of the United Mine Workers of America. On the day of the explosion, six men were engaged in doing work related to the improvement of safety conditions in the mine and four men were engaged in the production of coal, not related to the improvement of safety conditions.

Sufficient evidence was obtained during this investigation, and is presented in this report, to indicate that the explosion occurred as a result of the work that was being done in the production of coal and not as a result of the work that was being done toward compliance with the safety code.

The weather on the day of the explosion was clear and fair. Barometric readings taken at the State Mine Rescue Station at Terre Haute, Indiana, on April 28, 29, and 30 were recorded as follows:

Time	8:30 a.m.	12 Noon	4 p.m.
April 28	29.62	29.62	29.58
Time	8:30 a.m.	12 Noon	5 p.m.
April 29	29.32	29.28	29.20
Time	8:15 a.m.	1:10 p.m.	3 p.m.
April 30	29.08	29.10	29.10

While there was a gradual decrease in barometric pressure from the morning of April 28 to the morning of April 30, it is believed that barometric pressure did not have any bearing on this explosion because the mine is known to liberate only a slight amount of methane, there were no areas containing explosive gas under seal, and the presence of standing bodies of gas in old workings was highly improbable.

PROPERTY DAMAGE

The explosion caused no damage on the surface, and comparatively little underground. All stoppings from the bottom of the hoisting and return air shaft, between the main east and main south entries, up to the 1 and 2 east entries were damaged. Some of the stoppings were completely blown out while others had only a few boards blown off. The doors in the 1 and 2 main south entries that controlled the air for the 1 and 2 east entries and the 5 and 6 west entries were damaged. (The door between the 1 and 2 main south entries near the 1 east entry was intact.) Some of the timbers in the 1 main south and in the new air course entry were blown out. An empty mine car with two wheels blown off was found against the gob at the junction of the new air course and 2 west. Empty powder kegs, debris, dinner pails, and dust were strewn over the track and roadbed in the new air course entry.

Very little rehabilitation work will be required to put the mine back in operation, unless extensive damage is done by the mine fire.

STORY OF THE EXPLOSION AND RECOVERY OPERATIONS

The explosion occurred at 2:47 p.m., April 30, 1947. Workmen near the shaft bottom reported that they heard the explosion, and immediately felt the pressure from the blast, which had considerable force.

The Chief of the Bureau of Mines and Mining of the State of Indiana was notified, and he notified his deputy inspectors to go to the mine immediately.

The district office of the Federal Bureau of Mines at Vincennes, Indiana, first learned of the explosion when Mr. Wesley Harris, vocational mining instructor of Indiana State Teachers College, called the Bureau office at 4:05 p.m. Mr. W. A. Gallagher, acting in the place of the District Supervising Engineer, immediately proceeded to the scene with three inspectors and left instructions at the Vincennes office to inform other Bureau of Mines personnel at various locations. The first four Federal inspectors arrived at the mine at 5:25 p.m. Others arrived within a period of four hours. Ten Bureau of Mines employees were present and participated actively in the rescue and recovery operations. The names of the Bureau personnel are as follows: W. A. Gallagher, J. P. Sheridan, L. W. Kelly, L. A. Belt, C. M. Dovidas, J. A. McCune, F. J. Gallagher, J. S. Malesky, J. E. Bradburn, and Roy Capps. Four members of the State Bureau of Mines and Mining were present and participated in the rescue and recovery operations. The names and titles of these men are as follows: Griff Morris, director, William Gibbon, assistant mine inspector, George Tillie, assistant mine inspector, and Evan Evans, superintendent of Indiana Mine Rescue Station. Mr. Nick Anderson and Lee Graves, insurance company inspectors, were also present.

Four of the State inspectors arrived at the mine at about 4:00 p.m., and immediately entered the mine, and started to restore ventilation. Two of the Bureau of Mines personnel entered the mine at 5:45 p.m. and assisted with the restoration of ventilation. When the first rescue party arrived at the shaft bottom they met one of the three men who had escaped from the mine after the explosion and had reentered the mine.

The intake air enters at the fan shaft and was conducted through the mine in a continuous circuit. Haulage roads were in return air.

Recovery operations consisted of restoring the ventilation by erecting temporary canvas stoppings in crosscuts between the intake and return airways. This work was accomplished slowly due to the amount of smoke and carbon monoxide encountered, and carrying the material through the trackless air course entry. Stoppings were repaired or replaced in all crosscuts along the main east and main south entries and along a section of the new air course entry.

The first two bodies were located about 500 feet from the main south entry on the new air course entry at 9:10 p.m. and two additional bodies were located at 9:40 p.m. about 100 feet outby. The last four bodies were located at 11:55 p.m. All of the bodies were found within a space of about 200 feet along the new air course entry. The last body was about 700 feet outby the junction of the new air course entry with the main south entry.

The face workings in this mine were not examined, and a further exploration of the mine could not be made due to smoke from a fire at an undetermined location. During a conference between representatives of the Federal Bureau of Mines, the Indiana Bureau of Mines and Mining, and the Coal Mines Administration held in the State Mine Rescue Station at West Terre Haute, Indiana, on May 2, a decision was reached to seal the mine on the surface at the shafts. The mine was sealed at 5:00 p.m., May 5, 1947, under supervision of State and Federal Bureau of Mines representatives.

INVESTIGATION OF CAUSE OF EXPLOSION

The presence of a fire in the mine following the explosion necessitated sealing the mine and prevented a detailed study of evidence left by the explosion. Observations made by personnel of the Bureau of Mines during recovery operations and information obtained from survivors enabled the investigators to form a fairly definite conclusion as to the cause of the explosion.

In order to get a coherent story of events leading up to the explosion and of conditions and practices prevailing at the time the explosion occurred, a hearing, called by the Director, Bureau of Mines and Mining of the State of Indiana, was held in the State Mine Rescue Station at West Terre Haute, on May 2, 1947. Present at this hearing were representatives of the Federal Bureau of Mines, the Coal Mines Administration, the Indiana Bureau of Mines and Mining, and the United Mine Workers of America, and the coroner of Vigo County, a survivor of the explosion, one of the miners who was not on shift at the time of the explosion, and the co-owners of the coal mine. The Federal Bureau of Mines was represented by C. A. Herbert, supervising engineer, District E, M. J. Ankeny and W. A. Gallagher, coal-mine inspectors, J. S. Malesky, mining-explosives engineer, and Roy Capps and C. M. Dovidas, safety instructors.

Representatives of the Indiana Bureau of Mines and Mining were: Griff Morris, director, William Gibbon and George Tillie, assistant inspectors, and Evan Evans, superintendent of the Indiana Mine Rescue Station.

DETAILS OF EVIDENCE

The map of the mine, Appendix "A," shows the underground abandoned and active workings, the location of the shafts, the course of the ventilating current previous to the explosion, the possible points of origin, and the locations of the bodies of the victims of the disaster. The workings shown by dotted lines were developed since the last survey was made of the mine. This portion of the map, therefore, may be somewhat inaccurate.

Methane as a Factor in the Explosion

Very little methane was liberated in the mine during normal operations previous to the explosion. During seven Federal inspections from October 1942 to February 1947, the methane content of the air samples collected in return airways and at faces ranged from 0.00 to 0.12 percent. Methane has never been detected in the mine with a flame safety lamp and no indications of methane were found during recovery operations. These facts lead to the conclusion that methane was not involved to any appreciable extent in this explosion.

Force and Flame

Because of the presence of dense smoke from a fire in an unknown location, which could not be moved due to lack of ventilation, it was not possible to make a survey of the direction and extent of forces or to determine the limit of flame. It is known, however, that the forces traveled outby on 1 main south and also on the new air course entry from the junction of these two entries. Forces were extremely violent in the new air course entry as far as it could be explored, but they diminished in violence in the vicinity of the shaft bottom and probably did not extend very far beyond the shaft bottom. Considerable force was felt by the survivors at the shaft bottom, one of them having been thrown to the floor and rolled into the sump.

Positive evidence of flame was not observed by rescue parties, although the bodies of all victims of the explosion showed evidence of third degree burns and at least one fire was started at an unknown location.

Activities in the Mine at the Time of the Explosion

Eleven men were in the mine on the day of the explosion. Of this number, four laborers and a driver were engaged in the development of a new air course entry that was being driven from 1 main south, mainly through old workings, toward the upcast shaft. The development of this new air course entry was being done to provide an additional return airway so as to reduce the resistance of the ventilating system and thus enable the delivery of sufficient air to the working sections to comply with the requirements of the Federal Mine Safety Code. The work consisted of driving through caved material and through solid coal pillars, when such pillars were encountered, securing the excavations with timbers, and laying permanent track in the newly developed entry. It was learned from survivors of the explosion however, that on the day of the explosion the laborers employed to do this work were laying track in the new air course entry and, therefore, would have had no occasion to be blasting coal when the explosion occurred. The conclusion that no blasting was being done in this section is supported further by the fact that the bodies of the men nearest the point where the blasting might have been done were approximately 200 feet from that point. If blasting had been in progress in this section at the time the explosion occurred, the men would have been traveling toward the hoisting shaft and their bodies would have been nearer the hoisting shaft, probably on the main east entry.

In addition to the four laborers and the driver who were engaged in the development of the new air course, three entrymen were engaged in unauthorized development work on the day of the explosion. One man was working at the face of 2 east off 2 main south, another was working at the face of 2 main south, and the third was working at the face of 1 main south. The face of 1 east off 2 main south was also being developed contrary to orders of the Coal Mines Administrator but was idle on the day of the explosion. The man who would have been working in this entry on the day of the explosion, but for the fact that he laid off, Clarence Gosnel, by name, was interviewed by the committee and he definitely established the fact that the aforementioned places were being developed and that shots were being ignited by the miners themselves before the other men left the mine. A driver, Adam Harmon, who survived the explosion and who was later questioned by the investigating

committee, was assigned to hauling coal from these four places. This driver had visited the face of 1 main south at 2:30 p.m., seventeen minutes before the explosion occurred, and had traveled from there to the shaft bottom where he was at the time of the explosion. Upon being questioned, this driver stated that the miners at the faces of 1 and 2 main south had completed their day's work except for the igniting of shots when he was at the face of 2 main south.

The miner who usually worked in 1 east off 2 main south, but who did not work on the day of the explosion, informed the investigating committee that it was customary for the foreman, who was supervising the work on the new air course entry, to send a laborer to the faces of the development workings each day a short time before the end of the shift to notify the miners at the faces of the development places that it was time to ignite their shots. It is believed that this procedure, which was customary practice, was being followed on the day of the explosion. The bodies of the three miners from the development entries and an additional body, presumably the one of the laborer who notified them to ignite the shots, were found on the new air course entry approximately 900 feet from the faces of the development entries. This was approximately where one would expect to find the bodies of these men had they been firing shots on the day of the explosion in accordance with usual practice and had one of the shots ignited the coal dust. In other words, after igniting the shots at the faces, they would have been on their way to the shaft bottom through the new air course entry and would have had sufficient time to reach the point where their bodies were found when the explosion occurred. While the investigators did not have an opportunity to examine the faces of the development entries or to make a careful study of the evidences of force and flame, the foregoing circumstances indicate almost positively that the explosion was initiated by a shot of black blasting powder at the face of 1 main south, 2 main south, or 2 east off 2 main south. The fact that no operations, other than blasting, capable of raising and igniting a dust cloud, were in progress at the time of the explosion leads to the conclusion that the explosion was initiated by a shot of black blasting powder at the face of one of the aforementioned development entries.

SUMMARY OF EVIDENCE

Conditions observed in the mine during recovery operations, together with information obtained from survivors, provide ample evidence as to the cause of the explosion. Facts based on this evidence are summarized as follows:

1. The mine was generally dry and deposits of fine coal dust were present on the roof, ribs, floor, and timbers of rooms and entries.

2. Rock dust had not been applied in rooms and air courses and little rock dust had been applied in haulage entries.

3. No evidence was found to indicate that methane was involved in this explosion.

4. The explosion occurred near the end of the shift after all face operations had ceased, except the blasting operation. Blasting was the only operation in progress capable of raising an ignitible dust cloud into the air at the time of the explosion.

5. Coal was being blasted off the solid by means of black blasting powder while the working shift was in the mine.

6. Major forces from the explosion radiated outby from the junction of the new air course entry with 1 main south entry.

7. The location of the bodies of the men who worked in the new air course entry indicates that blasting was not in progress in the new air course entry.

8. The location of the bodies of the men who worked in the development entries, together with information concerning established practice, indicates that these men probably ignited the shots at the faces of the development entries and were on their way to the shaft bottom when the explosion occurred.

CAUSE OF THE DISASTER

Based on information available at the time this report is written, representatives of the United States Bureau of Mines who investigated the disaster are of the opinion that the explosion originated at the face of 1 main south entry of 2 main south entry or possibly at the face of 2 east entry off 2 main south, that it was strictly a coal-dust explosion that was propagated by coal dust throughout the working section of the mine, and that the coal dust was raised into the air and ignited by a shot of black blasting powder which was being used to blast coal off the solid while the working shift was in the mine.

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

1. The use of black blasting powder for blasting in coal mines has been condemned by the safety minded people in the coal mining industry for many years and no responsible operator should risk the lives of his employees and the safety of his property by taking black blasting powder into a mine. Its continued use by recalcitrant operators in the outer fringe of the industry, contrary to the Federal Mine Safety Code, is the result of utter disregard for safety or of ignorance as to the probable consequence if its use is continued long enough. The outstanding lesson from this disaster, and many others of a similar nature, is that means should be found to positively prevent the use of black blasting powder in any coal mine.

2. This mine was operating surreptitiously in violation of orders of the Coal Mines Administrator. If the operator had followed the procedure established in the reopening of the 518 mines closed by the Coal Mines Administrator, he would have had the mine adequately rock-dusted and would have called for a Federal inspection before putting men to work on coal production. He would not have been granted permission to operate the mine until it was determined that the mine was adequately rock-dusted. Had the mine been rock-dusted according to the requirements of the Federal Mine Safety Code, it is doubtful that anyone would have been killed in this explosion even though black blasting powder was used and an ignition of coal dust had occurred at one of the working faces.

3. A mine that liberates little or no methane is not immune from widespread and disastrous explosions. Fortunately for the owners and the men who are employed therein, such mines can be made immune from widespread explosions by the proper application of rock dust.

RECOMMENDATIONS

Recommendations concerning the safe operation of this mine were made in reports of previous Federal inspections, the last inspection having been made February 13, 1947. Recommendations in this report, therefore, are limited to conditions as they related to this explosion.

Recommendations Based on the Federal Mine Safety Code

ARTICLE IV - EXPLOSIVES AND BLASTING

Section 5a. Only permissible explosives or permissible blasting devices should be used for blasting and they should be used in a permissible manner.

ARTICLE VI - COAL AND ROCK DUST

Sections 2a and 2c. Rock dust should be applied to the roof, ribs, floor, and timbers of all rooms, entries, and air courses, and maintained to within 80 feet of the faces, in such quantity that the incombustible content of the mixed dust will not be less than 65 percent.

SUPPLEMENTAL RECOMMENDATIONS NOT SPECIFICALLY COVERED BY THE FEDERAL MINE SAFETY CODE

1. All workmen and other persons underground should use only permissible electric cap lamps for portable illumination.

2. Smoking or the carrying of matches or other flame-making devices into the mine should be discontinued.

3. Rock dust should be applied up to and including the last open crosscuts in rooms and entries. The face area from the end of the rock-dusted zone to the face should be kept damp with water or a wetting solution.

4. The coal should be undercut, topcut, centercut, or sheared before it is blasted.

ACKNOWLEDGMENT

The writers acknowledge the courtesies extended and help given by representatives of the Indiana Bureau of Mines and Mining and members of the United Mine Workers of America, who gave, without reservation, all information requested in connection with this investigation.

The assistance given by Roy Capps, C. M. Dovidas, and John Bradburn of the Federal Bureau of Mines, in the preparation of this report is also gratefully acknowledged.

Respectfully submitted,

(Signed)
M. J. Ankeny
Coal-Mine Inspector

(Signed)
W. A. Gallagher
Coal-Mine Inspector

(Signed)
L. W. Kelly
Coal-Mine Inspector

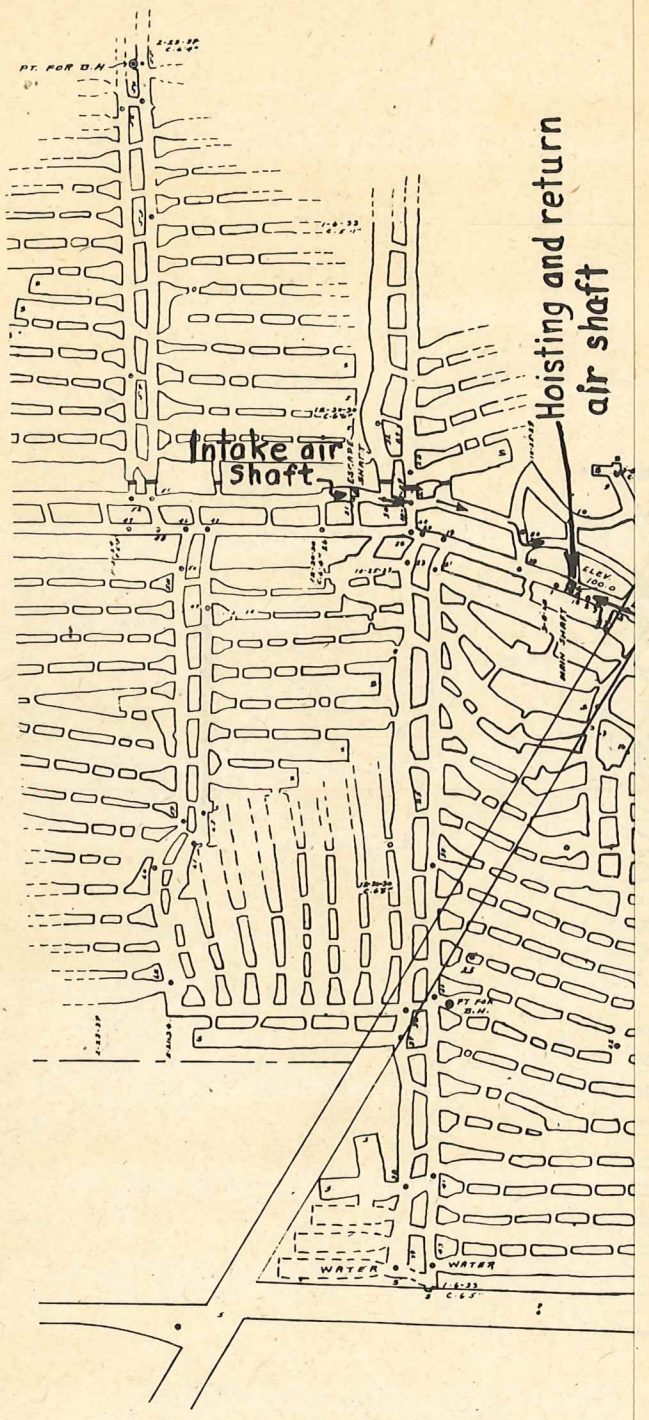
(Signed)
J. S. Malesky
Mining-Explosives Engineer

Approved:

(Signed)
C. A. Herbert
Supervising Engineer, District E

(Signed)
J. J. Forbes, Chief
Coal-Mine Inspection Division

(Signed)
D. Harrington, Chief
Health and Safety Branch



Appendix "A"
Coal Mine Explosion
Kerns Mine
Spring Hill Coal Co.
Terre Haute, Ind.
April 30, 1947.

APPENDIX B

List of men killed and survivors:

Name	Age	Occupation	Address
Calvin Wilson	69	Mine foreman	West Terre Haute, Indiana
Steve Summers	57	Laborer	West Terre Haute, Indiana
Mort Gates	60	Laborer	West Terre Haute, Indiana
John Brown	59	Bratticeman	Terre Haute, Indiana
Fern Earhart	53	Loader	Terre Haute, Indiana
Barney Riggs	67	Trackman	Terre Haute, Indiana
Desire Lete	60	Loader	Terre Haute, Indiana
Chauncey Blackburn	50	Loader	Liggett, Indiana
		Survivors	
Adam Harmon		Driver	West Terre Haute, Indiana
Everett Marshall		Driver	West Terre Haute, Indiana
Frank Pangrazio		Laborer	Clinton, Indiana

APPENDIX C

Coroner's Verdict

Cause of death: Accidental traumatism due to blast (explosion in coal mine)

Signed:

J. V. Richart, M. D.,
Coroner

APPENDIX D

SUPPLEMENTAL REPORT OF MINE EXPLOSION
KERNS MINE
SPRING HILL COAL COMPANY
TERRE HAUTE, VIGO COUNTY, INDIANA
APRIL 30, 1947

By W. A. Gallagher, L. W. Kelly
and J. P. Sheridan

On August 5, 1947, a group composed of Griff Morris, Chief State Mine Inspector, George Tilley and William Gibbons, State Mine Inspectors, W. A. Gallagher, L. W. Kelly, and J. P. Sheridan, Federal Coal Mine Inspectors, and Stewart McCammon, Mine Foreman, entered the Kerns Mine of the Spring Hill Coal Company for the purpose of determining the origin of the explosion and the cause of the mine fire that occurred April 30, 1947, in this mine.

All of the working places were visited and examined and it was the consensus of opinion of the investigating group that the explosion had originated in the No. 1 main south entry as the result of a blown out shot of black blasting powder.

Three shots had evidently been fired in the No. 1 main south entry. The left rib shot would have been fired last in the normal cycle of solid shooting and this was the shot that had blown out. The first two shots had apparently raised a cloud of dust and the blown out shot initiated the explosion.

The scene of the mine fire was located and was found to be in two adjacent crosscuts in the 1 and 2 west entries off the main south. The fire had been extinguished by sealing and the burned area in each crosscut was comparatively small.

The cause of the fire was obvious. Two dry wooden or brattice cloth stoppings had been set on fire by the flame of the explosion and had burned up completely. The traces of the stoppings were evident in the burned area. Some coal in each crosscut had burned but the prompt sealing of the mine had localized the fire to the two crosscuts.

Respectfully submitted,

(Signed)
W. A. Gallagher
Coal-Mine Inspector

(Signed)
L. W. Kelly,
Coal-Mine Inspector.

(Signed)
J. P. Sheridan,
Coal-Mine Inspector.

Approved:

(Signed)
C. A. Herbert,
Supervising Engineer, District E.

(Signed)
J. J. Forbes, Chief
Coal-Mine Inspection Division.

(Signed)
D. Harrington, Chief
Health and Safety Branch.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
WASHINGTON 25,D. C.

CONFIDENTIAL MEMORANDUM
(Not to be Published)

C. M. 3070
September 8, 1947.

TO MEMBERS OF THE HEALTH AND SAFETY BRANCH:

SUBJECT: Exhaust from underground gasoline pump causes two fatalities.

Two men, K. P. Kennedy and James Cox, died in the Kennedy mine near Tacoma, Wise County, Virginia, sometime during the night of May 22, 1947. Death apparently was caused by carbon monoxide from the exhaust of a gasoline-powered pump being used to unwater the mine.

The mine, a small operation, was, reportedly, opened in 1917, abandoned in 1919, reopened in 1943, and operated intermittently until 1946, shortly after which it was purchased by Kennedy. The main haulage slope, the only accessible opening to the surface, is driven on a pitch of about 8 percent. The working section of the mine was filled with water to about 175 feet from the surface and a small pump driven by a single-cylinder gasoline engine was started to unwater the mine about 2 weeks before the accident.

For about 10 days, Kennedy entered the mine every evening, filled the gasoline tank (3-gallon capacity), started the engine, and immediately returned to the surface. Three days before the accident, Cox was employed to keep the pump running continuously for about 14 to 16 hours a day, remaining in the mine only long enough to fill the tank and start the engine.

Cox was said to have filled the gasoline tank about 6:30 p.m., May 22, and returned to the surface. Kennedy came to the mine about 8:30 p.m., and both men entered the mine to see if the pump should be moved. When neither of them returned to the surface, Kennedy's father entered the mine about 10:00 a.m., the next morning, and found both bodies. The bodies were found about 30 feet and about 150 feet from the mine portal.

Four Federal coal-mine inspectors investigated the accident about 48 hours after the bodies had been recovered. Small traces of carbon monoxide were found with a carbon monoxide detector, and samples of the mine air indicated 0.03 percent CO, 0. 25 percent CO_2, and 20.65 percent oxygen. Surfaces 50 to 75 feet outby the pump were covered with heavy deposits of soot, presumably from the exhaust of the gasoline engine. Only a slight movement of air was found in the slope.

Prior to this accident, Cox, who was found 30 feet from the pump, complained of being ill several times when returning to the surface after starting the pump.

Lessons to be learned.

This incident again shows the dangers of using gasoline-motor equipment underground or in confined places. The carbon monoxide content in the exhaust of a gasoline motor varies from 7 to 10 percent when in good adjustment and considerably higher under adverse conditions, thus making it very difficult to reduce and render harmless the noxious gases by ordinary ventilation found in underground mines, especially small mines.

Accidents of this type also show the need for closer supervision and inspection of small operations by either State or Federal agencies if fatalities and injuries are to be reduced to reasonable rates. The figures for 1943 show that mines employing from 1 to 4 men produce only about 0.65 percent of the total production and employ only 1.39 percent of underground workers, yet are responsible for 3.10 percent of underground fatalities.

This memorandum is based on a letter report from Malcolm Davis, Federal mine inspector, and must not be published.

R. C. WARNCKE

APPROVED:

D. HARRINGTON.