

Bureau of Mines Information Circular/1983

Historical Summary of Coal Mine Explosions in the United States, 1959-81

By J. K. Richmond, G. C. Price, M. J. Sapko,
and E. M. Kawenski



UNITED STATES DEPARTMENT OF THE INTERIOR

Information Circular 8909

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UNITED STATES DEPARTMENT OF THE INTERIOR

James G. Watt, Secretary

BUREAU OF MINES

Robert C. Horton, Director

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

This publication has been cataloged as follows:

Historical summary of coal mine explosions in the United States, 1959-81.

(Information circular / United States Department of the Interior, Bureau of Mines) ; 8909.

Bibliography: p. 21-22.

I. Mine explosions--United States--History. 2. Coal mines and mining--United States--Accidents. I. Richmond, J. K. (James Kenneth). II. Series: Information circular (United States. Bureau of Mines) ; 8909.

TN 295.U4 [TN 313] 363.1'19622334'0973 82-600256

PREFACE

This report is a sequel to Bulletin 586, which summarized 148 years of coal mine explosions up to 1958. Although it was impossible to reproduce the drama and depth of the 1959 report, the present authors attempt to follow the same format, so that the reader will have a continuous record for another 23 years.

Even though the frequency and severity of major coal mine explosions have been reduced dramatically since the early days, problems remain and the threat still hangs over the heads of the miners and operators. For example, 28 miners were killed in 3 explosions in December 1981 and January 1982, too late for the accidents to be fully reviewed.

Included in this summary are analyses of the causes of ignition and explosions (to the extent known), and a brief review of how modern mining methods have changed the nature of hazards encountered and how safety research and enforcement of safety regulations have contributed to the reduction of disasters. Also included are brief reviews of the Federal mine health and safety acts of 1969 and 1977, with an estimate of how these laws have affected the coal mine explosion problem. The Mine Safety and Health Administration (MSHA) has increased safety in mines by more frequent and more thorough inspections, and by assessment of more severe penalties for noncompliance with safety regulations. Hopefully, hazards can be reduced still further through current research at the Bureau of Mines and by its research contractors.

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HISTORICAL SUMMARY OF COAL MINE EXPLOSIONS IN THE UNITED STATES, 1959-81

By J. K. Richmond,¹ G. C. Price,² M. J. Sapko,³ and E. M. Kawenski⁴

ABSTRACT

This Bureau of Mines publication presents investigators' reports of all major coal mine explosion disasters that occurred in the United States from 1959 through November 1981, along with a brief analysis of common factors in these disasters. The report reviews the Federal mine health and safety acts of 1969 and 1977, and discusses how implementation of these acts has reduced the number of both fatalities and disasters. Current Bureau health and safety research is summarized, and an appendix lists most of the ignitions and explosions in the period of record.

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INTRODUCTION

In 1959-81 there were 20 major explosions in U.S. coal mines; i.e., explosions in which 5 or more miners were killed. This publication, a sequel to Information Circular 7900 (9),⁵ represents a joint effort by the Bureau of Mines (BOM) and the Mine Safety and Health Administration (MSHA) to include in one document both the reports of 18 of these accidents and related research and supporting information. Two accidents in December 1981 and one in January 1982 occurred too late for their full reports to be included.

Accident reports in general came from BOM or MSHA inspectors and/or field investigators; BOM technical personnel sometimes contributed additional data. Most of the reports of the 18 major explosions of 1959-81 are printed herein verbatim, as a matter of historical record, with occasional comment by the present authors, by footnote or in the analysis sections. Unfortunately, much

relevant information, especially in connection with the largest disasters, is not available because of sealing of mines or because of litigation and impoundment of records by the courts.

It should be pointed out that the most violent explosions (relative to extent and property damage) did not necessarily cause the most deaths because sometimes there happened to be few miners underground when the explosion occurred. It should also be noted that although mechanization has tended to decrease the accident rate per ton of coal mined (because of higher productivity), it has had less effect on the accident rate per miner-hour worked.

All ignitions and explosions provide useful and necessary data for safety research. This report describes safety research that is directed to both long- and short-term solutions.

ACKNOWLEDGMENTS

The authors would like to acknowledge the assistance of their colleagues at the Bruceton Safety Technology Center of MSHA and at the Pittsburgh Research Center of the Bureau of Mines. They would

also like to pay their respects to H. B. Humphrey for his great work on the historical record of coal mine explosions, published in 1959 as Bureau of Mines Information Circular 7900.

MAJOR EXPLOSIONS, 1959-81

PHILLIPS AND WEST COAL CO.
NO. 1 MINE
ROBBINS, TN
MARCH 23, 1959 - 9 KILLED
(SEE FIGURE 1)

The mine was classified non-gassy by the Tennessee Division of Mines.⁶ Pre-shift, on-shaft, and weekly examinations for gas and other hazards were not made. No flame safety lamps were available at the mine.⁷

The fan was started each morning shortly before the men entered the mine and stopped when the shift was completed. This fan was not in operation between the completion of the shift on Friday and 6:40 a.m. Monday; the explosion occurred at approximately 7:30 a.m. Eight of the inby eleven stoppings in the main entries were constructed of brattice cloth and three were open. There was also a 32-inch opening in one of the permanent stoppings 550-feet outby the face of the entries.⁸

⁵Underlined numbers in parentheses refer to items in the list of references preceding the appendix.

⁶BOM classification not available.

⁷A possible consequence of the non-gassy classification.

⁸A source of leakage.

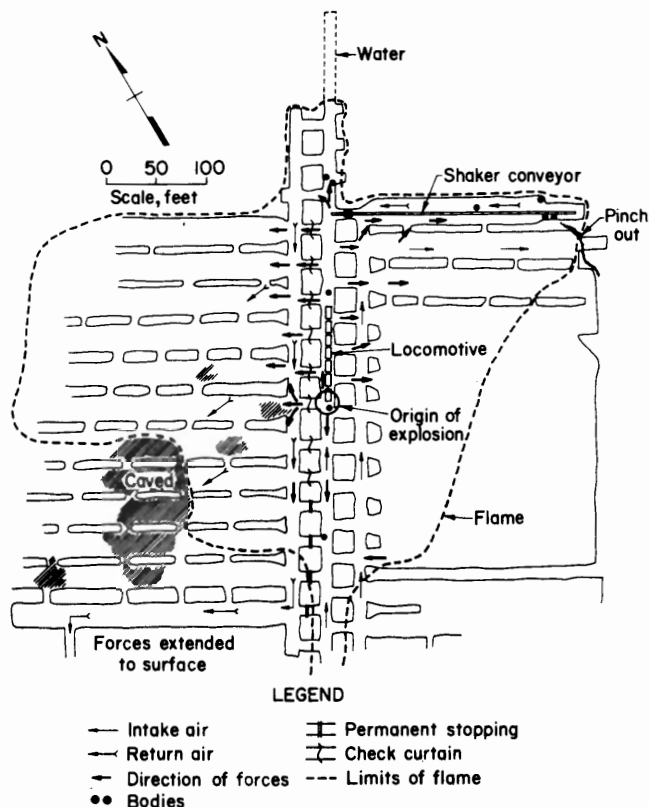


FIGURE 1. - Explosion area, Phillips and West Coal Co., No. 1 Mine, Robbins, TN, March 23, 1959.

Methane gas, believed to have been liberated from a faulted or "pinched" zone occurring in rooms adjacent to the active working area accumulated during the period the mine fan was down. When the fan was started, this gas migrated through the brattice cloth stoppings and/or open crosscuts to the haulage road where it was ignited by arcing when the trolley wheel of the locomotive left the wire or by workers smoking. All nine men underground died of burns or toxic gas fumes resulting from the gas and dust explosion.

VIKING MINE
TERRE HAUTE, IN
MARCH 2, 1961 - 22 KILLED
(SEE FIGURE 2)

An air dust explosion, originating near the intersection of 4-North Right "B" and

8-East Right "A" entries in the 4-North section of the northwest angles, killed 22 of 55 workers underground. The flame area encompassed most of the 4-North section from the track entries in the mains inby 6-East and 7-West, 8-West, 7-East, and the face of the mains. Forces occurred from the mouth to the faces of 4-North, a distance of 1500 feet, and throughout 6-East, 7-East, 7-West, and 8-West. All workers in the 4-North section were killed while workers in other areas of the mine escaped uninjured.

The mine was classified gassy. Evidence showed that the area where the explosion originated had encountered subsidence from the underlying mined out Nos. 3 and 4 coal seams. This may have increased methane liberation. Coal spillage and lack of adequate rockdusting in this area added to the severity of the explosion. The inby door of the airlock⁹ in the 6-East was removed during material recovery operations which would short-circuit air from the right side of the 4-North working section if the remaining door at 6-East were latched open. The line curtain in 8-East Right "A" was removed when the continuous miner moved to the 4-North Right "B" entry. These conditions could have permitted methane to accumulate.

Permissible equipment in the active faces of the explosion area consisted of Jeffrey Colmols and Joy Loading machines; nonpermissible face equipment consisted of Joy 6SC shuttle cars. However, the permissible equipment was not maintained in a permissible manner. Smoker's articles were listed among the personal effects of many of the victims including the foreman. Underground employees were not searched for smoker's articles before entering the mine. Either an electrical arc or open flame could have initiated this explosion.

⁹"stopping with door" on map.

- LEGEND
- Limit of flame
 - - - Limit of forces
 - Ventilation
 - Direction of forces
 - ++++ Track
 - Bodies
 - ⊥ Stopping with door
 - ⊞ Locomotive
 - Empty mine car
 - ▣ Loaded mine car
 - ≡ Wooden brattice
 - ≡ blown out
 - ≡ Concrete block stopping
 - ≡ blown out
 - ≡ Check curtain blown out

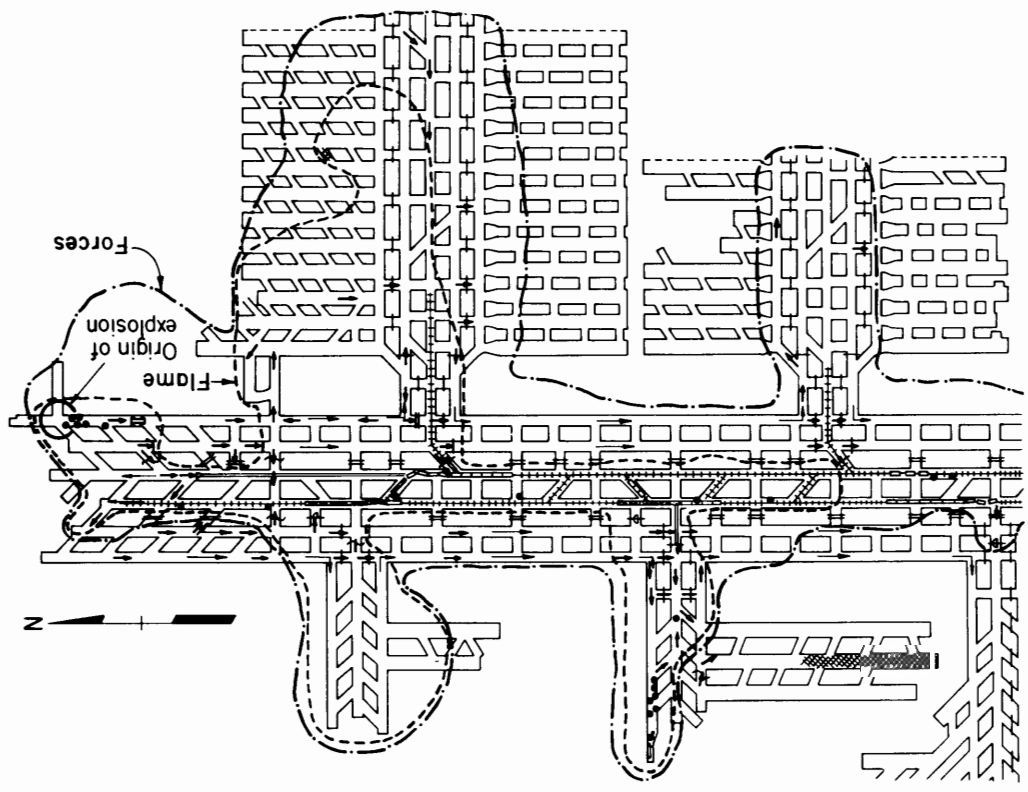


FIGURE 2. - Explosion area, Viking Mine, Terre Haute, IN, March 2, 1961.

BLUE BLAZE COAL CO.
 MINE NO. 2
 HERRIN, IL
 JANUARY 10, 1962 - 11 KILLED
 (SEE FIGURE 3)

The mine went into production on July 30, 1961. The main shaft provided the only escapeway from the mine. A second shaft, being drilled, was within 74 feet of breaking through into the coal seam at the time of the explosion.

The mine was not classified as gassy; however, all other mines in the Illinois No. 6 coal bed in the vicinity were classified gassy. Pre-shift and on-shift examinations were reportedly made; however, no flame¹⁰ safety lamp was found in the mine after the explosion.

A set of entries and rooms were driven for storage of rock and rubble produced while sinking the new shaft. This area was abandoned and sealed when it was 10 flame safety lamp would have been needed for inspections.

found to be too far to transport the rubble. On the day of the explosion, one room off 1-North inadvertently cut through into the sealed area, thus permitting methane, which had accumulated behind the seals, to enter the mine ventilation system.

Mine equipment was relatively new and maintained in permissible condition. At the time of the explosion, maintenance work was being performed in the control panel of the shuttle car. Under such conditions, it was customary at this mine to try equipment with the power on and with one person observing the contacts. The removal of the enclosure cover would provide several gas ignition sources which could have and probably did provide the primary ignition. Coal dust accumulations in the section provided fuel for widespread propagation.

Forces of the explosion traveled throughout the mine and up the shaft. All 11 men in the mine were killed by suffocation, burns, and/or forces.

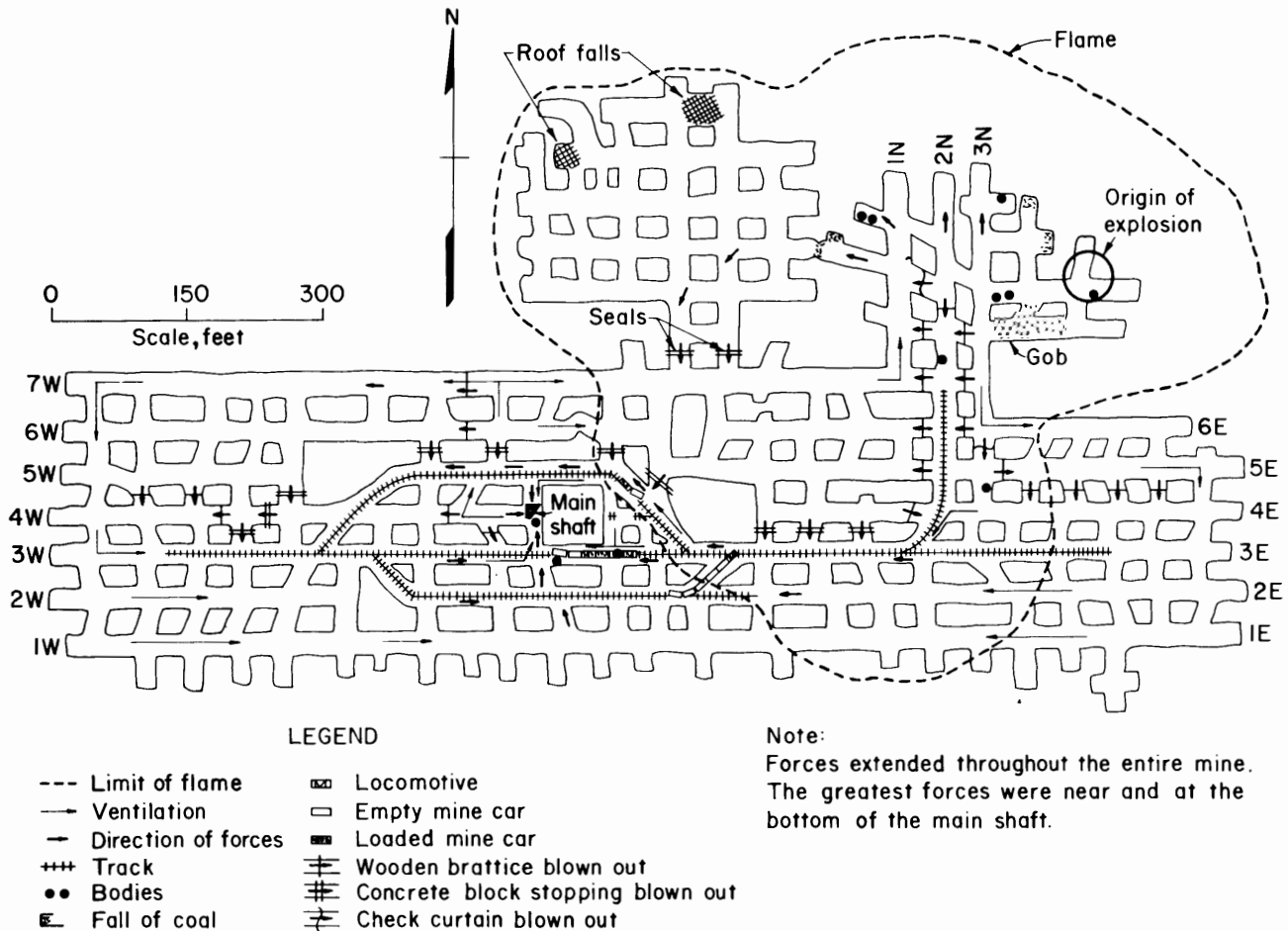


FIGURE 3. - Explosion area, Blue Blaze Coal Co., Mine No. 2, Herrin, IL, January 10, 1962.

ROBENA NO. 3
CARMICHAELS, PA
DECEMBER 6, 1962 - 37 KILLED
(SEE FIGURE 4)

Two explosions, the first at 1:05 p.m. and the second at 1:25 p.m., originated near the faces of 8-Left 4-Main entries. Thirty-seven miners were killed in the first explosion.

The customary system of development in 8-Left was to advance entries from the return airside of the split toward the intake or from left and right toward the center. Entries 0, 1, 2, 7, 8, and 9 being returns and 3, 4, 5, and 6 intakes. To facilitate development of entries at 90° to 8-Left that would intersect a recently sunk shaft (Kirby), the customary system of entry development was changed. The intake entries were advanced to get the radii driven for track

and expedite the construction of overcasts to permit splitting the air. These changes adversely affected the face ventilation permitting a methane build-up. The methane was ignited by an electric arc from an open-type fan, car-puller motor, fuse, frictional heat, or sparks from bits cutting through a clay vein in the face of slant between Nos. 7 and 8 entries. Coal spillage along the shuttle car runways, 53 loaded cars, and one partially loaded car of coal supplied coal dust to propagate a widespread explosion.

COMPASS NO. 2
DOLA, WV
APRIL 25, 1963 - 22 KILLED

The 22 men working in 3-Right area of the mine were killed by the explosion. All 36 other men in the mine escaped uninjured.

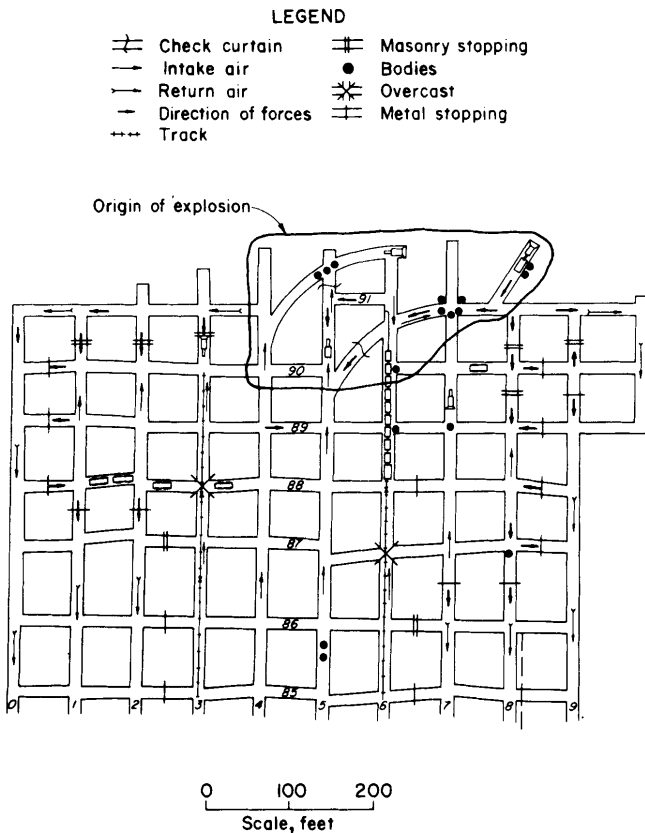


FIGURE 4. - Explosion area, Robena No. 3, Carmichaels, PA, December 6, 1962.

Serious and prolonged interruption of the ventilation current permitted an accumulation of methane in the working faces. An airlock door was found blocked open, a check curtain was rolled up and wrapped with wire, possibly a man door was left open, and stoppings and/or curtains removed to facilitate moving equipment may not have been replaced. Inadequate testing for methane allowed the accumulation of methane to remain undetected.¹¹

The greater part of the permissible-type electrical face equipment in the mine was not maintained in permissible condition. The loading machine was the only piece of electrical equipment in operation at the working face when the

¹¹A common factor in many mine disasters reported here.

explosion occurred. The bottom inspection cover was missing from the main motor housing of this machine. The commutator on this motor had high and low bars and heavy arcing was indicated at the brushes. It is presumed that this arcing was the source of the ignition.

Coal dust picked up from roadway spillage and accumulations at the belt tailpiece and transfer points aided in the widespread propagation of the explosion. Satisfactory rockdusting adjacent to and outby 3-Panel prevented the further spread at the explosion.

CARBON FUEL CO.
NO. 2 MINE
HELPER, UT

DECEMBER 16, 1963 - 9 KILLED, 1 INJURED

This disaster was caused by the ignition of a body of methane and coal dust initiated by frictional heat or sparks or by an electrical arc.

Methane was liberated in the face of No. 4 dip entry and accumulated because check curtains were not erected; the line canvas was poorly constructed and terminated 36 feet from the face. An inoperative water pump on the left side of the continuous mining machine permitted excessive float dust to collect in the return airway. This and coal dust from coal being transported on the belt conveyor provided fuel for propagation.

Possible ignition sources were an electric arc from permissible face equipment with permissibility deficiencies or frictional heat or sparks from the miner bits rubbing against or cutting top rock.

This explosion points out two common weaknesses. In a slightly gassy mine enough attention is not given to directing the ventilation current to the working faces and tests for gas are not made frequently enough to determine whether a dangerous gas condition is developing.

C. L. KLINE COAL CO.
NO. 2 MINE
(NEAR) ROBBINS, TN
MAY 24, 1965 - 5 KILLED
(SEE FIGURE 5)

An explosion, originating in the face area of the left main aircourse, killed all five men in the mine. The explosion occurred when a methane accumulation was ignited by a cigarette lighter. The methane was emitted from crevices in the roof near the face.

The mine was classified non-gassy by the State. The owner-operator was the only one that possessed a flame safety lamp. He reportedly made a gas check during his pre-shift examination.

Ventilation was inadequate. The mine fan was not capable of supplying air flow appropriate to the size of the mine. Also, the inby eight stoppings in the mains were constructed of brattice cloth and the left main aircourse was advanced

300 feet inby the last crosscut with a line curtain terminated 25 feet from the face.

Dust from coal on the conveyors and from spillage along the conveyor lines entered into the propagation.

MARS NO. 2
WILSONBURG, WV
OCTOBER 16, 1965 - 7 KILLED

A stripped down continuous miner was being trammed into the mine. Rubber conveyor belting was used to insulate the miner from the trolley and trolley feeder wires. However, the traction pump drive of the miner came in contact with the energized trolley and/or trolley feeder line. The ensuing electric arcing ignited the belting, coal, hydraulic oil and oil lines. Disconnect switches were not installed in the trolley and trolley feeder lines to permit timely and effective deenergizing of the circuit.

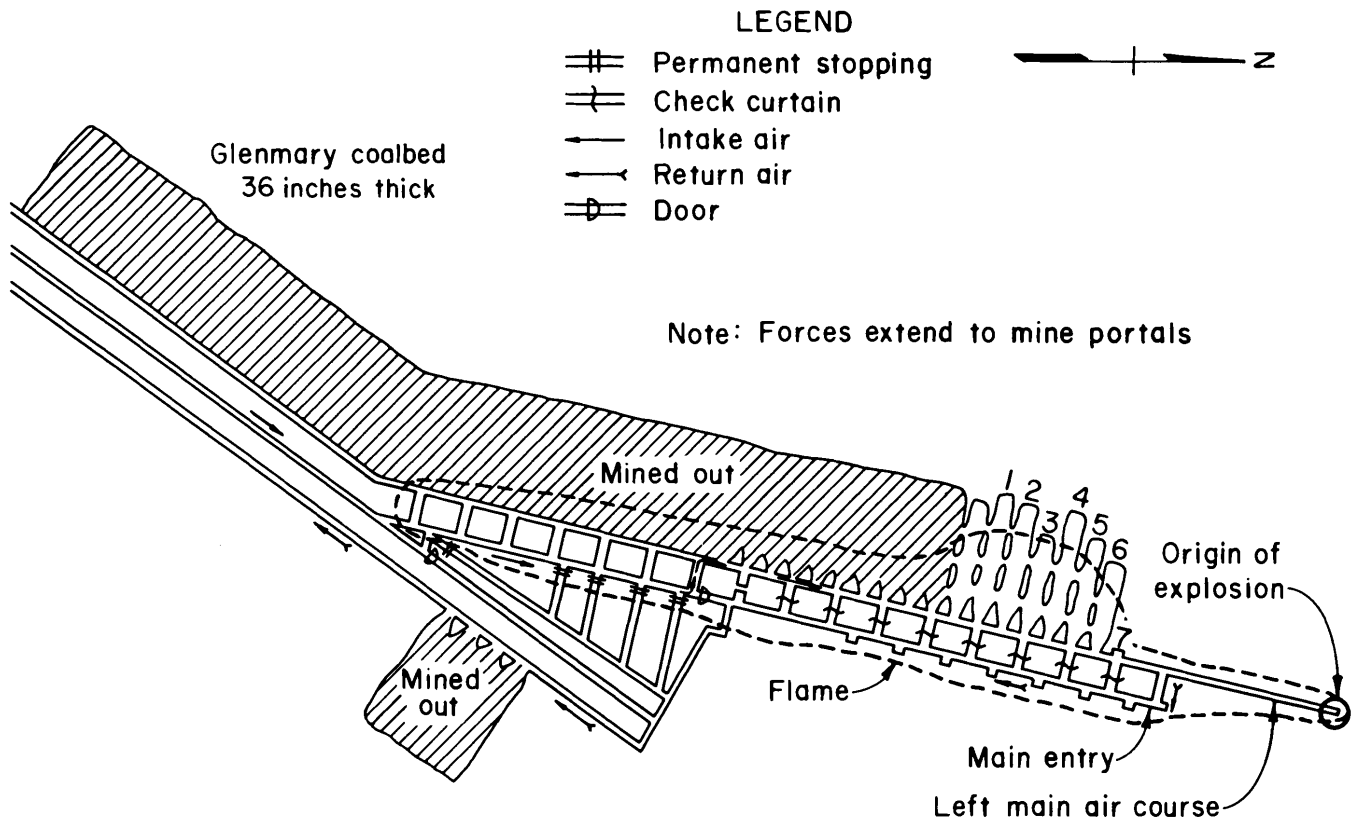


FIGURE 5. - Explosion area, C. L. Kline Coal Co., No. 2 Mine, near Robbins, TN, May 24, 1965.

Two foremen and five workmen inby the fire died of asphixiation while a crew tramping a miner outby the fire escaped uninjured.

The mine fan was stopped to prevent fanning of the fire by the air current. It was restarted after 15 to 20 minutes because smoke was backing up in the entry. Shortly after restarting the fan an explosion occurred when the distillate by-products were coursed over the fire by the renewed air currents.

No attempt was made to short-circuit contaminated air from the inby workings. Only 2 of 13 self-rescuers found in the possession of the 7 victims showed evidence of attempts to use them.¹²

DUTCH CREEK MINE
REDSTONE, CO
DECEMBER 28, 1965 - 9 KILLED

A gas and coal dust explosion killed 9 of 30 workers in the mine. The other 21 escaped uninjured.

Face ventilation was interrupted by 20 to 25 tons of coal piled on the floor by the continuous miner. Methane feeders were present at the face and a coal bump released additional gas. The gas was ignited either by a blown splice in the loading machine cable or by arcing from an exposed power conductor in the shuttle car cable. The gas ignition propagated¹³ coal dust from the piled coal or spillage along the tramway.

SILTIX MINE
MOUNT HOPE, WV
JULY 23, 1966 - 7 KILLED, 2 INJURED
(SEE FIGURE 6)

Methane from feeders and from pillar falls was ignited by an electric arc or

¹²Oxygen self-rescuer could have saved these.

spark. Coal dust played a very minor role in this disaster. Eleven men, trapped inby the explosion area, erected a barricade and remained behind this barricade until rescued about 1-1/2 hours later.

Ventilation in the explosion area was insufficient. Poorly constructed temporary stoppings, no line brattice in continuous miner places, lack of a regulator on air splits, and lack of a bleeder system combined to add to the hazard. The foreman was the only person on the section with a flame safety lamp. Sufficient lamps were not available at the mine to provide a lamp for the operator of each piece of face electric equipment.

The combination of a damp to wet section, rockdusting, and opened areas for explosion expansion inhibited propagation and caused the explosion forces to dissipate rapidly.

All electric equipment in the area was found to be in a non-permissible condition. Arcs or sparks at the cable-reel collector ring assembly of a shuttle car was the igniting agent. The explosion originated in the vicinity of the pillars being removed near the left edge of the map of Figure 6.

RIVER QUEEN UNDERGROUND MINE NO. 1
GREENVILLE, KY
AUGUST 7, 1968 - 9 KILLED, 2 INJURED
(SEE FIGURES 7 AND 8)

Permissible explosives, stored on a coal drill 45 feet from and in direct line with the face, were detonated by blasted material expelled from the coal face. Coal dust was involved to some degree, but propagation was short lived. Methane was not a factor.

¹³Initiated an explosion in the coal dust.

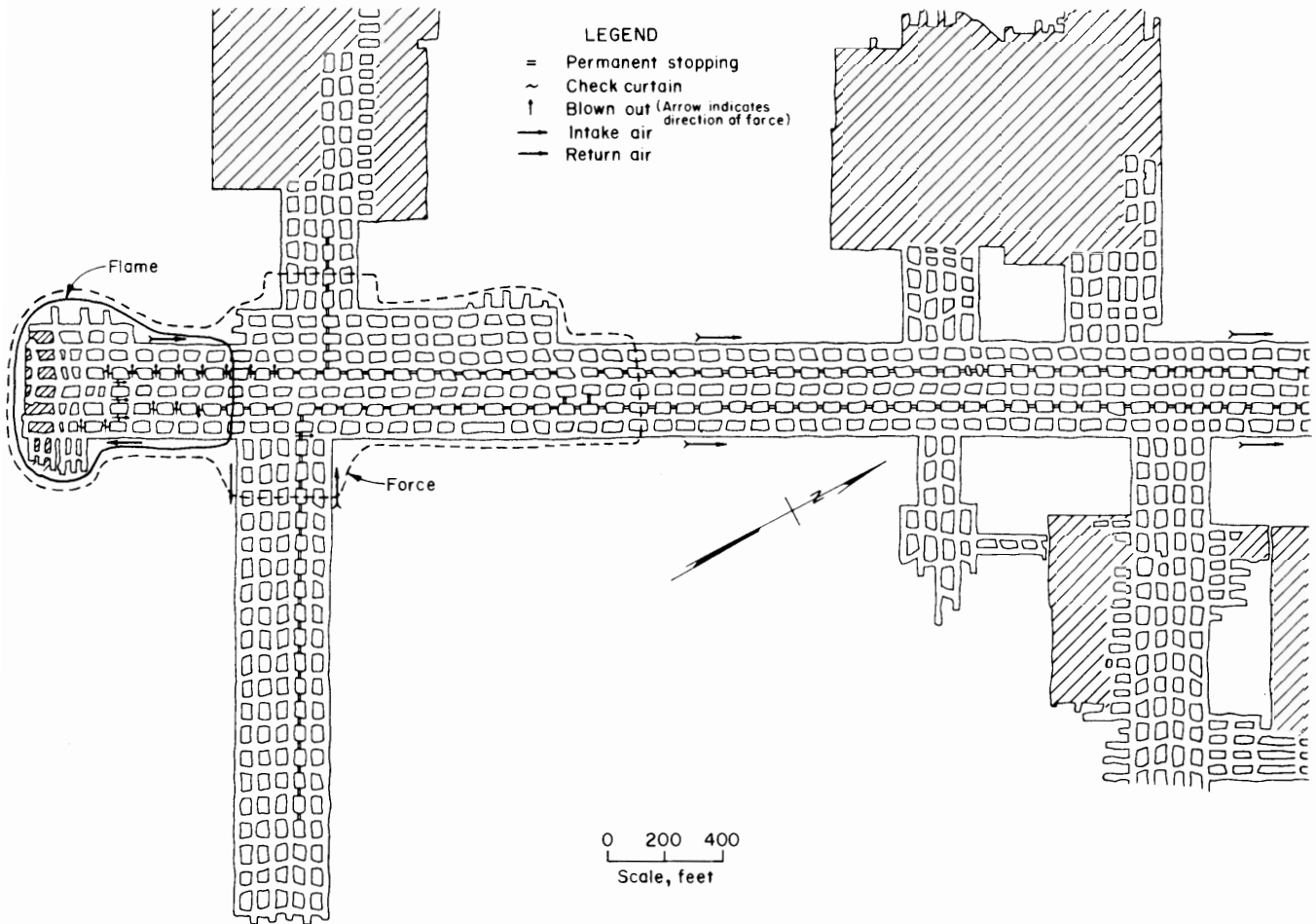


FIGURE 6. - Explosion area, Siltex Mine, Mt. Hope, WV, July 23, 1966

CONSOL NO. 9
FARMINGTON, WV
NOVEMBER 20, 1968--78 KILLED

The destruction due to this explosion, added to that caused by secondary explosions for several days afterwards, followed by final sealing of the mine prevented a complete investigation and the issuance of an official report. As of this writing, 13 years later, some of the bodies remain sealed in the mine, with the cause of the explosion sealed with them.

The following information is from an interview of Lewis Evans, Safety Director of the United Mine Workers of America (12). The first explosion took place at 5:30 a.m., November 20. The 21 men who

escaped came out shortly afterwards. Eleven escaped through the slope, two came out Atha's Run Portal, and eight were lifted by bucket up the Mahan shaft. After the explosion destroyed the shaft at Llewellyn Portal, fire and smoke belched forth, making conditions too hazardous even to consider putting mine rescue teams into the mine because of the danger of more explosions.

A succession of recordable explosions did take place. As of November 29 there had been 24 plus innumerable smaller "pops" and "puffs." Undamaged fans were kept running for a while in an effort to supply fresh air, but within 24 hours large fires developed along with dangerous levels of carbon monoxide and methane.

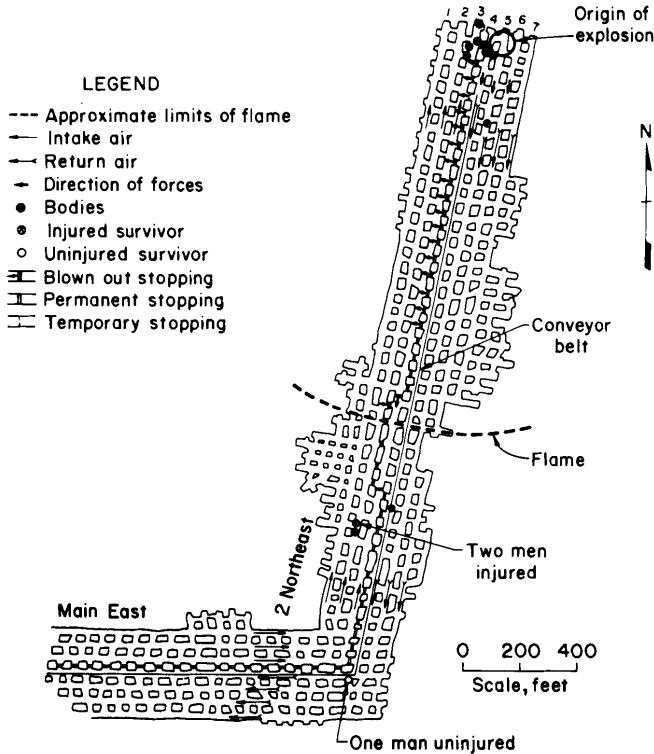


FIGURE 7. - Explosion area, River Queen Mine No. 1, Greenville, KY, August 7, 1968.

Another shaft that was damaged by the explosion was at Mod's Run. An attempt was made to seal the two portals at this location with 26 tons of steel and concrete on each shaft in what proved to be a vain attempt to cool off the fire. The seals were of short duration, being destroyed by subsequent explosions only minutes after placement.

The Mod's Run portals were later successfully sealed by dumping into each of them 500 tons of coarse limestone. This amount was put into each shaft, and this semiseal held until final decision to seal off all of the mine was made.

Consol No. 9 Mine was among the largest in the United States. Its underground tunnels extended through the West Virginia hills in a space roughly 10 miles by 6 miles. It worked three production shifts per day, and its crew of 380 men,

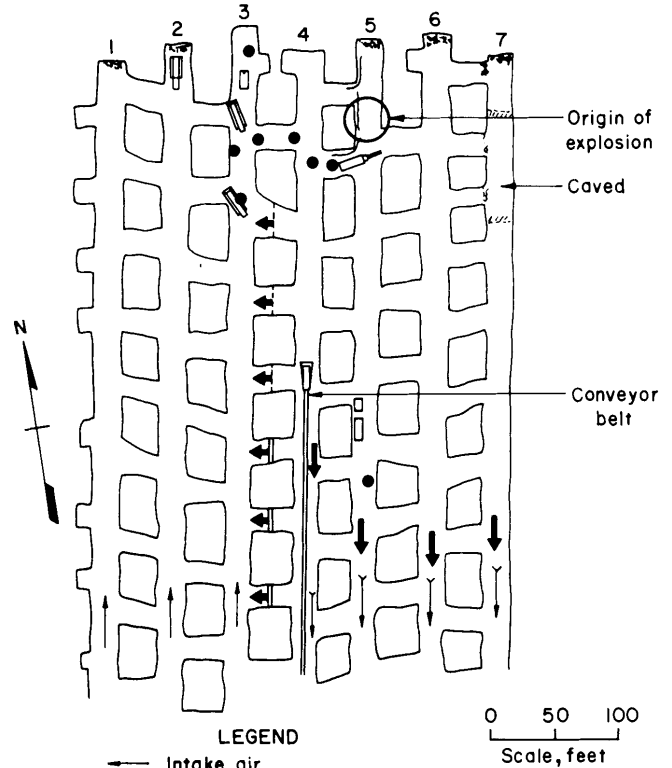


FIGURE 8. - Detail of River Queen Mine.

320 of whom worked underground, produced 9,500 tons of coal per day. It was a very gassy mine, releasing from 7 to 9 million cubic feet of methane per day. Consol No. 9 Mine was located in the Pittsburgh coal seam.

Fourteen years and one week prior to this explosion the same mine had blown up, killing 16 men (Nov. 13, 1954). Upon the present occasion, the mine was sealed and partially reopened 6 months later, at which time some of the bodies were recovered. These two blasts were considered by some to have been the most violent up to that time. The Bureau of Mines had inspected this mine 3 months before the disaster and the State of West Virginia 2 weeks before.

FINLEY COAL CO.
 NOS. 15 AND 16 MINES
 HYDEN, KY
 DECEMBER 30, 1970 - 38 KILLED
 (SEE FIGURES 9-11)

Coal dust was thrown into suspension and ignited during the blasting of roof rock for a loading point. Excessive accumulation of coal dust and inadequate rockdusting permitted propagation of the explosion throughout the mines.

According to former practices in blasting boom holes and evidence presented by various persons, found during the investigation, it must be concluded that on the day of the explosion, 100 or more shot holes were drilled into the roof, each charged with one or two cartridges of explosives, connected by a trunkline of Primacord with short leaders of Primacord to each charge with one electric detonator held in place with pieces of paper and fired by means of a blasting cable attached either to a shot-firing unit, power cable, or to the battery connections of a nearby battery-powered tractor.

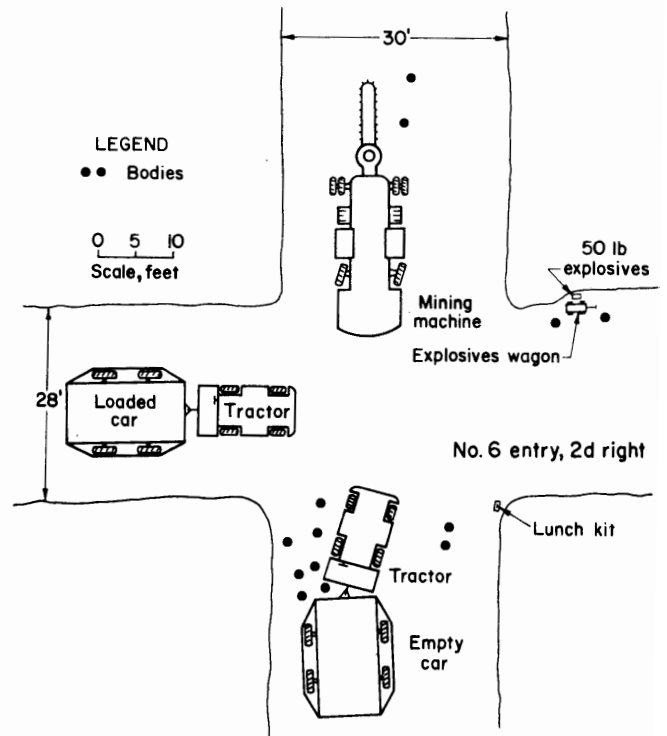


FIGURE 10. - Detail of explosion area, Finley Coal Co., No. 15 Mine.

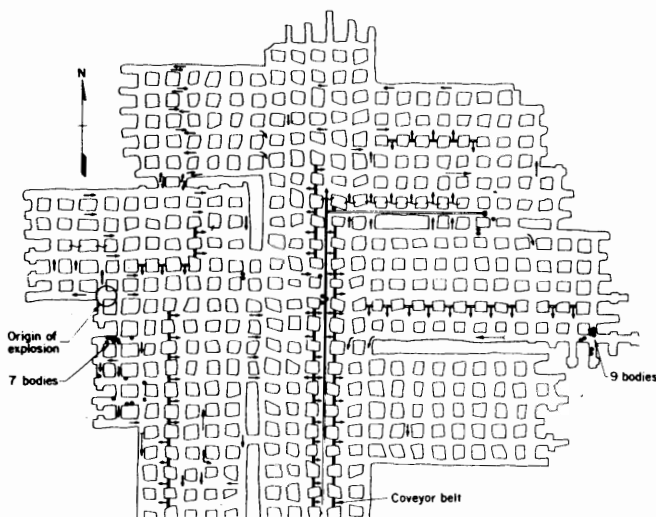


FIGURE 9. - Explosion area, Finley Coal Co., Nos. 15 and 16 Mines, Hyden, KY, December 30, 1970.

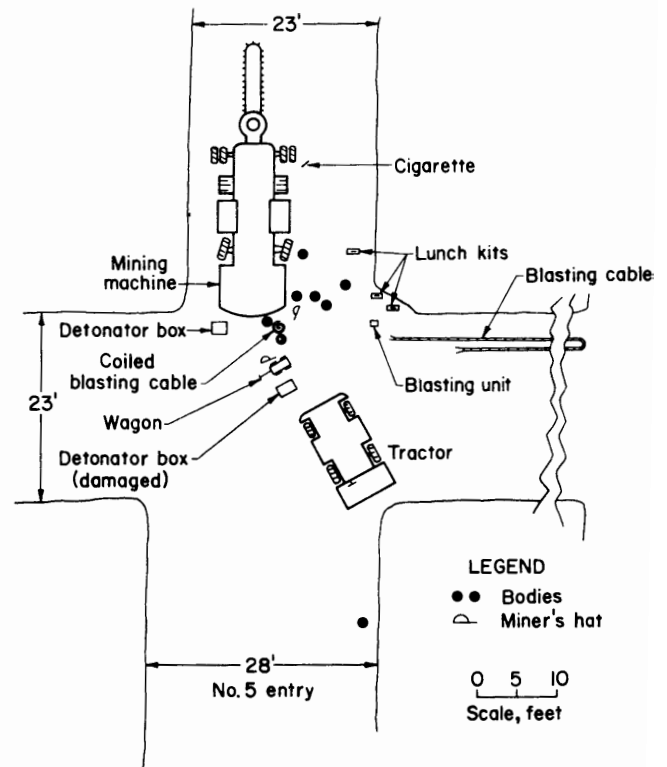


FIGURE 11. - Detail of explosion area, Finley Coal Co., No. 16 Mine.

Primacord was available in a storage area on the surface and was found at the blast site and other places underground. During clean-up of the rock from the loading point, only one set of leg wires was found. If electric detonators rather than Primacord were used to initiate the blast, there should have been at least 100 sets of leg wires in the blasted material. Testimony also indicated that wads of paper or brattice cloth were used to stem holes drilled for loading points. (This would constitute an unconfined shot.)

The mine was classified non-gassy and methane was not a factor in this explosion.

More background information was supplied by an article "Disaster at Hurricane Creek" in Popular Mechanics (1). Two state inspections and four federal inspections during the preceding nine months had revealed excessive coal dust and other combustible materials, insufficient rock dust, and other violations. The disaster occurred exactly one year after the 1969 Act became law. The coal dust explosion was so extensive that dust and other materials were expelled from all eight openings of the mine. (Non-permissible explosives were used in a

non-permissible manner.) In the previous August, one man had lost his eyesight, and a second suffered cuts and a ruptured eardrum, due to the accidental detonation of explosives underground. The account states that 120 shots were fired in blasting a "boom hole" in the roof, even though safety regulations permit only 20 shots to be fired at once. A physician found that 31 or 32 had died instantly from the blast, and the rest probably from carbon monoxide. Thirty four widows and 103 children were left to mourn the loss.

ITMANN NO. 3 MINE
ITMANN, WV
DECEMBER 16, 1972 - 5 KILLED, 3 INJURED
(SEE FIGURE 12)

This explosion resulted from the ignition of a methane-air mixture in the track-belt entry about 1,000-feet outby the working faces. The methane was ignited by an electric arc from a portal bus being used to transport the section crew to the surface. The electric arc occurred when the trolley-pole harp lost electrical contact with the trolley wire. The investigators were of the opinion that in addition to the usual methane liberation in the entry, excessive pressure from the adjacent strata released

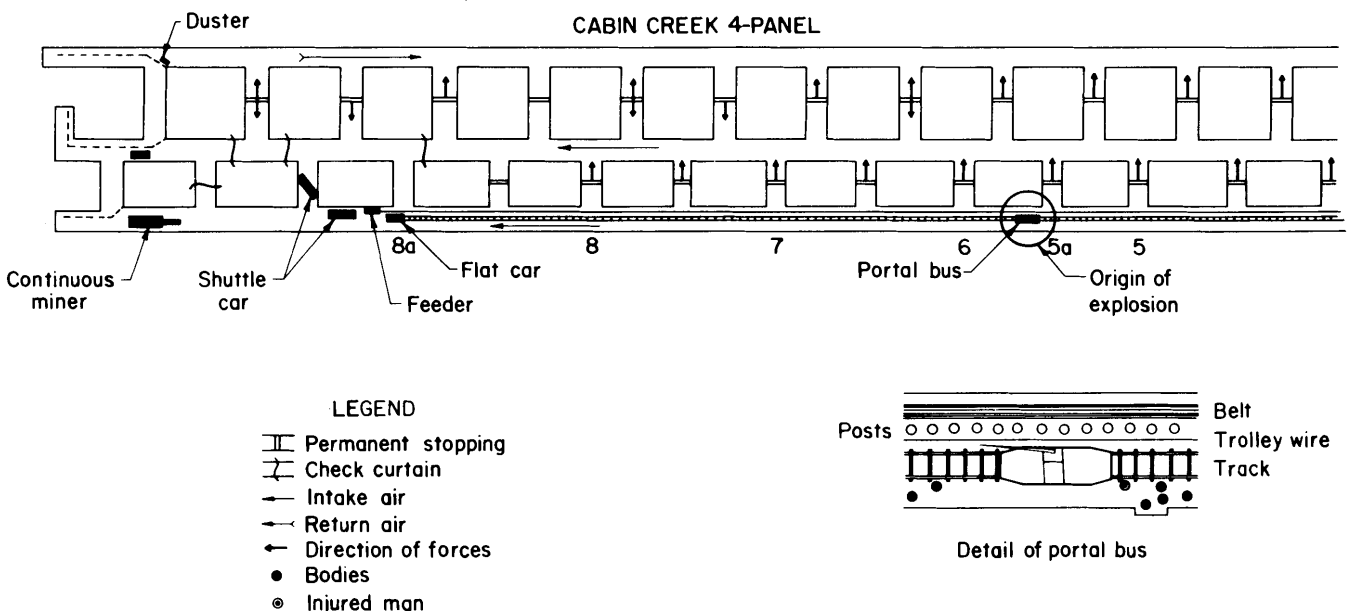


FIGURE 12. - Explosion area, Itmann No. 3 Mine, Itmann, WV, December 16, 1972.

additional methane shortly before the explosion occurred.¹⁴ Of the eight men in the portal bus at the time of the explosion, five were killed and 3 seriously burned.

This was primarily a methane explosion and coal dust entered into propagation only to a minor degree.

SCOTIA MINE
WHITESBURG, KY
MARCH 9, 1976 - 15 KILLED
MARCH 11, 1976 - 11 KILLED
 26 KILLED
(SEE FIGURE 13)

Because of the controversial nature of some aspects of this disaster and the lack of publication of an official account, we will confine this account to information included in a report published by the House Education and Labor committee, and a Grand Jury charge.

Two explosions occurred within 60 hours of each other, both apparently originating from ignitions of methane, although the mine had not been considered excessively gassy. It had been producing about 250,000 cubic feet of methane per day. Both explosions are considered to have originated in the No. 2 Southeast mains. Two mining locomotives were in the area, both equipped with battery-operated air compressors. There were also two methane "feeders" in this area. Nine men were killed almost instantly by the explosion on March 9, and six more survived for a while by taking refuge in No. 2 left off 2-Southeast, but were eventually overcome. In about 18 hours, rescue teams had recovered all bodies.

Mine Enforcement and Safety Administration (MESA) inspectors determined that a roof fall had occurred over a track entry, so roof bolters were called in, in order that further inspection could proceed. On March 11, in mid-afternoon, a 13-man crew entered, including 3 Federal inspectors and 10 company employees.

Then the second explosion occurred, and all but the two roof bolters were killed. The second explosion was more severe than the first, apparently originating about 2,000 feet from the origin of the first explosion. About 12 hours later, the rescue team found the 11 bodies, but was withdrawn without removing them because of imminent danger of another explosion. The mine was sealed, to be opened approximately a year later.

The Labor Standards Subcommittee of the House Education and Labor Committee published a report charging the Scotia Coal Co. with responsibility for the first explosion and MESA for the second. The No. 2 Southeast main had not been fire-bossed prior to the entry of the two locomotives; apparently inadequate ventilation prevailed in this section. Similar

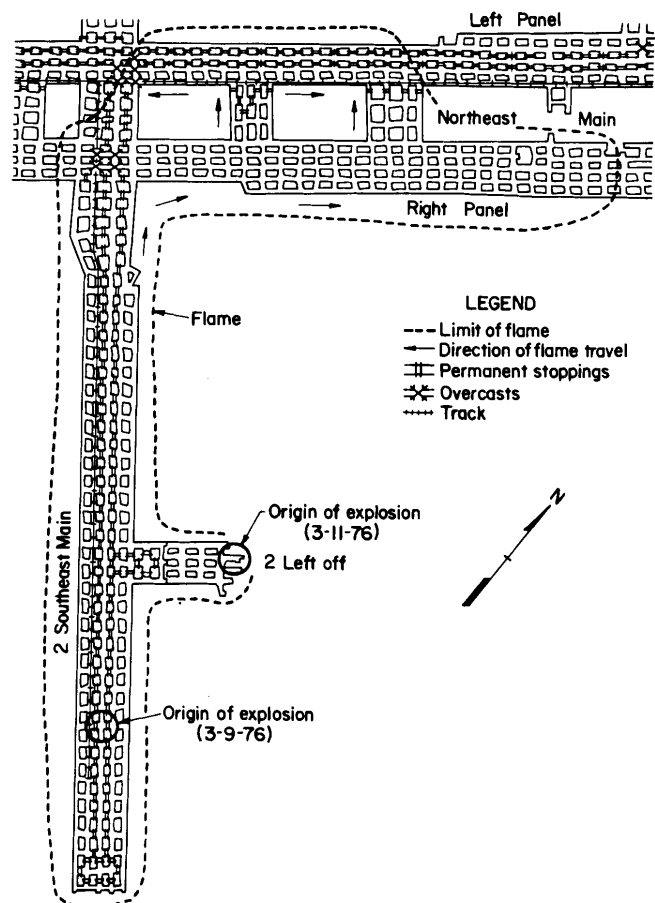


FIGURE 13. - Explosion area, Scotia Mine, Whitesburg, KY, March 9 and 11, 1976.

¹⁴Perhaps there was evidence of an outburst.

hazardous conditions existed prior to the second explosion. The above report was reviewed in Coal Age (4). Later, Coal Age (5) reported Grand Jury charges that the disaster was caused by the lack of adequate ventilation in all sections, failure to fire boss, and submission of false records. The Blue Diamond Coal Co. (owner of the mine) has sued MESA for responsibility for mine damage due to the second explosion, and widows of the first explosion were suing Blue Diamond.

FERRELL MINE NO. 17, WESTMORELAND
COAL CO.
BOONE COUNTY, WV
NOVEMBER 7, 1980--5 KILLED

The following account was taken from newspaper reports and from Coal Age (6) Five men, all maintenance workers, were removing track in an unused portion of the mine about 1 mile away from any other work crew when the explosive occurred. Another 70 men working in different parts of the mine escaped without injury. The blast resulted from an ignition of methane in the presence of inadequate ventilation. A spark from a "locomotive-type" vehicle the men used to get to their workplace may have set off the explosion, according to a company representative. The blast was so strong it blew large cinder blocks 150 feet and overturned a conveyor belt several hundred feet away. Apparently, the men were killed instantly. After the explosion, toxic or noxious gases, including methane, hampered rescue, so that a day passed before the bodies were reached.

DUTCH CREEK NO. 1 MINE
MID CONTINENT RESOURCES CO.
REDSTONE, CO
APRIL 15, 1981--15 KILLED
(SEE FIGURE 14)

The blast occurred at about 4:15 P.M. MST, when 22 men were in the mine. Three men came out uninjured, four were slightly injured, while the remaining 15 were killed, almost instantly, when a coal dust, methane-air mixture was ignited after a bump occurred at the working face. The same mine was the scene of

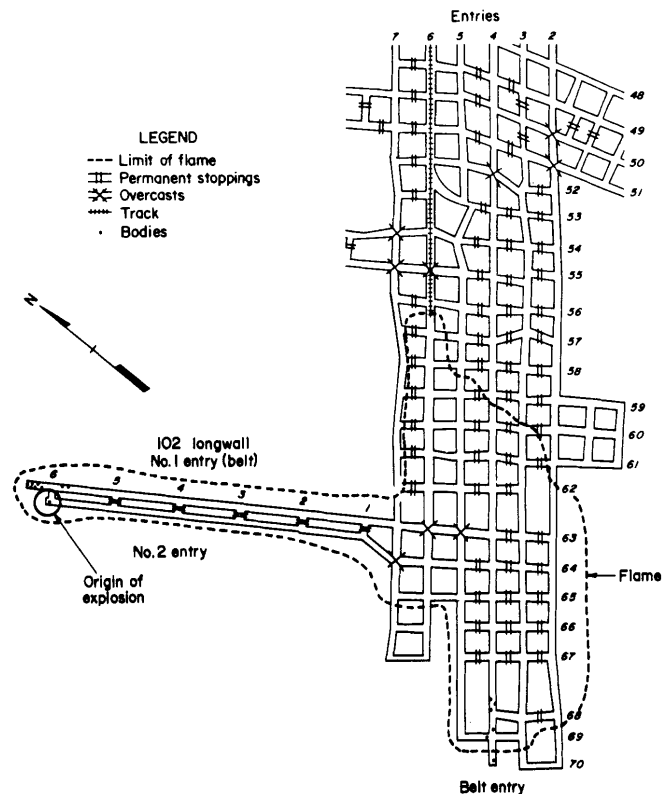


FIGURE 14. - Explosion area, Dutch Creek Mine, Redstone, CO, April 15, 1981.

an explosion that killed nine men on December 31, 1965.

Within 38 hours after the explosion all 15 bodies had been removed. The working areas were reached by a 15-degree slope which was partially flooded by water when the blast knocked out power to the pumps. The location of the blast was about 7,000 feet from the mine portal. The mine had been considered very gassy. A recent report by MSHA listed the following contributing factors:

1. Large amounts of methane and coal dust were dispersed over wide areas by the bump.
2. Face ventilation was disturbed by the destruction of brattice by the coal outburst.
3. The methanometer in the continuous miner located near the face of the 102 longwall entry shut off the main power to the machine but not to the lighting circuit.

4. The lighting circuit had been de-energized by throwing its two-pole switch to off.

5. The switch enclosure was later determined to be a non-permissible condition by virtue of a wire being caught under the lid. There was evidence of a flame propagating out of this enclosure so the latter is assumed to have been the ignition source.

6. Three of the six victims in the immediate face area of the 102 Section

died as a result of concussive blast injuries, two as a result of carbon monoxide poisoning, and one as a result of a combination of concussive blast injuries and carbon monoxide poisoning. The two victims near the shuttle car further outby in the 102 Section died as a result of concussive blast injuries caused by the explosion. The victim in the face of the No. 2 entry of the 102 section, and all six men in the Slope Section died as a result of carbon monoxide poisoning.

ANALYSIS OF 18 MAJOR EXPLOSIONS OF 1959-81

Eighteen major explosions are reported here, mostly verbatim from inspector's reports, often with only speculation as to the cause. Twelve were apparently caused by the electrical ignition of methane-air mixtures in areas where the normal ventilation had been seriously interrupted in the process of mining or transport. In most of these cases, coal dust contributed to the explosion. When methane is present, very much more rock dust is required to inert the coal dust; so much more, in fact, that such protection is very unlikely. To increase the incombustible content from 65% to 80%, more than twice as much rock dust is required. Even the 65% value required by law has a very small safety factor when considerable float dust is present. A mixture containing 70% incombustible with 80% of the coal passing through 200 mesh will propagate a strong explosion in a mixture of Pittsburgh pulverized coal dust (36% volatile matter) and rock dust (20). Although Richmond (20) listed surveys indicating that the fineness of coal dust has been increasing over recent years, chiefly as a result of the use of

continuous mining machines and longwall systems, regulations have not been changed to reflect this new situation. In some cases, supposedly permissible equipment was not so, or ignitions occurred outby the last open crosscut, where permissible equipment was not required.

Two explosions occurred as a direct result of a methane outburst, during attempts to ventilate the large quantity of gas, but nonpermissible or defective electrical equipment ignited the gas.

In one case, fuel-rich fumes from a fire were recirculated over the fire (improper ventilation) and ignited. Two disasters resulted from the improper use of explosives underground, resulting in the direct ignition of dust clouds, in the absence of methane. Damage resulting from the worst disaster at Consol No. 9 was so severe that no cause could be reported, but the mine was gassy, so one might assume that improper ventilation was a major contributing factor.

THE FEDERAL COAL MINE HEALTH AND SAFETY ACT OF 1969 (PUBLIC LAW 91-173)¹⁵

In the preamble to Public Law 91-173, Congress declared that the first priority

¹⁵Safety Act passed December 30, 1969, but Part 75, Mandatory Safety Standard - Underground Coal Mines, was not published initially in the Federal Register until November 20, 1970.

and concern of all in the coal mining industry must be the health and safety of its most precious resource--the miner; that there is a need to provide safer working conditions in the Nation's coal mines and to prevent occupational diseases; and that the existence of unsafe and unhealthful working conditions is a

serious impediment to the growth of the mining industry and to the growth of commerce.

The purpose of this act was to establish interim mandatory health and safety standards, by direction to the Secretary of Health, Education, and Welfare, and Secretary of the Interior; to require operators and miners to comply with such standards; to cooperate with and assist the States in setting up health and safety programs; and to improve and expand research, development, and training programs aimed at preventing coal mine accidents and occupationally caused diseases.

Among the many impacts this law has had are the following:

1. Established an advisory committee on coal mine health research.

2. Established right of entry into mines, with frequent entry.

3. Conferred power to issue withdrawal orders, with appeals, reviews, etc., upon finding that imminent danger exists.

4. Empowered the Secretary to issue injunctions in case of refusal to comply with orders.

5. Established civil and criminal penalties.

6. Established interim health standards, including those for respirable dust, medical examinations, and noise.

7. Established interim safety standards covering roof support, ventilation, methane monitoring, combustible materials and rock dusting, electrical equipment, trailing cables, grounding, high-, medium-, and low-voltage circuits, fires, blasting and explosives, etc.

An important section (title IV) dealt with black lung (pneumoconiosis) benefits

before and after December 31, 1972. Title V included a significant section requiring the Secretary of the Interior and the Secretary of Health, Education, and Welfare to conduct research to improve working conditions regarding both safety and health, to publish reports, etc. To assist with this research, the Secretaries may enter into contracts with, and make grants to, public and private agencies and organizations and individuals. Information so developed shall be available to the general public. Funds were appropriated to carry out this research--\$20 million for the fiscal year ending June 30, 1970; \$25 million for the fiscal year ending June 30, 1971; and \$30 million for the fiscal year ending June 30, 1972, and for each succeeding fiscal year thereafter. The actual appropriations in fiscal years 1974-79 follow, in millions:

FY 74	- \$27.1
FY 75	- \$27.5
FY 76	- \$29.2
Transition	- \$ 7.5
FY 77	- \$29.2
FY 78	- \$40.9
FY 79	- \$47.8

Among the immediate impacts of this act were increases in the number of coal mine inspectors and in the frequency of inspection; and a large increase in the amount of health and safety research, both in-house and by contract, resulting in many new techniques, devices, and systems to improve health and safety, along with more mandatory and advisory regulations. Training programs expanded rapidly, and the Coal Mine Health and Safety Academy was established in Beckley, WV, in 1971.

In the 10 years following the passing of the Federal Coal Mine Health and Safety Act of 1969, the number of major explosions was only one-third of that in the previous 10 years, and there were two 4-year periods with no major explosions.

THE FEDERAL MINE SAFETY AND HEALTH ACT OF 1977 (PUBLIC LAW 95-164)

The following paragraphs summarize Public Law 95-164 with emphasis on its modifications to the Federal Coal Mine Health and Safety Act of 1969 (Public Law 91-173).

The purpose of the act of 1977 is the same as that of the act of 1969, except it includes all other mines, as well as coal mines. The Federal Metal and Non-metallic Mine Safety Act and the Federal Coal Mine Safety Act are repealed. Section 405 of the act of November 16, 1973, Public Law 95-153 is repealed. "Coal or other mine" includes areas from which minerals are extracted in nonliquid form, or if in liquid form, are extracted with workers underground.

An Interim Compliance Panel of five members is established. The Secretary of the Interior shall appoint an advisory committee on coal or other mine safety research, and the Secretary of Health, Education, and Welfare shall appoint an advisory committee on coal or other mine health research. The Secretary of the Interior is authorized to institute civil action for relief, including injunctions, for violations or interference by operators with enforcement of this act. Penalties have been increased for

violations. The Federal Mine Safety and Health Review Commission is established, consisting of five members, appointed by the President by and with the advice and consent of the Senate.

Provision is made in this act for mandatory health and safety training of miners using both initial and refresher courses. Regulations include dust from drilling rock, and restricting quartz content to 5%. More details are provided to regulations concerning roof support, ventilation, combustible material, electrical equipment and circuits, fire protection, blasting and explosives, etc. More funds were authorized for research.

The Secretary or his/her delegate is required to make inspections of each underground coal or other mine in its entirety at least four times a year and of each surface coal or other mine in its entirety at least two times a year. Amendments include a definition of excessive quantities of methane to be 1 million cubic feet during a 24-hour period. The Mine Safety and Health Administration (MSHA) is created, and is transferred to the Department of Labor, headed by an assistant Secretary of Labor.

HOW NEW MINING METHODS HAVE CHANGED THE NATURE OF HAZARDS

Mining of coal by explosives has diminished to such an extent that ignition of dust or gas by permissible explosives when properly used is very rare. The only documented exception of recent date is the Finley disaster of 1970, in which nonpermissible explosives were used. But the advent of the continuous miner as well as longwall mining produced hazards of their own. These techniques tend to produce more fine dust, which is a hazard to both health and safety. As the tables

show, there has been an enormous increase in frictional ignitions of methane, usually resulting when the bits struck sandstone or pyrites.

As deeper seams are mined the methane content tends to increase, requiring larger fans and greater fan pressure. Current methane drainage techniques may not work owing to low porosity, lack of fracture, and high friability.

RESEARCH BEING CONDUCTED TO CORRECT PROBLEMS

SUPPRESSION OF IGNITIONS AND EXPLOSIONS

Problem: Most coal mine explosions originate with ignitions of methane at the face. At greater distances from the face, explosions sometimes propagate in spite of considerable rock dusting.

Short-Term Research: As required by the 1969 act, the Bureau of Mines conducted research on suppression of ignition at the face (2, 11, 17, 21) and funded a contract to equip a mining machine with such a system (10). The goal was to quench incipient ignition of methane at the face before noticeable pressure and flame can develop. This required a sophisticated combination of fast detection and efficient quenching. Unfortunately, the system has not found practical application.

Long-Term Research: More extensive research has involved passive and triggered barriers to suppress explosion of gas and/or dust which has developed considerable flame speed and pressure. Much of this research is based on European technology already in practice. A detailed description of the performance of stone dust barriers, water barriers, and triggered barriers in Polish and German mines may be found in chapter 9 of Professor Cybulski's book (7). Passive water barriers were tested extensively in the Bureau's Experimental Mine at Bruceton, based on devices developed by the Federal Republic of Germany (13). Modifications were invented to cope with very low speed explosions which might defeat the conventional device (14). For general use, as well as for special applications, triggered barriers were tested, using a variety of materials, with sophisticated sensors which had to respond rapidly to a real danger while remaining alert in the presence of false alarms (15). Conveyor beltways are especially vulnerable to explosion hazards, so a special task was devoted to that problem (16). More recent research has been directed toward suppression of methane ignition at a longwall face. Such work necessarily

involves triggered barriers, with large stored energy and fast response.

METHANE DETECTION

Short-Term Research: An accurate permissible methanometer has been made available (an improvement over the flame safety lamp), but requires the tedious checking of all working areas, which takes time and is all too frequently neglected.

Long-Term Research: The automatic remote sensing of methane involves fail-safe procedures including the use of tube bundles strategically located, with a remote gas analyzer (3, 8); local fixed gas sensors or machine-mounted sensors connected electrically to a remote alarm or recorder; and an infrared Raman scattering remote methanometer. The latter is still in the laboratory research stage. Remote detection reduces the hazard of local measurements and provides the opportunity for much more accurate analysis than is possible with hand-held devices.

COAL DUST HAZARD DETECTION

Problem: Coal dust explosions can occur if there are adequate deposits of fine coal dust inadequately inerted with rock dust.

Short-Term Research: Grab sampling followed by laboratory analysis is an acceptable technique for hazard detection, but the response time is very slow.

Long-Term Research: A device has been designed and built to provide a remote readout in real time of dust depositions in a mine. The system is composed of a diaphragm whose natural frequency changes as dust is deposited on it. The diaphragm is electromagnetically excited, and the frequency is read remotely on a separate device. The instantaneous measurement of incombustible content of mine dust in place has been made possible by another device employing absorption of nuclear radiation.

PREVENTION OF FRICTIONAL IGNITION

Problem: Frictional ignition due to the action of continuous miners on rock inclusions shows great potential for causing gas explosions.

Short-Term Research: Frictional ignition is considerably reduced by a low-volume water spray mounted in back of the cutting bits and impacting the freshly cut sandstone surface. This result was shown by tests conducted in large chambers containing methane-air mixtures and full-size cutter bits impacting on sandstone blocks.

Long-Term Research: Long-range research, both in-house and by contract, has been devoted to metallurgical investigations into a nonsparking tool bit and to bit shape design and mounting procedures intended to minimize sparking. Reducing cutter speeds also tends to reduce incendive sparking.

METHANE DRAINAGE

Problem: Most coal seams contain methane which is released upon mining, causing a severe explosion hazard.

Short-Term Research: The conventional method is to ventilate the methane as quickly as it is released so that explosive concentrations are never formed except when sudden outbursts occur.

Long-Term Research: This long-range research program has involved a number of projects with objective as follows:

1. To establish by means of data obtained in mine and laboratory studies the stratigraphy, lithology, and geologic structure conditions that contribute to the high and low concentrations of methane in coalbeds; to determine the peculiar composition of gases occurring in coal and associated rocks and the factors that influence the migration and retention of methane in coalbeds and associated strata; to develop procedures to predict the probability of encountering coalbed discontinuities.

2. To test and refine the various technologies previously developed to control methane in advance of mining in order to make them applicable by the coal mining industry. These include horizontal holes from shaft bottoms and from multipurpose boreholes, vertical borehole degasification, and directional drilling from surface locations (19). (Vertical borehole technology is effective, but expensive.)

RESEARCH ON EXPLOSIVES

In spite of the reduced use of explosives in the underground mining of coal, ignitions of gas or of coal dust by the use of explosives sometimes occur. The data included in this report indicate that about 15% of both the number of major disasters and the number of miners killed were the results of the improper use of explosives. Research in a number of areas, listed below, is designed to reduce the explosive hazard potential. This information was kindly furnished by J. E. Hay, Research Supervisor of the Explosives Group of the Bureau's Pittsburgh Research Center.

Problem: Criteria for permissibility sometimes give ambiguous results.

Research: Several tests are required for permissible status (inability to ignite methane). A new proposed test 8 is intended to be a replacement for one of them--test 4. The primary advantage of test 8 is that it is more quantitative, yielding more information than test 4 on the incendivity of an explosive relative to other explosives.

Problem: Leaky water stemming bags can cause loss of stemming in the borehole with consequent ejection of hot detonation products and the possibility of ignition.

Research: New tests for leakage and fragility were devised for water stemming devices.

Problem: Loose hanging roof and large boulders can only be broken down either

manually or with machinery, involving loss of efficiency and long exposure of personnel to hazardous conditions, or the temptation to use unsafe (and illegal) forms of blasting.

Research: Nonincendive rock breakers were developed, containing a built-in sheath of inhibiting material, such that gas is not ignited.

Problem: Some explosives are sensitive to accidental impact by friction, etc.

Research: New permissible explosives (water gels and emulsions) are less sensitive.

Problem: Tests have shown that the detonators are the most sensitive component to accidental initiation which

might result from inadvertent drilling into misfired holes or encountering misfired explosives in mucking.

Research: Development of less sensitive detonators has reduced this problem, and nonincendive detonating cords would give a safe alternative to electrical initiation, which is susceptible to premature initiation by stray currents, lightning, etc.

Problem: Several instances have occurred in which ignitions have resulted from burning explosives being ejected from a borehole.

Research: Determination of why and under what circumstances this occurs is important to specify ways to avoid it.

CONCLUSIONS

In the past 23 years, deaths due to coal mine explosions have been reduced considerably, compared with the previous 23 years--from 1,674 in 1936-58, inclusive, to 335 in 1959-81, inclusive. Greater volume of air required at face, canvas or tubing required closer to face, restriction on temporary splices in trailing cables, the requirement for permissible electrical equipment to be used in by the last open crosscut, and the gradual transition from dc to ac power systems for mine machinery are the main reasons for drop in the number of disasters and the number of fatalities.

New and improved techniques in mining, designed to increase productivity, often substitute new problems for old, so that safety research must continue to advance, to cope with the new problems. Also, many disasters are the result of gross negligence and violation of known safety rules, and safety research designed to reduce disasters of this nature becomes very expensive, because such research focuses on developing "fail safe" devices that will function in the presence of human failures. Overall, however, economical laboratory research, closely correlated with the more expensive

full-scale fire and explosion research, contributes much to the safety achieved per dollar available. Contract research has allowed Government programs to draw upon the expertise of industry, and technology transfer programs have been developed to transmit research results to mining industry representatives and thus to the mines.

Frictional ignitions may be expected to attract attention for some time, although, fortunately, disasters are infrequent in the presence of adequate ventilations. Figure A-1 in the appendix graphs the number of frictional ignitions and associated injuries and fatalities per year during most of the 1959-81. Details of these incidents will be found in tables A-1 to A-8. Figure A-2 graphs similar data for nonfrictional ignitions; details of these incidents will also be found in tables A-1 to A-8. Classification of the causes of minor ignitions is graphed in figure A-3. It will be seen that continuous miner bits cause far more ignitions than all other causes combined. To complete the story, frictional ignition, gas ignitions, and dust ignitions in surface facilities are listed in table A-9.

FINAL NOTE

During the final preparation of this report, three more major explosions occurred in coal mines in Appalachia. On December 8, 1981, an explosion killed eight miners in the Adkins Coal Co. Mine No. 18, in Topmost, Ky. On the next day, 13 miners were killed in an explosion in the Dogwood Flats Mountain Coal Mine of the Grundy Mining Co., a subsidiary of the Tennessee Consolidated Coal Mining Co. This mine is located near Palmer, TN. Forty-three miners survived the explosion, which occurred when one of the victims used a cigarette lighter in an explosive methane-air mixture that accumulated as a result of inadequate ventilation in 003 section.

Yet another explosion occurred on January 20, 1982, in RFH Mining Co.'s Mine

No. 1 in Floyd County, Ky. Seven miners were killed in this blast, which apparently resulted from the ignition of gas and coal dust by blasting. Investigators concluded that the explosion originated in the No. 5 room of the 001 section. Coal dust was ignited by flames from the explosives when the developing crosscut between the Nos. 5 and 6 rooms was shot through into the No. 5 room. Flames from the explosives were not contained within the limits of the coal being shot owing to a blown-out or a blown-through shot. Flame and/or major forces of the explosion propagated from the face area of the No. 5 room, traversed the entire mine, and traveled to the surface. Surface facilities that were in direct line of the forces coming out of the mine were extensively damaged.

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APPENDIX

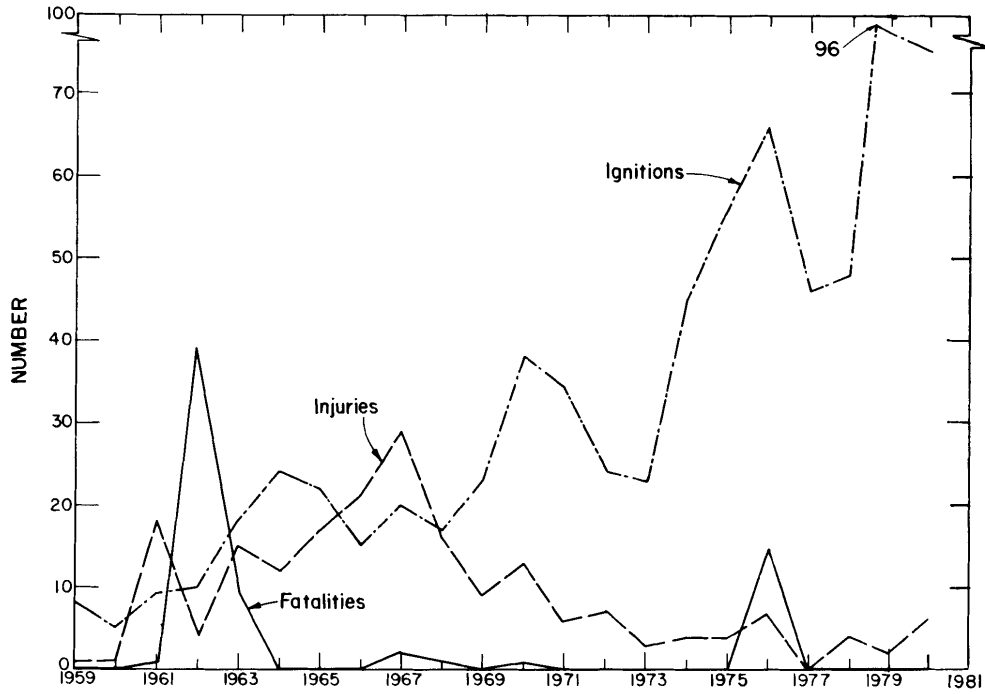


FIGURE A-1. - Number of frictional ignitions and associated injuries and fatalities per year, 1959-80.

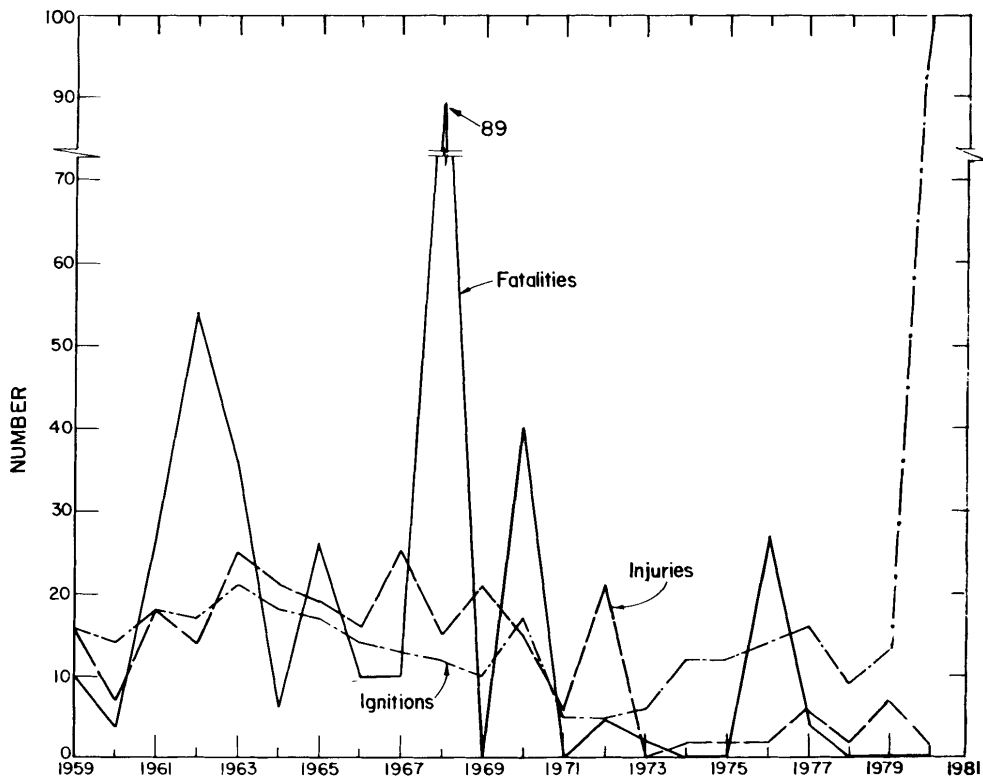


FIGURE A-2. - Number of nonfrictional ignitions and associated injuries and fatalities per year, 1959-80.

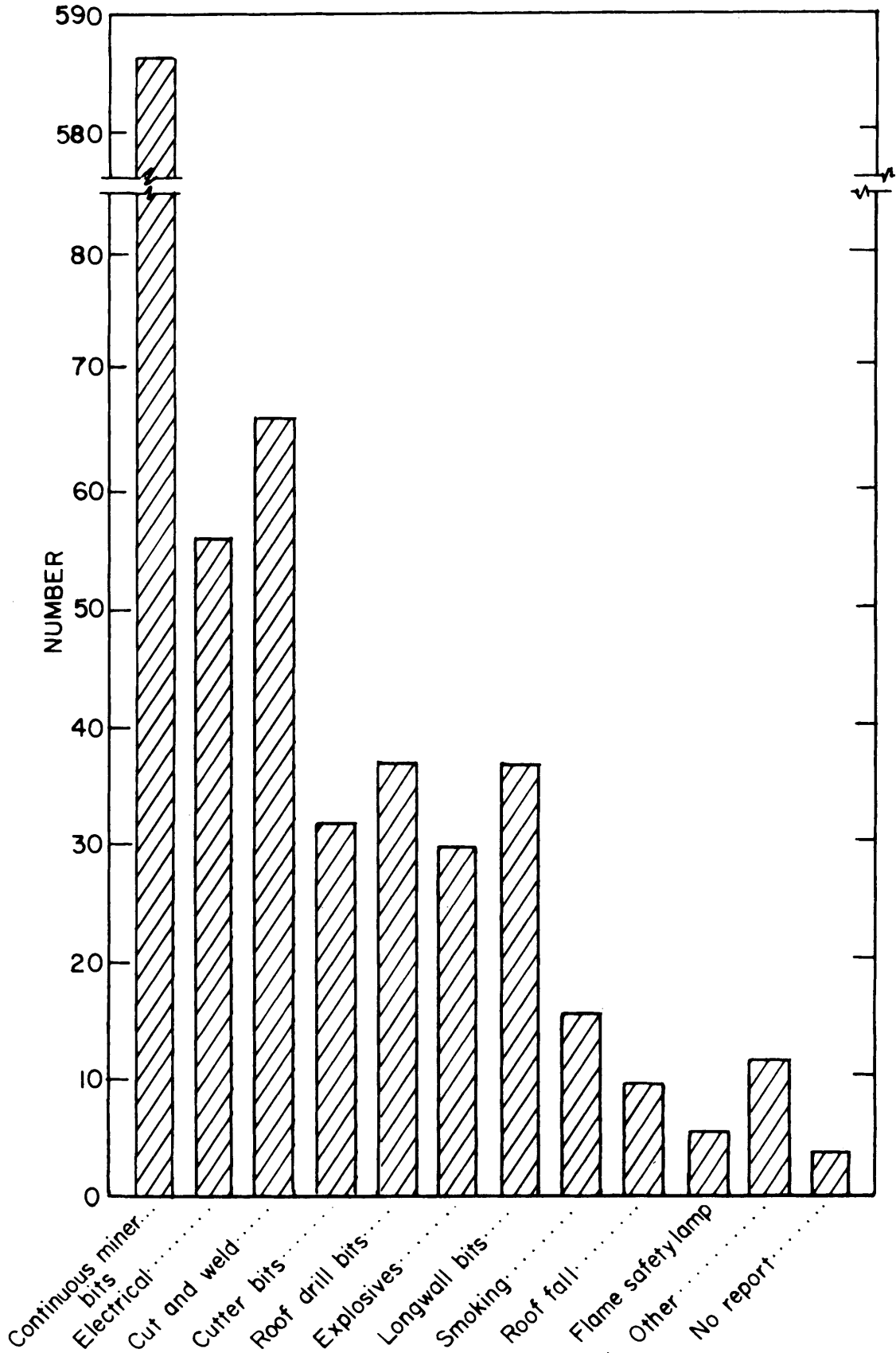


FIGURE A-3. - Number of minor ignitions and explosions by cause, 1959-80.

KEY FOR TABLES

- A = Anthracite
- CM = Frictional ignition from continuous miner bits
- Cut. = Frictional ignition from cutter bits
- C/W = Cutting and/or welding
- Drill = Frictional ignition by roof drill bits
- Elec. = Electrical arc
- Expl. = Explosive
- F = Fatalities
- FSL = Defective flame safety lamp
- I = Injuries
- LW = Longwall bits
- OF = Other frictional
- ONF = Other nonfrictional
- X = Multiple entries--report lists more than one possible cause of ignitions, and incident is listed under each. This accounts for discrepancy in adding columns and total.
- ? = Cause unknown or not yet specified

TABLE A-1. - Ignitions and explosions, 1959-68

Date	Mine	State	I-F	Cause
01/29/59	Loveridge.....	WV	0-1	FSL
02/05/59	.....do.....	WV	0-0	Cut.
02/06/59	#7 (Peerless).....	WV	0-0	Elec.
03/02/59	#5 (Pitfair).....	WV	1-0	Expl.
03/18/59	Nelms.....	OH	0-0	Elec.
03/23/59	#1 (Phillips & West).....	TN	0-9	Elec.
04/16/59	Robena.....	PA	1-0	CM
04/22/59	Peca Shaft.....	PA (A)	1-0	FSL
05/05/59	Buck Mountain Slope.....	PA (A)	2-0	Elec.
06/01/59	Lake Superior #3.....	WV	0-0	Elec.
06/04/59	Colver.....	PA	0-0	CM
06/27/59	#27 Island Creek.....	WV	1-0	Elec.
06/22/59	Compass #2.....	WV	0-0	Cut.
06/23/59	Moss #3.....	VA	0-0	FSL
08/15/59	Dutch Creek.....	CO	0-0	C/W
08/20/59	Lancashire #15.....	PA	1-0	Elec.
08/31/59	Compass #2.....	WV	0-0	Cut.

TABLE A-1. - Ignitions and explosions, 1959-68--Continued

Date	Mine	State	I-F	Cause
10/08/59	#64 Slope (S&M).....	PA (A)	2-0	FSL
10/09/59	Nelms.....	OH	0-0	CM
10/20/59	Buckhorn #2.....	IL	3-0	Elec.
11/04/59	#2 (Preston).....	VA	2-0	Smoking
12/11/59	Shannopin.....	PA	0-0	CM
12/21/59	Wildwood.....	PA	0-0	Drill
01/03/60	Colver.....	PA	0-0	Elec.
02/22/60	Nelms #1.....	OH	0-0	Elec.
03/01/60	Jensie.....	OH	0-0	Cut.
05/17/60	Marianna #58.....	PA	0-0	Cut.
07/06/60	#4 & 6 Slopes (Zerbe).....	PA (A)	2-0	Elec.
07/12/60	Nelms #2.....	OH	0-0	CM
07/20/60	Bessie.....	AL	2-0	CM
08/16/60	Dorothy Mae #7.....	VA	0-0	ONF
08/23/60	"A" #1.....	KY	0-0	ONF
08/26/60	Compass #2.....	WV	0-0	C/W
09/11/60	Olga #1.....	WV	0-1	Elec.
10/27/60	Dutch Creek.....	CO	0-0	Elec.
11/04/60	Enoco Colliery.....	IN	1-0	CM
11/05/60	#3 Rock Slope.....	PA (A)	0-0	Elec.
11/08/60	Lucerne #3.....	PA	0-0	Cut.
12/07/60	#1 Slope (Mason Herd).....	PA (A)	0-1	Elec.
12/22/60	Wharton #3.....	WV	3-0	ONF
12/28/60	Phillips #1.....	WV	0-2	Smoking
01/04/61	Scover & Slater Slope.....	PA (A)	1-0	Elec.
01/13/61	Dutch Creek.....	CO	0-0	Elec.
01/16/61	Enoco Colliery.....	IN	3-0	CM
01/17/61	O'Donnell #2.....	WV	0-0	CM
01/21/61	#19 (Wanamie).....	PA (A)	3-0	FSL
02/16/61	Marianna #58.....	PA	0-0	CM
03/02/61	Viking.....	IN	0-22	Elec. ONF
04/13/61	Burnwell #1.....	CO	1-0	Smoking
04/17/61	Itmann #1.....	WV	2-0	CM
04/18/61	Osage #3.....	WV	5-1	CM
05/08/61	Day.....	IN	1-1	Smoking
05/09/61	#16 (O'Quinn).....	VA	0-0	ONF
05/16/61	Moss #2.....	VA	1-0	C/W
05/29/61	#5 (Omar).....	WV	1-2	Elec.
05/30/61	#2 (C.B. & H.).....	WV	1-0	Smoking
07/25/61	Glen Rodgers #2.....	WV	1-0	C/W
07/29/61	#5 (Phillips).....	Va	2-1	ONF
08/03/61	Lynn Camp #1.....	VA	0-0	ONF
08/28/61	Holmes Slope.....	PA (A)	3-0	Elec.
10/07/61	#2 Lykes Slope.....	PA (A)	1-0	Elec.
10/17/61	Dome.....	WV	1-0	Elec.
10/20/61	Nelms #1.....	OH	0-0	Cut.
10/26/61	Lancashire #15.....	PA	4-0	CM
11/24/61	Marianna #58.....	PA	0-0	CM

TABLE A-1. - Ignitions and explosions, 1959-68--Continued

Date	Mine	State	I-F	Cause
11/18/61	#3 (Virginia City).....	VA	0-0	ONF
12/12/61	Federal #1.....	WV	4-0	CM
12/14/61	#2 & #3 Slopes.....	PA (A)	1-0	Elec.
01/10/62	#2 (Blue Blaze).....	IL	0-11	Elec.
01/11/62	#6 (Pound).....	VA	0-0	Expl.
02/02/62	Nelms #2.....	OH	2-0	CM
02/05/62	Glen Burn Colliery.....	PA (A)	1-0	Expl.
02/07/62	.....do.....	PA (A)	2-0	Expl.
04/04/62	#2 (Wilroe).....	WV	0-0	Drill
04/09/62	Middle Split Slope.....	PA (A)	1-0	Smoking
05/24/62	Shannopin.....	PA	0-0	?
06/06/62	Loyal.....	PA	5-0	Elec.
06/12/62	#3 (Fields Creek).....	WV	0-1	Elec.
07/12/62	#131 Slope.....	PA (A)	0-0	ONF
08/07/62	Banning #3.....	PA	0-0	Elec.
08/09/62	#1 (Grimsleyville).....	VA	1-0	Smoking
08/31/62	Wattis #2.....	UT	0-0	Cut.
09/07/62	.....do.....	UT	0-0	Cut.
09/28/62	Moss #3.....	VA	1-0	Elec.
10/02/62	Robena.....	PA	2-2	Rock fall
10/23/62	Dekoven.....	KY	0-1	Elec.
10/25/62	Kenilworth.....	UT	0-0	CM
11/12/62	Skidmore Slope.....	PA (A)	1-0	Elec.
11/15/62	Marianna #58.....	PA	0-0	CM
11/21/62	#5.....	VA	4-0	Smoking
11/29/62	Top Split Mammoth Seam.....	PA (A)	2-0	Elec.
12/06/62	Robena.....	PA	0-37	CM/Elec.
12/14/62	Lancashire #15.....	PA	0-0	Rock fall
12/24/62	Emerald.....	PA	0-0	CM
01/04/63	.....do.....	PA	1-0	CM
01/04/63	Maple Creek.....	PA	1-0	Cut.
01/08/63	Moss #2.....	VA	0-0	CM
01/14/63	#40 Slope.....	PA (A)	2-0	Smoking
01/29/63	Glen Burn Colliery.....	PA (A)	3-1	Expl.
01/29/63	Moss #2.....	VA	0-0	Elec.
02/04/63	Skidmore Slope.....	PA (A)	2-0	FSL
03/03/63	Itmann #3.....	WV	0-0	?
03/13/63	Oakwood.....	WV	1-0	ONF
03/20/63	Bird #3.....	PA	0-0	CM
04/08/63	#4 Acton.....	AL	2-0	Elec.
04/12/63	Moss #3.....	VA	0-0	OF
04/16/63	Forger Slope.....	PA (A)	8-4	Elec.
04/17/63	Bird #3.....	PA	2-0	CM
04/25/63	Compass #2.....	WV	1-0	Elec.
04/25/63	.....do.....	WV	0-22	Elec.
05/14/63	Moss #3.....	VA	1-0	Elec.
05/27/63	Geneva.....	UT	0-0	Expl.
07/17/63	#3 (Grace).....	KY	0-0	ONF

TABLE A-1. - Ignitions and explosions, 1959-68--Continued

Date	Mine	State	I-F	Cause
07/18/63	Mathies.....	PA	0-0	Elec.
07/23/63	Nelms #2.....	OH	0-0	CM
08/07/63	Moss #2.....	VA	0-0	CM
08/08/63	.....do.....	VA	0-0	CM
08/13/63	Kenilworth.....	UT	0-0	C/W
08/17/63	Itmann #3.....	WV	2-0	Elec.
08/21/63	Maple Creek.....	PA	0-0	Cut.
08/26/63	Lancashire #15.....	PA	1-0	CM
09/16/63	Mathies.....	PA	0-0	Elec.
09/27/63	Drifton #1.....	PA (A)	2-0	FSL
10/12/63	Moss #2.....	VA	0-0	Elec.
10/14/63	Compass #2.....	WV	1-0	CM
10/15/63	Robena.....	PA	0-0	CM
10/24/63	.....do.....	PA	0-0	CM
10/31/63	Ernest #3.....	PA	0-0	Expl.
11/04/63	Gateway.....	PA	0-0	CM
11/06/63	.....do.....	PA	0-0	CM
11/11/63	Dutch Creek.....	CO	9-0	CM
12/16/63	#2 (Carbon Fuel).....	UT	1-9	CM/Elec.
01/15/64	Westwood Slope.....	PA (A)	1-0	OF
02/03/64	Dutch Creek.....	CO	0-0	Elec.
02/03/64	Sednarczyk #2 & 3 Slopes.....	PA (A)	1-3	Expl.
02/24/64	Moss #2.....	VA	0-0	Cut.
02/26/64	Ireland.....	WV	0-0	CM
02/28/64	.....do.....	WV	0-0	CM
03/01/64	Crescent.....	PA	0-0	Cut.
03/11/64	Marion.....	PA	0-0	C/W
03/19/64	7 South Main.....	KY	0-0	CM
05/07/64	Bird #3.....	PA	1-0	CM
05/08/64	Moss #2.....	VA	0-0	CM
05/26/64	Dutch Creek.....	CO	0-0	Elec.
06/11/64	Diamond Slope.....	PA (A)	3-0	C/W
06/16/64	Compass #3.....	WV	0-0	Drill
06/24/64	Moss #2.....	VA	0-0	Cut.
06/24/64	O'Donnell #1.....	WV	4-0	CM
07/15/64	Huber Colliery.....	PA (A)	2-0	Smoking
07/17/64	#2 (Goodspring).....	PA (A)	2-0	Smoking
07/20/64	Robena.....	PA	0-0	CM
07/27/64	Concord #1.....	AL	0-0	Cut.
07/30/64	#2 (Alabama Rod Ash).....	AL	2-0	Elec.
08/05/64	Robena.....	PA	0-0	CM
08/18/64	Moss #2.....	VA	0-0	CM
08/19/64	#9 Vein South Main Slope.....	PA (A)	2-0	Expl.
09/03/64	Dekeven #6.....	KY	1-0	CM
09/15/64	Gateway.....	PA	0-0	CM
09/28/64	#6 (Island Creek).....	WV	0-3	Elec.
10/03/64	Nelms #2.....	OH	2-0	CM
10/05/64	Dutch Creek.....	CO	0-0	Elec.
10/07/64	Lady Dunn #107.....	WV	3-0	Elec.

TABLE A-1. - Ignitions and explosions, 1959-68--Continued

Date	Mine	State	I-F	Cause
10/14/64	#9A (Marvin).....	VA	0-0	ONF
10/17/64	Westland.....	PA (A)	0-0	Elec.
11/02/64	Lancashire #15.....	PA	2-0	CM
11/07/64	Colver.....	PA	0-0	Elec.
11/09/64	Beatrice.....	VA	0-0	CM
11/20/64	Itmann #3.....	WV	1-0	CM
12/03/64	Concord #1.....	AL	0-0	Cut.
12/07/64	#19 (Wonamie).....	PA (A)	5-0	Expl.
12/11/64	Gateway.....	PA	0-0	CM
12/16/64	#116 Slope.....	PA (A)	1-0	Elec.
12/29/64	Moss #3.....	VA	0-0	Elec.
01/07/65	Sunnyside #3.....	UT	0-0	C/W
01/25/65	Middle Split Slope.....	PA (A)	3-0	Elec.
01/26/65	Bird #3.....	PA	1-0	CM
02/03/65	Dekeven #6.....	PA	1-0	CM
02/11/65	#5 (Horn & Whited).....	VA	2-0	Smoking
02/18/65	Clyde.....	PA	0-0	CM
02/18/65	#217 Slope.....	PA (A)	1-0	FSL
02/26/65	Delmont 10B.....	PA	1-0	CM
03/03/65	Moss #2.....	VA	0-0	CM
03/03/65	Pleasant View.....	KY	0-0	OF
03/16/65	#2 (Carbon Fuel).....	UT	1-0	CM
03/25/65	Osage #3.....	WV	0-0	CM
03/31/65	Beatrice.....	VA	0-0	CM
04/13/65	Keystone #1.....	WV	4-0	Elec.
04/28/65	Moss #2.....	VA	0-0	CM
04/30/65	Llaellen Slope.....	WV	1-4	Elec.
05/24/65	#2A (C.L. Kline).....	TN	0-5	Smoking
06/03/65	Robena.....	PA	0-0	CM
06/08/65	Tracy Slope.....	PA (A)	0-0	Elec.
06/24/65	Lancashire #15.....	PA	4-0	CM
06/24/65	Loveridge.....	WV	1-0	CM
07/06/65	#3 Slope.....	PA (A)	2-0	FSL
07/06/65	Pandora.....	IN	0-0	Elec.
07/16/65	Dekoven #6.....	KY	2-0	CM
08/06/65	#5 (Pilgrim Knob).....	VA	1-0	Smoking
08/15/65	Sunnyside #1.....	UT	1-0	Elec.
08/27/65	Moss #2.....	VA	1-0	CM
09/27/65	.....do.....	VA	1-0	CM
10/16/65	.....do.....	WV	0-7	ONF
10/20/65	Compass #3.....	WV	1-0	CM
11/08/65	Flat Top.....	AL	1-0	Elec.
11/19/65	Hillsboro.....	IL	0-0	CM
11/29/65	Keystone #1.....	WV	1-0	CM
11/29/65	#11 (Pennington Gap).....	VA	2-0	Elec.
12/15/65	Keystone #1.....	WV	1-0	CM
12/16/65	Brule #4.....	WV	1-1	Elec.
12/21/65	Bishop.....	WV	0-0	CM
12/23/65	.....do.....	WV	1-0	CM

TABLE A-1. - Ignitions and explosions, 1959-68--Continued

Date	Mine	State	I-F	Cause
12/28/65	Dutch Creek.....	CO	0-9	Elec.
01/24/66	Dekeven #6.....	KY	0-0	Expl.
01/25/66	#19 (Wonamie).....	PA (A)	4-0	Elec./Expl.
01/28/66	Shannopin.....	PA	0-0	CM
01/29/66	.....do.....	PA	5-0	CM
02/11/66	#1 Lykens Vein Slope.....	PA (A)	1-0	Elec.
02/12/66	Gateway.....	PA	0-0	CM
03/02/66	Burnwell #1.....	CO	0-3	Elec.
03/11/66	Dekeven #6.....	KY	1-0	Expl.
03/28/66	Arkwright #1.....	WV	4-0	CM
04/19/66	Moss #2.....	VA	1-0	CM
06/01/66	Beatrice.....	VA	3-0	CM
06/13/66	Shannopin.....	PA	0-0	CM
06/20/66	#1 (Kermit).....	WV	2-0	Smoking
06/23/66	Robena.....	PA	4-0	Rock fall
07/20/66	#2 Dutch Creek.....	CO	0-0	CM
07/23/66	Siltix.....	WV	2-7	Elec.
08/04/66	Concord #1.....	AL	0-0	Cut.
08/12/66	Warwick #2.....	PA	0-0	Elec.
08/31/66	Huber Colliery.....	PA (A)	2-0	Smoking
09/01/66	#3 & 4 Carrelton.....	WV	2-0	Elec.
10/06/66	Ireland.....	WV	0-0	CM
10/27/66	Stanaford #2.....	WV	1-0	FSL
11/04/66	Concord #1.....	AL	0-0	Cut.
11/07/66	#5 (Wade).....	VA	1-0	Elec.
11/30/66	Beatrice.....	VA	0-0	Elec.
12/02/66	Moss #2.....	VA	1-0	CM
12/14/66	Concord #1.....	AL	0-0	Cut.
12/14/66	#1 Dutch Creek.....	CO	3-0	CM
12/26/66	Lancashire #24.....	PA	0-0	Elec.
01/10/67	Mathies.....	PA	0-0	Elec.
01/24/67	Virginia Pocahontas #1.....	VA	4-3	Elec.
01/24/67	Zeni-McKenney-Williams.....	VA	5-3	Elec.
01/30/67	Joanne.....	WV	4-2	CM
02/02/67	Nelms #2.....	OH	0-0	CM
02/07/67	Jamison #1.....	PA	6-0	CM
03/06/67	Beatrice.....	VA	3-0	CM
03/10/67	Concord #1.....	AL	0-0	Cut.
03/30/67	Compass #2.....	WV	1-0	CM
04/03/67	Moss #2.....	VA	0-0	Rock fall
04/19/67	#32 (Bethlehem).....	PA	0-0	C/W
05/12/67	Gateway.....	PA	0-0	CM
06/01/67	.....do.....	PA	0-0	CM
06/14/67	Dekeven #6.....	KY	0-0	Cut.
06/20/67	Rose Valley #6.....	OH	1-0	Elec.
06/22/67	#1 (Island Creek).....	WV	2-0	Smoking/ONF
06/29/67	Osage #3.....	WV	3-0	CM
07/06/67	Humphrey #7.....	WV	0-0	CM

TABLE A-1. - Ignitions and explosions, 1959-68--Continued

Date	Mine	State	I-F	Cause
07/28/67	#1 (Princess Coak)	KY	0-4	Smoking/Elec.
08/10/67	Moss #2	VA	0-0	Rock fall
08/17/67	Forge Slope	PA (A)	2-0	Rock fall/ Smoking.
08/18/67	Robena	PA	0-0	CM
09/06/67	#7 (Hern & Whited)	VA	6-0	Elec.
09/23/67	Robena	PA	0-0	C/W
09/27/67	Lancashire #15	PA	4-0	CM
10/10/67	Ireland	WV	0-0	CM
10/17/67	Compass #2	WV	3-0	CM
10/17/67	#32 (Bethlehem)	PA	0-0	Elec.
10/17/67	Buck Slope	PA (A)	1-0	Smoking
11/17/67	Dekoven #6	KY	4-0	C/W
11/27/67	Gateway	PA	0-0	CM
11/28/67	Compass #3	WV	3-0	CM
01/13/68	Gateway	PA	0-0	CM
01/20/68	Jamison	WV	0-0	?
01/22/68	West Gulf #5	WV	2-0	Elec.
01/24/68	#6 (Pearly)	VA	1-2	C/W
02/08/68	Clyde	PA	0-0	CM
02/22/68	Sunnyside #1	UT	0-0	Elec.
04/09/68	Vesta #5	PA	0-0	CM
05/08/68	Virginia Pocahontas #1	VA	2-0	CM
06/23/68	Choctaw	OK	0-0	C/W
06/25/68	....do	OK	0-0	ONF
07/05/68	Howe #1	OK	0-0	CM
07/10/68	Concord #1	AL	0-0	Expl.
07/15/68	Mars #2	WV	3-0	FSL
07/19/68	Howe #1	OK	0-0	CM
07/24/68	Slab Fork #8	WV	8-0	CM
07/26/68	Howe #1	OK	0-0	CM
07/30/68	....do	OK	0-0	CM
08/02/68	#8 (Allen Fork)	KY	3-0	Smoking
08/07/68	River Queen	KY	2-9	Expl.
08/27/68	Ireland	WV	0-0	CM
08/30/68	Moss #2	VA	2-0	CM
09/12/68	Nelms #2	OH	0-0	CM
09/18/68	Auger	WV	1-1	CM
10/03/68	Howe #1	OK	2-0	CM
10/21/68	Middle Split Slope	PA (A)	1-0	Smoking

TABLE A-2. - Ignitions and explosions, 1969-80

Date	Mine	State	I-F	Cause
01/08/69	#10 (Slab Fork).....	WV	3-0	Elec.
02/06/69	Howe #1.....	OK	0-0	CM
02/12/69	Robena.....	PA	0-0	CM
02/13/69	#1 Dutch Creek.....	CO	0-0	Elec.
03/19/69	Howe #1.....	OK	0-0	CM
04/28/69	Robinson Run #95.....	WO	0-0	C/W
04/29/69	#2 (Carbon Fuel).....	UT	0-0	CM
05/23/69	Concord #1.....	AL	0-0	Expl.
05/26/69	Gateway.....	PA	0-0	CM
06/05/69	Blacksville #1.....	WV	0-0	CM
06/09/69	Gateway.....	PA	0-0	CM
06/10/69	Lambert Fork.....	VA	2-0	CM
06/10/69	Keystone 3B.....	WV	5-0	Elec.
07/23/69	Skidmore Slope.....	PA (A)	6-1	Elec.
07/24/69	Atrian.....	WV	2-0	Smoking
07/30/69	Howe #1.....	OK	0-0	CM
07/30/69	Zeigler #9.....	KY	1-0	FSL
08/13/69	Loveridge.....	WV	0-0	CM
08/13/69	Concord #1.....	AL	0-0	Cut.
08/18/69	Virginia Pocahontas #1.....	VA	3-0	CM
09/02/69	Forge Slope.....	PA (A)	4-0	Expl.
09/05/69	Joanne.....	WV	3-0	CM
09/05/69	Badger #14.....	WV	0-0	Elec.
09/09/69	Federal #2.....	WV	0-0	CM
09/19/69	Howe #1.....	OK	0-0	CM
10/15/69	Moss #2.....	VA	1-0	CM
11/10/69	Howe #1.....	OK	0-0	CM
11/18/69	#2 (Carbon Fuel).....	UT	0-0	CM
11/18/69	Howe #1.....	OK	0-0	CM
11/15/69	Concord #1.....	AL	0-0	Cut.
12/01/69	#1 Cedar Grove.....	WV	0-0	Cut.
12/11/69	Concord #1.....	AL	0-0	Cut.
12/23/69	Maple Creek.....	PA	0-0	CM
01/06/70	Moss #2.....	VA	1-0	CM
01/07/70	#1 Cedar Grove.....	WV	0-0	Cut.
01/20/70	Howe #1.....	OK	0-0	CM
01/23/70	Eagle #2.....	IL	2-0	CM
01/29/70	South Dip Skidmore Slope.....	PA (A)	2-0	Expl.
01/30/70	Howe #1.....	OK	0-0	CM
02/04/70	.....do.....	OK	0-0	CM
02/25/70	Blacksville.....	WV	0-0	Elec.
02/27/70	#18 (Wonamie).....	PA (A)	3-0	Expl./ONF
03/05/70	Forge Slope.....	PA (A)	4-0	FSL
03/05/70	Seggo #2.....	AL	1-0	C/W
03/25/70	#31 (Carbon Fuel).....	WV	1-0	C/W
03/30/70	Vesta #5.....	PA	0-0	CM
04/02/70	Compass #3.....	WV	0-1	Elec.
04/03/70	Vesta #5.....	PA	0-0	CM
04/08/70	Joanne.....	WV	0-0	CM
04/10/70	Homer City.....	PA	3-1	CM
04/13/70	Loveridge.....	WV	0-0	CM

TABLE A-2. - Ignitions and explosions, 1969-80--Continued

Date	Mine	State	I-F	Cause
04/17/70	Loveridge.....	WV	0-0	CM
04/17/70	Somerset.....	CO	0-0	Elec.
04/29/70	Howe #1.....	OK	0-0	CM
05/15/70	Joanne.....	WV	0-0	Expl.
05/22/70	Loveridge.....	WV	0-0	CM
06/02/70	#3 (Kem).....	VA	1-0	Elec.
06/05/70	Howe #1.....	OK	0-0	CM
06/12/70	Lambert Fork.....	VA	0-0	Elec.
06/13/70	Vesta #5.....	PA	0-0	CM
07/05/70	#28 (Verdonville).....	WV	1-0	Elec.
07/06/70	Gateway.....	PA	0-0	CM
07/08/70	Moose Run.....	PA	0-0	CM
07/15/70	Williams.....	WV	0-0	CM
07/15/70	Howe #1.....	OK	0-0	CM
07/20/70	Maple Creek.....	PA	0-0	CM
08/11/70	Lambert Fork.....	VA	0-0	CM
08/13/70	Gateway.....	PA	0-0	CM
08/17/70	Otsego.....	WV	0-0	CM
08/28/70	Lambert Fork.....	VA	1-0	CM
09/02/70	.....do.....	VA	2-0	CM
09/10/70	#1 Cedar Grove.....	WV	1-0	CM
09/30/70	Blacksville #1.....	WV	2-0	CM
10/12/70	Howe #1.....	OK	0-0	CM
10/13/70	.....do.....	OK	0-0	CM
10/17/70	#1 Cedar Grove.....	WV	0-0	CM
10/26/70	St. Charles.....	KY	2-0	Smoking
10/26/70	Maple Creek.....	PA	0-0	CM
10/28/70	Virginia Pocahontas #2.....	VA	1-0	CM
10/29/70	Williams.....	WV	0-0	CM
11/02/70	Homer City.....	PA	0-0	CM
11/05/70	.....do.....	PA	0-0	CM
11/19/70	L.S. Ward.....	CO	0-0	CM
11/30/70	Pyro #2.....	KY	0-1	Smoking
11/30/70	Howe #1.....	OK	0-0	CM
12/18/70	Homer City.....	PA	0-0	CM
12/30/70	#15 & 16 (Finley).....	KY	0-38	Expl.
01/19/71	Howe #1.....	OK	0-0	CM
02/01/71	Maitland.....	WV	1-0	CM
02/03/71	Kepler.....	WV	0-0	CM
02/04/71	Howe #1.....	OK	0-0	CM
02/08/71	Dixiana.....	VA	0-0	Elec./Smoking
02/11/71	Howe #1.....	OK	0-0	CM
02/16/71	Robena.....	PA	0-0	CM
02/22/71	Gateway.....	PA	0-0	CM
02/25/71	Olga.....	WV	0-0	CM
03/04/71	Howe #1.....	OK	0-0	CM
03/10/71	.....do.....	OK	0-0	CM
03/15/71	Forge Slope.....	PA (A)	3-0	Expl.
03/16/71	Virginia Pocahontas #4.....	VA	2-0	Smoking
03/22/71	Howe #1.....	OK	0-0	CM
04/06/71	.....do.....	OK	0-0	CM

TABLE A-2. - Ignitions and explosions, 1969-80--Continued

Date	Mine	State	I-F	Cause
04/12/71	Howe #1.....	OK	0-0	CM
04/13/71	.....do.....	OK	0-0	CM
04/13/71	Nelms #2.....	OH	0-0	CM
04/19/71	Vesta #5.....	PA	0-0	C/W
04/23/71	#1 Cedar Grove.....	WV	0-0	Cut.
05/12/71	Dotiki.....	KY	0-0	CM
05/14/71	Howe #1.....	OK	0-0	CM
05/21/71	#3 Carbon Fuel.....	UT	0-0	CM
05/21/71	Eagle #1.....	IL	0-0	CM
05/22/71	#3 Carbon Fuel.....	UT	0-0	CM
05/24/71	Eagle #1.....	IL	2-0	CM
05/26/71	Howe #1.....	OK	0-0	CM
05/27/71	Florence #2.....	PA	3-0	CM
06/01/71	Howe #1.....	OK	0-0	CM
06/05/71	Humphrey #7.....	WV	1-0	Rock fall
07/08/71	#3 Carbon Fuel.....	UT	0-0	CM
07/16/71	Eagle #2.....	IL	0-0	CM
08/03/71	Concord #1.....	AL	0-0	Cut.
08/28/71	Eagle #1.....	IL	0-0	CM
09/10/71	.....do.....	IL	0-0	CM
09/17/71	.....do.....	IL	0-0	CM
09/20/71	Nelms #2.....	OH	0-0	CM
10/26/71	Gordon Creek #2.....	UT	0-0	CM
11/23/71	Concord #1.....	AL	0-0	Cut.
01/04/72	Itmann #3.....	WV	3-0	C/W
01/14/72	Compass #3.....	WV	0-0	CM
02/23/72	Bishop.....	WV	0-0	CM
02/29/72	Virginia Pocahontas #2.....	VA	0-0	CM
03/01/72	Kepler.....	WV	0-0	CM
04/11/72	Virginia Pocahontas #3.....	VA	0-0	CM
04/19/72	#6 (Sue).....	VA	2-0	Expl.
04/24/72	Virginia Pocahontas #2.....	VA	0-0	CM
04/25/72	Virginia Pocahontas #3.....	VA	0-0	CM
05/01/72	Delmont.....	PA	0-0	CM
05/20/72	Moss #2.....	VA	0-0	Elec.
06/09/72	Nelms #2.....	OH	0-0	CM.
06/13/72	Concord #1.....	AL	16-0	C/W
06/15/72	Zeigler #9.....	KY	2-0	CM
06/19/72	Itmann #3.....	WV	0-0	CM
06/21/72	Concord #1.....	AL	0-0	Cut.
07/17/72	Greenwich Colliery #1.....	PA	1-0	CM
08/02/72	Virginia Pocahontas #3.....	VA	0-0	CM
08/07/72	Maple Creek #2.....	PA	0-0	CM
08/16/72	Bishop.....	WV	1-0	CM
09/28/72	Robinson Run #95.....	WV	0-0	CM
10/11/72	Eagle #1.....	IL	0-0	CM
11/10/72	Virginia Pocahontas #2.....	VA	0-0	CM
12/01/72	Robinson Run #95.....	WV	0-0	CM
12/02/72	Virginia Pocahontas #1.....	VA	0-0	CM
12/05/72	Virginia Pocahontas #3.....	VA	0-0	Rock fall
12/07/72	Marianna #58.....	PA	2-0	Drill

TABLE A-2. - Ignitions and explosions, 1969-80--Continued

Date	Mine	State	I-F	Cause
12/14/72	Itmann #3.....	WV	0-5	Elec.
12/26/72	Moss #2.....	VA	1-0	Rock fall
01/03/73	Virginia Pocahontas #2.....	VA	0-0	CM
01/30/73	#3 Carbon Fuel.....	UT	0-0	CM
02/28/73	Wabash.....	IL	0-0	C/W
03/10/73	Virginia Pocahontas #1.....	VA	2-0	Drill
04/04/73	Kepler.....	WV	0-0	CM
04/16/73	Bird #3.....	PA	0-0	CM
04/26/73	Eagle #1.....	IL	0-0	CM
04/29/73	Lancashire #20.....	PA	0-0	Elec.
05/10/73	Cambria Slope #33.....	PA	0-0	C/W
05/14/73	Itmann #3.....	WV	0-0	Expl.
06/01/73	.....do.....	WV	0-0	CM
06/08/73	Maple Creek #2.....	PA	0-0	CM
07/18/73	#1 Cedar Grove.....	WV	0-0	CM
08/13/73	Virginia Pocahontas #3.....	VA	0-0	CM
08/31/73	#33-37 (Bishop).....	VA	0-0	CM
09/11/73	Itmann #3.....	WV	0-0	CM
09/18/73	Nelms #2.....	OH	0-0	CM
09/19/73	#32 (Bethlehem).....	PA	0-0	C/W
09/24/73	Gateway.....	PA	0-0	CM
09/25/73	#4 (Oakwood Red Ash).....	PA	0-2	Elec.
10/03/73	Eagle #1.....	IL	0-0	CM
10/24/73	Beatrice.....	VA	0-0	CM
10/29/73	Virginia Pocahontas #4.....	VA	0-0	CM
11/09/73	Virginia Pocahontas #2.....	VA	1-0	CM
11/09/73	#1 Cedar Grove.....	WV	0-0	CM
11/16/73	Itmann #3.....	WV	0-0	CM
11/22/73	.....do.....	WV	0-0	CM
11/16/73	Moss #2.....	VA	0-0	CM
12/17/73	Virginia Pocahontas #4.....	VA	0-0	CM
01/09/74	Maitland.....	WV	0-0	?
01/09/74	Itmann #3.....	WV	0-0	CM
01/10/74	#50 Pinnacle Creek.....	WV	0-0	CM
01/11/74	Maitland.....	WV	0-0	Elec.
01/14/74	Cambria Slope #33.....	PA	0-0	C/W
01/29/74	Virginia Pocahontas #4.....	VA	0-0	CM
02/04/74	Virginia Pocahontas #2.....	VA	1-0	CM
02/05/74	Maitland.....	WV	0-0	CM
02/05/74	Mulga.....	AL	1-0	CM
02/11/74	Dehue.....	WV	0-0	CM
02/12/74	Keystone #1.....	WV	0-0	CM
02/15/74	Shannon Branch.....	WV	0-0	CM
02/20/74	Dehue.....	WV	0-0	CM
02/21/74	Maitland.....	WV	0-0	CM
03/01/74	Beatrice.....	WV	0-0	CM
03/01/74	Virginia Pocahontas #3.....	VA	0-0	CM
03/04/74	Oak Park #7.....	OH	0-0	CM
03/05/74	Blacksville #1.....	WV	0-0	CM
04/01/74	Virginia Pocahontas #1.....	WV	1-0	CM

TABLE A-2. - Ignitions and explosions, 1969-80--Continued

Date	Mine	State	I-F	Cause
04/08/74	Beech Fork.....	WV	0-0	CM
04/12/74	Keystone #1.....	WV	0-0	C/W
04/18/74	#36 (Bishop).....	WV	0-0	CM
04/29/74	Oak Park #7.....	OH	0-0	CM
05/06/74	Marion.....	PA	0-0	CM
05/08/74	Maitland.....	WV	0-0	CM
05/09/74	Itmann #2.....	WV	0-0	CM
05/21/74	.....do.....	WV	0-0	CM
05/23/74	Beech Fork.....	WV	0-0	CM
05/23/74	Oak Park #7.....	OH	0-0	CM
05/25/74	Loveridge.....	WV	0-0	CM
05/30/74	Oak Park #7.....	OH	0-0	CM
05/31/74	#1 Cedar Grove.....	WV	0-0	ONF
06/15/74	#50 Pinnacle Creek.....	WV	0-0	CM
06/18/74	Dehue.....	WV	0-0	CM
06/29/74	Wentz #1.....	VA	0-0	C/W
07/09/74	Marion.....	PA	0-0	CM
07/15/74	Bishop.....	WV	0-0	CM
07/19/74	Virginia Pocahontas #1.....	VA	0-0	CM
07/23/74	Beech Fork.....	WV	0-0	CM
08/08/74	Keystone #1.....	WV	0-0	CM
08/09/74	Royal #5.....	WV	1-0	C/W
08/12/74	U.S. Pipe #3.....	AL	0-0	CM
08/13/74	Meigs #2.....	OH	0-0	Expl.
08/30/74	Virginia Pocahontas #4.....	VA	0-0	CM
09/09/74	#20 (Stirrat).....	WV	1-0	C/W
09/13/74	Virginia Pocahontas #4.....	VA	0-0	CM
09/16/74	.....do.....	VA	0-0	CM
09/18/74	Beech Fork.....	WV	0-0	CM
09/19/74	Kitt #1.....	WV	0-0	C/W
09/20/74	Bishop.....	WV	0-0	CM
09/24/74	Kitt #1.....	WV	0-0	C/W
10/07/74	U.S. Pipe #3.....	AL	0-0	CM
10/15/74	#50 Pinnacle Creek.....	WV	0-0	CM
10/22/74	Beatrice.....	VA	0-0	Elec.
10/25/74	#32 (Bethlehem).....	PA	1-0	CM
10/29/74	Concord #1.....	AL	0-0	Cut.
11/06/74	U.S. Pipe #3.....	AL	0-0	CM
01/06/75	Beckley.....	WV	0-0	CM
01/10/75	Maitland.....	WV	0-0	CM
01/14/75	Nelms #2.....	OH	0-0	CM
01/24/75	Itmann #3.....	WV	0-0	Expl.
01/28/75	Bird #3.....	PA	1-0	CM
02/03/75	Keystone #5.....	WV	0-0	CM
02/05/75	Bear Creek #4.....	CO	0-0	Elec.
02/12/75	Beatrice.....	VA	0-0	CM
02/13/75	Royal #5.....	WV	0-0	CM
02/18/75	Deer Creek #0255.....	UT	0-0	CM
02/20/75	Concord #1.....	AL	0-0	Cut.
02/25/75	Somerset #60.....	PA	0-0	Elec.
02/27/75	Mulga.....	AL	0-0	CM

TABLE A-2. - Ignitions and explosions, 1969-80--Continued

Date	Mine	State	I-F	Cause
03/06/75	U.S. Pipe #3.....	AL	0-0	Drill
03/08/75	Bear Creek #4.....	CO	0-0	CM
03/10/75	Dutch Creek #2.....	CO	0-0	CM
03/15/75	Mulga.....	AL	0-0	CM
03/15/75	Virginia Pocahontas #3.....	VA	0-0	Rock fall
03/25/75	Virginia Pocahontas #5.....	VA	0-0	CM
04/04/75	U.S. Pipe #3.....	AL	0-0	CM
04/28/75	Mulga.....	AL	0-0	CM
04/28/75	McElroy.....	WV	0-0	CM
04/30/75	Osage #3.....	WO	0-0	CM
05/08/75	U.S. Pipe #3.....	AL	0-0	CM
05/09/75	.....do.....	AL	0-0	CM
05/15/75	#51 Bethlehem.....	PA	0-0	Elec.
05/23/75	Osage #3.....	WV	0-0	CM
05/30/75	Dutch Creek #2.....	CO	0-0	CM
06/02/75	Cambria Slope #33.....	PA	0-0	Elec.
06/04/75	Virginia Pocahontas #4.....	VA	2-0	CM
06/05/75	Virginia Pocahontas #5.....	VA	0-0	C/W
06/06/75	Itmann #3.....	WV	0-0	CM
06/14/75	Osage #3.....	WV	0-0	CM
06/16/75	.....do.....	WV	0-0	CM
06/19/75	Maple Meadow.....	WV	0-0	CM
06/20/75	Itmann #3.....	WV	0-0	CM
06/20/75	Dehue.....	WV	0-0	CM
07/24/75	Itmann #3.....	WV	0-0	CM
07/29/75	Beatrice.....	VA	0-0	CM
08/01/75	Jewel 18 (Lower Jewel).....	VA	0-0	CM
08/02/75	Virginia Pocahontas #4.....	VA	0-0	CM
08/04/75	Virginia Pocahontas #1.....	VA	0-0	CM
08/05/75	U.S. Pipe #3.....	AL	0-0	CM
08/07/75	Beckley.....	WV	0-0	Drill
08/11/75	U.S. Pipe #3.....	AL	0-0	CM
08/20/75	.....do.....	AL	0-0	CM
09/15/75	Lancashire #20.....	PA	0-0	Expl.
09/22/75	Beatrice.....	VA	0-0	CM
09/23/75	Dehue.....	WV	0-0	CM
10/13/75	Royal #5.....	WV	0-0	CM
10/15/75	Ireland.....	WV	0-0	CM
10/21/75	Beatrice.....	VA	0-0	CM
10/23/75	#5 (Island Creek).....	VA	0-0	C/W
10/24/75	Beatrice.....	VA	0-0	CM
10/31/75	Bessie.....	AL	1-0	Expl.
11/12/75	Beckley #1.....	WV	1-0	CM
11/18/75	Dutch Creek #1.....	CO	0-0	Elec.
11/20/75	Itmann #3.....	WV	0-0	CM
12/05/75	#3 Carbon Fuel.....	UT	0-0	CM
12/12/75	Virginia Pocahontas #4.....	VA	0-0	CM
12/12/75	Beckley #1.....	WV	0-0	CM
12/15/75	Beatrice.....	VA	0-0	CM
12/16/75	Vesta #5.....	PA	0-0	CM
12/16/75	Hamilton #1.....	KY	1-0	Expl.
12/19/75	Olga.....	WV	0-0	Rock fall
12/30/75	U.S. Pipe #4.....	AL	0-0	OFR

TABLE A-2. - Ignitions and explosions, 1969-80--Continued

Date	Mine	State	I-F	Cause
01/06/76	Lucerne #6.....	PA	0-0	CM
01/08/76	Vesta #5.....	PA	0-0	CM
01/14/76	Robinson Run #95.....	WV	0-0	CM
02/06/76	Hamilton #1.....	KY	0-0	CM
02/10/76	#4 (Wolf Creek).....	KY	1-0	CM
02/17/76	.....do.....	KY	1-0	CM
02/18/76	Keystone #1.....	WV	0-0	Cut
02/20/76	U.S. Pipe #3.....	AL	0-0	CM
02/26/76	Virginia Pocahontas #4.....	VA	0-0	CM
02/27/76	Keystone #1.....	WV	0-0	C/W
03/02/76	Robinson Run #95.....	WV	0-0	CM
03/03/76	Lancashire #20.....	PA	0-0	Elec.
03/06/76	.....do.....	PA	0-0	Rock fall
03/09/76	.....do.....	PA	0-0	Elec.
03/09/76	Scotia.....	KY	0-15	?
03/09/76	.....do.....	KY	0-11	?
03/11/76	Deer Creek.....	UT	0-0	CM
03/15/76	Beckley.....	WV	0-0	CM
03/16/76	Consol #20.....	WV	0-0	CM
03/16/76	#1 (Kermit).....	WV	1-0	CM
03/17/76	Bishop.....	WV	0-0	CM
03/18/76	Lucerne #6.....	PA	0-0	CM
04/02/76	#3 Carbon Fuel.....	UT	0-0	LW
04/07/76	Maitland.....	WV	0-0	Elec.
04/15/76	Beech Fork.....	WV	0-0	CM
04/21/76	#3 Carbon Fuel.....	UT	0-0	LW
04/23/76	Maple Meadows.....	WV	0-0	CM
04/23/76	Federal #2.....	WV	0-0	C/W
04/27/76	Consol #20.....	WV	0-0	CM
04/30/76	Jensie.....	OH	0-0	CM
05/04/76	#108 (Bethlehem).....	WV	0-0	CM
05/05/76	#36 (Bishop).....	WV	0-0	CM
05/05/76	Maitland.....	WV	0-0	CM
05/13/76	Beckley.....	WV	0-0	CM
05/13/76	Mulga.....	AL	2-0	C/W
05/18/76	#3 (J. Walter).....	AL	2-0	CM
05/25/76	#108 (Bethlehem).....	WV	0-0	CM
05/26/76	Loveridge.....	WV	0-0	CM
06/01/76	Moss #2.....	VA	0-0	CM
06/02/76	Gateway.....	PA	0-0	CM
06/08/76	Ireland.....	WV	0-0	CM
06/09/76	Moss #2.....	VA	0-0	CM
06/16/76	Beckley #1.....	WV	0-0	CM
06/24/76	McElroy.....	WV	0-0	CM
06/29/76	Lady Dunn #105.....	WV	0-0	C/W
07/13/76	Moss #2.....	VA	0-0	CM
07/14/76	Cambria Slope #33.....	PA	0-0	CM
07/21/76	Beckley #1.....	WV	0-0	CM
07/24/76	Federal #1.....	WV	0-0	CM
07/24/76	Flat Top Water Pumping Shaft.....	WV	0-0	ONF
07/30/76	Braztah #5.....	UT	1-0	CM
08/16/76	#36 (Bishop).....	WV	0-0	CM
08/23/76	Urline #1.....	PA	0-0	C/W

TABLE A-2. - Ignitions and explosions, 1969-80--Continued

Date	Mine	State	I-F	Cause
08/23/76	#58 Pinnacle Creek.....	WV	0-0	C/W
08/27/76	Kitt #1.....	WV	0-0	C/W
09/13/76	Oak Park #7.....	OH	0-0	CM
09/16/76	.....do.....	OH	0-0	CM
09/25/76	Beatrice.....	VA	0-0	CM
09/29/76	Maitland.....	WV	0-0	CM
09/30/76	Braztah #5.....	UT	0-0	LW
10/07/76	Maple Meadows.....	WV	0-0	CM
10/08/76	Oak Grove.....	AL	0-0	CM
10/11/76	Braztah #3.....	UT	0-0	LW
10/11/76	#50 Pinnacle Creek.....	WV	0-0	CM
10/20/76	#6 Blue Boy.....	WV	0-0	Drill
10/21/76	Braztah #5.....	UT	1-0	CM
11/02/76	Chancy Creek #2.....	VA	0-0	CM
11/03/76	Moss #2.....	VA	0-0	CM
11/06/76	Beckley.....	WV	0-0	Drill
11/16/76	Beckley #1.....	WV	0-0	CM
11/30/76	Virginia Pocahontas.....	VA	0-0	CM
12/02/76	Maple Meadows.....	WV	0-0	CM
12/06/76	Humphrey #7.....	WV	0-0	CM
12/07/76	Virginia Pocahontas.....	VA	0-0	CM
12/07/76	McElroy.....	WV	0-0	CM
12/09/76	Oak Grove.....	AL	0-0	Drill
12/13/76	Moss #2.....	VA	0-0	CM
12/16/76	.....do.....	VA	0-0	CM
12/16/76	Emerald #1.....	PA	0-0	C/W
12/18/76	Virginia Pocahontas #5.....	VA	0-0	CM
12/28/76	Gaston #2	WV	0-0	CM
01/03/77	Consol #20.....	WV	0-0	CM
01/06/77	Cambria Slope #33.....	PA	0-0	LW
01/12/77	Braztah #3.....	UT	0-0	LW
03/04/77	Moss #2.....	VA	0-0	CM
02/08/77	Keystone #1.....	WV	0-0	Elec.
02/14/77	Nelms #2.....	OH	0-0	CM
02/22/77	Virginia Pocahontas #5.....	VA	0-0	C/W
02/23/77	North River #1.....	AL	0-0	CM
03/09/77	Raccoon #3.....	OH	0-0	Drill
03/16/77	Meigs #2.....	OH	0-0	Drill
03/17/77	#4 (J. Walter).....	AL	0-0	CM
03/18/77	Braztah #3.....	UT	0-0	LW
03/18/77	Valley Camp #12A.....	WV	0-0	Elec.
03/23/77	Sunnyside #3.....	UT	0-0	CM
04/08/77	Virginia Pocahontas #4.....	VA	0-0	CM
04/10/77	Vesta #5.....	PA	0-0	?
04/11/77	Cambria Slope #33.....	PA	0-0	LW
04/12/77	Beatrice.....	VA	0-0	CM
04/18/77	#2 (Ron).....	WV	1-0	C/W
04/21/77	Virginia Pocahontas #2.....	VA	0-0	C/W
04/27/77	#7 (J. Walter).....	AL	0-0	C/W
04/28/77	Blacksville #2.....	WV	0-0	Elec.
04/29/77	Virginia Pocahontas.....	VA	0-0	C/W
04/30/77	Loveridge.....	WV	0-0	CM

TABLE A-2. - Ignitions and explosions, 1969-80--Continued

Date	Mine	State	I-F	Cause
05/05/77	#3 (J. Walter).....	AL	0-0	CM
05/06/77	Beckley.....	WV	0-0	CM
05/11/77	#3 (J. Walter).....	AL	0-0	CM
05/16/77	Moss #2.....	VA	0-0	CM
05/18/77	Beckley #1.....	WV	0-0	C/W
05/23/77	Powhattan #6.....	OH	0-0	CM
05/26/77	Virginia Pocahontas #4.....	VA	0-0	CM
05/30/77	National Poca.....	WV	0-0	C/W
05/31/77	Robinson Run #95.....	WV	0-0	CM
06/06/77	Virginia Pocahontas #4.....	VA	0-0	CM
06/07/77	Braztah #3.....	UT	0-0	LW
06/09/77	#4 (Oakwood Red Ash).....	VA	0-0	CM
06/22/77	.....do.....	VA	0-0	CM
07/07/77	#2 (P&P).....	VA	0-4	Smoking
07/15/77	#1 (Terry Glen).....	KY	5-0	Smoking
08/25/77	#12A.....	VA	0-0	CM
08/26/77	Maitland.....	WV	0-0	CM
08/26/77	#236 (Amigo).....	WV	0-0	CM
09/19/77	Bishop.....	WV	0-0	CM
09/21/77	Cambria Slope #33.....	PA	0-0	CM
09/21/77	Maitland.....	WV	0-0	CM
09/23/77	Lick Run.....	WV	0-0	C/W
09/27/77	Sugarloaf #2.....	AR	0-0	CM
09/30/77	Beech Fork.....	WV	0-0	CM
10/11/77	Cumberland.....	PA	0-0	CM
10/11/77	.....do.....	PA	0-0	CM
10/26/77	Moss #2.....	VA	0-0	CM
10/27/77	Cumberland.....	PA	0-0	CM
10/28/77	Bishop.....	WV	0-0	CM
10/31/77	Keystone #2.....	WV	0-0	Expl.
10/31/77	.....do.....	WV	0-0	Expl.
11/02/77	Robinson Run #95.....	WV	0-0	LW
11/07/77	Braztah #5.....	UT	0-0	CM
11/08/77	Jensie.....	OH	0-0	CM
11/09/77	Keystone #5.....	WV	0-0	CM
11/09/77	Sunnyside #3.....	UT	0-0	LW
11/14/77	#3 (J. Walter).....	AL	0-0	CM
11/21/77	Lucerne #6.....	PA	0-0	Drill
03/29/78	Virginia Pocahontas.....	VA	0-0	CM
03/29/78	Consol #20.....	WV	0-0	CM
04/04/78	Beatrice.....	VA	0-0	CM
04/12/78	Greenwich Colliery #2.....	PA	0-0	C/W
04/13/78	Cambria Slope #33.....	PA	0-0	LW
04/17/78	Loveridge.....	WV	0-0	CM
04/20/78	Consol #20.....	WV	1-0	CM
04/25/78	.....do.....	WV	0-0	CM
04/26/78	Oak Grove.....	AL	0-0	Drill
05/03/78	Consol #20.....	WV	0-0	CM
05/05/78	#4 (J. Walter).....	AL	0-0	Drill
05/06/78	#3 (J. Walter).....	AL	0-0	CM
05/10/78	Virginia Pocahontas #5.....	VA	0-0	CM

TABLE A-2. - Ignitions and explosions, 1969-80--Continued

Date	Mine	State	I-F	Cause
05/18/78	Seaboard #2.....	VA	0-0	CM
05/25/78	Loveridge.....	WV	0-0	CM
05/30/78	Maple Meadows.....	WV	0-0	Drill
06/01/78	Emerald #1.....	PA	0-0	Drill
06/06/78	#3 (J. Walter).....	AL	0-0	Drill
06/07/78	Consol #20.....	WV	0-0	CM
06/12/78	Lucerne #6.....	PA	0-0	CM
06/14/78	Loveridge.....	WV	0-0	CM
06/14/78	Cumberland.....	PA	0-0	CM
06/16/78	Lick Rum.....	WV	0-0	C/W
06/19/78	Emerald #1.....	PA	0-0	CM
07/10/78	#3 (J. Walter).....	AL	0-0	Drill
07/11/78	Greenwich Colliery #2.....	PA	0-0	C/W
07/12/78	Cambria Slope #33.....	PA	0-0	LW
08/14/78	Lancashire #20.....	PA	0-0	C/W
08/16/78	Cumberland.....	PA	0-0	CM
08/22/78	Keystone #2.....	WV	0-0	Expl.
08/25/78	Maple Meadows.....	WV	0-0	CM
08/29/78	#4 (J. Walter).....	AL	0-0	Drill
09/01/78	#3 (J. Walter).....	AL	0-0	CM
09/06/78	Oak Grove.....	AL	0-0	CM
09/12/78	#3 (J. Walter).....	AL	0-0	CM
09/13/78	.....do.....	AL	0-0	CM
09/18/78	National Pocahontas.....	WV	0-0	CM
09/20/78	#3 (J. Walter).....	AL	0-0	CM
09/21/78	Beckley.....	WV	0-0	CM
09/28/78	Federal #2.....	WV	0-0	Drill
10/11/78	.....do.....	WV	0-0	C/W
10/12/78	Moss #2.....	VA	0-0	CM
10/26/78	National Pocahontas.....	WV	0-0	Elec.
11/03/78	Gateway.....	PA	0-0	CM
11/13/78	Emerald #1.....	PA	0-0	CM
11/15/78	Sewall #1A.....	WV	0-0	CM
11/15/78	Consol #20.....	WV	0-0	CM
11/16/78	Moss #2.....	VA	0-0	CM
11/21/78	Loveridge.....	WV	0-0	CM
11/27/78	Humphrey #7.....	WV	0-0	Expl.
11/27/78	Thompson Creek.....	CO	2-0	ONF
11/28/78	#36 (Bishop).....	WV	0-0	CM
12/07/78	#4 Vein Slope.....	PA (A)	3-0	OFR
12/12/78	Consol #20.....	WV	0-0	CM
12/12/78	.....do.....	WV	0-0	CM
12/13/78	Cumberland.....	PA	0-0	CM
12/19/78	Mars #2.....	WV	0-0	?
12/19/78	Moss #2.....	VA	0-0	CM
01/08/79	Beckley.....	WV	0-0	Drill
01/10/79	#3 (J. Walter).....	AL	0-0	Elec.
01/12/79	Itmann #3.....	WV	0-0	CM
01/18/79	#13 (O&G).....	VA	4-0	Expl.
01/22/79	Cumberland.....	PA	0-0	CM
01/23/79	#3 (J. Walter).....	AL	0-0	CM

TABLE A-2. - Ignitions and explosions, 1969-80--Continued

Date	Mine	State	I-F	Cause
01/24/79	#3 (J. Walter).....	AL	0-0	CM
01/26/79	.....do.....	AL	0-0	CM
02/07/79	Braztah #3.....	UT	0-0	LW
02/07/79	#7 (J. Walter).....	AL	0-0	Drill
02/28/79	Loveridge.....	WV	0-0	CM
03/06/79	Emerald #1.....	PA	0-0	Drill
03/09/79	Itmann #3.....	WV	0-0	CM
03/13/79	Braztah #3.....	UT	0-0	LW
03/15/79	#3 (J. Walter).....	AL	0-0	C/W
03/16/79	Moss #2.....	VA	0-0	CM
03/19/79	Loveridge.....	WV	0-0	CM
03/19/79	Nebo.....	AL	0-0	Expl.
03/21/79	King #5.....	UT	0-0	CM
03/23/79	Valley Camp #15-A.....	WV	0-0	Elec.
03/28/79	Braztah #3.....	UT	0-0	LW
03/28/79	Emerald #1.....	PA	0-0	CM
03/30/79	Valley Camp #3.....	WV	0-0	CM
04/04/79	Moss #2.....	VA	0-0	CM
04/05/79	King #5.....	UT	0-0	CM
04/06/79	Braztah #3.....	UT	0-0	LW
04/10/79	#3 (J. Walter).....	AL	0-0	CM
04/10/79	Braztah #3.....	UT	0-0	LW
04/12/79	#3 (J. Walter).....	AL	0-0	CM
04/12/79	Braztah #3.....	UT	0-0	LW
04/16/79	Keystone #1.....	WV	0-0	C/W
04/19/79	Maple Meadows.....	WV	0-0	C/W
04/20/79	Arkwright #1.....	WV	0-0	C.M.
04/20/79	Braztah #3.....	UT	0-0	LW
04/25/79	Cambria Slope #33.....	PA	0-0	LW
04/25/79	Maple Creek #2.....	PA	0-0	Drill
04/26/79	Braztah #3.....	UT	0-0	CM
04/26/79	Consol #20.....	WV	0-0	CM
04/27/79	#3 (J. Walter).....	AL	0-0	CM
04/29/79	Sunnyside #1.....	UT	0-0	Elec.
05/02/79	King #5.....	UT	0-0	CM
05/09/79	Beckley.....	WV	0-0	CM
05/10/79	Braztah #3.....	UT	0-0	CM
05/15/79	Soldier Canyon.....	UT	0-0	Drill
05/15/79	Homer City.....	PA	0-0	CM
05/15/79	Oak Grove.....	AL	0-0	CM
05/16/79	.....do.....	AL	0-0	CM
05/18/79	Maple Meadows.....	WV	0-0	CM
05/29/79	Braztah #3.....	UT	0-0	LW
05/29/79	Beckley #1.....	WV	0-0	CM
05/31/79	Homer City.....	PA	0-0	CM
06/04/79	Braztah #3.....	UT	0-0	LW
06/04/79	Oak Grove.....	AL	0-0	CM
06/06/79	.....do.....	AL	0-0	CM
06/12/79	Braztah #3.....	UT	0-0	CM
06/12/79	Consol #20.....	WV	0-0	CM
06/14/79	#3 (J. Walter).....	AL	0-0	LW
06/19/79	Braztah #3.....	UT	0-0	LW

TABLE A-2. - Ignitions and explosions, 1969-80--Continued

Date	Mine	State	I-F	Cause
06/25/79	Federal #2.....	WV	0-0	C/W
07/02/79	King #5.....	UT	0-0	CM
07/11/79	Oak Grove.....	AL	0-0	CM
07/11/79	King #5.....	UT	0-0	CM
07/18/79	Chancy Creek #2.....	VA	0-0	CM
07/19/79	Cambria Slope #33.....	PA	0-0	LW
07/20/79	Braztah #3.....	UT	0-0	CM
07/30/79	Homer City.....	PA	0-0	CM
08/02/79	#5 (J. Walter).....	AL	0-0	C/W
08/03/79	Braztah #3.....	UT	0-0	CM
08/09/79	Lucerne #6.....	PA	0-0	CM
08/10/79	Dutch Creek #2.....	CO	2-0	CM
08/16/79	Itmann #2.....	WV	0-0	CM
08/20/79	#50 Pinnacle Creek.....	WV	0-0	CM
08/21/79	King #4.....	UT	0-0	CM
08/29/79	.....do.....	UT	0-0	CM
08/31/79	#4 (J. Walter).....	AL	0-0	Drill
09/18/79	Emerald #1.....	PA	0-0	C/W
09/19/79	Itmann #3.....	WV	0-0	CM
09/19/79	Beckley #1.....	WV	0-0	CM
09/25/79	.....do.....	WV	0-0	CM
09/26/79	Maple Creek #2.....	PA	0-0	CM
10/08/79	Maple Creek #2.....	PA	0-0	CM
10/08/79	Emerald #1.....	PA	0-0	CM
10/09/79	Loveridge.....	WV	0-0	CM
10/10/79	Emerald #1.....	PA	0-0	CM
10/11/79	.....do.....	PA	0-0	CM
10/11/79	#3 (J. Walter).....	AL	0-0	CM
10/12/79	Emerald #1.....	PA	0-0	CM
10/15/79	.....do.....	PA	0-0	CM
10/24/79	Humphrey #7.....	WV	0-0	CM
10/25/79	Deer Creek.....	UT	0-0	CM
10/26/79	Emerald #1.....	PA	0-0	CM
10/30/79	.....do.....	PA	0-0	CM
10/30/79	#3 (J. Walter).....	AL	3-0	Expl.
11/05/79	#7 (J. Walter).....	AL	0-0	CM
11/13/79	King #5.....	UT	0-0	CM
11/14/79	Emerald #1.....	PA	0-0	CM
11/14/79	.....do.....	PA	0-0	Drill
11/19/79	Itmann #3.....	WV	0-0	CM
11/18/79	Consol #20.....	WV	0-0	CM
11/28/79	Oak Grove.....	AL	0-0	CM
11/28/79	Loveridge.....	WV	0-0	CM
11/30/79	Federal #2.....	WV	0-0	CM
12/06/79	Hawks Nest East.....	CO	0-0	Drill
12/06/79	King #5.....	UT	0-0	CM
12/19/79	Homer City.....	PA	0-0	CM
12/19/79	Humphrey #7.....	WV	0-0	CM
12/26/79	East Gulf.....	WV	0-0	CM
12/28/79	#7 (J. Walter).....	AL	0-0	Drill
12/31/79	Vesta #5.....	PA	0-0	Drill

TABLE A-2. - Ignitions and explosions, 1969-80--Continued

Date	Mine	State	I-F	Cause
01/04/80	Bessie.....	AL	0-0	Expl.
01/15/80	#3 (J. Walter).....	AL	0-0	CM
01/16/80	.....do.....	AL	0-0	CM
01/21/80	.....do.....	AL	0-0	CM
01/22/80	York Canyon.....	NM	0-0	CM
01/22/80	.....do.....	NM	0-0	CM
01/24/80	Price River #3.....	UT	0-0	CM
01/29/80	Beckley.....	WV	2-0	CM
01/29/80	#3 (J. Walter).....	AL	0-0	CM
01/29/80	#7 (J. Walter).....	AL	0-0	C/W
02/02/80	.....do.....	AL	0-0	C/W
02/03/80	.....do.....	AL	0-0	C/W
02/05/80	Emerald #1.....	PA	0-0	CM
02/05/80	Federal #2.....	WV	0-0	CM
02/07/80	#33 (Bishop).....	WV	0-0	CM
02/08/80	North River #1.....	AL	2-0	CM
02/13/80	Maple Creek #2.....	PA	0-0	CM
02/19/80	Bessie.....	AL	0-0	Drill
02/22/80	Osage #3.....	WV	0-0	Drill
02/27/80	Thompson Creek #1.....	CO	0-0	C/W
02/28/80	#5 (J. Walter).....	AL	0-0	C/W
02/29/80	Price River #3.....	UT	0-0	LW
03/03/80	#5 (J. Walter).....	AL	0-0	C/W
03/04/80	#7 (J. Walter).....	AL	0-0	CM
03/05/80	Greenwich Colliery #2.....	PA	0-0	CM
03/05/80	#3 (J. Walter).....	AL	0-0	CM
03/07/80	Oak Grove.....	AL	0-0	CM
03/17/80	Bonny.....	WV	0-0	CM
03/17/80	#3 (J. Walter).....	AL	0-0	CM
03/19/80	Beckley #1.....	WV	0-0	CM
03/19/80	.....do.....	WV	0-0	CM
03/19/80	#7 (J. Walter).....	AL	0-0	CM
03/20/80	#3 (J. Walter).....	AL	0-0	CM
03/20/80	Dehue.....	WV	0-0	CM
03/21/80	Beckley.....	WV	0-0	CM
03/21/80	#7 (J. Walter).....	AL	0-0	CM
03/24/80	Bessie.....	AL	0-0	Cut.
03/25/80	Greenwich Colliery.....	PA	1-0	CM
03/27/80	Greenwich Colliery #2.....	PA	0-0	CM
03/28/80	Keystone #2.....	WV	0-0	LW
04/07/80	#7 (J. Walter).....	AL	0-0	CM
04/08/80	Price River #3.....	UT	0-0	LW
04/09/80	Thompson Creek #1.....	CO	0-0	C/W
04/11/80	#36 (Bishop).....	WV	0-0	CM
04/14/80	#7 (J. Walter).....	AL	0-0	CM
04/22/80	Mulga.....	AL	0-0	CM
04/24/80	#7 (J. Walter).....	AL	0-0	CM
04/26/80	Emerald #1.....	PA	0-0	CM
04/28/80	Price River #3.....	UT	0-0	LW
04/28/80	#3 (J. Walter).....	AL	0-0	LW
04/29/80	Bonny.....	WV	0-0	Drill
05/01/80	#3 (J. Walter).....	AL	0-0	LW

TABLE A-2. - Ignitions and explosions, 1969-80--Continued

Date	Mine	State	I-F	Cause
05/09/80	#3 (J. Walter).....	AL	0-0	LW
05/19/80	#7 (J. Walter).....	AL	0-0	Drill
05/29/80	Price River #3.....	UT	0-0	LW
06/04/80	King #5.....	UT	0-0	CM
06/05/80	Eagle #2.....	IL	0-0	CM
06/07/80	Beckley #2.....	WV	0-0	CM
06/10/80	#3 (J. Walter).....	AL	0-0	CM
06/16/80	.....do.....	AL	0-0	CM
06/17/80	.....do.....	AL	0-0	CM
06/23/80	Beckley #1.....	WV	0-0	CM
06/24/80	Dents Run.....	WV	0-0	C/W
06/25/80	Cumberland.....	PA	0-0	CM
07/14/80	Beckley #2.....	WV	0-0	CM
07/15/80	#5 (J. Walter).....	AL	0-0	Drill
07/21/80	#7 (J. Walter).....	AL	0-0	CM
07/29/80	Osage #3.....	WV	0-0	CM
07/31/80	#3 (J. Walter).....	AL	0-0	CM
08/07/80	.....do.....	AL	0-0	CM
08/19/80	Cambria Slope #33.....	PA	0-0	C/W
08/20/80	Emerald #1.....	PA	0-0	CM
08/21/80	Arkwright #1.....	WV	0-0	CM
08/21/80	Price River #3.....	UT	0-0	LW
08/22/80	.....do.....	UT	0-0	LW
09/03/80	.....do.....	UT	0-0	CM
09/05/80	#3 (J. Walter).....	AL	0-0	CM
09/08/80	North River #1.....	AL	0-0	C/W
09/20/80	#4 (J. Walter).....	AL	1-0	C/W
10/01/80	#3 (J. Walter).....	AL	0-0	LW
10/08/80	Beckley #1.....	WV	0-0	CM
10/08/80	#4 (J. Walter).....	AL	0-0	C/W
10/16/80	Beckley #2.....	WV	0-0	CM
11/03/80	#50 Pinnacle Creek.....	WV	0-0	CM
11/06/80	#3 (J. Walter).....	AL	0-0	CM
11/10/80	Beckley #2.....	WV	0-0	CM
11/14/80	#5 (J. Walter).....	AL	0-0	CM
11/14/80	#3 (J. Walter).....	AL	0-0	Drill
11/14/80	#4 (J. Walter).....	AL	0-0	C/W
11/17/80	#50 Pinnacle Creek.....	WV	0-0	CM
11/18/80	Price River #5.....	UT	0-0	CM
11/26/80	L. S. Wood #3	CO	0-0	Elec.
12/03/80	#4 (J. Walter).....	AL	0-0	Drill
12/08/80	Dutch Creek #2.....	CO	0-0	CM
12/15/80	Bessie.....	AL	0-0	Cut.
12/17/80	Dents Run.....	WV	0-0	C/W
12/22/80	#4 (J. Walter).....	AL	0-0	CM
12/19/80	Beckley #2.....	WV	0-0	CM
12/31/80	Emerald #1.....	PA	0-0	CM

TABLE A-3. - Ignitions and explosions classified by cause, 1959-68

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968
Frictional:										
Continuous miner.....	4	3	8	5X	15X	16	21	11	15	16
Cutter.....	3	3	1	2	2	6	-	3	2	1
Longwall.....	-	-	-	-	-	-	-	-	-	-
Drill.....	1	-	-	1	-	1	-	-	-	-
Rock fall.....	-	-	-	2	-	-	-	1	3X	-
Other.....	-	-	-	-	1	1	1	-	-	-
Total.....	8	6	9	10	18	24	22	15	20X	17
Nonfrictional:										
Electrical.....	8	7	8X	9X	11X	10	10	9X	7X	2
Explosive.....	1	-	-	3	3	3	-	3X	-	3
Cutting and/or welding.	1	1	2	-	1	2	1	-	3	2
Smoking.....	1	1	3	3	1	2	3	2	4X	2
Defective flame safety lamp.....	4	-	1	-	1	-	2	1	-	1
Other.....	-	3	5X	1	3	1	1	-	1X	1
Total.....	15	12	18	16	20	18	17	14	13X	11
Not classified.....	-	-	-	1	1	-	-	-	-	1
Grand total.....	23	18	27	26	38	42	39	29	32	29

TABLE A-4. - Summary of injuries by cause, 1959-68

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968
Frictional:										
Continuous miner.....	1	3	18	2	14X	11	17	17	27	16
Cutter.....	-	-	-	-	1	-	-	-	-	-
Longwall.....	-	-	-	-	-	-	-	-	-	-
Drill.....	-	-	-	-	-	-	-	-	-	-
Rock fall.....	-	-	-	2	-	-	-	4	2X	-
Other.....	-	-	-	-	-	1	-	-	-	-
Total.....	1	3	18	4	15	12	17	21	29X	16
Nonfrictional:										
Electrical.....	7	2	8	9	15X	6	13	10X	16	2
Explosive.....	1	-	-	3	3	8	-	5X	-	5
Cutting and/or welding.	-	-	2	-	-	3	-	-	4	1
Smoking.....	2	-	3	6	2	4	3	4	5X	4
Defective flame safety lamp.....	3	-	3	-	2	-	3	1	-	3
Other.....	-	3	2	-	3	-	-	-	2X	-
Total.....	13	5	18	18	25	21	19	16	25	15
Not classified.....	-	-	-	-	-	-	-	-	-	-
Grand total.....	14	8	36	22	39	33	36	37	52	31

TABLE A-5. - Summary of fatalities by cause, 1959-68

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968
Frictional:										
Continuous miner.....	-	-	1	37X	9X	-	-	-	2	1
Cutter.....	-	-	-	-	-	-	-	-	-	-
Longwall.....	-	-	-	-	-	-	-	-	-	-
Drill.....	-	-	-	-	-	-	-	-	-	-
Rock fall.....	-	-	-	2	-	-	-	-	-	-
Other.....	-	-	-	-	-	-	-	-	-	-
Total.....	-	-	1	39X	9X	-	-	-	2	1
Nonfrictional:										
Electrical.....	9	2	24X	50X	35X	3	14	10	10X	-
Explosive.....	-	-	-	-	1	3	-	-	-	9
Cutting and/or welding.	-	-	-	-	-	-	-	-	-	2
Smoking.....	-	2	1	-	-	-	5	-	4X	-
Defective flame safety lamp.....	1	-	-	-	-	-	-	-	-	-
Other.....	-	-	23X	-	-	7	-	-	-	-
Total.....	10	4	26	50X	36X	6	26	10	10	11
Not classified.....	-	-	-	-	-	-	-	-	-	78
Grand total.....	10	4	27	52	36	6	26	10	12	90

TABLE A-6. - Ignitions and explosions classified by cause, 1969-80

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Frictional:												
Continuous miner.....	19	37	31	20	22	44	49	58	36	37	74	61
Cutter.....	4	1	3	1	-	1	1	1	-	-	-	2
Longwall.....	-	-	-	-	-	-	-	4	7	2	13	11
Drill.....	-	-	-	1	1	-	2	3	3	8	10	7
Rock fall.....	-	-	1	2	-	-	2	1	-	-	-	-
Other.....	-	-	-	-	-	-	1	-	-	1	-	-
Total.....	23	38	35	24	23	45	55	67	46	48	97	81
Nonfrictional:												
Electrical.....	5	7	1X	2	2	2	5	3	3	1	3	1
Explosive.....	2	4X	1	1	1	1	4	-	2	2	3	1
Cutting and/or welding	1	2	1	2	3	7	3	8	8	5	6	16
Smoking.....	1	2	2X	-	-	-	-	-	2	-	-	-
Defective flame safety lamp.....	1	1	-	-	-	-	-	-	-	-	-	-
Other.....	-	1X	-	-	-	1	-	2	-	1	-	-
Total.....	10	16	4	5	6	11	12	13	15	9	12	18
Not classified.....	-	-	-	-	-	1	-	2	-	-	-	-
Grand total.....	33	54	39	29	29	57	67	82	62	58	109	99

TABLE A-7. - Summary of injuries by cause, 1969-80

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Frictional:												
Continuous miner.....	9	13	6	4	1	4	4	7	-	1	2	6
Cutter.....	-	-	-	-	-	-	-	-	-	-	-	-
Longwall.....	-	-	-	-	-	-	-	-	-	-	-	-
Drill.....	-	-	-	2	2	-	-	-	-	-	-	-
Rock fall.....	-	-	1	1	-	-	-	-	-	-	-	-
Other.....	-	-	-	-	-	-	-	-	-	3	-	-
Total.....	9	13	7	7	3	4	4	7	-	4	2	6
Nonfrictional:												
Electrical.....	14	2	-	-	-	-	-	-	-	-	-	-
Explosive.....	4	5X	3	2	-	-	2	-	-	-	7	-
Cutting and/or welding	-	2	-	19	-	2	-	2	1	-	-	1
Smoking.....	2	2	2	-	-	-	-	-	5	-	-	-
Defective flame safety lamp.....	1	4	-	-	-	-	-	-	-	-	-	-
Other.....	-	3X	-	-	-	-	-	-	-	2	-	-
Total.....	21	15	5	21	-	2	2	2	6	2	7	1
Not classified.....	-	-	-	-	-	-	-	-	-	-	-	-
Grand total.....	30	28	12	28	3	6	6	9	6	6	9	1

TABLE A-8. - Summary of fatalities by cause, 1969-80

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Frictional:												
Continuous miner.....	-	1	-	-	-	-	-	-	-	-	-	-
Cutter.....	-	-	-	-	-	-	-	-	-	-	-	-
Longwall.....	-	-	-	-	-	-	-	-	-	-	-	-
Drill.....	-	-	-	-	-	-	-	-	-	-	-	-
Rock fall.....	-	-	-	-	-	-	-	-	-	-	-	-
Other.....	-	-	-	-	-	-	-	-	-	-	-	-
Total.....	-	1	-	-	-	-	-	-	-	-	-	-
Nonfrictional:												
Electrical.....	1	1	-	5	2	-	-	-	-	-	-	-
Explosive.....	-	38	-	-	-	-	-	-	-	-	-	-
Cutting and/or welding	-	-	-	-	-	-	-	1	-	-	-	-
Smoking.....	-	1	-	-	-	-	-	-	4	-	-	-
Defective flame safety lamp.....	-	-	-	-	-	-	-	-	-	-	-	-
Other.....	-	-	-	-	-	-	-	-	-	-	-	-
Total.....	1	40	-	5	2	-	-	1	4	-	-	-
Not classified.....	-	-	-	-	-	-	-	26	-	-	-	-
Grand total.....	1	41	-	5	2	-	-	27	4	-	-	-

TABLE A-9. - Frictional and/or methane ignitions in surface facilities, 1959-79

Date	Mine	Location	Nature of ignition	Fatal or injured
1959				
07/24	Dekoven raw coal tunnel.	Dekoven, KY...	Methane from raw coal in hopper ignited by filament of broken light bulb.	2 F 0 I
08/12	Champion #1 fine coal dryer.	McDonald, PA..	Broken hydraulic line fed vaporized hydraulic fluid into high temperature of dryer.	0 F 1 I
1960				
02/01	Central coal preparation plant.	Stirrate, WV..	Dust in suspension at loading ramp ignited by flame from oil drum heater.	0 F 1 I
1961				
08/02	Joanne coal thermal dryer.	Rachel, WV....	Sparks from dryer furnace or frictional heat from iron in screw conveyor ignited methane.	0 F 1 I
1962				
02/05	Federal #1 thermal dryer.	Grant Town, WV	Thermal dryer overheated for lack of water; ignited methane.	0 F 0 I
03/08	.....do.....	.....do.....	Excessive heat ignited coal dust in furnace, cyclone, or connecting duct work.	0 F 1 I
03/19	.....do.....	.....do.....	.....do.....	0 F 0 I
03/23	.....do.....	.....do.....	.....do.....	0 F 0 I
03/28	Nelms #2 coal storage silo.	Hopedale, OH..	Methane-coal dust ignited while cutting hole in discharge chute atop silo.	0 F 1 I
05/07	Federal #1 thermal dryer.	Grant Town, WV	Dust in suspension in dry coal conveyor ignited by sparks from fire in combustion chamber.	0 F 0 I
10/26	No. 6 thermal dryer.	Winifrede, WV.	Hot clinkers ignited dried coal near furnace door; coal dust ignition followed.	0 F 4 I
11/01	Kopperston thermal dryer.	Kopperston, WV	Dust in suspension blown into fire in bottom of combustion chamber.	0 F 0 I
12/05	Red Wing preparation plant.	Axial, CO.....	Frictional heat from teeth of sprocket sheaving off ignited dust in suspension.	0 F 0 I

TABLE A-9. - Frictional and/or methane ignitions in surface facilities, 1959-79--Continued

Date	Mine	Location	Nature of ignition	Fatal or injured
1963				
10/11	Moss #3 preparation plant.	South Clinchfield, VA.	Coal dust swept from top of furnace ignited by hot stack emitting sparks.	0 F 0 I
1964				
02/03	Compass #3 thermal dryer.	Dola, WV.....	Dust in suspension ignited by hot flyash induced into dryer by exhaust fan.	0 F 0 I
03/15	Maidon #3 thermal dryer.	Newton and Poland Mines, PA.	Flame from furnace blown through coal feed conveyor.	0 F 0 I
06/17	Saxsewell thermal dryer.	Richwood, WV..	Dust ignited by smoldering coal in dryer.	1 F 3 I
11/11	Mine #22 thermal dryer.	Deane, KY.....	Dust in dryer ignited by hot material conveyed by the louvre pans.	0 F 0 I
12/31	Thermal dryer...	Corbin, KY....	Attempted to relight furnace in an explosive mixture of propane and coal dust.	0 F 4 I
1965				
03/18	King preparation plant.	Hiawatha, UT..	Coal dust dispersed during cleanup operations ignited by welder.	0 F 1 I
08/08	Moss #3 preparation plant.	South Clinchfield, VA.	Coal dust in suspension ignited during a severe wind storm by a "blow back" from furnace.	0 F 0 I
1966				
09/16	No. 1A Strip....	Shinnston, WV.	Natural gas pipeline ruptured and ignited during blasting operations.	1 F 0 I
1968				
01/22	Loveridge thermal dryer.	Fairview, WV..	Hot coals, discharged from cyclone dust collector, ignited fine coal dust.	0 F 2 I
05/17	Nos. 7 and 8 preparation plant.	Standardville, UT.	Coal chute fell after being cut by torch, resulting in dust ignited by torch.	0 F 0 I
08/15	Orient #5 raw coal tunnel.	Benton, IL....	Making repairs to belt feeder, methane-air mixture ignited by torch.	4 F 0 I
10/31	Thermal dryer...	Biggs, KY.....	Dust ignited by burning coal particles in dryer.	0 F 1 I

TABLE A-9. - Frictional and/or methane ignitions in surface facilities, 1959-79--Continued

Date	Mine	Location	Nature of ignition	Fatal or injured
1969				
02/06	Robinson Run #95 thermal dryer.	Lumberport, WV	Dust ignited when fan pulled hot material into exhaust dusts and cyclones.	0 F 0 I
05/14	Federal #2 pump-house building.	Micacle Run, WV.	Gas from borehole collected in building and ignited by electrical arc.	0 F 0 I
07/29	Consol #9 surface building.	Farmington, WV	Gas from sealed shaft leaked into building and ignited by electrical arc.	0 F 0 I
1970				
02/06	Guyan #1 preparation plant.	Amherstdale, WV.	Lighted torch placed on acetylene tank, flame heated oxygen cylinder and it exploded.	1 F 2 I
02/14	Humphrey #7 preparation plant.	Maidsville, WV	Coal dust ignited by torch.....	0 F 1 I
1971				
04/20	Jenkinjones thermal dryer.	Jenkinjones, WV.	Dust ignited by smoldering coal or sparks present in cyclones or duct work.	0 F 4 I
07/12	Inland preparation plant.	Jefferson County, IL.	Coal dust in froth tank ignited by torch.	0 F 1 I
1974				
06/08	Splashdam #2 Strip.	Haysi, VA.....	Lightning set off one hole of blast	0 F 1 I
08/14	Smith & Rogos Strip.	Brandy Camp, PA.	Oil on inner surface of oxygen regulator ignited when oxygen valve was opened.	1 F 0 I
10/19	Captain Shop....	Cutler, IL....	Explosive vapors from inner liner and underlying materials of truck tire ignited while welding rim.	1 F 0 I
10/30	Bee Hive surface gallery belt structure.	Orangeville, UT.	Overlying soil and rock caused roof to collapse; broken light bulb ignited dust.	0 F 0 I
1975				
09/22	McKinley preparation plant.	Galup, NM.....	Cut off exhaust hood; when it fell it resulted in dust cloud being ignited by torch.	0 F 2 I

TABLE A-9. - Frictional and/or methane ignitions in surface facilities, 1959-79--Continued

Date	Mine	Location	Nature of ignition	Fatal or injured
1976				
07/12	No. 131 preparation plant.	Van, WV.....	Oxygen regulator exploded, probably due to back charge of acetylene or other combustibles.	0 F 0 I
10/12	.....do.....	.....do.....	Pump running "on air;" steam pressure caused pump to burst.	0 F 0 I
11/09	Wharton #4 Shop.	Wharton, WV...	Oxygen regulator exploded, probably due to back charge of acetylene.	0 F 1 I
11/11	Preparation Plant #1.	Mavidale, VA.	Methane accumulation in wellhouse ignited by electrical arc.	0 F 1 I
1977				
01/18	Bottom Creek #2 pumphouse.	Keystone, WV..	Methane liberated at top of well; ignited by smoking.	0 F 6 I
03/01	Welch #1 Shop...	Welch, OK.....	Horseplay; homemade bomb exploded in victim's hand.	0 F 1 I
05/05	Revloc Mine #32 Shaft.	Revloc, PA....	Torch slag ignited methane in shaft; victim struck by dislodged I-beam.	1 F 0 I
06/01	Robinson Run #95	Lumberport, WV	Methane from borehole ignited by electric arc from impact wrench.	0 F 1 I
06/10	Lancashire #25 clean coal storage silo.	Bakerton, PA..	Torch used to enlarge chute opening while coal was discharging into silo; dust ignited.	0 F 3 I
07/29	Florence #2.....	Huff, PA.....	Welding at borehole being drilled igniting methane.	0 F 0 I
09/29	Jenkinjones thermal dryer.	Jenkinjones, WV.	High temperature in drying compartment ignited coal dust in suspension.	0 F 0 I
10/31	.....do.....	.....do.....	Explosive mixture of oil and coal ignited, throwing coal dust into suspension.	0 F 0 I
12/04	No. 51 preparation plant.	Ellsworth, PA.	Boiler exploded owing to deterioration of supporting stays between firebox and wrapper sheet.	0 F 0 I
12/06	Revloc Mine #33.	Revloc, PA....	Short in shielded 2,300-volt cable to submersible pump ignited methane at borehole.	0 F 0 I

TABLE A-9. - Frictional and/or methane ignitions in surface facilities, 1959-79--Continued

Date	Mine	Location	Nature of ignition	Fatal or injured
1978				
05/12	No. 50 clean coal silo.	Pineville, WV.	Hot or burning material from thermal dryer discharged into silo; dust in suspension ignited.	0 F 0 I
06/13	Jenkinjones thermal dryer.	Jenkinjones, WV.	Fine coal spilled or bedplates ignited by spark from combustion chamber during startup.	0 F 0 I
06/22	Absaloka.....	Hardin, MT....	Propane torch left in tub of drag-line; torch went out and propane gas accumulation was ignited by another torch.	0 F 1 I
07/31	Black Mesa #1 storage bin.	Keyenta, AZ...	Truckload of coal inadvertently dumped into bin while working with torch.	0 F 2 I
09/17	Itmann #3 fan shaft.	Itmann, WV....	Gas in shaft ignited by slag from cutting operations.	0 F 0 I
1979				
01/02	Black Thunder preparation plant.	Gillette, WY..	Hot coals from fire in storage shed ignited dust within loadout facilities.	0 F 0 I
02/19	Jenkinjones thermal dryer.	Jenkinjones, WV.	Atomized fuel oil being fed into furnace ignited by heat from burner.	0 F 0 I
03/29	Valley Camp #41 battery-charging station.	Shrewsburg, WV	Batteries charged with covers closed; hydrogen gas ignited by unknown source.	0 F 0 I