

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

District D

FINAL REPORT ON MAJOR MINE-EXPLOSION DISASTER
RIVER QUEEN UNDERGROUND MINE NO. 1
PEABODY COAL COMPANY
GREENVILLE, MUHLENBERG COUNTY, KENTUCKY

August 7, 1968

by

James A. O'Connor
Supervisory Mining Engineer

and

William M. Craft
Federal Coal-Mine Inspector

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Federal Coal-Mine Inspector

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INTRODUCTION

This report is based on an investigation made in accordance with the provisions of the Federal Coal Mine Safety Act (66 Stat. 692; 30 U.S.C. Secs. 451-483) as amended.

About 12:45 p.m., on Wednesday, August 7, 1968, the accidental (not mudcap) detonation of unconfined explosives, and, subsequently, a coal-dust explosion, occurred in the No. 2 northeast main entry section, main east, in the River Queen Underground Mine No. 1. At the time, 55 men were underground; nine in the affected section died from effects of forces, flame, or asphyxiation, and 46 at scattered locations escaped unassisted, two having been injured slightly by forces. The names of the victims are recorded in Appendix A of this report.

The evidence indicated that an undetermined, but appreciable, quantity of permissible explosives on a coal drill parked near an entry face was detonated, probably by a fragment projected from the face when the coal was blasted, and that this detonation ignited coal dust, but that propagation did not extend far beyond the working areas of the seven entries comprising the section. Property damage was confined essentially to destruction of the drill and a number of block stoppings.

GENERAL INFORMATION

The mine is off Kentucky Highway Route No. 181, about 5 miles north of Greenville, Muhlenberg County, Kentucky. Mined material is transported from the mine by a company-owned railroad to a loading dock on the Green River, where it is loaded into barges.

Names and addresses of the principal officers of Peabody Coal Company are:

T. C. Mullins	President	301 North Memorial Drive St. Louis, Missouri 63102
H. C. McCollum	Vice President	301 North Memorial Drive St. Louis, Missouri 63102
Joseph Craggs	Vice President Administration Underground Operations	Post Office Box 530 Taylorville, Illinois 62568
E. E. Quenon	Director of Safety	301 North Memorial Drive St. Louis, Missouri 63102
Fred Rice	Assistant to Vice President Underground Operations	Post Office Box 530 Taylorville, Illinois 62568
John E. Wagner	Chief Coal-Mine Inspector Underground Operations	Post Office Box 530 Taylorville, Illinois 62568
Foster Siler	General Superintendent Kentucky Division	Post Office Box 289 Greenville, Kentucky 42345

This mine is opened by three drifts along the highwall of a former stripping operation into the Kentucky No. 9 coalbed, which averages about 52 inches in thickness and is relatively flat at this location. A total of 136 persons was employed, 12 of whom were surface employees, and 124 underground workmen. The average daily production was 4,000 tons of coal. The immediate roof overlying the coalbed was laminated friable shale, and the floor was soft fire clay.

Analysis of the coal in this area, as determined in the company laboratory, is as follows:

	<u>Percent</u>
Moisture	7.9
Volatile Matter	36.7
Fixed Carbon	42.7
Ash	<u>12.7</u>
TOTAL	100.0

From this analysis, the volatile ratio (volatile matter to total combustibles) is 0.46, and the coal dust is, therefore, highly explosive.

The last previous regular Federal inspection of this mine was made on May 9-10 and 13-16, 1968. A spot-check inspection was made June 20, 1968.

MINING METHODS, CONDITIONS, AND EQUIPMENT

Mining Methods

The method of mining being followed consisted of an entry-and-room system, with main entries in sets of seven, panel entries in sets of five, off the main entries, and rooms off the panel entries. The maximum crosscut interval was 60 feet. The mining was done with mechanical equipment, four conventional units, and one continuous-miner unit. Pillars were not recovered. Roof bolts were the predominant type of roof support, and all bolting was done according to a Bureau-approved plan. Posts and crossbars were used to supplement the bolting where needed. In the explosion area proper, roof bolts were used throughout, and supplemental timbering had not been required.

Explosives

Blasting supplies were delivered to the working-section storage boxes by third-shift supply crews. The type of explosives in the two-compartment storage box in 2 northeast section was Hercules Red HA, a permissible explosive, in 1-1/2- by 8-inch cartridges, in conventional paper cartons containing 50 pounds each. The supply was within the 48-hour quantity limit, as specified in the Federal Mine Safety Code for Bituminous-Coal and Lignite Mines of the United States. All detonators found in 2 northeast were instantaneous type, Hercules Instadet electric blasting caps, with 10-foot copper leg wires. On hand in the box were 1,400 detonators, far more than a 48-hour supply, but the excess quantity had no bearing upon the explosion. Knapsack-type bags, of plastic material, were provided for the shot firers to carry explosives and detonators separately from the section storage boxes to the working faces; however, in this instance, the evidence made it obvious that the explosives were being transported on the coal drill.

The coal was undercut before being blasted, and the blasting was done by designated shot firers during the working shift. Stemming material was obtained by cutting into the fire clay bottom with the cutting machine, and boreholes were stemmed with at least 24 inches of this incombustible material in paper dummy bags. As disclosed during the hearing, entry faces and crosscuts were usually blasted with four holes in one row near the top. Usually, the rib holes were charged with three cartridges of explosives, size 1-1/2 by 8 inches, and two such cartridges in the center holes, which is well within the allowable charge limit. The charge in each hole was subject to some variation according to change in the coal-bed from area to area, but in the 2 northeast entries, the drilling pattern and charge per hole were said to have been as above. Detonators for each face round were connected in series and initiated with a permissible blasting unit. The unit found in 2 northeast section was labeled: "Approved Permissible Multiple Shot Blasting Unit, Approval No. 1604, Fidelity Electric Co. Inc." A length of yellow-plastic-coated

connecting wire was still attached to one conductor of the blasting cable after the explosion, indicating that the last round fired had been a multiple-shot round. Multiple-shot blasting had no bearing upon the occurrence; the indication is, rather, that the stated usual procedures were being followed.

Ventilation and Gases

The mine is classed nongassy.

Ventilation was induced by a 6-foot, Jeffrey Aerodyne, axial-flow fan, operated blowing, and installed on the surface. The fan develops a positive pressure of 4.0 to 4.4 inches of water gage in normal operation.

More than 6,000 cubic feet of air a minute was reaching the last open crosscuts in each set of active entries during the inspection completed May 16, 1968. The analyses of the air samples collected at faces during the preceding Federal inspection were within normal ranges, and the highest concentration of methane revealed was 0.13 percent. Approximately 120,000 cubic feet of air a minute enters the mine and is divided nearly equally at the mouth of the south main entries (Appendix B). Suitable preshift examinations were made before the first coal-producing shift each day, and on-shift examinations were made by each foreman.

Dust

Dangerous accumulations of loose coal and coal dust were not observed in the mine during the preceding Federal inspection. Waterlines, with water under pressure, parallel the belt conveyors, and outlets are provided at suitable locations to allow sprinkling along the belts when necessary.

The mine surfaces ranged from generally damp to extremely wet; however, the natural moisture was not depended upon to control coal dust. Rock-dusting was done, and, according to the report of the previous routine inspection, "A systematic sampling of the rock-dusting was made in the first south entries, and spot-location samples were collected throughout the mine. The incombustible content of 21 of the survey samples and eight of the spot-location samples was less than the minimum requirement. Company officials were notified of the discrepancies promptly upon receipt of the analyses, and a reexamination of the affected areas on May 27, 1968, disclosed that additional rock dust, in ample quantity, had been applied. Rock-dust applications throughout the mine, including parallel and back entries, appeared to be adequate at the close of the inspection."

No violation of those mine safety provisions of the Federal Coal Mine Safety Act which pertain to the dust hazard was observed during the spot-check inspection made June 20, 1968, in the No. 5 unit, new main east entries (which are off the main south, not near the explosion area).

At the time of the last previous regular Federal inspection, the 2 northeast entry development was bogged down by extremely adverse roof conditions, together with an inflow of water from the roof which created a very muddy bottom, and the entries had advanced only 800 feet off main east. From that time until the day of the explosion the entries had been advanced 1,400 feet farther. It is thus not possible to know the status of the section as to rock-dusting.

Transportation

Coal was hauled in shuttle cars from the face regions and discharged onto fire-resistant belt conveyors, which transported the coal to the surface. Men were transported in cars moved by battery locomotives, both on and off track. A two-way Femco Pagephone communication system was provided between the surface and underground.

Electricity

In the No. 2 northeast main entry section, electric power, 4,160 volts, 3-phase, alternating current, was transformed to 440 volts, 3-phase, by a dry-type transformer, rated at 300 kv.-a., connected delta/gye. The transformer was properly frame-grounded, and the gye secondary midpoint was utilized for ground-fault protection of inby equipment through an impedance and a relay. From the transformer, power was taken through a 3-conductor cable with ground to a distribution center serving individual face machines. Overcurrent and short-circuit protection were provided for face equipment both at the transformer and at the distribution center. Additional ground-fault protection for each individual piece of face equipment and trailing cable was provided by relays at the distribution center, set to trip instantaneously at 1.3 amperes. Trailing cables were Bureau-listed, fire-resistant type, and each trailing cable contained a ground conductor.

Face equipment in the 2 northeast section consisted of two Joy 16SC-6 shuttle cars, a Joy 15 RU cutting machine, a Fletcher S-DMA-E-C-13-C7R-3 roof-bolting machine, a Joy 14BU-10-11BH loading machine, and a Long-Airdox TDF-24A coal drill.

The coal drill was equipped with a 500-foot trailing cable, identified "P-120-BM, 4 Conductor, Size No. 6." That portion of trailing cable remaining on the spooling reel was mangled by the explosion, but the ground conductor was continuous from a point near the drill, where it had been severed by the explosion, to the distribution center; it would be impossible to state whether it had been intact also from the point of explosion-induced severance to the drill frame. The protective breaker for this cable at the distribution center was found in a tripped position after the explosion.

Mine Rescue

A mine rescue team was not maintained at this operation; however, rescue teams from Island Creek Coal Company, West Kentucky Division, and from The Pittsburg & Midway Coal Mining Company, arrived at the mine soon after the occurrence. The rescue work was accomplished with universal gas masks. Firefighting facilities were available but not needed during the recovery operations. A check-in and check-out system, providing positive identification upon the person of every individual underground, was provided; however, identification checks could not be found on some victims, and identity could not be established with certainty until they were brought out of the mine.

STORY OF EXPLOSION AND RECOVERY OPERATIONS

Participating Organizations

Assisting during recovery operations were officials and workmen from Peabody Coal Company, the two mine rescue teams mentioned above, the Muhlenberg County Sheriff's Department, State and local police, several ambulance services, Ladies Auxiliaries of the American Legion, Greenville, Kentucky, Civil Defense units, Red Cross units, ministers and ladies' groups of area churches, insurance company inspectors, the Kentucky Department of Mines and Minerals, and the United States Bureau of Mines.

Activities of Bureau of Mines Personnel

William M. Craft, Federal coal-mine inspector at the Madisonville, Kentucky, office of the Bureau of Mines, received a telephone call from the mine bookkeeper at 12:55 p.m., August 7, 1968, informing him of the occurrence. Craft went immediately to the mine, arriving there about 1:20 p.m. James R. Laird and Mike Sakovich, Federal coal-mine inspectors, arrived about 3:30 p.m. and 4 p.m., respectively. Subsequently Inspectors B. E. Hill, Mike Wolfe, D. W. Kouche, and Donald E. Martin arrived. William M. Demkowicz, technical assistant, temporarily on assignment in the vicinity, went to the mine promptly upon learning of the explosion. District Manager H. A. Schrecengost and James A. O'Connor, mining engineer, arrived about 9:30 p.m. Frank C. Memmott, Associate Director--Health and Safety, and A. D. Sisk, technical assistant, arrived the following morning. All participated until recovery and the investigation were completed. Mr. Memmott headed the investigation for the Bureau of Mines.

Upon arrival at the mine, Craft issued two withdrawal orders citing explosion and mine-fire dangers under Section 203(a)(1) of the Federal Coal Mine Safety Act, in accordance with Bureau policy.

Activities of Other Agencies

Among those who responded promptly to lend assistance were representatives of the mine workers and of the Commonwealth of Kentucky.

Louis Austin, President, District 23, United Mine Workers of America, arrived at the mine at 4:30 p.m., August 7, 1968, and remained at the mine until recovery was completed. Allen Condra and Charles Head, International Representatives, District 23, arrived at the mine at 5:30 p.m., August 7, 1968, and Lewis E. Evans, Director, Safety Division, United Mine Workers of America, and Rex Lauck, Assistant Editor, United Mine Workers Journal, arrived at the mine the following morning.

J. H. Mosgrove, Assistant to Commissioner, Kentucky Department of Mines and Minerals, arrived at the mine at 5:30 p.m. on the day of the occurrence and directed recovery operations until the next morning. Other personnel of the Kentucky Department of Mines and Minerals from eastern Kentucky, listed in Appendix E, assisted in the recovery operations.

Mine Conditions Immediately Prior to Explosion

According to the records of the U. S. Weather Bureau at Evansville, Indiana, about 65 air miles from the mine, the weather on August 7, 1968, was fair, and temperature ranged from a low of 75 to a high of 95 degrees, Fahrenheit. Barometric pressure, read and recorded twice daily, was as follows:

6 a.m.	August 7, 1968	30.14 in. Hg.
6 p.m.	August 7, 1968	30.05 in. Hg.

The barometer reading considered normal for this area is 30.06 in. Hg. The foregoing information was obtained routinely during the investigation; the data are significant negatively as regards methane liberation, but, in this instance, the significance is academic, since it was later determined that methane was not a factor in the explosion.

The mine was operating normally on the day of the explosion, except for mechanical difficulty with the conveyor belt in No. 2 northeast section, which required the mechanic, Will Rice, to travel to the belt drive at the mouth of the section, at the main east entries. Rice was in contact with employees on the surface shortly before the explosion and informed them that he was leaving the belt drive and returning to the face area of

the No. 2 northeast section. The fan operation was normal just before the explosion; however, the fan was stopped twice for short periods after the explosion by overheated bearings on the jack shaft. A gasoline-powered auxiliary (standby) engine was utilized while the electric drive was out of service. An examination of the mine had been made before the start of the day shift, and, according to the record, the examiner, a certified fire boss, found no dangerous condition.

Evidence of Activities and Story of Explosion

The day-shift crew entered the mine at 7 a.m., August 7, 1968, and they were transported to their respective sections and worked without incident until the concussion was felt. At approximately 12:45 p.m., an outside employee observed dust and smoke coming from the return-air drifts. Company officials were contacted, and State and Federal authorities were notified. There were 55 men in the mine at this time, 40 men distributed in five working sections, and the remaining 15 men, including supply men, beltmen, officials, and mechanics, at other locations.

As Cecil Ledford, superintendent of this mine, was known to be underground, Thomas Barton, superintendent of the company's nearby mine, was notified, and Barton arrived on the scene shortly and assumed charge. The underground electrical power supply was disconnected at the portal. Communication was established with employees in all sections, except the men in the No. 2 northeast entries, two supply men known to have been in the No. 2 northeast section within the preceding 30 minutes, the belt mechanic last known to have been at the belt drive at the mouth of No. 2 northeast entries, a man assigned to cleaning along the belt near the mouth of No. 2 northeast panel, and two men timbering intake-air courses in the general area of main east and 2 northeast intersection.

The crews from No. 1 north section, main east, from the 2 west and the east entries off main south entries, and nine men from scattered locations escaped readily to the surface unharmed. The two supply men, who had been approximately 1,800 feet outby the face of No. 2 entry, No. 2 northeast, in the intake-air course, were blown from the battery-powered locomotive on which they were riding; however, they suffered only minor injuries, and they made their way to the surface afoot. The man cleaning the belt at the mouth of the No. 2 northeast was jolted by the concussion and witnessed the smoke and dust; he made his way to the intake-air course in the main east and escaped uninjured. Two timbermen did likewise. Ledford, superintendent, was in the track entry (return) in main east, about 2,500 feet inby the portal, and nearly 1 mile outby the face of No. 2 northeast, when the force wave struck him. He made his way to the intake airway at the mouth

of the No. 1 north panel and, with the help of two men he met coming off the 2-south-panel crew, hung a curtain at the mouth of 1 north section, where a door had been blown out. After contacting other men in the mine and issuing necessary instructions, Ledford and the other two men made their way to the surface.

Recovery Operations

When Inspector Craft arrived at the mine, at about 1:20 p.m., he was informed of the conditions by Barton and T. C. Stone, District State Inspector. It appeared, that since survivors had come out from the inby end of the main east entries, the chief obstacle to reaching the mouth of 2 northeast would be the necessity of walking via the unbrushed intake-air courses, meanwhile checking the east returns at intervals, to keep apprised of toxic gas concentrations and any indication of fire. A recovery group, designated Crew No. 1, was organized of those immediately available. Later, as other capable people arrived, they were formed into other crews. To simplify the recovery narrative, their names are omitted here and listed in Appendix E.

At this time all men were accounted for and out of the mine, except the eight-man crew and the mechanic in 2 northeast, and the six men remaining in 2 south, main east. The latter group was known to be alive, and it was evident that an explosion had occurred in 2 northeast. The 2 south panel was normally in the return of the 2 northeast split, but since the men in 2 south had not been disabled by contaminated air, and since the return air in the main east entries was contaminated but not to lethal degree, logic indicated that the air in 2 south panel and in the main east returns must be of the same quality. Craft established contact with Siria, section foreman, and advised him to take his five men across the main east returns to the intake side, which could be done without additional risk, and further advised him that he (Craft) and others would travel via the intake airway to meet them. Whereupon, Crew No. 1 entered the mine at 1:30 p.m., met the six men at a point inby No. 1 north panel, main east, 2,500 feet from the portal (Appendix B), and escorted them to the surface, still using the intake airway, and arriving outside at 2:30 p.m.

Later, it became obvious that short-circuiting of the air outby the explosion area proper, when stoppings in 2 northeast were demolished and a door at the mouth of the section was blown ajar, saved the men in 2 south panel by keeping contamination minimal.

Air currents were separated by a single line of stoppings. In the main east entries, the northerly entries of the set served as the intake-air course, and the track haulageway was in the (southerly) return side, so that, in the beginning, the recovery men were deprived of use of battery-powered transportation units. Frequent tests were made with methane and

carbon-monoxide detectors at the portal of the supply entries, and, of course, by the rescue crews as they explored. Flammable gas concentrations ranged from none to 0.2 percent, and carbon monoxide ranged from none to 0.05 percent. It then began to appear that recovery might, with due caution, be expedited by using the track haulageway.

Mine rescue teams from Island Creek Coal Company, West Kentucky Division, and The Pittsburg & Midway Coal Mining Company had been summoned, and both teams arrived at the mine before 4 p.m. At 4:13 p.m., Crew No. 2 entered the mine through the intake airway, and proceeded to the mouth of No. 1 north panel (Point 1, Appendix B). Using universal gas masks, members of the crew crossed over into the return airways to a telephone located along the track entry. After making tests, they advised those on the surface that the return atmosphere would sustain life and permit travel, provided that gas masks be used. Crew No. 3 then entered the mine at 5:44 p.m., using a track-mounted battery locomotive, joined Crew No. 2 at the mouth of No. 1 north panel, and traveled the intake airway to a point opposite the mouth of No. 2 south panel, 3,300 feet from the surface, where another telephone was located (Point 2, Appendix B).

The procedure used at the No. 1 north panel was repeated, and Crews Nos. 4 and 5 entered the mine at 6:33 p.m., and 6:38 p.m., respectively, using battery track locomotives, joined Crews Nos. 2 and 3, and the four crews advanced to the mouth of No. 2 northeast main entries, where a fresh-air base was established in the intake-air course and the telephone line extended to the base (Point 3, Appendix B).

At this point, plans were made for exploring the No. 2 northeast entry section. It was known that one of the missing persons was the mechanic, the last person heard from in the section, and that he would most likely be along the belt entry, a return airway. The four crews were then divided into two groups; one group continued to travel in the intake airways (left, or west side, entries, Nos. 1-3) toward the faces, and the other group donned their universal gas masks and explored the belt entry and the parallel return-air entries. At about 7:30 p.m., the latter group found the body of the mechanic along the belt in No. 4 entry, about 500 feet inby the belt drive unit at main east, and 1,700 feet outby the face. This group then rejoined the group in the intake airways.

This combined recovery group had advanced about 900 feet from main east, when they found two permanent concrete-block stoppings blown out. One was in a crosscut between Nos. 2 and 3 entries, and one was across No. 3 entry at the inby end of a line of stoppings between Nos. 2 and 3 entries, so arranged as to cause the intake air to bypass a major fall of roof in No. 3 entry; from here inby, there were again three intake entries (Appendix C). Temporary stoppings were erected, but the group had advanced only about 250 feet farther, when another blown-out stopping was

encountered. It could be reasonably assumed that other permanent stoppings were out, and Thomas Mills, a mine worker, and Federal Inspector Laird donned their universal gas masks to explore the advance area. They traveled as far as possible, until smoke and dust were so dense that visibility was practically zero. Later reference to the map showed that they had advanced to about 300 feet of the face, and they had determined that 13 stoppings, definitely, and more, presumably, had been shattered and must be replaced with temporary brattices before the missing persons could be found. After deliberating upon this information, the rescue crews decided that it was advisable to return to the surface, so that fresh crews might be sent in with adequate bratticing materials. Leaving men at the fresh-air base to maintain communications, Crews Nos. 2-5 withdrew and reached the portal at 9:15 p.m.

Crew No. 6 entered the mine at 9:45 p.m., August 7, 1968, and built all the required brattices. Considerable difficulty was encountered in getting materials into the section. The floor is fire clay, readily softened by water. A naturally wet and muddy area existed for several hundred feet toward the outby end. With power disconnected, the pump nearby was inoperative, and the muck became knee deep. Some of the battery-powered tractors bogged down, and batteries began to die from long use. However, all the brattices were installed and all victims accounted for and tentatively identified, and Crew No. 6 returned to the surface at 2:15 a.m., August 8, 1968.

Crew No. 7 entered at 2:30 a.m. to recover the victims. Difficulties recounted above were again encountered in transporting the victims out of the section. In addition, a relatively small fall had occurred at a point where it formed a bottleneck which could not be bypassed. Rock had to be broken with sledges and gobbled to the side to let equipment pass, and, meanwhile, the roof continued to work intermittently. Working against time, passage was accomplished before a further fall occurred. (Next day, the fallen material was 10 feet high.) Crew No. 7 returned to the surface, with their mission accomplished, at 6:30 a.m., Thursday, August 8, 1968.

Locations where victims were found, locations of the different units of electrical face equipment, and other items of information are shown in Appendix D.

2. Supervisors had observed explosives being hauled on the drills, and they had ordered the explosives removed.
3. Explosives were not hauled on drills whenever a "stranger" was known to be on the property.
4. Safety meetings were held every Monday on each section, and, in some of such meetings, the proper method of handling explosives and detonators was discussed.
5. Most of the officials and employees were not cognizant of the fact that transportation of explosives on electrical equipment created real dangers of accidental detonation of explosives.
6. Detonators were not hauled nor kept on drills.

Methane and/or Dust as a Factor in the Explosion

The mine is classed nongassy.

Mine records do not indicate that methane has been found in the mine. Of 12 air samples collected during five regular Federal inspections prior to the explosion, five samples collected at faces and in returns contained no methane, and seven face samples contained from 0.02 to 0.18 percent methane. The highest concentration of methane detected with a permissible detector during recovery operations was 0.2 percent. The analyses of four air samples collected on August 9, 1968, during the investigation, and analyzed by the gas laboratory of the U. S. Bureau of Mines, Mt. Hope, West Virginia, are shown in Table 1, attached. Those four samples, collected at faces in 2 northeast, with air in the section being directed by the line of temporary brattices erected by the recovery men, contained methane ranging from 0.09 to 0.23 percent. The composite evidence of air samples collected during regular inspections, and during this investigation, and numerous instrument tests during recovery operations, establishes that methane was not a factor in the explosion.

Dust samples were collected systematically during the investigation, according to a predetermined pattern, in the main east entries, approaching the 2 northeast entries, and continuing inby in the 2 northeast entries (Appendix C). Samples were collected also from the surfaces of face equipment. The analyses of these numerous samples are attached as Tables 2 and 3. Only a few samples contained more than 65 percent incombustible material; however, since dust samples collected following an explosion cannot be considered representative of mine-dust conditions prior to an explosion, these samples were collected primarily to determine the extent of flame or heat by the presence of coke. Additionally, the

presence of coke in the samples, together with soot or coke needles on equipment and roof-bolt plates to limited extent, and plastic coke on equipment to very limited extent, indicates that coal dust became involved in the explosion to some degree.

Flame

Evidence of heat or flame in the form of soot or coke was observed in all seven of the No. 2 northeast main entries for distances of approximately 1,400 feet outby the faces. As to face equipment, the sample from the loading machine in No. 2 entry (the machine farthest to the left) indicates relatively less coke present than on other machines. The last inby row of samples, at about 400 feet from the face, showed relatively less coke in entries Nos. 1-3 than in the other four entries to the right. Taking all seven entries as a group, the relative amounts of coke in the different samples indicates that flame and heat were most pronounced for about 800 feet outby the face. At 1,000 feet outby, the amount of coke began to diminish, even in the belt entry (No. 4), where some coal dust might be expected to be present along the belt. The decrease in amounts of coke continued to 1,300 feet outby, being reported there as from a "trace amount" to a "small amount." All the entries were definitely wet outby this point.

Outby the wet area, in entries Nos. 1-4, surfaces were sufficiently dry to permit sampling. Coke in these samples was reported as "none." The "trace" amount reported in one sample collected in the main east entries near the intersection with 2 northeast must thus be discounted as probably having been airborne across the wet zone.

Plastic liners in some of the cartons of explosives in the section explosives-storage box, in a crosscut about 200 feet outby the faces, were shrivelled. The plastic head-harnesses of miners' protective caps were shrivelled, and some of the caps were distorted by heat. Fragments of paper tamping bags about the coal drill, and pieces of woven material in the outby crosscut, possibly cotton clothing, appeared baked, but not definitely charred. Timber was not needed to supplement roof bolts in this particular area, and housekeeping had been rather good; however, there were some scattered pieces of rock-dust bags and paperboard cartons, and full rock-dust bags to a distance of at least 700 feet outby, which, though quite damp, showed slight signs of scorching.

Forces

Extent of forces developed by the explosion were determined chiefly by damage to ventilation facilities. Eighteen stoppings in 2 northeast, mostly concrete-block, were demolished, and another was damaged. A

door at the mouth of 2 northeast entries was blown ajar and damaged. Another door at the No. 1 north panel, main east, was blown from its frame, and Cecil Ledford, superintendent, was knocked down by the force wave in the main east entries, just inby No. 1 north panel. This puts the extent of violent forces at about 1 mile outby the faces of 2 northeast. It has been mentioned previously that the concussion was felt generally, and that a blast of dust was observed issuing from the portal.

Intense forces radiated in all directions from the drill in No. 5 entry, 2 northeast. The left front wheel and its mounting assembly were wrenched off and thrown onto the fall of coal at the face, 45 feet away; the 40 hp. electric motor, estimated to weigh 350 pounds, was blown about 25 feet outby its normal location on the drill, the reel and reel motor were torn off, and other parts and fragments of metal, large and small, were scattered in all directions.

Although the coal drill was demolished, the cutting machine close by was not damaged. Shuttle cars in No. 3 entry, to the west of No. 5 entry, showed definite indications of forces from the east. There were no units of equipment or loose objects to the east of No. 5 entry by which to assess forces in that direction. The belt tail assembly and feeder, and the portable transformer and the distribution box, in Nos. 4 and 5 entries, respectively, 300 feet outby the faces, appeared undisturbed. There was no distinct evidence of sweeping along the floor and piling of dust against objects.

Probable Point of Origin

The evidence definitely established the point of origin at the coal drill, parked about 45 feet from the face of No. 5 entry, 2 northeast entries.

Factors Preventing Spread of Explosion

Rock dust and general dampness probably retarded propagation, as indicated by diminishing amounts of coke in samples from locations progressively outby from the immediate working area. The extremely wet condition of the entries farther outby, together with blockage of some entries by previous roof falls in the wet area, apparently arrested propagation completely. The total impression from all the evidence suggested a coal-dust ignition which did not build up progressively, but rather peaked quickly and immediately receded.

Summary of Evidence

Conditions observed in the mine during the investigation following the explosion, together with information available from previous Federal

coal-mine inspection reports, from the hearing, and from company officials, workmen, and mine records, provided evidence as to the cause and origin of the explosion. The evidence from which the conclusions of the Federal investigators are drawn is summarized as follows:

1. The analyses of air samples collected prior to and after the explosion, the methane-detector indications during recovery work, and the daily reports of the fire boss, on the record as a whole, establish that the mine had been properly classified as nongassy, and that methane was not a factor in the explosion.
2. The coal drill, the cutting machine, and the roof-bolt drill were backed off from the faces and ready to move to other places.
3. The outby shuttle car was loaded, with the control set for "fast tram," obviously headed for the belt. The inby car was empty, with the control set for "fast tram," obviously headed for the last crosscut from No. 3 entry to the loading machine in No. 2 entry.
4. The loading machine controls were set for reverse tram and on the first point, indicating that it was being maneuvered during shuttle-car change.
5. The foregoing evidence of face activity, items 2, 3, 4, eliminates any possibility of presence of a cloud of coal dust which might be ignited by an electric arc.
6. Nos. 3 and 4 entries were cleaned up and roof-bolted with the roof-bolt drill in No. 3. All other entries had a fall of coal ready for loading, and the loading machine was in No. 2 entry. Obviously the cycle was from right to left.
7. The coal drill was in No. 5 entry, with a fall of coal at the face, indicating from the cycle that this was the last place drilled.
8. The blasting cable was in No. 5 entry, extended from the face area to, and westward in, the second crosscut from the face. The shot-firing unit was lying in the intersection of the same crosscut and No. 4 entry. The cutting-machine operator, the driller, and the shot firer were grouped about the same intersection. Together, these observations indicate that the last face operation performed before the explosion was blasting in No. 5 entry.
9. There was no rock down in No. 5 entry, and no evidence of a mudcapped rock.

10. Moreover, to one conductor at the face end of the blasting cable was still firmly connected a piece of copper wire with yellow rubber or plastic insulation, of the type known as "connecting wire" for completing the circuit in multiple-shot blasting. Since such connecting wire is not needed to fire a mudcap shot, but is commonly used in this mine for face blasting, it is evident that the blast in No. 5 entry was a usual face blast.

11. The nature of the damage to the coal drill clearly indicated intense, concentrated, disintegrating force, radiating from the midsection of the machine, entirely unlike the sort of damage seen when forces of an explosion thrust against equipment. Conversely, the two shuttle cars exhibited effects, which, though slight, were typical of sweeping, or thrust, forces.

12. The blasting cable had been severed at more than one place by flying "shrapnel" from the drill. Since the face was shot, it was obviously blasted before the drill was disintegrated.

13. Since the blasting cable had not been coiled up after blasting, the damage to the drill occurred soon after the face was blasted.

14. The coal drill was left parked in the line of blast in No. 5 entry, approximately 45 feet outby the face while a round of four holes was fired simultaneously with instantaneous detonators.

15. A fragment thrown off the face by blasting could, without question, have struck any explosives or detonators on the drill with forceful impact.

16. Explosives were hauled on coal drills at times from the section storage magazines to the working faces, and from place to place, which is a hazardous practice.

17. Most officials and employees were not fully cognizant of the dangers inherent in the above practice.

18. Explosives were transported and handled properly whenever any "stranger" was present.

19. A goodly supply of detonators, estimated as about 100, in a carrying bag, with a few detonators scattered nearby, was found in the No. 4 entry, in the intersection of the second crosscut outby the face, not far from the blasting unit and the end of the blasting cable. Judging by the quantity, it would appear unlikely that additional detonators would have been on the drill.

20. During the hearing, it was stated that detonators were not transported nor left upon the drills.

21. No evidence, such as scattered detonators, either detonated or undetonated, was found in the near vicinity of the drill, though fragments of tamping bags were plentiful.

22. All evidence points to presence of an undetermined, but appreciable, quantity of permissible explosives on the drill.

23. Coal dust was involved to some degree, but propagation was short-lived.

24. Some of the survivors felt two strong concussions, closely spaced, but distinct.

25. From statements of several persons, events were reconstructed, and the time of the explosion was deduced to be at about 12:45 p.m. A watch found near one of the victims was stopped at 12:47 p.m. by fusing and swelling of its plastic "crystal," presumably by abnormal heat.

26. Three samples of explosives, identified by the manufacturer's markings as being from the same batches as explosives in the section storage box in 2 northeast entries during the investigation, were later tested at the Bureau of Mines Explosives Research Center. The tests and analyses indicated that the explosives conformed to specifications for permissible explosives.

The tests further indicated that the explosives could be readily detonated by impact from a projectile fired at the distance from the face to the drill in the case in hand. The findings from the tests were, in part: "Thus this material is quite impact sensitive but not abnormally so for this permissible explosive."

Cause of Explosion

It was the consensus of the investigating committee:

That the explosion was initiated by a fragment of material, which was projected from the face of No. 5 entry by blasting, and which struck and detonated an unknown, but appreciable, quantity of permissible explosive on the coal drill parked a short distance from the face in direct line of blast; and

That coal dust in the face areas was ignited by the detonation of the unconfined explosives, but propagation did not extend far from the working area.

Failure to store and transport explosives in an approved manner was a primary factor in this disaster.

The results of tests of samples of the explosives were not available during the investigation and hearing on August 9, 1968; however, the results substantiate the findings of the investigating committee arrived at from the preponderance of other evidence.

RECOMMENDATIONS

The following recommendations are made to prevent similar occurrences:

1. Explosives or detonators should not be transported on any self-propelled mobile equipment, except that explosives or detonators may be transported in shuttle cars in special closed containers.
2. Explosives and detonators stored near the working faces should be in separate, closed containers, in a location out of line of blast, not less than 50 feet from the face, and at least 15 feet from any powerline.
3. Employee training programs should include specific instruction concerning the intrinsic hazards of explosives, and the safe use and handling of such materials.
4. Close supervision should be given to the transportation, handling, and use of explosives, in accordance with the provisions of the Federal Mine Safety Code for Bituminous-Coal and Lignite Mines of the United States.

ACKNOWLEDGMENT

The writers gratefully acknowledge the courtesies, cooperation, and assistance rendered in the recovery work and the investigation by the many organizations and individuals named in the report, and by any whose names have been omitted inadvertently.

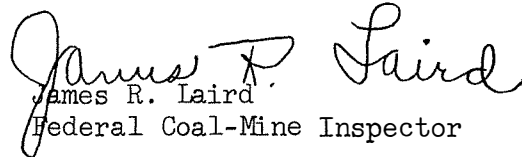
Respectfully submitted,



James A. O'Connor
Supervisory Mining Engineer

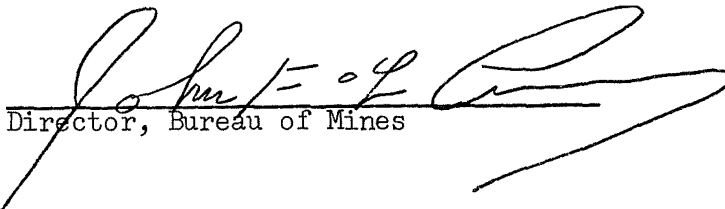


William M. Craft
Federal Coal-Mine Inspector



James R. Laird
Federal Coal-Mine Inspector

Approved by:


Director, Bureau of Mines


Associate Director--Health and Safety

ANALYSES OF AIR SAMPLES

TABLE 1

DATE COLLECTED August 9, 1968MINE River Queen Underground Mine No. 1 COMPANY Peabody Coal Company COLLECTED BY William M. Craft

BOTTLE NO.	LABORATORY NO.	LOCATION IN MINE	PERCENT IN VOLUME					CUBIC FEET AIR PER MINUTE	CUBIC FEET METHANE IN 24 HOURS
			CARBON DIOXIDE	OXYGEN	METHANE	CARBON MONOXIDE	NITROGEN		
		EXPLOSION SAMPLES							
I5252	92429	face No. 4 main northeast entry	0.08	20.75	0.10	none	79.07		
I5253	92430	face No. 5 main northeast entry	0.06	20.78	0.09	none	79.07		
I5193	92431	face No. 2 main northeast entry	0.40	20.41	0.11	none	79.08		
I5194	92432	face No. 3 main northeast entry	0.08	20.67	0.23	none	79.02		

LAB. NOS. 275950-275953TABLE 2 ANALYSES OF DUST SAMPLESDATE COLLECTED August 9, 1968MINE River Queen Underground Mine No. 1 COMPANY Peabody Coal Company COLLECTED BY D.E. Martin and J. Matekovic

LAB. NO.	CAN NO.	SAMPLE OF DUST FROM	LOCATION IN MINE	ALCOHOL COKE TEST	AS-RECEIVED PERCENT INCOMBUSTIBLE
			EXPLOSION SAMPLES		
			face area - main north entries samples collected off mining equipment in the explosion area		
275950	1		Joy loading machine, face No. 2 entry	large	29.2
275951	2		Joy 16 S C shuttle car (off standard) No. 3 entry	extra large	31.5
275952	3		Joy 16 S C shuttle car (standard drive) No. 3 entry	extra large	30.9
275953	4		cutting machine second crosscut between Nos. 4 and 5 entries	extra large	35.2

LAB. NOS. 275954-275970

Sheet No. 1

TABLE 3

ANALYSES OF DUST SAMPLES

DATE COLLECTED August 9, 1968

M. Sakovich, and M. Wolfe

MINE River Queen Underground Mine No. 1 COMPANY Peabody Coal Company COLLECTED BY D.E. Martin, J. Matekovic,

LAB. NO.	CAN NO.	SAMPLE OF DUST FROM	LOCATION IN MINE	ALCOHOL COKE TEST	AS-RECEIVED PERCENT INCOMBUSTIBLE
EXPLOSION SAMPLES					
sampling area = main east inby 0 zero = inby rib No. 5 entry 2 south panel + 100 feet					
275954	1A1	floor	0 + 00'	none	37.0*
	1A2		0 + 480'		
	1A3		0 + 960'		
	1A4		0 + 1,440'		
275955 275956	1B1	"	0 + 00'	none	37.5*
	1B2		0 + 480'		
	1B3		0 + 960'		
	1B4		0 + 1,440'		
275957 275958 275959 275960	1C1	band	0 + 00'	none	90.0*
	1C2	"	0 + 480'	none	88.5*
	1C3	floor	0 + 960'	none	88.0*
	1C4	rib and roof	0 + 1,440'	none	39.5*
275961 275962 275963 275964	1D1	band	0 + 00'	none	66.0*
	1D2	"	0 + 480'	none	63.4
	1D3	"	0 + 960'	none	33.0*
	1D4	"	0 + 1,440'	none	27.5*
275965 275966 275967	1E1	floor	0 + 00'	none	51.5*
	1E2	"	0 + 480'	too wet, no sample	30.0*
	1E3	"	0 + 960'		
	1E4	"	0 + 1,440'	trace	36.5*

LAB. NOS. 275954-275970

Sheet No. 2

TABLE 3

ANALYSES OF DUST SAMPLES

DATE COLLECTED

August 9, 1968

M. Sakovich, and M. Wolfe

MINE River Queen Underground Mine No. 1 COMPANY Peabody Coal Company COLLECTED BY D.E. Martin, J. Matekovic,

LAB. NO.	CAN NO.	SAMPLE OF DUST FROM	LOCATION IN MINE	ALCOHOL COKE TEST	AS-RECEIVED PERCENT INCOMBUSTIBLE
275968	1F1	floor	0 + 00' too wet, no sample	none	36.0*
	1F2		0 + 480'		
	1F3		0 + 960' too wet, no sample		
275969	1F4	"	0 + 1,440'	none	32.0*
	1G1	"	0 + 00' too wet, no sample	none	28.0*
	1G2		0 + 480' same		
	1G3		0 + 960' same		
275970	1G4		0 + 1,440'		

*By Volumeter

LAB. NOS. 275971-276021

Sheet No. 1

TABLE 3

ANALYSES OF DUST SAMPLES

DATE COLLECTED August 9, 1968MINE River Queen Underground Mine No. 1 COMPANY Peabody Coal Company COLLECTED BY M. Sakovich and M. Wolfe
D.E. Martin, J. Matekovic,

LAB. NO.	CAN NO.	SAMPLE OF DUST FROM	LOCATION IN MINE	ALCOHOL COKE TEST	AS-RECEIVED PERCENT INCOMBUSTIBLE
EXPLOSION SAMPLES					
sampling area = north mains inby 0					
zero = centerline No. 7 entry main east					
+ 25 feet					
No. 1 Entry					
275971	2A1	floor	0 + 00'	none	35.0*
275972	2A2	"	0 + 150'	none	33.0*
	2A3		0 + 300'	too wet, no sample	
	2A4		0 + 450'	same	
	2A5		0 + 600'	same	
	2A6		0 + 750'	roof fall, no sample	
	2A7		0 + 900'	same	
	2A8		0 + 1,050'	too wet, no sample	
	2A9		0 + 1,200'	same	
275973	2A10	band	0 + 1,350'	extra large	31.6
275974	2A11	"	0 + 1,500'	extra large	41.7
275975	2A12	"	0 + 1,650'	large	28.0
275976	2A13	"	0 + 1,800'	small	23.1
No. 2 Entry					
275977	2B1	"	0 + 00'	none	28.5*
275978	2B2	floor	0 + 150'	none	63.0
	2B3		0 + 300'	roof fall, no sample	
275979	2B4	floor and rib	0 + 450'	none	47.5*
	2B5		0 + 600'	roof fall, no sample	
	2B6		0 + 750'	same	
275980	2B7	band	0 + 900'	trace	36.0*
	2B8		0 + 1,050'	too wet, no sample	
	2B9		0 + 1,200'	same	
275981	2B10	"	0 + 1,350'	extra large	29.3
275982	2B11	"	0 + 1,500'	large	37.4
275983	2B12	"	0 + 1,650'	extra large	34.0
275984	2B13	"	0 + 1,800'	small	29.4

TABLE 3 ANALYSES OF DUST SAMPLESDATE COLLECTED August 9, 1968MINE River Queen Underground Mine No. 1 COMPANY Peabody Coal Company COLLECTED BY M.Sakovich and M.Wolfe
D.E.Martin, J.Matekovic

LAB. NO.	CAN NO.	SAMPLE OF DUST FROM	LOCATION IN MINE	ALCOHOL COKE TEST	AS-RECEIVED PERCENT INCOMBUSTIBLE
No. 3 Entry					
275985	2C1	floor	0 + 00'	none	43.0*
	2C2		0 + 150'		
	2C3		0 + 300'		
	2C4		0 + 450'		
	2C5		0 + 600'		
	2C6		0 + 750'		
			roof fall, no sample		
275986	2C7	band	0 + 900'	trace	38.0*
275987	2C8	"	0 + 1,050'	trace	21.0*
275988	2C9	"	0 + 1,200'	large	38.9
275989	2C10	"	0 + 1,350'	large	31.9
275990	2C11	"	0 + 1,500'	extra large	39.6
275991	2C12	"	0 + 1,650'	extra large	34.8
275992	2C13	"	0 + 1,800'	small	38.5
No. 4 Entry					
275993	2D1	floor	0 + 00'	none	41.5*
	2D2		0 + 150'		
	2D3		0 + 300'		
	2D4		0 + 450'		
	2D5		0 + 600'		
	2D6		0 + 750'		
275994	2D7	rib and floor	0 + 900'	small	39.6
275995	2D8	same	0 + 1,050'	trace	32.0*
275996	2D9	same	0 + 1,200'	small	32.9
275997	2D10	band	0 + 1,350'	large	31.5
275998	2D11	rib and floor	0 + 1,500'	large	50.5
275999	2D12	band	0 + 1,650'	extra large	35.7
276000	2D13	"	0 + 1,800'	large	29.9
No. 5 Entry					
	2E1		0 + 00'	too wet, no sample	
	2E2		0 + 150'		
	2E3		0 + 300'		
	2E4		0 + 450'		

LAB. NOS. 275971-276021TABLE 3

ANALYSES OF DUST SAMPLES

DATE COLLECTED August 9, 1968M. Sakovich and M. WolfeMINE River Queen Underground Mine No. 1 COMPANY Peabody Coal Company COLLECTED BY D.E. Martin, J. Matekovic,

LAB. NO.	CAN NO.	SAMPLE OF DUST FROM	LOCATION IN MINE		ALCOHOL COKE TEST	AS-RECEIVED PERCENT INCOMBUSTIBLE
	2E5		0 + 600'	too wet, no sample		
	2E6		0 + 750'	same		
276001	2E7	floor	0 + 900'		small	36.3
276002	2E8	rib and floor	0 + 1,050'		small	33.8
276003	2E9	same	0 + 1,200'		small	28.9
276004	2E10	same	0 + 1,350'		large	36.6
276005	2E11	same	0 + 1,500'		large	36.2
276006	2E12	band	0 + 1,650'		extra large	37.7
276007	2E13	"	0 + 1,800'		extra large	45.3
			No. 6 Entry			
	2F1		0 + 00'	too wet, no sample		
	2F2		0 + 150'	same		
	2F3		0 + 300'	same		
	2F4		0 + 450'	gob area, no sample		
	2F5		0 + 600'	too wet, no sample		
	2F6		0 + 750'	same		
276008	2F7	floor	0 + 900'		small	39.2
276009	2F8	rib and floor	0 + 1,050'		small	37.8
276010	2F9	same	0 + 1,200'		large	45.0
276011	2F10	same	0 + 1,350'		large	42.7
276012	2F11	same	0 + 1,500'		large	37.1
276013	2F12	band	0 + 1,650'		large	35.0
276014	2F13	"	0 + 1,800'		extra large	34.2
			No. 7 Entry			
	2G1		0 + 00'	not developed, no sample		
	2G2		0 + 150'	too wet, no sample		
	2G3		0 + 300'	roof fall, no sample		
	2G4		0 + 450'	same		
	2G5		0 + 600'	too wet, no sample		
	2G6		0 + 750'	same		
276015	2G7	floor	0 + 900'		small	48.7

LAB. NOS. 275971-276021

Sheet No. 4.

TABLE 3

ANALYSES OF DUST SAMPLES

DATE COLLECTED

August 9, 1968MINE River Queen Underground Mine No. 1 COMPANY Peabody Coal Company COLLECTED BY M.Sakovich and M.Wolfe
D.E.Martin, J.Matekovic,

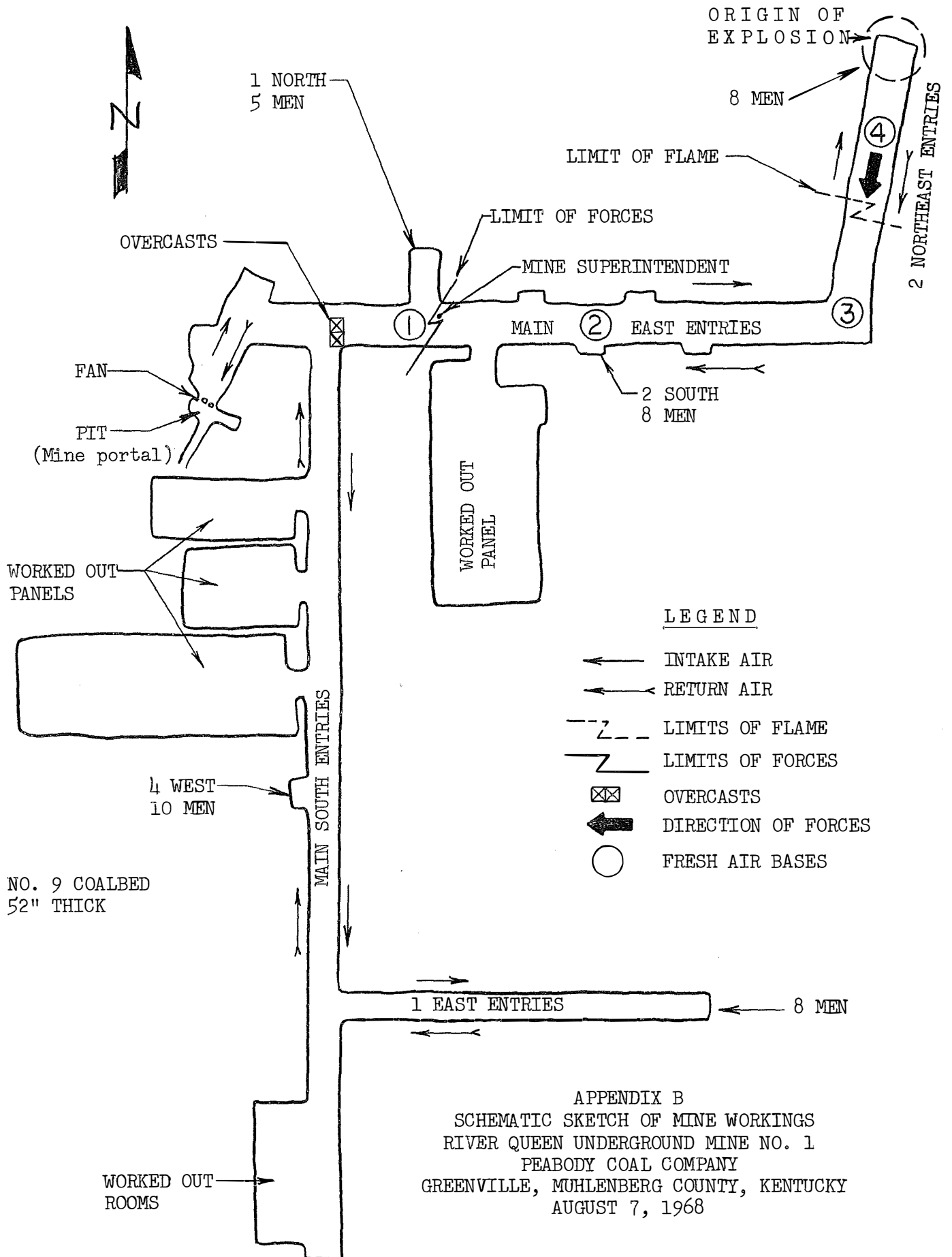
LAB. NO.	CAN NO.	SAMPLE OF DUST FROM	LOCATION IN MINE	ALCOHOL COKE TEST	AS-RECEIVED PERCENT INCOMBUSTIBLE
276016	2G8	rib and floor	0 ± 1,050'	small	34.5
276017	2G9	same	0 ± 1,200'	large	38.2
276018	2G10	floor	0 ± 1,350'	large	41.4
276019	2G11	rib and floor	0 ± 1,500'	extra large	41.8
276020	2G12	same	0 ± 1,650'	extra large	41.0
276021	2G13	floor	0 ± 1,800'	extra large	40.3

*By Volumeter

APPENDIX A

VICTIMS OF EXPLOSION
RIVER QUEEN UNDERGROUND MINE NO. 1, PEABODY COAL COMPANY
GREENVILLE, MUHLENBERG COUNTY, KENTUCKY
August 7, 1968

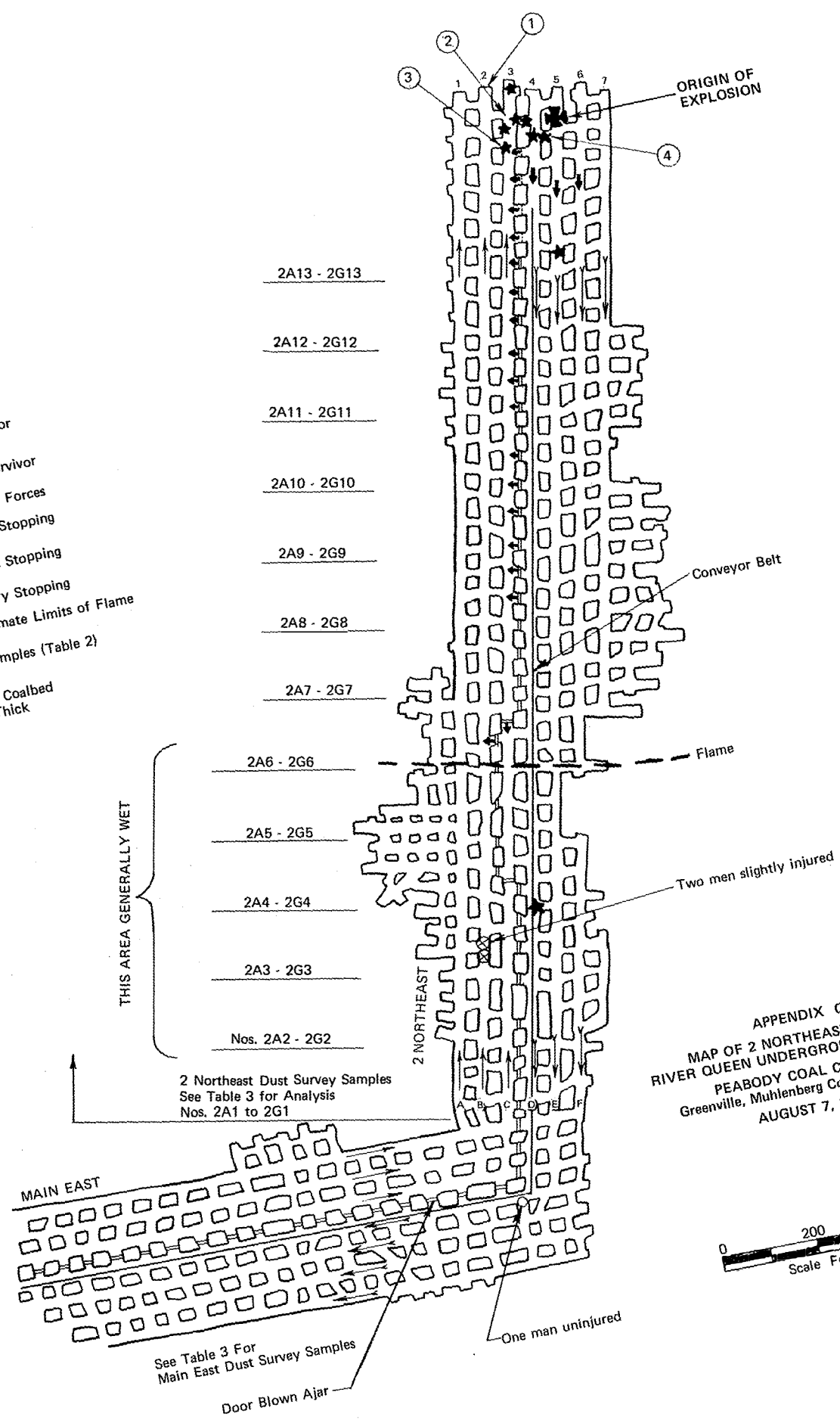
<u>Name</u>	<u>Age</u>	<u>Number of Dependents</u>
James Bryant	25	3
Paul Creekmore	44	1
Bobby G. English	34	5
Frankie Epley	45	4
Robert Fridinger	38	3
James Harris	33	5
Ernest W. Miller	45	6
Will Rice	31	3
Dennie Saling	56	3



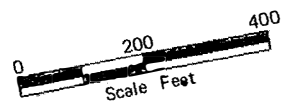
APPENDIX B
SCHEMATIC SKETCH OF MINE WORKINGS
RIVER QUEEN UNDERGROUND MINE NO. 1
PEABODY COAL COMPANY
GREENVILLE, MUHLENBERG COUNTY, KENTUCKY
AUGUST 7, 1968

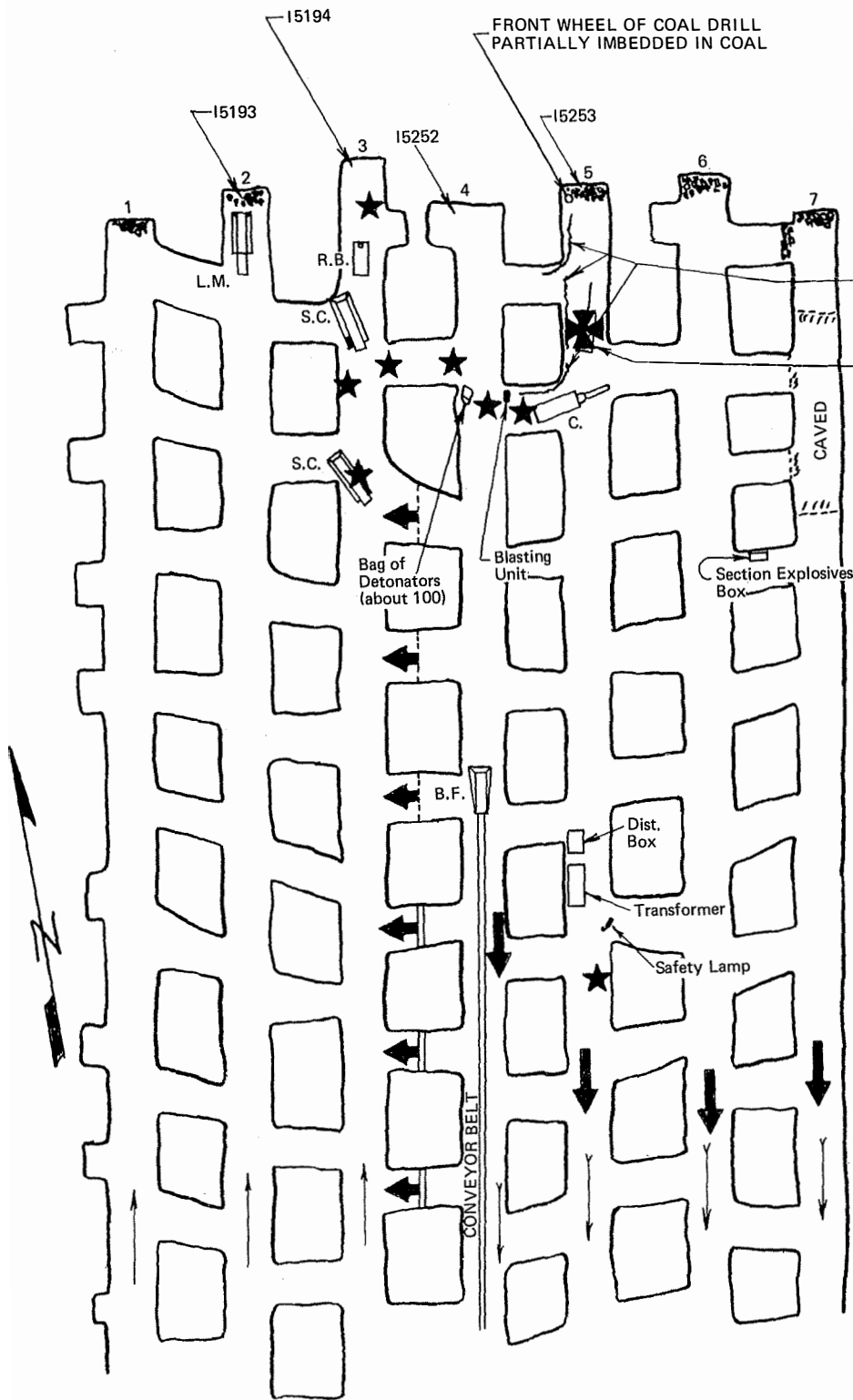
LEGEND

- Intake Air
- Return Air
- Body
- Injured Survivor
- Uninjured Survivor
- Direction of Forces
- Blown out Stopping
- Permanent Stopping
- Temporary Stopping
- Approximate Limits of Flame
- Dust Samples (Table 2)
- No. 9 Coalbed 52" Thick



APPENDIX C
 MAP OF 2 NORTHEAST ENTRIES
 RIVER QUEEN UNDERGROUND MINE NO. 1
 PEABODY COAL COMPANY
 Greenville, Muhlenberg County, Kentucky
 AUGUST 7, 1968





NO. 9 COAL BED
52" THICK

BLASTING CABLE - UNSHUNTED - WITH
CONNECTING WIRE ATTACHED - BROKEN
IN SEVERAL PIECES

ORIGIN OF EXPLOSION
COAL DRILL - BLOWN APART -
PIECES SCATTERED OVER
A WIDE AREA

LEGEND

- ← Intake Air
- ← Return Air
- ★ Body
- ⌂ Temporary Stopping
Blown Out
- ⌂ Permanent Stopping
Blown Out
- ➡ Direction of Forces
- L.M.** Loading Machine
- S.C.** Shuttle Car
- R.B.** Roof Bolting Machine
- C.** Cutting Machine
- B.F.** Belt Feeder
- I5252** Air Samples (Table 1)

APPENDIX D
MAP OF 2 NORTHEAST SECTION
RIVER QUEEN UNDERGROUND MINE NO. 1
PEABODY COAL COMPANY
Greenville, Muhlenberg County, Kentucky
AUGUST 7, 1968

0 50 100
Scale Feet

APPENDIX E

EXPLOSION, RIVER QUEEN UNDERGROUND MINE NO. 1, PEABODY COAL COMPANY PERSONS CARRYING OUT RECOVERY OPERATIONS, August 7-8, 1968

Crew No. 1 entered mine 1:30 p.m. Out 2:30 p.m.

T. C. Stone	District State Inspector
James Thorp	District State Inspector
Wendell Griffith	Mine Foreman, River Queen Underground Mine No. 1
Harmon Stubblefield	Mine Worker, River Queen Underground Mine No. 1
George Ozee	Mine Worker, River Queen Underground Mine No. 1
William M. Craft	Federal Coal-Mine Inspector

Crew No. 2 entered mine 4:13 p.m. Out 9:15 p.m.

James Thorp	District State Inspector
Louis Henderson	Rescue Team Member, Island Creek Coal Company
James R. Laird	Federal Coal-Mine Inspector

Crew No. 3 entered mine 5:44 p.m. Out 9:15 p.m.

Fred Rice	Assistant to Vice President, Peabody Coal Company
George Siria	Section Foreman, River Queen Underground Mine No. 1
Dexter Hibbs	Safety Engineer, Island Creek Coal Company

Crew No. 4 entered mine 6:33 p.m. Out 9:15 p.m.

William Dupree	Rescue Team Member, Island Creek Coal Company
Thomas Mills	Mine Worker, River Queen Underground Mine No. 1
Mike Sakovich	Federal Coal-Mine Inspector

Crew No. 5 entered mine 6:38 p.m. Out 9:15 p.m.

T. C. Stone	District State Inspector
A. R. Blair	Rescue Team Member, Island Creek Coal Company
Paul Lee	Rescue Team Member, Island Creek Coal Company
Dilford Holmes	Rescue Team Member, Island Creek Coal Company
William M. Craft	Federal Coal-Mine Inspector

APPENDIX E (Continued)

Crew No. 6 entered mine 9:45 p.m., August 7, 1968. Out 2:15 a.m., August 8, 1968.

Everett Bartlett	District Supervisor, Kentucky Department of Mines and Minerals
Paul Sexton	District State Inspector
Lawrence Risley	Safety Director, The Pittsburg & Midway Coal Mining Company
Doug Gregory	Rescue Team Member, The Pittsburg & Midway Coal Mining Company
Eddie Holeman	Mine Rescue Team Member, The Pittsburg & Midway Coal Mining Company
Jack Patterson	Mine Rescue Team Member, The Pittsburg & Midway Coal Mining Company
James Reynolds	Mine Rescue Team Member, The Pittsburg & Midway Coal Mining Company
Tommy Steel	Safety Inspector, Peabody Coal Company
Woodrow Birchell	Mine Worker, Peabody Coal Company
T. R. Ford	Mine Worker, Peabody Coal Company
Steve Little	Mine Worker, Peabody Coal Company
Hubert Boyken	Mine Worker, Peabody Coal Company
Maurice Utley	Section Foreman, Peabody Coal Company
David Howard	Mine Worker, Peabody Coal Company
George Ozee	Mine Worker, Peabody Coal Company
William Whitaker	Mine Worker, Peabody Coal Company
Donald E. Martin	Federal Coal-Mine Inspector
B. E. Hill	Federal Coal-Mine Inspector

Crew No. 7 entered mine 2:30 a.m. Out 6:30 a.m.

Everett Brown	District Supervisor, Kentucky Department of Mines and Minerals
Julius Ferrell	District State Inspector
Elihu Coyer	District State Inspector
Dexter Hibbs	Safety Engineer, Island Creek Coal Company
Jerry Sisk	Rescue Team Member, Island Creek Coal Company
Paul Lee	Rescue Team Member, Island Creek Coal Company
A. R. Blair	Rescue Team Member, Island Creek Coal Company
William Dupree	Rescue Team Member, Island Creek Coal Company
Louis Henderson	Rescue Team Member, Island Creek Coal Company
George Siria	Section Foreman, Peabody Coal Company
Bryant Markham	Mine Worker, Peabody Coal Company
Thomas Mills	Mine Worker, Peabody Coal Company
Mike Sakovich	Federal Coal-Mine Inspector
Mike Wolfe	Federal Coal-Mine Inspector
David Kouche	Federal Coal-Mine Inspector