United States
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Mine Safety and Health Administration
Office of the Administrator
Coal Mine Safety and Health

Report of Investigation
Underground Coal Mine Explosion
No. 21 Mine - I.D. No. 40-00524
Grundy Mining Company, Incorporated
Whitwell, Marion County, Tennessee
December 8, 1981

by

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ABSTRACT

This report is the result of an investigation by the Mine Safety and Health Administration (MSHA) made pursuant to Section 103(a) of the Federal Mine Safety and Health Act of 1977 ("Mine Act"), Public Law 91-173, as amended by Public Law 95-164, 30 U.S.C. 813(a) (Supp. IV, 1980).

At approximately 12 noon (CST) on December 8, 1981, an explosion occurred in 003 Section of the No. 21 Mine of Grundy Mining Company, Incorporated. There were 56 men in the mine when the explosion occurred, 13 of whom were killed by or died from the results of the explosion. The other 43 men survived the explosion and, except for 6 men who remained underground and participated in the recovery operations, escaped to the surface; 12 men were working in the adjacent 007 section; 18 men were working in the 008 section and 13 men were working at various locations along the belt conveyor and track entries. The explosion 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.

The names of the victims, their ages, occupations, mining experience and training are listed in Appendix A. Autopsies were not performed.

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APPENDIX

GENERAL INFORMATION

The No. 21 Mine, Grundy Mining Company, Incorporated, owned by Tennessee Consolidated Coal Company was opened during 1966, and is located approximately 15 miles northwest of Whitwell, Marion County, Tennessee. At the time of the explosion, the President, Vice President and Chief Engineer of Tennessee Consolidated Coal Company also held the same positions in Grundy Mining Company, Incorporated. Other operating supervisory officials served Grundy Mining Company, Incorporated only. Among the surpervisory officials with responsibility for the No. 21 Mine were:

William B. Allison	President
Ronald C. Calhoun	Executive Vice President
Ed Presley	Chief Engineer
James Saynes	Superintendent
* Jimmy Wayne Rogers	Assistant Superintendent
Buddy Gene Layne	Assistant Superintendent
Wade Shadrick	Maintenance Superintendent
Jewell Shadrick	Assistant Maintenance Superintendent
Jerry R. Morrison	Assistant Maintenance Superintendent
* Roy White	General Mine Foreman
Hollis Rogers	Safety Director
Dan Basham	General Mine Foreman/Second Shift
* Jackie Tate	Section Foreman/003 Section
Don Bivens	Second Shift Section Foreman
Ladue Bouldin	Electrician Foreman
Leonard Sutherland	Preshift Examiner

* Rogers, White and Tate were victims of the explosion.

The No. 21 Mine was opened by nine drift openings into the medium volatile Sewanee coalbed which averages 39 inches in thickness in the present mining areas. A total of 127 men were employed; 123 worked underground on two production and one maintenance shifts a day. Production during the last Federal inspection of the entire mine completed October 30, 1981, was approximately 900 tons of coal per day. The floor is firm shale. The immediate roof is fragile shale. The main roof is sandstone and the maximum overburden is approximately 450 feet. The mine map did not indicate any gas or oil wells penetrating the mine area (Appendix B-1).

The analysis of a raw coal sample taken in the Sewanee coalbed in the No. 21 Mine is as follows:

	Percent
Moisture	1.9
Volatile matter	27.8
Fixed carbon	61.6
Ash	8.7

Numerous tests by the Bureau of Mines have shown that coal dust having a volatile ratio of 0.12 and higher is explosive. The volatile ratio of the coal dust in the mine is 0.31 indicating the coal dust is explosive. The volatile ratio is the ratio of volatile matter to fixed carbon plus volatile matter:

$$VR = \frac{v}{fc + v}$$

MINING METHODS, CONDITIONS AND EQUIPMENT

Mining Methods

A block system of mining was employed. Multiple entries were developed, 20-22 feet wide. Entries and crosscuts were approximately 60 feet apart. The main headings were developed approximately 13,000 feet in a southeasterly direction. Panels were developed right and left off the main headings at irregular intervals due to irregular conditions of the coalbed. In December 1981, mining consisted of developing three panels using conventional mechanical equipment.

The 003 section was developed off 6 right toward the abandoned 2 left off 5 right section, a distance of approximately 3,800 feet. According to management, the 003 section was to be mined into the abandoned gob area to develop a bleeder system for second mining. On approaching the abandoned area test boreholes were drilled in advance of the faces. Test boreholes, penetrating the gob area prior to mining through, indicated air from the abandoned gob area was flowing into the active 003 section. According to an entry in the preshift examiners book dated December 7, 1981, 5.2 percent methane was detected flowing from the boreholes. The gob area was directly connected to the main return aircourses and air from the active area should have been flowing through the test boreholes, across the gob and to the fan. The reverse flow in the boreholes indicated the gob ventilation was ineffective.

Ventilation and Gases

Ventilation was induced by a continuously operated Model 8 HU-72, Aerodyne fan manufactured by Jeffrey Manufacturing Company, belt driven at 1195 rpm by a 300 horsepower alternating-current motor. During the investigation, measurements by personnel from the MSHA Ventilation Section, Pittsburgh Health Technology Center, Pittsburgh, Pennsylvania, indicated the fan was exhausting 176,000 cubic feet of air a minute at 5.8 inches water gauge pressure. The methane content of the return air was 0.01 percent. Approximately 152,000 cubic feet of air a minute was measured at the six intake openings. Total methane liberation from the mine as calculated from the analysis of samples collected during the last inspection was 17,000 cubic feet in 24 hours. Air flow was controlled by permanent stoppings, overcasts, and regulators constructed of incombustible

materials. Plastic flame-resistant brattice material was used for check curtains and line brattice. The last ventilation system and methane and dust control plan for the mine was approved October 1, 1981.

003 Section Ventilation

A split system of ventilation was used for ventilating the three active sections. However, during the investigation it was discovered that air lock doors or a stopping was missing in a cut-through developed during November 1981, between the return aircourses of 007 section and the intake aircourses in 003 section. The belt conveyor entries were to be separated from the intake and return aircourses; however, in the 003 section the belt conveyor entry was not separated from the return aircourse outby the belt tailpiece for a distance of about 200 feet. A permanent stopping, as required by the approved ventilation plan, had not been constructed between the intake and return aircourses, in the third open crosscut outby the working faces. Also, it could not be determined if a permanent stopping had been constructed in the crosscut between the intake entry and the belt conveyor entry just outby the tailpiece, due to a large roof fall in the area. Plastic check curtains were installed between the intake and return aircourses in the first, second and fourth crosscuts inby the tailpiece. The third crosscut, shuttle car roadway, was open and the air was short circuited and was not effectively ventilating the working faces.

Bleeders

The 5 right gob area was developed after the effective date of the Federal Coal Mine Health and Safety Act of 1969. Section 303(z)(2) of the provisions of the Act states in part:

> "...All areas from which pillars have been wholly or partially extracted and abandoned areas, as determined by the Secretary or his authorized representative, shall be ventilated by bleeder entries or bleeder systems or equivalent means, or be sealed, as determined by the Secretary or his authorized representative...."

Section 303(z)(3) states in part:

> "In the case of mines opened on or after the operative date of the title, or in the case of working sections opened on or after such date in mines opened prior to such date, the mining system shall be designed in accordance with a plan and revision thereof approved by the Secretary and adopted by such operator so that, as each working section of the mine is abandoned, it can be isolated from the active workings of the mine...."

Blocks of coal were left around the perimeter of second mined (pillared) 5 right areas to serve as bleeder entries. Such "bleeder entries" were not travelable and, as was indicated by the direction of air flow from the gob area into the active areas of 003 section, were ineffective. During the mine recovery and investigation, it was determined that the extensive pillared areas from 1 right to 5 right were not sealed and were not effectively ventilated.

According to records of the preshift and onshift examinations and tests, methane had been detected on shifts immediately preceding the 7 a.m. - 3 p.m. shift of December 8, 1981. During the investigation 0.3 percent methane was detected from test boreholes leading into the abandoned area from the No. 3 entry, 003 section. Although preshift and onshift examinations and tests were conducted by certified persons, a preshift examination was not made for the 11 p.m. - 7 a.m. shift on December 7 and 8, 1981. Also, records of the preshift examinations and tests for maintenance shifts were not in the preshift examiner's book.

Rock Dust and Coal Dust

A clean-up program was in effect at the mine. Rock dust was applied to the roof, floor and ribs of the mine surfaces. During inspections of the entire mine made during 1980 and 1981, 132 dust samples were collected; 86 were substandard. A total of 58 of the samples were collected in the 003 section; 30 of which were substandard. The 003 working section was rerockdusted on the shift from 11 p.m. December 7, 1981, to 7 a.m. December 8, 1981.

Electricity

Three-phase power was purchased from the Sequatchie Valley Cooperative at 13,200 volts and transmitted to a surface substation near the mine portal. At the surface substation the electric power was reduced to 4,160 volt, 3-phase power for underground distribution by a bank of three 333-kVA transformers connected delta-wye. The secondary neutral was properly grounded through a 25-ampere, current-limiting resistor. A grounding circuit, originating at the grounded side of the resistor, was used to ground the metallic frames of all electric equipment supplied from the underground high-voltage distribution system.

A 600-ampere, oil filled circuit breaker in the surface substation was equipped with a ground check circuit and relays designed to provide overload, short-circuit, grounded-phase, and undervoltage protection for the underground high-voltage distribution system. Three, single-pole fuse cutouts were provided in the surface substation to open the phase conductors of the underground high-voltage distribution system.

The underground high-voltage distribution system consisted of approximately 18,200 feet of shielded, No. 2/0 AWG, 3-conductor, 15 KV mine power cable. Nine sets of three, single-pole fuse cutouts were installed at or near the beginning of the branch circuits in the underground high-voltage distribution system. The fuse cutouts were equipped with either 100-ampere or 125-ampere K-rated fuse links to provide additional overcurrent protection for the transformers and branch circuit conductors. A one-line diagram of the underground high-voltage distribution system is contained in Appendix C-1.

Nine portable power centers, 6 rated at 300 kVA and 3 rated at 150 kVA, reduced the 4,160-volt, 3-phase power to 480-volt, 3-phase power for the operation of 6 belt conveyor drive units and 3 battery charging stations. Three 750-kVA portable power centers reduced the 4,160-volt, 3-phase power to 480-volt, 3-phase power and 300-volt, direct-current power for the operation of the electric equipment on the three coal-producing sections. However, the direct-current portions of the portable power centers in the 007 and 008 sections were not in use at the time of the explosion.

The portable power center in the 003 section was used to supply 480-volt, 3-phase power to a cutting machine, face drill, loading machine, roof-bolting machine, belt feeder-breaker and battery charger and 300-volt, direct-current power to two shuttle cars. The primary windings of the power transformer in the portable power center were connected delta. The 480-volt secondary windings of the power transformer were connected wye with the secondary neutral properly grounded through a 15-ampere current limiting resistor. The 222-volt secondary windings of the power transformer were connected ungrounded delta. The negative polarity of the rectifier bridge in the portable power center was solidly grounded to the power center frame. The portable power center contained 7 molded-case circuit breakers which were equipped with devices to provide short-circuit, grounded-phase and undervoltage protection for the 480-volt, 3-phase circuits originating at the power center. Ground check circuits were provided to monitor the continuity of the grounding circuits for the 480-volt, 3-phase circuits originating at the power center. The portable power center contained 3 molded-case circuit breakers which were equipped with devices to provide short-circuit and undervoltage protection for the 300-volt, direct-current circuits originating at the power center. A cable coupler was provided in conjunction with each 3-phase, alternating-current and each direct-current circuit breaker to provide visual evidence that the power is disconnected when the cable plug is withdrawn from the receptacle.

The electric face equipment was of a permissible type and, according to the mine record books, was examined weekly. A record of these examinations was kept in a book in the mine office on the surface.

Blasting and Explosives

The coal was undercut, drilled and blasted onshift. Permissible-type explosives, fired by permissible-type shot firing units were used. The shot firers were certified. Explosives were stored in separate storage-magazines on the surface. A special container was used for transporting explosives underground. The container was transported on a rubber-tired car pulled by a rubber-tired battery tractor. Explosive storage-magazines were used for underground storage. It was observed that supplies of explosives and detonators in excess of that which can be stored in the section magazines were stored on the 003 section. Explosives and detonators in their original containers were transported on the section equipment in the face areas of 003 section.

Transportation and Communications

The coal was hauled in shuttle cars or rubber-tired mine cars and battery tractors from the face regions to belt conveyors which transported the coal to the surface. Battery-powered track haulage equipment was used to transport supplies to the section supply areas. Men were transported underground in battery-powered covered mantrip vehicles and in open-type, rubber-tired, battery-powered vehicles. A two-way telephone paging system was provided between the surface and the underground areas of the mine in compliance with Sections 75.1600 through 75.1600-2, 30 CFR 75.

Mine Rescue

Two trained mine rescue teams, equipped with oxygen breathing apparatus, were maintained at the company's mines. The two teams performed the underground recovery operations in the 003 section. Information obtained during the investigation indicates one-hour filter-type self-rescuers were carried by all underground employees and each employee had been trained in the use of the self-rescuers. Self-contained self-rescuers were not available to the miners at the mine. However, these rescuers had been ordered on June 18, 1981.

Fire Protection

The underground firefighting facilities included water lines installed along belt conveyors to near the faces. Water outlets were provided at 300-foot intervals along the lines and firehose and fittings were available at strategic locations. Fire extinguishers were provided on mobile equipment, and at stationary electric equipment. The electric face equipment was equipped with dry chemical fire suppression systems or used fire resistant hydraulic fluid. A portable-type rock dusting machine was available underground. An automatic, deluge-type water spray system was installed at each belt drive. According to the mine records, fire

According to Charles Cooley, Belt Maintenance Man, White tried for about an hour to contact 003 section by telephone, but could not. White then called Joe Ray Layman, Belt Maintenance Man, at 003 Section beltdrive and told Joe to contact Jackie Tate, Section Foreman, and tell him to get the telephone line fixed. White further told Layman that he would be in after a while because they would be shooting a ventilation hole through into the gob from 003 section. Not long after this conversation, Jackie Tate called outside and talked to White and Jimmy Rogers, Assistant Superintendent. J. Tate told White and Rogers they had cut through with the cutting machine and he had detected five percent methane. He further explained he did not know how much gas was in the gob into which they had cut. After this was reported, Rogers told Tate to use a low flame on his safety lamp, recheck the place for methane and call this information outside. About twenty minutes later, Jackie Tate called back and stated there was no black damp but there was methane because when he checked the face the flame in the safety lamp came to a peak like a christmas tree. At this point, Rogers told J. Tate to hold everything and ventilate, and said that he and White were coming in the mine to 003 section. Rayburn Tate, Electrician Repairman, Robert Roddy, Belt Maintenance Man, and Charles W. Cooley, overheard Jackie Tate telephone the mine office and discuss 003 section conditions with White and Rogers. Rayburn Tate, Roddy and Cooley were at telephones in 007 section, at No. 4 beltdrive and at the No. 2 beltdrive, respectively, when they overheard the conversation between Tate and Rogers.

About 10:10 a.m., the mantrip carrying White and Rogers reportedly passed the No. 4 beltdrive on its way to the end of the track in 003 section. While White and Rogers were enroute to 003 section, Buddy Gene Layne, another Assistant Superintendent, called 003 section beltdrive and asked Layman to stop Rogers and have him call outside because Layne wanted some information about a spad which was 120 feet from the 003 section beltdrive. When Rogers arrived at the 003 section beltdrive at about 10:45 a.m., he called Layne and stated he would get the spad information when he returned from 003 section. The last account of White and Rogers was when Stanley Scissom, Section Supervisor, traded battery-powered covered mantrip vehicles (rail runner) with them on 003 section track about 12 crosscuts inby the 003 section beltdrive.

Between 8 a.m. and 8:30 a.m., Ray Brown, a Company Belt Inspector, arrived at the end of 003 section track. Before going into the 003 section belt entry, he stopped 3 to 4 minutes and helped the scoop operator who was loading supplies. After supplies were loaded, he observed the scoop operator traveling toward the face of the 003 section. At this time Brown left the track entry and traveled in the 003 section belt entry, aligning the belt and making repairs. According to Brown, he made three trips up and down the belt during the morning, and on his last trip to the section dumping point he asked Lee Grimes, Shuttle Car Operator (victim) to help repair the belt to prevent coal from being spilled. Once the repair was made, Grimes told Brown they were getting ready to shoot in the face area. As near as Brown remembered he heard the report of

the shots 30 to 40 minutes before the explosion while traveling to the 003 section belt drive. He arrived at the 003 section belt drive about 11:55 a.m.

About 12:00 noon on December 8, 1981, an explosion occurred in the 003 section. Evidence that there had been an explosion was witnessed by Layman, Brown and James Meeks, who were working at the beltdrive and were preparing to eat lunch at this location when they felt a blast of hot air followed by high concentrations of airborne dust. They reported that airborne dust was in such high concentrations that they could not see for 3 to 4 minutes until the dust either settled or ventilation in the area carried the dust away. Robert Roddy and Charles Cooley stated that all electric power to the belt conveyors went off at about the same time as the explosion.

After observing evidence of the explosion, Layman began making telephone contacts to various locations in the mine and to the mine office. He first tried to contact the 003 section face crew but received no response. While Layman was on the telephone to 003 section, Jerry Fultz, Section Foreman on 007 section, tried to call about the power being off. At this time, Layman told Fultz there was a lot of dust at 003 section beltdrive. Next, Louis Nunley, Belt Maintenance Man at 6 right beltdrive, called on the telephone and stated there was a lot of dust coming down the belt-line. Fultz then called outside to Ladue Bouldin, Electrician Foreman, saying there might have been an explosion in 003 section. Bouldin told Fultz to go check 003 section. Next, Layman contacted Jimmy Frizzell, Slate Picker, on the surface and told Frizzell to have Bouldin disconnect all electrical power going into the mine. Bouldin disconnected the underground mine power. While this was taking place, Charles Morrison, Utility Man on 008 section, called Bouldin telling him to get the men out of the mine. Bouldin then ordered the men to leave the mine. Most of the miners began to leave either by riding a mantrip or walking.

Recovery

Fultz told his crew, except Jack Foshee, Section Electrician on 007 section, to leave the mine. In transit to 003 section, Fultz and Foshee stopped at 003 section beltdrive, where Fultz called Bouldin at the mine office and told him to Call James Saynes, General Superintendent. While Fultz and Foshee were traveling from 007 to 003 section on a battery-powered personnel carrier (3-wheeler), Scissom, picked up Brown and Mark Bivens, Utility Man, at the 003 section beltdrive and proceeded to the end of the 003 section track. Layman also traveled from the beltdrive to the end of the track in 003 section. After the six men arrived at the end of the track, Fultz took the telephone he had brought from 007 section and hooked it to the telephone line. The receiver on the telephone that was at the end of the 003 track was missing. According to Fultz, Scissom and Brown explored about 11 crosscuts

According to testimony of Don E. Bivens, 3 p.m. - 11 p.m. Section Foreman, 003 section, test boreholes were drilled into the abandoned area at 8:15 p.m., Monday, December 7, 1981, at the face of No. 3 entry (Appendix F, Photograph No. 4). The air was flowing from the abandoned area into the active working area. Tests were made using a methane detector and 5.2 percent methane was detected. The hole was plugged. The results of the tests were reported to Dan Basham, Second Shift General Mine Foreman. The onshift record book of December 7, 1981, shows this entry. On Monday night, prior to Leonard Sutherland entering the mine, Basham instructed Sutherland, Preshift Examiner for the day shift, to remove the plug installed by Bivens and to let the effluent from the gob bleed into the return. James R. Lyle, Electrician, accompanied Sutherland on an examination of the faces in the 003 section and Lyle detected 3.3 percent methane. Sutherland had all the equipment, except the shuttle cars, moved to the intake side of the working section and the working section was rerockdusted. On completion of the rock dusting, Sutherland painted the word "stop" on the faces where test boreholes penetrated the gob in Nos. 2 and 3 faces and removed the plug from the test boreholes in No. 3 face as instructed by Basham. Lyle informed Roy White, General Mine Foreman, on completion of his shift, that he had detected 3.3 percent methane in the 003 section.

The weather on December 8, 1981, was cold and cloudy. The barometric pressures for the period of time from December 6 to 10, 1981, recorded at the U.S. Department of Commerce, National Weather Service in Chattanooga, Tennessee, which is approximately 30 air miles from the No. 21 Mine, are as follows:

Date	Time	Barometric Pressure
December 6	12 Noon	29.5
December 7	12 Noon	29.4
December 8	12 Noon	29.42
December 9	12 Noon	29.3

MSHA investigators believe the slight change in the atmospheric pressure did not contribute to the explosion.

Explosion

Prior to entering the mine at 7 a.m. (CST) on December 8, 1981, Jimmy Holtzclaw, 008 Section Foreman, overheard Leonard Sutherland report to Roy White that there was 5 percent methane in the 003 section. The eleven man production crew assigned to 003 section entered the No. 21 Mine about 7 a.m. on December 8, 1981. They traveled in the track entry of the mains, through 6 right and then to the end of the track in 003 section. Although it was normal for 003 section miners to ride the scoop from the end of the track to the working place, it could not be determined during the investigation how this crew traveled to the working places from the end of the track on the day of the accident.

drills were conducted every six weeks in each coal producing section.

Escapeways

At least two separate and distinct travelable passageways, which were maintained to insure passage at all times of any persons including disabled persons, and which were designated as escapeways were provided. One of the escapeways was ventilated with intake air. The entries used as intake and return aircourses were required to be separated from the belt conveyor entries and air from the belt haulage entries was not used to ventilate the active working places. A section map showing escapeways was maintained with the section first-aid equipment.

Training Program - Medical Assistance Program

Management had submitted and received approval for a training program as required in Part 48, Title 30, Code of Federal Regulations. According to mine records, the miners received the required training. The operator had an approved plan for evacuation and firefighting. Arrangements had been made for 24-hour ambulance and medical services.

Illumination and Smoking

Permissible-type electric cap lamps were used for portable illumination in the mine. The operator submitted a plan, which was approved May 5, 1970, to prevent smoking articles from being taken into the mine. Searches were to be made weekly. However, the last search prior to December 8, 1981, as recorded in the book maintained for that purpose, was October 12, 1981.

MINE EXPLOSION AND RECOVERY OPERATIONS

Mining Condition Prior to the Explosion

The 003 section had been developed off 6 right toward the abandoned pillared area of 2 left and 3 left off 5 right. The immediate area to be intersected had not been pillared. Management had planned to intersect the abandoned area to provide a bleeder system for the 003 section. Blocks of coal were left around the perimeter of the 1 right through 5 right panels to serve as bleeders when the panels were second mined. The bleeder entries became unsafe for travel and the areas were not sealed. Because of the system of developing and retreating the panels, evaluation points had not been established at locations that would allow management to determine if the gob areas were being ventilated. Management did not know if mining 003 section into 2 left off 5 right gob would provide an effective bleeder for 003 section. Test boreholes drilled into the area from 003 section indicated it would not.

inby the end of the track toward the faces but returned because a stopping had been blown out. Scissom and Brown reported there was no air and visibility was poor because of so much airborne dust. Fultz called this finding outside to Saynes and Saynes told them to stay at the end of the track until the rescue team arrived.

Members of the Tennessee Consolidated Coal Company's two rescue teams were contacted at various company mines or at their residences and were told to report to Hollis Rogers, Safety Director at the No. 21 Mine. James Saynes, Hollis Rogers, Ron Calhoun, Vice President, Max Condra, MSHA Supervisor, and MSHA Inspectors Johnny McDaniel, Billy C. Layne, Tommy Frizzell and Clyde Layne arrived at the mine office between 12:30 p.m. and 2:30 p.m. As members of the two rescue teams assembled at the No. 21 Mine, team equipment was being prepared for use. Rogers briefed the teams concerning the apparent explosion, the 13 men in 003 section face area, and the other miners and foreman who were at the end of the 003 section track. Prior to anyone's entering the mine, a check-in and check-out system was established. Also, Jimmy Holtzclaw made an examination at the main surface fan and found no smoke or methane and only a trace of carbon monoxide in the exhaust air leaving the mine.

The following personnel were assigned to either the rescue teams or to provide underground support to the recovery effort:

Company Personnel and Mine Rescue Teams

Don Bivens
Jack Foshee
Jerry Fultz
Jimmy Holtcamp
Chris Johnson
Jimmy Johnson
H. Jones
Joe Ray Layman
Dwight Morrison
Hollis Rogers
Stanley Scissom
Ikey Slatton
Greg Worley

Team No. 1

Albert Mears, Team Captain
Richard Gholston
Michael Holland
Jimmy Holtzclaw
Henry Melton

Team No. 2

J.T. Shadrick, Team Captain
Jim Daux
Ray Frizzell
Leslie Green
John Lawson

Tennessee Division of Mines

Otto Scarborough, Field Representative

Mine Safety and Health Administration

Max Condra
Tommy Frizzell
Billy C. Layne
Johnny McDaniel

Rescue Team No. 1 entered the mine about 2:20 p.m. and was followed by support personnel and members of Rescue Team No. 2. Upon arrival at the end of 003 section track, Dwight Morrison stayed at the telephone and maintained contact with the fresh air base and mine office during most of the recovery operation. After the teams and support personnel arrived, Joe Layman and Ray Brown each took a mantrip to the surface and returned with supplies for the recovery operation.

As the No. 1 Team advanced inby the end of the track in No. 2 entry to establish a fresh air base, tests were made for methane and carbon monoxide. Upon reaching the seventh crosscut inby the end of the track, a smoldering seat cushion was found in the No. 2 entry and it was extinguished. Upon reaching the eleventh crosscut inby the end of the 003 section track, a fresh air base was established in the crosscut between Nos. 2 and 3 entries. At this location, the permanent stopping separating the intake (No. 2 track entry) and belt entry had been destroyed by the explosion. A few feet outby this crosscut, in the No. 2 entry, Johnny McDaniel took an air measurement which showed a quantity of about 8,500 feet of air per minute passing this point. Tests were made at the fresh air base and no methane or carbon monoxide was found.

When the fresh air base was established, the No. 1 Team under oxygen advanced toward the 003 section faces. Although some smoke was present, no fire was found. As the team advanced to each crosscut inby the fresh air base, tests for methane and carbon monoxide were made. The exploratory work continued until the team advanced to a location between the first and second crosscuts outby the face in No. 2 entry. From this location outby toward the end of the track, the team had explored both No. 1 and 2 entries and had located thirteen bodies. The exploratory work was interrupted at this time when the whistle sounded on a team member's oxygen breathing apparatus. The team retreated to the fresh air base.

Meanwhile, John Weekly, Birmingham MSHA Subdistrict Manager, and Jerry Early, MSHA Ventilation Specialist, had arrived at the mine at about 5:00 p.m. Clyde Layne, MSHA Inspector, had been making methane and carbon monoxide tests at the surface fan at 15 minute intervals. Weekly gave instructions to make these examinations at 5 to 10 minute intervals. Weekly and company officials were in contact with the fresh air base as the recovery operations were in progress.

Upon their return to the fresh air base, the No. 1 Team was debriefed and the No. 2 Team got ready to advance to the faces about 6:30 p.m. Albert Mears, No. 1 Team Captain, requested and was permitted to be the Captain of Team No. 2. This was allowed because he was familiar with the explored areas and it was felt the recovery

would progress more expeditiously. J.T. Shadrick, who was normally No. 2 Team Captain, went with Team No. 2 as Mears' back-up and No. 1 man on the No. 2 Team. Because the right side of the 003 section and faces had not been explored, the No. 2 Team advanced through these areas. Upon reaching the face of No. 2 entry, it was noted that the face had been holed into the 5 right gob area. The hole was about 4 feet high by 7 feet wide with the loading machine at the opening, (Appendix F, Photograph No. 3). About half of this cut had been loaded out. Measurements made with three methane detectors showed that 2.8 percent methane was flowing from the gob area into the 003 section through the hole. The team detected 1.2 percent methane in the face of the adjacent No. 3 entry. Also, it was noted that several holes had been drilled from the face to the gob in this entry. The team found about one and one-half rolls of line brattice behind the coal drill in a crosscut to the right and two crosscuts outby the face of No. 3 entry. They used this brattice and erected a barrier behind the loading machine to stop the flow of air and methane from the gob into the No. 2 entry. After installing the barrier, Team No. 2 retreated to the fresh air base.

Hollis Rogers reported to Weekly on the surface that 2.8 percent methane had been found. Weekly told Rogers that everyone should leave the mine if the methane increased to 3 percent. At this time, Rogers and Condra requested permission to close the regulator in 007 section return just outby 003 section belt entry overcast in 6 right. Permission was granted by Weekly and company personnel. Don Bivens, Dwight Morrison and another unidentified person installed brattice across the return regulator for 007 section in 6 right. By closing this return air regulator, it was believed that additional air would be directed into 003 section.

Next, it was decided to repair and replace the damaged and blown out stoppings between the No. 2 track entry and No. 3 belt entry in 003 section. Tommy Frizzell, MSHA Inspector, stayed one crosscut inby Billy C. Layne, MSHA Inspector, and Stanley Scissom, and made methane and carbon monoxide tests as stoppings were repaired and replaced by Layne and Scissom. Ikey Slatton advanced a personnel carrier (3-wheeler) to just outby each crosscut with supplies. Otto Scarborough, Tennessee Division of Mines, advanced telephone communication behind the personnel carrier as ventilation repairs were made. He stopped several crosscuts outby the faces. Condra advanced with the crew to the faces.

After ventilation controls had been reestablished, recovery of the bodies was begun. There was no evidence that any of the victims had attempted to use a self-rescuer. Before each body was moved, the lamp number and a diagram of each victim's position was noted on the roof directly over the body. Each body was wrapped in plastic brattice cloth and placed in a rubber-tired mine car for removal from the section. Condra granted rescue workers permission to move the standard-drive shuttle car about twenty feet from where it

was parked in a crosscut to the right rib of No. 2 entry to facilitate the removal of bodies. The shuttle car was moved by a battery-powered tractor that was brought on the section. Also, the three wheel personnel carrier was moved about five feet into the crosscut from No. 2 entry. After the first group of bodies was loaded, Jack Foshee transported the victims to the end of the track. Between trips, McDaniel and Shadrick went to the faces of No. 1, 2, and 3 entries and on the right side of the section where the roof bolting machine was parked and collected bottle samples. After the tractor returned a second time and the remaining bodies were loaded, they were removed from the 003 section to the end of the track and placed on cars with the other victims and transported to the surface. The rescue teams, recovery support personnel and bodies arrived on the surface about 11:45 p.m. on December 8, 1981.

ACTIVITIES OF MINE SAFETY AND HEALTH ADMINISTRATION

Personnel

About 1:25 p.m., Tuesday, December 8, 1981, Tommy D. Frizzell, at MSHA's Jasper, Tennessee, field office received a telephone call from a company official of Grundy Mining Company Incorporated, informing him that 12 men were trapped inside the company's No. 21 Mine. Johnny McDaniel, who was in the office when the call was received, notified Max Condra, who was on leave at the time. The Subdistrict Office in Birmingham, Alabama, was notified by Frizzell and shortly thereafter John Weekly, Subdistrict Manager notified Jerry Spicer, District Manager at the District 7 office at Barbourville, Kentucky. Spicer notified Joseph A. Lamonica, Administrator for Coal Mine Safety and Health at Arlington, Virginia. The Mine Emergency Operations Group was notified of the occurrence by the Arlington office. In the meantime, Frizzell and McDaniel traveled to the mine, picking up Condra enroute. They arrived at the mine about 2:20 p.m. Billy C. Layne and Clyde J. Layne, arrived about the same time. Condra, Frizzell, McDaniel and Billy C. Layne entered the mine with the rescue teams, arriving at the end of the track in 003 section about 3:30 p.m. Clyde Layne remained on the surface and monitored the fan. John Weekly and Jerry Early arrived at the mine via helicopter about 5:00 p.m. Donald W. Huntley, District Manager, District 2, Pittsburgh, Pennsylvania, was instructed by the Administrator to proceed to the No. 21 Mine to assist in the recovery operations. Huntley and J.D. Breedon, Subdistrict Manager, Monroeville, Pennsylvania, arrived at the mine about 10:15 p.m. They remained until the mine was recovered and reventilated on December 17, 1981. Other MSHA inspection personnel arrived at various times thereafter and participated in the recovery operations. The four MSHA inspection personnel who accompanied the mine rescue teams underground, assisted erecting temporary stoppings after the mine rescue teams had explored the explosion area and determined there was no fire. MSHA personnel marked the locations where the

victims were lying and assisted in wrapping them in plastic brattice cloth and removing the bodies to the surface. They arrived on the surface with the bodies of the 13 victims about 11:45 p.m. MSHA special investigators were at the Hooper Funeral Home in Whitwell, Tennessee when the bodies arrived and inventoried items removed from the clothing of each victim.

The Mine Emergency Operations mobile unit, which was in operation at a mine in Grundy, Virginia, was alerted about 4:00 p.m., Tuesday, December 8, 1981, and arrived at the mine about 8:15 p.m., Thursday, December 10, 1981. The unit remained at the site, analyzing samples, until the mine was fully recovered on December 17, 1981.

103(k) Order

Because an explosion had occurred in the active workings in the No. 21 Mine, on December 8, 1981, Johnny McDaniel, Coal Mine Inspector, issued a 103(k) Order on the entire mine. On December 9, 1981, this Order was modified to include the adjacent Nos. 24, 25, 27 and 30 Mines interconnected with the No. 21 Mine. Once the No. 21 Mine was examined, reventilated and found safe for travel, the 103(k) Order was modified, allowing Mines No. 24, 25, 27 and 30 to continue normal operation. The 103(k) Order was terminated on January 7, 1982, after recovery operations and the underground investigation were completed (Appendix G).

ACTIVITIES BETWEEN THE RECOVERY AND INVESTIGATION

During the 11:00 p.m. - 7:00 a.m. shift on December 9, 1981, Don Mize, MSHA Coal Mine Inspection Supervisor, made methane and carbon monoxide tests and collected a bottle sample at the holed-through area where the 003 section, No. 2 entry, intersected the gob. Mize reported finding methane in excess of 5 percent and traces of carbon monoxide. Huntley and Weekly decided to withdraw the company preshift examiners, accompanied by MSHA personnel, from the mine until the bottle sample was analyzed. The company made arrangements to have the sample flown to the MSHA's laboratory in Pittsburgh, Pennsylvania. The sample collected by Mize and other samples that had been collected at the mine December 8 and 9, 1981, were analyzed. These carbon monoxide readings were not consistent.

The intersected area could not be examined and the extent of dangerous gases in the gob were not known. Because of the carbon monoxide readings and what appeared to be slight changes on the fan recording chart (from 12 noon to 4:00 p.m. on December 9, 1981), Weekly held a meeting with company and state officials. The meeting was held December 10, 1981, and the company, State and MSHA agreed to drill two boreholes from the surface into the mine. One borehole would be drilled to penetrate the gob inby the holed-through area from 003 section to provide a point for monitoring the mine atmosphere. This borehole (Hole A) was drilled first because the surface area

was more accessible. The second borehole to be drilled would penetrate into the 003 section face area. Borehole "A" was started about 7:45 p.m. on December 10, 1981. Before borehole "A" penetrated the coalbed, Weekly and Calhoun decided to begin exploratory work from the portal to 6 right. The first advance was from the portal to 3 right, then to 5 right and finally to 6 right. Two members of the exploratory team (one MSHA and one company person) crawled the track entry (intake air) while a similar team crawled the main returns. As each leg of the exploratory work was advanced, telephone communications were established and maintained to the mine office. Also, five members of the rescue team followed behind the 4-member exploratory group and made additional tests for methane and carbon monoxide. All tests indicated good air and no harmful quantities of methane or carbon monoxide.

About 10:20 a.m. on December 11, 1981, borehole "A" penetrated the coalbed in the gob area inby 003 section. Sampling of the mine air was started as soon as a hose was inserted through the borehole and an evacuation pump was installed. Sampling was done on two-hour intervals. Because of favorable sample results from borehole "A" and the difficult surface terrain (cliff) at the location where borehole "B" was to be drilled, it was decided by Calhoun and Weekly that this borehole would not be drilled. At this time, it was decided to continue the exploratory work from 6 right to the end of 003 section track and adjacent entries to this depth. The 6 right, 007 and 003 sections were recovered December 11, 1981. From December 11 thru 14, 1981, samples were collected in a return aircourse entry opposite the track in 003 section. Prior to the underground investigation starting on December 15, 1981, the company preshift examiners, each accompanied by an MSHA Coal Mine Inspector, made a preshift examination before the investigation team entered the mine.

INVESTIGATION

Investigation Committee

The investigation into the cause of the explosion was conducted December 15 thru 19, 1981, and January 5 thru 9, 1982.

List of officials present during the investigation:

Grundy Mining Company, Incorporated

Officials and Employees

Ronald E. Calhoun	Executive Vice President
Ed Presley	Chief Engineer
Hollis Rogers	Safety Director
Buddy G. Layne	Assistant Superintendent
Jewell Shadrick	Assistant Maintenance Superintendent
Joe Ray Layman	Miner Representative

Tennessee Division of Mines

Woody Ducan	Director
Otto Scarborough	Field Representative
Wayne Farmer	Field Representative

Mine Safety and Health Administration

William A. Holgate	Mine Safety and Health Specialist
Paul J. Componation	Mine Safety and Health Specialist
Harry J. Carter	Mine Safety and Health Specialist
George M. Fesak	Electrical Engineer
Page H. Jackson	Office of the Solicitor
Edward M. Kawenski	Supervisory Mining Engineer

Inspectors from the MSHA Birmingham Subdistrict Office and a Special Investigator from the MSHA District 6 Subdistrict Office at Paintsville, Kentucky, assisted the accident investigators in collecting notes, plotting data and taking dust samples.

Interviews

As part of the investigation into the cause of the explosion, MSHA conducted interviews with numerous company officials and employees from December 15-18, 1981, and on January 6, 1982.

Underground Investigation

MSHA's investigating team arrived at the mine site at 8:10 a.m., Thursday, December 10, 1981. An investigation could not be started until the explosion area was recovered and ventilated. The investigating team assisted with the mine recovery and formulated a plan and made necessary arrangements for the investigation.

A meeting was held Saturday afternoon, December 12, 1981, at the company office. Company officials, State, and MSHA personnel assigned to participate in the investigation attended. Plans for conducting the investigation were finalized and agreed to by all parties.

The plan stipulated that a preshift examination of the entire mine be made prior to entrance of anyone else to the underground areas of the mine. The examination would be made by a certified company official accompanied by an MSHA inspector. The first team to enter the explosion area for investigative purposes would be the mapping team. The team would consist of MSHA representatives, a company representative and a representative of the miners. Two MSHA Inspectors would assist with note keeping, measuring and plotting data on a map. A similar team of electrical personnel would follow making necessary electrical checks and tests. The

dust team would follow collecting dust samples. A Special Investigator was to accompany the mapping team to take photographs, identify, and gather evidence.

During the investigation, the Mine Emergency Operations mobile testing unit would analyze samples collected from the mine fan, the borehole drilled into the gob area and any other samples collected during the investigation. Communications would be maintained with an MSHA representative on the surface.

At approximately 9:18 a.m., Tuesday, December 15, 1981, the team assigned to measure and plot all pertinent data entered the mine via battery-powered track-haulage personnel carriers. They arrived at the end of the track in the 003 section about 9:45 a.m. The track ended approximately 1,200 feet outby the faces. Team members made the necessary tests to assure the area was safe as they crawled toward the faces. The location of the victims, the effects of flames and forces, the location of all equipment and any other information necessary to conduct a thorough investigation were plotted accurately on the map and a complete description was provided in notes. A team of electrical personnel followed checking the position of all switches, and examining and testing all electric equipment and circuits. A Special Investigator took photographs and identified items that could be used as evidence in determining the cause of the explosion. The material collected was removed to a repository on the surface. The repository was fitted with two locks; an MSHA Special Investigator had the keys to one lock and company personnel had the keys to the second lock. A dust collecting team collected dust samples.

The extent of the flame and forces, as near as could be determined from a visual observation, was plotted by the Supervisory Mining Engineer. The dust samples were also analyzed for presence of coke and material affected by the flame was analyzed for extent of heat. The extent of the flame and forces is shown on the map (Appendix D-1). The locations and analyses of dust samples collected during the investigation are in Appendix E.

DISCUSSION OF OBSERVATIONS

Ventilation

The 003 section was developed approximately 3,800 feet using a block system of mining. Intake air was coursed into the area through the Nos. 1 and 2 entries. The haulage track was in the No. 2 entry. There were no trolley wires used in the mine. The belt conveyor was installed in the No. 3 entry and according to the ventilation plan, last approved October 1, 1981, was to be separated from the intake and return aircourses using permanent stoppings. The belt conveyor was to be ventilated by a separate split of air regulated to the return near the belt conveyor tailpiece. The No. 4 entry was the return aircourse. Additional intake and return aircourses

were developed at various locations along the intake and return aircourses. During the investigation it was observed that a connecting entry between the return entries of the parallel 007 section and the intake entries of the 003 section had not been closed. It was impossible to determine the effects of the open connecting entry on the ventilation of the 003 and 007 sections because of damage to permanent stoppings and the uncertainty of the ventilation on 007 section at the time of the explosion. The 003 and 007 regulators were adjusted to their position prior to the explosion, but the results were inconclusive. Permanent stoppings between the belt conveyor entry and the section return aircourse had not been constructed in four crosscuts just outby the tailpiece. Also, it could not be determined whether the crosscut between the belt conveyor entry and the intake aircourse was closed just outby the tailpiece, due to a large roof fall in the area.

There was a plastic check in the crosscut between the Nos. 2 and 3 entries just inby the tailpiece. Plastic checks had been installed in the first, second, and fourth crosscuts between Nos. 2 and 3 entries inby the tailpiece; the third crosscut through which shuttle cars passed on their way to the tailpiece was open. Due to irregular coalbed conditions, the No. 4 entry was not developed inby the belt conveyor tailpiece. The No. 3 entry served as the section return aircourse from just inby the tailpiece. The ventilation was short-circuited from reaching the active working faces of the 003 section. The was no indication of a plastic check curtain having been installed in the crosscut through which the shuttle cars traveled. A piece of plastic brattice was observed lying on the floor of No. 3 entry opposite the open crosscut. The plastic brattice showed indications of having been subject to heat but was not melted. Other plastic curtains that had been hanging in the vicinity were melted by the heat. If the plastic check had been up at the time of the explosion, it too would have been melted. Furthermore, careful observation of the roof and ribs disclosed no evidence that a check curtain was in place at the time of the explosion.

Section 75.302-1(a) requires that line brattice be installed to within 10 feet of the point of deepest penetration where coal is being cut, loaded or mined. This line brattice installation requirement includes areas where coal is drilled for blasting by mobile coal drills. The line brattice was approximately 70 feet outby the face where the coal drill was located at the face.

Bleeders in the No. 21 Mine were developed by leaving blocks of coal around the perimeter of areas to be second mined. Such blocks were left around the 1 right through 5 right pillared areas. These areas are on the return aircourse of the main entries and just inby the exhaust fan. The effluent from this gob area was flowing into the 003 section indicating the bleeders were not effective. The perimeter entry left to serve as a bleeder around

the area could not be traveled nor effectively evaluated. It could not be determined if the bleeder was ineffective due to water, falls of roof, bottom heaving or a combination of all. Because of the bleeder design, evaluation points to determine effectiveness of the bleeder system were not available. During the recovery, MSHA personnel determined to the extent possible that only the fringe of the gob along the main return aircourse was being ventilated.

During the investigation it was observed that the tops of the overcasts at the mouth of 003 section were constructed of sheets of metal laid across rails. The metal had been moved leaving an opening in the overcast over the track haulage entry. Reportedly this occurs when supplies are loaded too high on supply cars and contact the top of the overcast. Some entries, crosscuts and dead end places had been gobbed with rock. The belt conveyor haulage system in the mine was not adaptable to hauling both coal and rock from the mine and rock was stored underground. This made some areas untravelable and difficult to examine.

The mine works two production shifts and one maintenance shift a day. The Preshift Examiner's book did not indicate a preshift examination was made on December 7, 1981, for the 11 p.m. - 7 a.m. maintenance shift. Reportedly, as maintenance men enter the mine and start working, an examination is made during the shift by a certified person.

Methane

The analysis of an air sample collected in the main return, just inby the fan during the last regular inspection indicated the mine was liberating 17,000 cubic feet of methane in 24 hours. The 003 section was liberating a small amount of methane. About 8:15 p.m., Monday, December 7, 1981, a test borehole was drilled in the No. 3 entry face into the abandoned gob and 5.2 percent methane was measured in effluent flowing from the gob into the active working place. The Preshift Examiner for the day shift, informed the Mine Foreman that he had detected methane in the 003 section. The Onshift (3 p.m. - 11 p.m.) Examiner's book dated December 7, 1981, indicated the Onshift Examiner had detected 5.2 percent of methane in the 003 section. An employee stated that he had detected 1 percent methane in the 003 section about 6 months prior to the explosion. During the recovery operation, the mine rescue team detected 2.8 percent methane near the face of the entry that holed into the gob area.

Coal Dust

During the investigation, band dust samples were collected by MSHA personnel in 6 right, 007 and 003 sections. Samples were collected approximately 180 feet apart except in the explosion area in 003 section where samples were collected at 60-foot intervals. The samples were analyzed for incombustible and coke content. A total of 265 samples was collected. In the 6 right section, 27 of 48, or 56 percent of the samples collected in the intake aircourses were substandard; 11 of 12, or 92 percent of the samples collected in the return

aircourses were substandard. In 007 section, 27 of 48, or 56 percent of the samples collected in the intake aircourses were substandard; all, or 100 percent of the 10 samples collected in the return aircourses were substandard. In the 003 section, the analysis of dust samples collected indicated areas to approximately 1,800 feet outby the faces were affected by the explosion. Analysis of dust samples collected in the intake and return aircourses outby the area affected by the explosion indicated 34 of 57, or 60 percent were substandard; all 22 samples collected in the return aircourses outby the affected area were substandard. The 003 working section had been rerockdusted on the 11 p.m. - 7 a.m. shift, Tuesday, December 8, 1981. Although, some coal dust participated in the explosion along the belt entry where 9 stoppings were blown out, it is believed the rock dust prevented coal dust from significant participation in the explosion.

Electricity

The investigation revealed that the following electric equipment and cables were present inby the No. 44 crosscut of the 003 section at the time of the explosion:

(1) Approximately 1,200 feet of high-voltage cable supplying 4,160-volt, 3-phase power to the section power center.

(2) One high-voltage splice box installed in the high-voltage cable.

(3) One portable power center supplying 480-volt, 3-phase power and 300-volt, direct-current power to the electric equipment in the 003 section.

(4) One cutting machine with approximately 500 feet of trailing cable.

(5) One belt feeder-breaker with approximately 400 feet of trailing cable.

(6) One face drill with approximately 400 feet of trailing cable.

(7) One loading machine with approximately 500 feet of trailing cable.

(8) One roof-bolting machine with approximately 400 feet of trailing cable.

(9) One standard-drive shuttle car with approximately 500 feet of trailing cable.

(10) One off-standard-drive shuttle car with approximately 500 feet of trailing cable.

(11) One electric welding machine with associated supply and welding cables.

(12) One battery charger with associated supply and charging cables.

(13) One battery-powered scoop.

(14) One battery-powere personnel carrier.

(15) One 2-pole, 30-ampere, disconnect switch used as a remote start/stop switch for the 003 section belt conveyor. The switch was connected into the remote control circuit for the belt conveyor controller by means of a control cable installed in the belt entry.

(16) Approximately 840 feet of heat detection cable installed along the 003 section belt conveyor and connected into the mine belt conveyor fire detection system.

(17) One battery-powered mine telephone.

(18) Thirteen electric cap lamps.

(19) One methane detector.

The location of each unit of electric equipment listed above, with the exception of the electric cap lamps and methane detector, is shown on the map of the 003 section in Appendix B-2.

Smoking

Smoking materials and a cigarette lighter were observed in underground areas of the No. 21 Mine during the investigation. One lunch bucket found on the roof bolting machine in 003 section contained two packages of cigarettes, one opened and one not opened. Another package of cigarettes (not opened) was observed in a lunch bucket investigators found on the three-wheel personnel carrier in a crosscut between Nos. 2 and 3 entries of 003 section. A cigarette lighter was observed in the No. 1 entry of 003 section just inby No. 62 crosscut during the recovery operations on 003 section. This observation was made by an MSHA inspector and was witnessed by an MSHA supervisor and two company officials on December 8, 1981, during the recovery operation. Also, an MSHA inspector found a full package of cigarettes and an empty cigarette package in a lunch bucket that was on a battery-powered tractor in the 007 section of the No. 21 Mine. This observation was made on December 12, 1981, as mine recovery operations were in progress. Also, possessions of four victims (one management official and three miners) that were inventoried at the funeral home included five cigarette butts, eight cigarettes and two lighters. During interviews,

miners stated that smoking was observed underground in the No. 21 Mine.

Flame Safety Lamps

During the investigation, two flame safety lamps were observed in the explosion area about 80 and 125 feet, respectively, from the face of No. 2 entry of 003 section. An examination of these lamps revealed the expansion ring on one lamp was damaged.

EVALUATION

Ventilation and Gases

The bleeder system for the 5 right abandoned area was ineffective, permitting methane to accumulate in the abandoned area. Because intake air to the faces was short circuited as a result of a missing plastic check curtain between Nos. 2 and 3 entries in the third crosscut inby the tailpiece, methane migrated from the abandoned area into the 003 section and was not diluted, rendered harmless and carried away.

Rock Dust and Coal Dust

Although the medium volatile Sewanee coal dust is explosive, it is concluded that litte coal dust participated in the explosion. The 11 p.m. - 7 a.m. shift of December 8, 1981, had rerockdusted the 003 working section just prior to when the explosion occurred. Further observations in the explosion area during the investigation showed only minor damage had resulted along the belt entry and areas inby the belt conveyor tailpiece. Some coal dust participated along the belt conveyor entry where nine stoppings were blown out and approximately 250 feet of the belt conveyor was dislodged from the top rollers.

Electricity

MSHA electrical personnel thoroughly tested or examined all electric equipment and cables located in areas of the mine in which evidence of heat or flame was found or which supplied power to electric equipment in these areas to determine if the source of the ignition was of electrical origin. The electrical tests or examinations revealed no evidence to indicate that the electric cables or equipment provided the ignition source for the explosion. A description and analysis of the tests and examinations conducted by MSHA electrical personnel is contained in Appendix C-2. Also, the

results of tests (listed in Appendix C-3)[1/] conducted on the 13 cap lamps, the methane detector and the mine telephone in 003 section, indicate that this equipment was not the source of ignition.

Flame Safety Lamps

Under certain conditions, attempts to relight a flame safety lamp in an explosive methane/air mixture may initiate an explosion. An ignition is likely to occur when parts of the lamp are damaged, such as the gaskets or gauzes. When laboratory tests of the two lamps from the 003 section were made in explosive methane/air mixtures, methane was ignited within the lamp in each instance, but did not propagate through the gauzes to ignite methane outside the lamp. Each lamp was tested six times (see Appendix D-3).

Forces

It was the consensus of the MSHA investigators that the accident was primarily a methane explosion with very little force associated with the occurrence. The only evidence of force inby the belt conveyor tailpiece was a lid off the section power center blown outby. It is concluded that some dust along the belt conveyor entry entered into the explosion generating sufficient force to dislodge the top belt from the rollers for approximately 250 feet, and to blow out 9 stoppings. The stoppings were constructed of concrete blocks, stacked dry and plastered. Very little force is required to dislodge stoppings constructed in this manner. (See report Appendix D-2; see map Appendix B-2.)

Flame

In the explosion, much of the 003 section's affected area was engulfed in flame or subjected to heat. Evidence of flame in the form of coke, melted plastic brattice material, charred cable insulation and burned material was observed from the faces outby for a distance of approximately 1,100 feet (see Appendix D-1). In some areas there were indications of heat near the roof of the entries, yet paper on the floor did not show any indication of heat or burning. The 13 victims all appeared to be severely burned on areas of their bodies that were exposed.

[1/] A detailed report (Special Investigation X-160) of the examinations and tests on cap lamps, a methane detector and mine telephone (130 pages) can be obtained by contacting the Mine Safety and Health Administration's Approval and Certification Center, Industrial Park Boulevard, RR 1, Box 201 B, Triadelphia, West Virginia 26059.

Some of the lighter articles of clothing worn by the victims showed signs of flame. A partially melted miner's hat, a sample of the plastic brattice material that was used underground and a partially burned jacket worn by one of the victims were tested at the MSHA Safety Technology Center at Bruceton, Pennsylvania, in an attempt to determine the extent of heat; Appendix F, Photograph Nos. 5, 6 and 7. The tests were inconclusive because the items melted or ignited at comparatively low temperatures as compared to the ignition point of methane, about 1200 degrees fahrenheit (see Appendix D-3). A rescue team extinguished a burning cushion approximately 1,000 feet outby the faces.

Point of Origin

Observations were made during the investigation which indicated the conditions that existed minutes before and during the explosion. The last shuttle car of coal that had been dumped at the 003 section tailpiece was being discharged from the 003 section beltdrive onto the 6 right belt conveyor when the explosion occurred and power to the section and belt conveyors was deenergized. Calculating the speed of the 003 section belt and determining the distance that this coal had traveled, it was determined that the last shuttle car of coal had been dumped at the tailpiece at least 10 minutes prior to the explosion. During this 10 minute interval, other production activity in the face areas had ceased. All mobile equipment was parked. Both shuttle cars were empty and were located outby the loading machine. The loading machine had been backed from the face, the cutting machine was in a crosscut outby the faces and the roof-bolting machine was parked away from face areas. The coal drill was parked in the face of the No. 62 crosscut. The evidence indicates that when the ignition occurred all but one victim observed the burning atmosphere and immediately began to leave the area. The operator of the standard-drive shuttle car was the only victim found facing inby. Twelve of the thirteen victims had traveled a short distance outby before they were overcome by asphyxia. Personal effects were located inby the bodies of the victims.

A careful search and evaluation was made for all potential sources of ignition to pinpoint the exact cause. Based upon the analysis of the electrical examinations and tests, the extent and direction of flames and forces and location of victims, it is concluded that a miner used a cigarette lighter and ignited the surrounding atmosphere in No. 1 entry of 003 section. The bill of a miner's hat in the No. 1 entry was melted when the ignition occurred, but he was able to travel a short distance outby before being overcome by asphyxia. A jacket of one of the victims was burned on the inside.

FINDINGS - SUMMARY OF EVIDENCE

The findings of this part are derived from the following sources: conditions observed in the mine by MSHA personnel during the

recovery and investigation of the 003 section; information obtained from the mine rescue teams; from interviews of miners and supervisors; and evidence taken from the No. 21 Mine. After analysis of all available evidence, MSHA summarizes their findings below:

(1) The No. 21 Mine liberates methane.

(2) The analysis of a raw coal sample taken in the Sewanee coalbed in the No. 21 Mine indicates that this coal dust is explosive.

(3) The Ventilation System and Methane and Dust Control Plan was last approved October 1, 1981.

(4) The 003 section was projected to intersect Nos. 2 and 3 left gob area off 5 right.

(5) Blocks of coal were left around the perimeter of second mined areas to serve as bleeder entries. The bleeder entries around the 1 right to 5 right pillared areas were not travelable. Evaluation points were not established at locations that would accurately indicate the effectiveness of ventilation in these gob areas.

(6) Holes were being drilled in 003 section faces in advance of mining. On Monday, December 7, 1981, a borehole in No. 3 entry of 003 section penetrated into the gob area.

(7) Effluent from the gob area was flowing through the hole into the active working place of 003 section and 5.2 percent methane was detected. After methane was detected, the borehole was plugged. The bleeder system was ineffective.

(8) On December 7, 1981, the Section Foreman (3 p.m. - 11 p.m.) advised the General Mine Foreman (3 p.m. - 11 p.m.) that he had detected methane. After receiving this information, the General Mine Foreman (3 p.m. - 11 p.m.) informed the third shift Preshift Examiner (11 p.m. - 7 a.m.).

(9) Upon receiving instructions from the General Mine Foreman, the third shift Preshift Examiner removed the plug from the borehole in No. 3 entry of 003 section to bleed the methane from the gob area. The Preshift Examiner advised the General Mine Foreman that 5.0 percent methane was detected in 003 section.

(10) The 003 Section Foreman (7 a.m. - 3 p.m.) telephoned the General Mine Foreman and Assistant Superintendent and reported that methane in excess of 5 percent was present in an 003 section working place on December 8, 1981.

(11) The Assistant Superintendent instructed the 003 Section Foreman to stop production activities and ventilate. Further, the Section Foreman was informed that the General Mine Foreman and Assistant Superintendent were coming into the 003 section. The Assistant Superintendent and General Mine Foreman arrived on the 003 section shortly after 10:45 a.m. on December 8, 1981.

(12) The company belt inspector heard the report of blasting in the 003 section about 11:30 a.m. on December 8, 1981.

(13) An explosion occurred on the 003 section about 12:00 noon (CST) on December 8, 1981. Forces resulting from the explosion were felt at the 003 section beltdrive.

(14) The first Mine Rescue Team entered the No. 21 Mine about 2:20 p.m. on December 8, 1981.

(15) About 6:00 p.m. on December 8, 1981, 13 bodies were found in the 003 section by a rescue team and all bodies were removed to the surface by 11:45 p.m. All victims were burned. Evidence indicated that none of the victims attempted to use their self-rescuers.

(16) At 2:30 p.m. on December 8, 1981, a Federal Coal Mine Inspector issued a 103(k) Order on the entire mine. Upon learning that four adjacent active mines were interconnected with the No. 21 Mine, the 103(k) Order was modified on December 9, 1981, to include Mines No. 24, 25, 27 and 30. After No. 21 Mine was examined, reventilated, and determined safe to travel in, the 103(k) Order was modified to permit these interconnected mines to resume operations on December 12, 1981. Once the rescue, recovery, and underground investigation to determine the cause of the explosion were completed, the 103(k) Order was terminated.

(17) The 007 section return aircourse was interconnected to the 003 section intake aircourses. There were no ventilation controls in this interconnecting entry.

(18) Four permanent stoppings had not been erected between the belt entry and return aircourse immediately outby the 003 section tailpiece.

(19) A permanent stopping was not erected between the intake and return aircourse entries in the third connecting crosscut outby the faces.

(20) A check curtain was not installed between the intake and return aircourses in the third crosscut inby the belt tailpiece. Because this check curtain was not installed, the intake air for the faces was short-circuited to the return aircourse.

(21) Line brattice was not installed to within 10 feet of deepest point of penetration of the face in the place where the face drill was located. The approved ventilation plan did not permit a greater distance.

(22) All electric equipment, cables and flame safety lamps inby the No. 44 crosscut in 003 section were examined, tested and eliminated as a source of ignition.

(23) All the victims were in Nos. 1 and 2 entries and interconnecting crosscut within 150 feet of the faces.

(24) The direction of travel of all but one victim at the time of the explosion was away from the face areas.

(25) According to the position of coal near the outby end of the 003 section belt conveyor and the speed of this belt, no coal had been dumped at the tailpiece for at least 10 minutes. Approximately one half of the cut of coal in the No. 2 entry had been loaded.

(26) About 63 percent of the dust samples collected in areas not affected by the explosion were substandard. The 003 working section was rerockdusted on the 11 p.m. - 7 a.m. shift December 8, 1981, prior to the explosion.

(27) Smoking articles, cigarette butts, cigarettes, and two lighters were removed from the pockets of four victims (management officials and workers) at funeral homes after the explosion.

(28) Cigarettes were found in two of the victims lunch buckets on the 003 section during the investigation (Appendix F, Photograph No. 2). Also, cigarettes were found in a lunch bucket in a personnel carrier from the 007 section.

(29) A cigarette lighter was observed on the floor of No. 1 entry during the recovery operation on December 8, 1981, and was photographed and taken by an MSHA Special Investigator as evidence during the investigation (Appendix F, Photograph No. 1).

(30) During interviews, miners who worked underground in the No. 21 Mine stated smoking was observed underground.

(31) The company had adopted and MSHA had approved a program to insure that any person entering the underground area of No. 21 Mine did not carry smoking materials, matches, or lighters. The last search of workmen for smoking articles made prior to December 8, 1981, as shown in company records maintained for that purpose, was October 12, 1981.

(32) Primarily, the explosion was an ignited methane-air mixture; very little coal dust participated in the explosion. Forces of the explosion were minimal as evidenced by the amount of destruction.

(33) According to death certificates, all victims died of asphyxia resulting from an explosion.

(34) The investigators concluded that five violations observed contributed to the cause of the explosion. These violations are listed in Appendix H.

CONCLUSION

The investigators conclude that methane accumulations in the Nos. 2 and 3 left gob off 5 right flowed through the 4 foot by 7 foot hole and test boreholes in Nos. 2 and 3 entries of 003 section. Because intake air to the section was short-circuited from the faces at a crosscut between Nos. 2 and 3 entries (3 crosscuts outby the faces), methane migrated into the 003 section from the faces of Nos. 2 and 3 entries. It is concluded that a miner used a cigarette lighter igniting the methane-air mixture causing the explosion. Apparently the miners saw the burning gases just after ignition. This observation is supported by the fact that 12 of the 13 miners (victims) were headed outby when they were overcome by the explosion. In further support of this conclusion, personal effects (miners hats, a hammer, two flame safety lamps and a jacket) were located inby the bodies of the respective victims. These observations indicate to the investigators that the miners were traveling away from the ignition source.

The failure of management and miners to abide by the smoking prohibition and the failure of management to provide ventilation controls necessary to maintain adequate ventilation in the 003 section and to maintain an effective bleeder system for the 5 right abandoned area were the direct causes of the explosion. Contributing thereto was the failure of management to enforce the approved smoking prohibition program and the failure of management to remove miners from the area affected by methane migrating from the intersected 5 right abandoned area.

Respectfully submitted,

William A. Holgate
William A. Holgate
Mine Safety and Health Specialist

Paul J. Componation
Paul J. Componation
Mine Safety and Health Specialist

Harry J. Carter
Harry J. Carter
Mine Safety and Health Specialist

George M. Fesak
George M. Fesak
Electrical Engineer

Edward M. Kawenski
Edward M. Kawenski
Supervisory Mining Engineer

Approved by:

J. A. Lamonica
Joseph A. Lamonica
Administrator--Coal Mine Safety and Health

APPENDIX A
003 Section

The following men were killed in the explosion:

NAME	AGE	OCCUPATION
Cooley, Larry	28	Cutting Machine Operator
Nolan, Harvey	34	Loading Machine Operator
Myers, Charlie	34	Shot Firer - Face Drill Operator
Parsons, Gaylon	28	Roof Bolting Machine Operator
Rollins, Darrell	28	Roof Bolting Machine Operator Helper
Cooley, Danny	27	Scoop Operator
Grimes, Lee	23	Off-Standard-Drive Shuttle Car Operator
Wilburn, Franky	29	Standard-Drive Shuttle Car Operator
Kilgore, Jacob	37	Ventilation Man
French, Ed	47	Electrician
Tate, Jackie	38	Foreman
White, Roy	37	General Mine Foreman
Rogers, Jimmy W.	43	Assistant Superintendent

APPENDIX A

NAME: LARRY B. COOLEY

Section I (Coal Only)

MSHA and/or State Certification and/or Qualification Mine ID 40-00524

Date Training Plan Approved 1979

	Date Training Received		Date Training Received
* [X] Certified Person (Underground)		[ ] Dust (Sampling)	
* [ ] Certified Person (Surface)		[ ] Dust (Calibration)	
* [ ] Methane & Oxygen Deficiency Testing	1981	[ ] Noise	
* [ ] Electrical		* [ ] Impoundments	
* [ ] Energized Surface High Voltage		* [ ] Hoisting Engineer	

* Annual Retraining Required

Section II (Metal-Non-metal and Coal)
MSHA Training Programs Completed

Date of Hire 5-27-1973 Date Training Plan Approved 1979

Required Training (Victim)	Date Training Received	[ ] Required Training (Victim)	Date Training Received
[ ] New Miner (U.B.)		[ ] Hazard Training (U.G.)	
[ ] New Miner (Sur.)		[ ] Hazard Training (Sur.)	
[ ] Newly Employed Experienced (U.G.)			
[ ] Newly Employed Experienced (Sur.)			
[X] Annual Refresher (U.G.)	1981		
[ ] Annual Refresher (Sur.)			

Task Training Specify Type:

Section III

Company Training Program Completed:

Training	OJT/Formal	Instructor	Date Completed

Section IV

DID VICTIM HAVE TRAINING SPECIFICALLY RELATED TO THE TASK BEING PERFORMED AT THE TIME OF THE ACCIDENT?

[X] YES [ ] NO WHEN? 1981

BY WHOM? Charles Terpo - Hollis Rogers HOW WAS TRAINING GIVEN? At Mine Location And Training Center

Section V

RECOMMEND TRAINING PLAN EVALUATION BY EDUCATION & TRAINING OFFICE

[X] YES [ ] NO

APPENDIX A

NAME: HARVEY NOLAN, JR.

Section I (Coal Only)

MSHA and/or State Certification and/or Qualification Mine ID 40-00524

	Date Training Plan Approved	Date Training Received		Date Training Received
* [X] Certified Person (Underground)	1979		[ ] Dust (Sampling)	
* [ ] Certified Person (Surface)			[ ] Dust (Calibration)	
* [ ] Methane & Oxygen Deficiency Testing			[ ] Noise	
* [ ] Electrical			* [ ] Impoundments	
* [ ] Energized Surface High Voltage			* [ ] Hoisting Engineer	

* Annual Retraining Required

Section II (Metal-Non-metal and Coal)
MSHA Training Programs Completed

Date of Hire 7-16-1974 Date Training Plan Approved 1979

Required Training (Victim)	Date Training Received	Required Training (Victim)	Date Training Received
[X] New Miner (U.B.)	1974	[ ] Hazard Training (U.G.)	
[ ] New Miner (Sur.)		[ ] Hazard Training (Sur.)	
[ ] Newly Employed Experienced (U.G.)			
[ ] Newly Employed Experienced (Sur.)			
[X] Annual Refresher (U.G.)	1981		
[ ] Annual Refresher (Sur.)			

Task Training Specify Type:

Section III

Company Training Program Completed:

Training	OJT/Formal	Instructor	Date Completed

Section IV

DID VICTIM HAVE TRAINING SPECIFICALLY RELATED TO THE TASK BEING PERFORMED AT THE TIME OF THE ACCIDENT?

[X] YES [ ] NO WHEN? 1981

BY WHOM? Hollis Rogers HOW WAS TRAINING GIVEN? Training Center

Section V

RECOMMEND TRAINING PLAN EVALUATION BY EDUCATION & TRAINING OFFICE

[X] YES [ ] NO

APPENDIX A

NAME: CHARLES R. MYERS

Section I (Coal Only)

MSHA and/or State Certification and/or Qualification

Mine ID 40-00524

	Date Training Plan Approved 1979		Date Training Received
* [X] Certified Person (Underground)		[ ] Dust (Sampling)	
* [ ] Certified Person (Surface)		[ ] Dust (Calibration)	
* [X] Methane & Oxygen Deficiency Testing	1981	[ ] Noise	
* [ ] Electrical		* [ ] Impoundments	
* [ ] Energized Surface High Voltage		* [ ] Hoisting Engineer	

* Annual Retraining Required

Section II (Metal-Non-metal and Coal)
MSHA Training Programs Completed

Date of Hire 7-21-1975 Date Training Plan Approved 1979

Required Training (Victim)	Date Training Received	Required Training (Victim)	Date Training Received
[X] New Miner (U.B.)	1975	[ ] Hazard Training (U.G.)	
[ ] New Miner (Sur.)		[ ] Hazard Training (Sur.)	
[ ] Newly Employed Experienced (U.G.)			
[ ] Newly Employed Experienced (Sur.)			
[X] Annual Refresher (U.G.)	1981		
[ ] Annual Refresher (Sur.)			

Task Training Specify Type:

Section III

Company Training Program Completed:

Training	OJT/Formal	Instructor	Date Completed

Section IV

DID VICTIM HAVE TRAINING SPECIFICALLY RELATED TO THE TASK BEING PERFORMED AT THE TIME OF THE ACCIDENT?

[X] YES [ ] NO WHEN? 1981

BY WHOM? Charles Terpo - Hollis Rogers HOW WAS TRAINING GIVEN? At Mine Location - Training Center

Section V

RECOMMEND TRAINING PLAN EVALUATION BY EDUCATION & TRAINING OFFICE

[X] YES [ ] NO

APPENDIX A

NAME: GAYLON L. PARSON

Section I (Coal Only)

MSHA and/or State Certification and/or Qualification

Mine ID 40-00524

Date Training Plan Approved 1979

	Date Training Received		Date Training Received
* [X] Certified Person (Underground)		[ ] Dust (Sampling)	
* [ ] Certified Person (Surface)		[ ] Dust (Calibration)	
* [X] Methane & Oxygen Deficiency Testing	1981	[ ] Noise	
* [ ] Electrical		* [ ] Impoundments	
* [ ] Energized Surface High Voltage		* [ ] Hoisting Engineer	

* Annual Retraining Required

Section II (Metal-Non-metal and Coal)
MSHA Training Programs Completed

Date of Hire 7-21-1975

Date Training Plan Approved 1979

Required Training (Victim)	Date Training Received	Required Training (Victim)	Date Training Received
[X] New Miner (U.B.)	1975	[ ] Hazard Training (U.G.)	
[ ] New Miner (Sur.)		[ ] Hazard Training (Sur.)	
[ ] Newly Employed Experienced (U.G.)			
[ ] Newly Employed Experienced (Sur.)			
[X] Annual Refresher (U.G.)	1981		
[ ] Annual Refresher (Sur.)			

Task Training Specify Type:

Section III

Company Training Program Completed:

Training	OJT/Formal	Instructor	Date Completed

Section IV

DID VICTIM HAVE TRAINING SPECIFICALLY RELATED TO THE TASK BEING PERFORMED AT THE TIME OF THE ACCIDENT?

[X] YES [ ] NO WHEN? 1981

BY WHOM? Charles Terpo - Hollis Rogers HOW WAS TRAINING GIVEN? At Mine Location - Training Center

Section V

RECOMMEND TRAINING PLAN EVALUATION BY EDUCATION & TRAINING OFFICE

[X] YES [ ] NO

APPENDIX A

NAME: DARRELL G. ROLLINS

Section I (Coal Only)

MSHA and/or State Certification and/or Qualification

Mine ID 40-00524

	Date Training Plan Approved 1979		Date Training Received
* [X] Certified Person (Underground)		[ ] Dust (Sampling)	
* [ ] Certified Person (Surface)		[ ] Dust (Calibration)	
* [X] Methane & Oxygen Deficiency Testing	1981	[ ] Noise	
* [ ] Electrical		* [ ] Impoundments	
* [ ] Energized Surface High Voltage		* [ ] Hoisting Engineer	

* Annual Retraining Required

Section II (Metal-Non-metal and Coal)
MSHA Training Programs Completed

Date of Hire 4-17-1978 Date Training Plan Approved 1979

Required Training (Victim)	Date Training Received	[ ] Required Training (Victim)	Date Training Received
[X] New Miner (U.B.)		[ ] Hazard Training (U.G.)	
[ ] New Miner (Sur.)		[ ] Hazard Training (Sur.)	
[ ] Newly Employed Experienced (U.G.)			
[ ] Newly Employed Experienced (Sur.)		Task Training Specify Type:	
[X] Annual Refresher (U.G.)	1981		
[ ] Annual Refresher (Sur.)			

Section III

Company Training Program Completed:

Training	OJT/Formal	Instructor	Date Completed

Section IV

DID VICTIM HAVE TRAINING SPECIFICALLY RELATED TO THE TASK BEING PERFORMED AT THE TIME OF THE ACCIDENT?

[X] YES [ ] NO WHEN? 1981

BY WHOM? Charles Terpo - Hollis Rogers HOW WAS TRAINING GIVEN? At Mine Location - Training Center

Section V

RECOMMEND TRAINING PLAN EVALUATION BY EDUCATION & TRAINING OFFICE

[X] YES [ ] NO

APPENDIX A

NAME: DANNY J. COOLEY

Section I (Coal Only)

MSHA and/or State Certification and/or Qualification

Mine ID 40-00524

Date Training Plan Approved 1979

	Date Training Received		Date Training Received
* [X] Certified Person (Underground)		[ ] Dust (Sampling)	
* [ ] Certified Person (Surface)		[ ] Dust (Calibration)	
* [ ] Methane & Oxygen Deficiency Testing		[ ] Noise	
* [ ] Electrical		* [ ] Impoundments	
* [ ] Energized Surface High Voltage		* [ ] Hoisting Engineer	

* Annual Retraining Required

Section II (Metal-Non-metal and Coal)
MSHA Training Programs Completed

Date of Hire 10-30-1972

Date Training Plan Approved 1979

Required Training (Victim)	Date Training Received	Required Training (Victim)	Date Training Received
[ ] New Miner (U.B.)		[ ] Hazard Training (U.G.)	
[ ] New Miner (Sur.)		[ ] Hazard Training (Sur.)	
[ ] Newly Employed Experienced (U.G.)			
[ ] Newly Employed Experienced (Sur.)			
[X] Annual Refresher (U.G.)	1981		
[ ] Annual Refresher (Sur.)			

Task Training
Specify Type:

Section III

Company Training Program Completed:

Training	OJT/Formal	Instructor	Date Completed

Section IV

DID VICTIM HAVE TRAINING SPECIFICALLY RELATED TO THE TASK BEING PERFORMED AT THE TIME OF THE ACCIDENT?

[X] YES [ ] NO WHEN? 1981

BY WHOM? Hollis Rogers HOW WAS TRAINING GIVEN? Training Center

Section V

RECOMMEND TRAINING PLAN EVALUATION BY EDUCATION & TRAINING OFFICE

[X] YES [ ] NO

APPENDIX A

NAME: HERBERT L. GRIMES

Section I (Coal Only)

MSHA and/or State Certification and/or Qualification Mine ID 40-00524

Date Training Plan Approved 1979

	Date Training Received		Date Training Received
* [X] Certified Person (Underground)		[ ] Dust (Sampling)	
* [ ] Certified Person (Surface)		[ ] Dust (Calibration)	
* [X] Methane & Oxygen Deficiency Testing	4-6-81	[ ] Noise	
* [ ] Electrical		* [ ] Impoundments	
* [ ] Energized Surface High Voltage		* [ ] Hoisting Engineer	

* Annual Retraining Required

Section II (Metal-Non-metal and Coal)
MSHA Training Programs Completed

Date of Hire 5-16-1977 Date Training Plan Approved 1979

Required Training (Victim)	Date Training Received	Required Training (Victim)	Date Training Received
[X] New Miner (U.B.)	1977	[ ] Hazard Training (U.G.)	
[ ] New Miner (Sur.)		[ ] Hazard Training (Sur.)	
[ ] Newly Employed Experienced (U.G.)			
[ ] Newly Employed Experienced (Sur.)			
[X] Annual Refresher (U.G.)	9-28-81		
[ ] Annual Refresher (Sur.)			

Task Training Specify Type:

Section III

Company Training Program Completed:

Training	OJT/Formal	Instructor	Date Completed

Section IV

DID VICTIM HAVE TRAINING SPECIFICALLY RELATED TO THE TASK BEING PERFORMED AT THE TIME OF THE ACCIDENT?

[X] YES [ ] NO WHEN? 1981

BY WHOM? Charles Terpo - Hollis Rogers HOW WAS TRAINING GIVEN? At Mine Location - Training Center

Section V

RECOMMEND TRAINING PLAN EVALUATION BY EDUCATION & TRAINING OFFICE

[X] YES [ ] NO

APPENDIX A

NAME: FRANKLIN E. WILBURN

Section I (Coal Only)

MSHA and/or State Certification and/or Qualification

Mine ID 40-00524

Date Training Plan Approved 1979

	Date Training Received		Date Training Received
* [X] Certified Person (Underground)	1975	[ ] Dust (Sampling)	
* [ ] Certified Person (Surface)		[ ] Dust (Calibration)	
* [ ] Methane & Oxygen Deficiency Testing		[ ] Noise	
* [ ] Electrical		* [ ] Impoundments	
* [ ] Energized Surface High Voltage		* [ ] Hoisting Engineer	

* Annual Retraining Required

Section II (Metal-Non-metal and Coal)
MSHA Training Programs Completed

Date of Hire 10-26-1975

Date Training Plan Approved 1979

Required Training (Victim)	Date Training Received	Required Training (Victim)	Date Training Received
[X] New Miner (U.B.)	1975	[ ] Hazard Training (U.G.)	
[ ] New Miner (Sur.)		[ ] Hazard Training (Sur.)	
[ ] Newly Employed Experienced (U.G.)			
[ ] Newly Employed Experienced (Sur.)			
[X] Annual Refresher (U.G.)	1981		
[ ] Annual Refresher (Sur.)			

Task Training
Specify Type:

Section III

Company Training Program Completed:

Training	OJT/Formal	Instructor	Date Completed

Section IV

DID VICTIM HAVE TRAINING SPECIFICALLY RELATED TO THE TASK BEING PERFORMED AT THE TIME OF THE ACCIDENT?

[X] **YES** [ ] **NO** **WHEN?** 1981

BY WHOM? Charles Terpo - Hollis Rogers **HOW WAS TRAINING GIVEN?** Otto Scarbourgh

At Mine Location - At Training Center

Section V

RECOMMEND TRAINING PLAN EVALUATION BY EDUCATION & TRAINING OFFICE

[X] **YES** [ ] **NO**

APPENDIX A

NAME: JACOB B. KILGORE

Section I (Coal Only)

MSHA and/or State Certification and/or Qualification Mine ID 40-00524

	Date Training Plan Approved 1979 / Date Training Received		Date Training Received
* [X] Certified Person (Underground)		[ ] Dust (Sampling)	
* [ ] Certified Person (Surface)		[ ] Dust (Calibration)	
* [X] Methane & Oxygen Deficiency Testing	1981	[ ] Noise	
* [ ] Electrical		* [ ] Impoundments	
* [ ] Energized Surface High Voltage		* [ ] Hoisting Engineer	

* Annual Retraining Required

Section II (Metal-Non-metal and Coal)
MSHA Training Programs Completed

Date of Hire 5-16-1977 Date Training Plan Approved 1979

Required Training (Victim)	Date Training Received	Required Training (Victim)	Date Training Received
[X] New Miner (U.B.)	1977	[ ] Hazard Training (U.G.)	
[ ] New Miner (Sur.)		[ ] Hazard Training (Sur.)	
[ ] Newly Employed Experienced (U.G.)			
[ ] Newly Employed Experienced (Sur.)			
[X] Annual Refresher (U.G.)	1981		
[ ] Annual Refresher (Sur.)			

Task Training Specify Type:

Section III

Company Training Program Completed:

Training	OJT/Formal	Instructor	Date Completed

Section IV

DID VICTIM HAVE TRAINING SPECIFICALLY RELATED TO THE TASK BEING PERFORMED AT THE TIME OF THE ACCIDENT?

[X] YES [ ] NO WHEN? 1981

BY WHOM? Charles Terpo - Hollis Rogers HOW WAS TRAINING GIVEN? At Mine Location - Training Center

Section V

RECOMMEND TRAINING PLAN EVALUATION BY EDUCATION & TRAINING OFFICE

[X] YES [ ] NO

APPENDIX A

NAME: CLARENCE E. FRENCH

Section I (Coal Only)

MSHA and/or State Certification and/or Qualification

Mine ID 40-00524

	Date Training Plan Approved 1979		Date Training Received
* [X] Certified Person (Underground)		[ ] Dust (Sampling)	
* [ ] Certified Person (Surface)		[ ] Dust (Calibration)	
* [X] Methane & Oxygen Deficiency Testing	4-6-81	[ ] Noise	
* [X] Electrical	1981	* [ ] Impoundments	
* [ ] Energized Surface High Voltage		* [ ] Hoisting Engineer	

* Annual Retraining Required

Section II (Metal-Non-metal and Coal)
MSHA Training Programs Completed

Date of Hire 6-5-1973 Date Training Plan Approved 1979

Required Training (Victim)	Date Training Received	[ ] Required Training (Victim)	Date Training Received
[ ] New Miner (U.B.)		[ ] Hazard Training (U.G.)	
[ ] New Miner (Sur.)		[ ] Hazard Training (Sur.)	
[ ] Newly Employed Experienced (U.G.)			
[ ] Newly Employed Experienced (Sur.)			
[X] Annual Refresher (U.G.)	1981		
[ ] Annual Refresher (Sur.)			

Task Training Specify Type:

Section III

Company Training Program Completed:

Training	OJT/Formal	Instructor	Date Completed

Section IV

DID VICTIM HAVE TRAINING SPECIFICALLY RELATED TO THE TASK BEING PERFORMED AT THE TIME OF THE ACCIDENT?

[X] YES [ ] NO WHEN? 1981

BY WHOM? Hollis Rogers HOW WAS TRAINING GIVEN? Training Center

Section V

RECOMMEND TRAINING PLAN EVALUATION BY EDUCATION & TRAINING OFFICE

[X] YES [ ] NO

APPENDIX A

NAME: JACKIE O. TATE

Section I (Coal Only)

MSHA and/or State Certification and/or Qualification

Mine ID 40-00524

	Date Training Plan Approved 1979		Date Training Received
* [X] Certified Person (Underground)		[ ] Dust (Sampling)	
* [ ] Certified Person (Surface)		[ ] Dust (Calibration)	
* [X] Methane & Oxygen Deficiency Testing	1981	[ ] Noise	
* [ ] Electrical		* [ ] Impoundments	
* [ ] Energized Surface High Voltage		* [ ] Hoisting Engineer	

* Annual Retraining Required

Section II (Metal-Non-metal and Coal)
MSHA Training Programs Completed

Date of Hire 6-27-1973 Date Training Plan Approved 1979

Required Training (Victim)	Date Training Received	[ ] Required Training (Victim)	Date Training Received
[ ] New Miner (U.B.)		[ ] Hazard Training (U.G.)	
[ ] New Miner (Sur.)		[ ] Hazard Training (Sur.)	
[ ] Newly Employed Experienced (U.G.)			
[ ] Newly Employed Experienced (Sur.)			
[X] Annual Refresher (U.G.)	1981		
[ ] Annual Refresher (Sur.)			

Task Training Specify Type:

Section III

Company Training Program Completed:

Training	OJT/Formal	Instructor	Date Completed

Section IV

DID VICTIM HAVE TRAINING SPECIFICALLY RELATED TO THE TASK BEING PERFORMED AT THE TIME OF THE ACCIDENT?

[X] YES [ ] NO WHEN? 1981

BY WHOM? Charles Terpo - Hollis Rogers HOW WAS TRAINING GIVEN? At Mine Location & Training Center

Section V

RECOMMEND TRAINING PLAN EVALUATION BY EDUCATION & TRAINING OFFICE

[X] YES [ ] NO

APPENDIX A

NAME: ROY L. WHITE, JR.

Section I (Coal Only)

MSHA and/or State Certification and/or Qualification

Mine ID 40-00524

Date Training Plan Approved 1979

	Date Training Received		Date Training Received
* [X] Certified Person (Underground)		[X] Dust (Sampling)	10-1980
* [X] Certified Person (Surface)		[ ] Dust (Calibration)	
* [X] Methane & Oxygen Deficiency Testing	4-6-1981 5-6-1981	[ ] Noise	
* [ ] Electrical		* [ ] Impoundments	
* [ ] Energized Surface High Voltage		* [ ] Hoisting Engineer	

* Annual Retraining Required

Section II (Metal-Non-metal and Coal)
MSHA Training Programs Completed

Date of Hire 7-30-1974

Date Training Plan Approved 1979

Required Training (Victim)	Date Training Received	[ ] Required Training (Victim)	Date Training Received
[ ] New Miner (U.B.)		[ ] Hazard Training (U.G.)	
[ ] New Miner (Sur.)		[ ] Hazard Training (Sur.)	
[ ] Newly Employed Experienced (U.G.)			
[ ] Newly Employed Experienced (Sur.)			
[X] Annual Refresher (U.G.)	9-29-81		
[ ] Annual Refresher (Sur.)			

Task Training Specify Type:

Section III

Company Training Program Completed:

Training	OJT/Formal	Instructor	Date Completed

Section IV

DID VICTIM HAVE TRAINING SPECIFICALLY RELATED TO THE TASK BEING PERFORMED AT THE TIME OF THE ACCIDENT?

[X] **YES** [ ] **NO** **WHEN?** 4-6-1981 5-6-1981

BY WHOM? Charles Terpo **HOW WAS TRAINING GIVEN?**

At Mine Location - Training Center (Hollis Rogers)

Section V

RECOMMEND TRAINING PLAN EVALUATION BY EDUCATION & TRAINING OFFICE

[X] **YES** [ ] **NO**

APPENDIX A

NAME: JIMMY WAYNE ROGERS

Section I (Coal Only)

MSHA and/or State Certification and/or Qualification

Mine ID 40-00524

	Date Training Plan Approved 1979		Date Training Received
* [X] Certified Person (Underground)		[ ] Dust (Sampling)	
* [X] Certified Person (Surface)		[ ] Dust (Calibration)	
* [X] Methane & Oxygen Deficiency Testing	3-31-81 5-3-81	[ ] Noise	
* [ ] Electrical		* [ ] Impoundments	
* [ ] Energized Surface High Voltage		* [ ] Hoisting Engineer	

* Annual Retraining Required

Section II (Metal-Non-metal and Coal)
MSHA Training Programs Completed

Date of Hire 8-1-1963 Date Training Plan Approved 1979

Required Training (Victim)	Date Training Received	Required Training (Victim)	Date Training Received
[ ] New Miner (U.B.)		[ ] Hazard Training (U.G.)	
[ ] New Miner (Sur.)		[ ] Hazard Training (Sur.)	
[ ] Newly Employed Experienced (U.G.)			
[ ] Newly Employed Experienced (Sur.)		Task Training Specify Type:	
[X] Annual Refresher (U.G.)	8-1-1980		
[X] Annual Refresher (Sur.)	8-1-1980		

Section III

Company Training Program Completed:

Training	OJT/Formal	Instructor	Date Completed

Section IV

DID VICTIM HAVE TRAINING SPECIFICALLY RELATED TO THE TASK BEING PERFORMED AT THE TIME OF THE ACCIDENT?

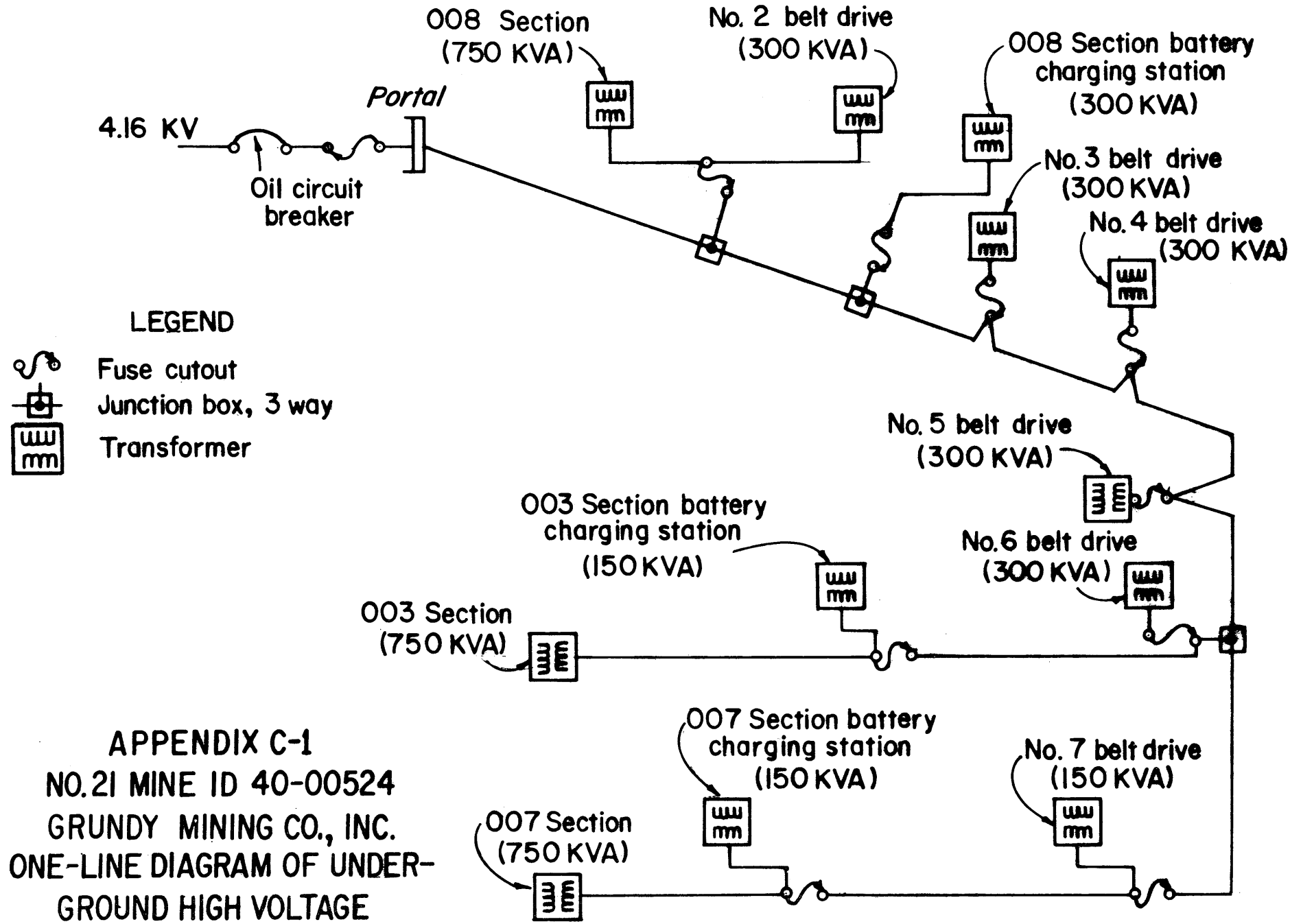
[X] YES [ ] NO WHEN? 3-31-81 5-5-81

BY WHOM? Charles Terpo HOW WAS TRAINING GIVEN? At Mine Location And Training Center (Hollis Rogers)

Section V

RECOMMEND TRAINING PLAN EVALUATION BY EDUCATION & TRAINING OFFICE

[X] YES [ ] NO



APPENDIX C-1
NO. 21 MINE ID 40-00524
GRUNDY MINING CO., INC.
ONE-LINE DIAGRAM OF UNDER-
GROUND HIGH VOLTAGE
DISTRIBUTION SYSTEM

APPENDIX C-2. DISCUSSION AND EVALUATION OF POTENTIAL ELECTRICAL IGNITION SOURCES

Introduction

During the investigation, all electric equipment and cables located in the explosion area (i.e., inby the No. 44 crosscut in the 003 section) or which supplied power to electric equipment or cables in the explosion area were carefully tested and examined by MSHA electrical personnel for any evidence that the equipment or cables provided the ignition source for the explosion. These tests and examinations were conducted by George M. Fesak, Electrical Engineer, Billy G. Donaldson, Coal Mine Inspector (Electrical), William E. Herren, Coal Mine Inspector (Electrical) and Kirby G. Smith, Coal Mine Inspector (Electrical) with the assistance of officials and employees of Grundy Mining Company, Incorporated. Several violations of Title 30, Code of Federal Regulations, Part 75, electrical regulations were observed during the electrical part of the investigation. However, it was determined that none of these violations was related to the cause of the explosion. Consequently, citations for these violations were issued as part of a separate spot inspection.

Electric Equipment and Cables Present in the Explosion Area

The investigation revealed that, at the time of the explosion, the following electric equipment and cables were present in the explosion area:

High-Voltage Cable and Splice Box: (1) Approximately 1,200 feet of No. 4/0 AWG, 15KV, 3-conductor, type MP-GC mine power cable supplying 4,160-Volt, 3-phase power to the section power center; (2) One shop-made, high-voltage splice box installed in the high-voltage cable supplying 4,160-Volt, 3-phase power to the section power center;

Section Power Center: One Control Products, Incorporated, 750 kVA/150KW, 4,160-Volt AC/480-Volt AC/300-Volt DC, combination power center, Serial No. 10757-5, supplying 480-Volt, 3-phase power and 300-Volt, direct current power to electric equipment on the 003 section;

Trailing Cables: (1) Approximately 500 feet of No. 2/0 AWG, 2,000-Volt, 3-conductor, type G-GC portable power cable supplying 480-Volt, 3-phase power to the cutting machine in the 003 section; (2) Approximately 250 feet of No. 2 AWG, 600/2000-Volt, 3-conductor, type G-GC portable power cable and approximately 150 feet of No. 4 AWG, 2000-Volt, 3-conductor, type G-GC portable power cable supplying 480-Volt, 3-phase power to the belt feeder-breaker in the 003 section; (3) Approximately 400 feet of No. 4 AWG, 600/2000-Volt, 3-conductor, type G-GC portable power cable supplying 480-Volt, 3-phase power to the face drill in the 003 section; (4) Approximately 500 feet of No. 2 AWG, 2000-Volt, 3-conductor, type G portable power cable supplying 480-Volt, 3-phase power to the loading machine in the 003 section; (5) Approximately 400 feet of No. 6 AWG, 2000-Volt, 3-conductor, type G-GC portable power cable supplying 480-Volt, 3-phase power to the roof-bolting machine in the 003 section; (6) Approximately 500 feet of No. 3 AWG, 2000-Volt,

2-conductor, type W portable power cable supplying 300-Volt, direct-current power to the standard-drive shuttle car in the 003 section; (7) Approximately 500 feet of No. 3 AWG, 2000-Volt, 2-conductor, type W portable power cable supplying 300-Volt, direct-current power to the off-standard-drive shuttle car in the 003 section;

Low-Voltage Equipment Connected to the Section Power Center: (1) One Joy Manufacturing Company permissible cutting machine, Type 16RB-3BH, Approval No. 2F-1713A-16, Serial No. 17778; (2) One W.R. Stamler Corporation nonpermissible belt feeder-breaker, Model No. BF-17B, Serial No. 11252, with a B and B Electrical Manufacturing Company nonpermissible belt sequence switch, Model No. RA9M, Serial No. 209; (3) One Schroeder Brothers Corporation permissible face drill, Model No. CDB-2000A-19, Approval No. 2G-2646A-6, Serial No. 268; (4) One Joy Manufacturing Company permissible loading machine, Type 14BU10-11AH, Approval No. 2F-1532A-105, Serial No. 9600; (5) One Lee-Norse Company permissible roof-bolting machine, Model No. TD1-24-2-1E, Approval No. 2G-2645A-1, Serial No. 21255; (6) One Joy Manufacturing Company permissible, standard-drive shuttle car, Model No. 18SC7PE-4, Approval No. 2G-2499-2, Serial No. ET13895; (7) One Joy Manufacturing Company permissible, off-standard-drive shuttle car, Model No. 18SC7PXE-4, Approval No. 2G-2499-2, Serial No. ET13896;

Low-Voltage Equipment and Cables Not Connected to a Source of Supply: (1) One Lincoln Electric Company nonpermissible electric welding machine, Model No. 250-250, Serial No. AC-484159, with associated supply and welding cables; (2) One Ferro Mac nonpermissible battery charger, Type LA, Model No. J1-1419-24-48571C7, with associated supply and charging cables;

Battery-Powered, Rubber-Tired Equipment: (1) One S and S Corporation permissible scoop, Model No. 482, Approval No. 2G-3056, Serial No. 482-1286; (2) One Long-Airdox Company permissible personnel carrier, Model No. 3B-372, Approval No. 2G-2549-4, Serial No. 3B-229;

Belt Control and Fire Detection Cables and Equipment: (1) One 2-pole, 30-ampere, nonpermissible disconnect switch used as a remote start/stop switch for the 003 section belt conveyor; the disconnect switch was connected into the 120-Volt remote control circuit for the 003 section belt conveyor controller by means of a No. 12 AWG, 3-conductor, type SO cord; (2) Approximately 840 feet of Pyott-Boone, Incorporated, Model K250-2 fire detection cable installed along the 003 section belt conveyor and connected into the mine belt conveyor fire detection system; the control unit for the system was a Pyott-Boone, Incorporated, permissible belt fire detection system control unit, Model 211, Approval No. 9B-36, Serial No. 344, located in the surface guardhouse;

Mine Telephone, Cap Lamps and Methane Detector: (1) One Mine Safety Appliances Company "Pager III" permissible mine telephone, Approval No. 9B-85, Serial No. 02763; connected into the mine telephone system with a No. 22 AWG, 4-conductor, PVC-jacketed telephone cable; (2) Four Koehler Manufacturing Company permissible cap lamps, Model No. 5100, Approval No. 6D-30; (3) Nine Koehler Manufacturing Company permissible cap lamps, Model No. 5200, Approval No. 6D-36; (4) One Mine Safety Appliances Company "Methane Spotter" permissible methane detector, Approval No. 8C-24, Serial No. 36400. The mine telephone, cap lamps and methane

detector were sent to the MSHA Approval and Certification Center for testing and evaluation. A summary of the results of the testing and evaluation of these items is contained in Appendix C-3.

The location of each unit of electric equipment listed above, with the exception of the electric cap lamps and the methane detector, is shown on the map of the 003 section which is contained in Appendix B-2.

Tests and Examinations of Electric Equipment and Cables

A detailed description and analysis of the results of the tests and examinations conducted by MSHA electrical personnel follows.

High-Voltage Cable and Equipment

The investigation revealed that the entire underground high-voltage system (including the high-voltage cable in the 003 section, the high-voltage splice box located near the intersection of No. 2 entry and No. 57 crosscut in the 003 section, and the section power center located in No. 2 entry between Nos. 60 and 61 crosscuts in the 003 section) was energized at the time of the explosion. The investigation also revealed that the high-voltage circuit breaker in the surface substation tripped at or about the time the explosion occurred. Consequently, extensive testing was conducted by MSHA electrical personnel to determine why the high-voltage circuit breaker tripped and if a fault in the high-voltage cable or equipment in the 003 section could have initiated the explosion.

Ladue Bouldin, Electrician Foreman, was on the surface of the mine when the high-voltage circuit breaker tripped at approximately 12:00 noon. Shortly thereafter, Bouldin learned of the explosion from Jerry Fultz who called Bouldin from the mine telephone located in the 007 section. Bouldin proceeded to the surface substation, determined that the high-voltage circuit breaker had tripped, opened the high-voltage fuse cutouts on the load side of the circuit breaker, and locked the substation gate. Bouldin noticed that there were no flags showing on the two phase-overcurrent relays associated with the circuit breaker, indicating that an overcurrent condition (i.e., short circuit or overload) had not caused the circuit breaker to trip. The ground-fault relay associated with the circuit breaker was not of a type that displays a flag when it operates.

Tests and examinations conducted during the investigation revealed that none of the fuses installed in the high-voltage system from the surface substation to the 003 section power center had cleared, further indicating that a short circuit in the high-voltage system had not occurred.

The high-voltage cable inby crosscut No. 44 in the 003 section was carefully examined for evidence of a short circuit or a ground fault. No such evidence was found. Furthermore, tests conducted during the investigation revealed that the cable was free from short circuits and ground faults.

The high-voltage splice box located near the intersection of No. 2 entry and No. 57 crosscut had not been damaged by the explosion. Tests conducted during the investigation revealed that the splice box was free from short circuits

and ground faults.

The section power center, located in No. 2 entry between Nos. 60 and 61 crosscuts, had been damaged by the explosion; however, most of the damage was confined to the inby (low-voltage) end of the power center. The outby cover on the power center had not been bolted down and was blown off by the explosion forces. Otherwise, the outby (high-voltage) end of the power center did not appear to have been damaged. The manually-operated, high-voltage, load-break switch in the power center was in the closed position. Tests conducted during the investigation revealed that none of the high-voltage fuses in the power center had cleared and that the high-voltage portion of the power center was free from short circuits and ground faults.

MSHA electrical personnel found no evidence to indicate that a short circuit or ground fault occurred in the high-voltage cable or equipment located in the explosion area either immediately before or as a result of the explosion. Consequently, MSHA electrical personnel conclude that the high-voltage cable and equipment did not provide the ignition source for the explosion.

The ground check relay associated with the high-voltage circuit breaker in the surface substation was not of a type that displays a flag when it operates. However, tests and examinations conducted during the investigation revealed that the ground check circuit was intact and operational from the surface substation to the 003 section power center at the time the explosion occurred. The power center was equipped with two interlock switches installed under the outby (high-voltage end) cover of the power center. These switches were wired in series with the ground check conductor so as to open the ground check circuit when the cover is removed. Based on an analysis of this evidence, MSHA electrical personnel conclude that the high-voltage circuit breaker in the surface substation tripped because the explosion forces blew the outby cover off of the 003 section power center, thereby interrupting the high-voltage ground check circuit at the power center.

Section Power Center

The section power center was located in No. 2 entry between Nos. 60 and 61 crosscuts in the 003 section approximately 190 feet outby the face of No. 2 entry. The manually-operated, high-voltage, load-break switch in the power center was in the closed position at the time of the explosion. Consequently, the power center was energized at the time of the explosion.

The trailing cables for the cutting machine, belt feeder-breaker, face drill, loading machine, roof-bolting machine, standard-drive shuttle car and off-standard-drive shuttle car were connected to the power center at the time of the explosion. The trailing cable for the battery charger for the personnel carrier was not connected to the power center at the time of the explosion.

The circuit breaker protecting the 480-volt, 3-phase trailing cable for the cutting machine was equipped with a shunt trip device. Because the circuit breaker was found in the closed position during the investigation, it can be concluded that the circuit breaker was closed at the time of the explosion.

The circuit breakers protecting the 480-volt, 3-phase trailing cables for the belt feeder-breaker, face drill and loading machine and the circuit breakers protecting the 300-volt, direct-current trailing cables for the two shuttle cars were each equipped with the same type of undervoltage release device. This type of undervoltage release device causes the circuit breaker to go to the tripped position when control power is lost while the circuit breaker is in the closed position but does not cause the circuit breaker to go to the tripped position when control power is lost while the circuit breaker is in the open position. Because all five of the circuit breakers were found in the tripped position during the investigation, it can be concluded that none of the circuit breakers was in the open position at the time of the explosion. However, it could not be definitely determined if the circuit breakers were manually placed in the tripped position prior to the explosion or if the circuit breakers were in the closed position at the time of the explosion and tripped as a result of the loss of control voltage when the high-voltage circuit breaker tripped. Because it is unusual for a miner to manually place a circuit breaker in the tripped position, MSHA electrical personnel believe that the five circuit breakers were closed at the time of the explosion.

The circuit breaker protecting the 480-volt, 3-phase trailing cable for the roof-bolting machine and the circuit breaker protecting the 300-volt, direct-current rectifier bridge in the power center were each equipped with another type of undervoltage release device. This type of undervoltage release device causes the circuit breaker to go to the tripped position when control power is lost while the circuit breaker is in either the open or closed position. Consequently, the position of the two circuit breakers at the time of the explosion could not be definitely determined. Nevertheless, it is likely that the two circuit breakers were closed at the time of the explosion.

The section power center was not of a permissible design and consequently contained numerous devices (e.g., switches, relays and circuit breakers) that, in normal operation (either manual or automatic), would create arcing containing sufficient energy to ignite an explosive methane-air mixture. However, the locations of the victims in the 003 section indicate that none of the victims was in a position to manually operate any of these devices. In addition, extensive tests and examinations of the trailing cables that were connected to the power center did not reveal any faults capable of causing automatic operation of any of these devices. (See following section.) Tests and examinations of the power center revealed that no short circuits or ground faults were present within the low-voltage portion of the power center. The direction of the explosion forces and the manner in which the explosion moved the power center lid indicate that the explosion was intitiated inby the power center. Finally, MSHA electrical personnel found no evidence to indicate that the low-voltage portion of the 003 section power center provided the ignition source for the explosion.

Trailing Cables

The investigation revealed that the trailing cable supplying 480-volt, 3-phase power to the cutting machine was energized at the time of the explosion. It could not be definitely determined if the trailing cables supplying 480-volt,

3-phase power to the belt feeder-breaker, face drill, loading machine and roof-bolting machine and the trailing cables supplying 300-volt, direct-current power to the two shuttle cars were energized at the time of the explosion. (See preceding section). Because it is likely that all seven trailing cables were energized at the time of the explosion, MSHA electrical personnel carefully examined and tested each trailing cable to determine if a fault in one of the cables could have initiated the explosion.

MSHA electrical personnel visually examined the entire length of each trailing cable in the 003 section for evidence of short circuits and ground faults. In all, 48 splices, 21 cable repairs and 11 damaged places in the trailing cables in the 003 section were examined. At several locations, plastic tape which had been applied over damaged places or damaged permanent splice boots in the cables had been melted or burned by the heat of the explosion. At these locations, the underlying cable or splice was carefully examined for evidence that a fault had occurred. At several other locations, cable repairs and permanent splices were opened to determine if a fault had occurred.

Evidence of a fault was observed at only one location in all of the trailing cables in the 003 section. The evidence of a fault was observed in a taped cable repair in the 2-conductor, type-W trailing cable supplying 300-volt, direct-current power to the off-standard-drive shuttle car in the section. The cable repair was located near the intersection of No. 3 entry and No. 61 crosscut approximately 100 feet (cable length) from the shuttle car. A small pinhole was found in the plastic tape that had been applied over the damaged place in the cable. The tape was carefully removed, revealing that the cable jacket and the insulation (black) on the ungrounded power conductor had been damaged. One strand of the conductor had pierced the tape and had apparently faulted to the grounded frame of the shuttle or some other grounded object, melting the tip of the conductor strand. There was no evidence of damage to the insulation (white) on the grounded power conductor and no other evidence of a fault at this location. Because the fault was observed approximately 100 feet (cable length) from the shuttle car, MSHA electrical personnel conclude that the fault had occurred prior to the explosion.

In addition to the visual examinations, the insulation resistance from line-to-line and line-to-ground on the five 480-volt, 3-phase trailing cables in the section and the resistance from line-to-line on the two 300-volt, direct-current trailing cables in the section was tested. With the exception of the trailing cable supplying 480-volt, 3-phase power to the face drill, all of the trailing cables in the section tested free from line-to-line and, where applicable, line-to-ground faults. The insulation resistance tests of the face drill cable revealed line-to-line and line-to-ground leakage, indicating a possible fault. The leakage was localized to a permanent splice in the face drill trailing cable near the intersection of No. 3 entry and No. 62 crosscut. The splice was carefully opened and closely examined. There was no evidence (e.g., carbon and burned or damaged insulation) of a line-to-line or line-to-ground fault in the splice. However, the inside of the splice was saturated with water which explains the leakage readings that were obtained during the insulation resistance tests.

In summary, MSHA electrical personnel found no evidence to indicate that any of the trailing cables in the 003 section provided the ignition source for the explosion.

Low-Voltage Equipment Connected to the Section Power Center

At the time of the explosion, seven units of electric equipment were connected to the 003 section power center. MSHA electrical personnel carefully tested and examined each unit of equipment to determine if it could have provided the source of ignition for the explosion. The results of the tests and examinations are as follows:

Intermachine Arcing. No two units of electric equipment were located in close proximity to each other at the time of the explosion. Consequently, MSHA electrical personnel conclude that arcing between the frames of two units of electric equipment did not provide the ignition source for the explosion.

Cutting Machine. At the time of the explosion, the cutting machine was located in No. 62 crosscut between Nos. 1 and 2 entries in the 003 section. The investigation revealed the following information regarding the status of the cutting machine at the time the explosion occurred:

1. The cutting machine trailing cable was energized;

2. The cutting motor circuit breaker was in the closed position, the cutting motor direction switch was in the forward position and the cutting motor control switch was in the off position;

3. The pump motor circuit breaker was in the closed position;

4. The pump motor control switch was mechanically linked to the panic bar. The position of the switch at the time of the explosion was not definitely determined due to the design of the linkage; and

5. The light switch was in the on position.

Consequently, MSHA electrical personnel conclude that the cutting machine was parked with the trailing cable, methane monitor and lighting system energized at the time of the explosion. It could not be definitely determined if the pump motor was running at the time of the explosion.

The locations of the victims in the 003 section indicate that at least one victim may have been in a position to operate the controls on the cutting machine when the explosion occurred. Tests and examinations conducted during the investigation revealed that the cutting machine trailing cable, cable reel, the onboard cable from the cable reel to the line side of the pump motor circuit breaker and the onboard cable from the line side of the pump motor circuit breaker to the line side of the cutter motor circuit breaker were free from short circuits and ground faults.

The cutting machine was of a permissible type but was not maintained in permissible condition. The following permissibility deficiencies were observed:

1. The main controller enclosure had been modified without approval as required by 30 CFR 18.81. The enclosure had been modified by welding a plate over the original pump motor cable entrance gland stuffing box and cutting a new hole and welding another stuffing box in the enclosure. Three unjacketed, single-conductor pump motor power conductors entered the stuffing box which was not provided with packing, bushing or packing gland nut;

2. The methane monitor fuse in the main controller enclosure was bridged out with a strand of wire; and

3. The pump motor and cutting motor cable entrance glands were not provided with sufficient packing allowing less than 1/8-inch clearance between the packing gland nuts and the enclosure housings.

The permissibility deficiency listed in No. 1 above, compromised the explosion-proof integrity of the main controller enclosure. MSHA electrical personnel believe that if the cutting machine controls had been manually operated or if the methane monitor had operated and automatically deenergized the lighting circuits and/or pump motor power circuits, sufficient electrical energy would have been released to ignite an explosive methane-air mixture within the enclosure. Moreover, it is possible that an internal methane ignition would propagate outside of the enclosure through the improper pump motor power conductor entrance. However, MSHA electrical personnel carefully examined the inside of the main controller enclosure and found no evidence to indicate that an internal methane-air ignition had occurred.

Regarding the permissibility deficiency listed in No. 2 above, MSHA electrical personnel tested the methane monitoring system and found that the system was free from short circuits and ground faults. Furthermore, MSHA electrical personnel found no evidence to indicate that the methane monitoring system provided the ignition source for the explosion.

Regarding the permissibility deficiency listed in No. 3 above, MSHA electrical personnel determined that the cutting motor was not energized at the time of the explosion. Furthermore, MSHA electrical personnel found no evicence to indicate that the pump motor or the cutting motor provided the ignition source for the explosion.

MSHA electrical personnel also carefully examined the inside of the cutting motor circuit breaker enclosure and found no evidence to indicate that an internal methane-air ignition had occurred.

The cutting machine was equipped with a General Monitors, Incorporated, Model 420, permissible methane monitor, MSHA Certification No. 32A-6/MS. The methane monitor was energized at the time the explosion occurred. The methane monitor was properly connected into the control circuitry of the cutting machine so as to deenergize all electric circuits and components of the machine with the exception of the trailing cable, the cable reel, the onboard power cables from the

cable reel to the line side of the pump motor and cutter motor contactors, and the methane monitor itself when the methane monitor was activated by means of the test switch or an excessive concentration of methane.

The methane monitor was tested by MSHA investigators with a known test mixture of 2.5 percent methane in air. With no test mixture applied to the sensor assembly, the methane monitor meter indicated 0.0 percent methane. When the test mixture was applied to the sensor assembly with the dust cover in place, the methane monitor meter reading increased from 0.0 percent methane to a maximum of 1.25 percent methane. When the meter reading reached 1.0 percent methane, the yellow warning light came on.

When the test mixture was applied to the sensor assembly with the dust cover removed, the methane monitor meter reading increased from 0.0 percent methane to a maximum of 2.0 percent methane. When the meter reading reached 1.0 percent methane, the yellow warning light came on. When the meter reading reached 2.0 percent, the red warning light came on and the methane monitor shut the machine down. These tests indicate that the methane monitor was not properly calibrated and that the dust cover on the sensor assembly was practically obstructed by dust.

In summary, MSHA electrical personnel found no evidence to indicate that the cutting machine provided the ignition source for the explosion.

Belt Feeder-Breaker. At the time of the explosion, the nonpermissible belt feeder-breaker was located in No. 3 entry between Nos. 58 and 59 crosscuts in the 003 section. The belt feeder-breaker was connected to a nonpermissible belt sequence switch which had been installed on the 003 section belt conveyor just outby the tail roller. The investigation revealed the following information regarding the status of the belt feeder-breaker at the time of the explosion:

1. The 003 section belt conveyor was running;

2. The circuit breaker in the belt feeder-breaker controller was in the closed position;

3. The emergency-stop control switch was in the closed position;

4. The conveyor/off/tram control switch was in the "conveyor" position;

5. The manually operated conveyor start control switch had been removed and the control circuitry had been modified so that the operation of the belt feeder-breaker conveyor was controlled automatically by the belt sequence switch installed on the 003 section belt conveyor;

6. The conveyor direction switch was in the "forward" position; and

7. The belt feeder-breaker conveyor was empty.

Based on this information, and the assumption that the belt feeder-breaker trailing cable was energized, MSHA electrical personnel conclude that, at the time of the explosion, the belt feeder-breaker was operating with the conveyor and breaker motors running.

The belt feeder-breaker was not of a permissible design and consequently contained several components (e.g., circuit breaker, contactors, relays and switches) that, in normal operation (either manual or automatic), would create arcing containing sufficient energy to ignite an explosive methane-air mixture. However, the locations of the victims in the 003 section indicate that none of the victims was in a position to manually operate any of the controls on the belt feeder-breaker at the time the explosion occurred. Several of the arcing components would operate automatically if the 003 section belt conveyor were to stop. However, there was no evidence to indicate that the 003 section belt conveyor stopped until the high-voltage circuit breaker tripped just after the explosion occurred. An examination of the electric components of the belt feeder-breaker did not reveal any evidence of a short circuit or ground fault which could have been the ignition source for the explosion. Finally, an evaluation of the flame travel (See Appendix D-1) indicates that the explosion was initiated inby the location of the belt feeder-breaker.

Face Drill. At the time of the explosion, the permissible face drill was located in the face of No. 62 crosscut to the right of No. 3 entry in the 003 section. The investigation revealed the following information regarding the status of the face drill at the time of the explosion:

1. The circuit breaker in the face drill controller was in the open position;

2. The face drill control switch was in the off position;

3. The light switch was in the on position; and

4. The face drill was in position to drill holes in the coal face.

Based on this informaton and the assumption that the face drill trailing cable was energized, MSHA electrical personnel conclude that, at the time of the explosion, the face drill was parked with all of its circuits and components deenergized with the exception of the trailing cable, the cable reel and the onboard cable from the cable reel to the line side of the circuit breaker in the controller.

The locations of the victims in the 003 section indicate that none of the victims was in a position to operate any of the controls on the face drill at the time the explosion occurred. Tests and examinations conducted during the investigation revealed that the face drill trailing cable, cable reel and onboard cable from the cable reel to the controller were free from short circuits and ground faults. Several permissibility deficiencies were found on the face drill; however, none of these deficiencies involved a component of the machine that was energized at the time the explosion occurred. The insides of the explosion-proof cable reel and controller enclosures were carefully examined

by MSHA electrical personnel. Neither enclosure showed any evidence of an internal methane-air ignition.

In summary, MSHA electrical personnel found no evidence to indicate that the face drill provided the ignition source for the explosion.

Loading Machine. At the time of the explosion, the permissible loading machine was located near the face of No. 2 entry in the 003 section. The investigation revealed the following information regarding the status of the loading machine at the time of the explosion:

1. The circuit breaker in the operator's control station enclosure was in the open position;

2. The main control switch which was mechanically linked to the panic bar was in the run position;

3. The head and conveyor motor control switch was in the off position;

4. The tram motor control switches were in the off (center) position;

5. The light switch was in the on position; and

6. The conveyor was loaded with coal and the loading head was down and empty.

Based on this information, and the assumption that the loading machine trailing cable was energized, MSHA electrical personnel conclude that, at the time of the explosion, the loading machine was parked with only its trailing cable and the line side of the main circuit breaker energized.

The locations of the victims in the 003 section indicate that none of the victims was in a position to operate any of the controls on the loading machine at the time the explosion occurred. Tests and examinations conducted during the investigation revealed that the loading machine trailing cable was free from short circuits and ground faults.

The loading machine was of a permissible type but was not maintained in permissible condition. Three permissibility deficiencies were found on the loading machine; however, none of these deficiencies involved a component of the machine that was energized at the time of the explosion. The insides of the operator's control station enclosure and the main controller enclosure were carefully examined by MSHA electrical personnel. Neither enclosure showed any evidence of an internal methane-air ignition.

The loading machine was equipped with a General Monitors, Incorporated, Model 420, permissible methane monitor, MSHA Certification No. 32A-6/MS. The methane monitor, however, was not energized at the time the explosion occurred. The methane monitor was properly connected into the control circuitry of the loading machine so as to deenergize all electric circuits and components of the machine with the exception of the trailing cable, the power cable between the load side

of the main circuit breaker and the main controller, and the methane monitor itself when the methane monitor was activated by means of the test switch or an excessive concentration of methane.

The methane monitor was tested by MSHA electrical personnel with a known test mixture of 2.5 percent methane in air. With no test mixture applied to the sensor assembly, the methane monitor meter indicated 0.0 percent methane. When the test mixture was applied to the sensor assembly with the dust cover in place, the methane monitor meter reading increased from 0.0 percent methane to a maximum of 1.9 percent methane. When the meter reading reached 1.0 percent methane, the yellow warning light came on. When the meter reading reached 1.9 percent, the red warning light came on and the methane monitor shut the loading machine down.

When the test mixture was applied to the sensor assembly with the dust cover removed, the methane monitor meter reading increased from 0.0 percent methane to a maximum of 2.5 percent methane. When the meter reading reached 1.0 percent methane, the yellow warning light came on. When the meter reading reached 1.9 percent methane, the red warning light came on and the methane monitor shut the machine down. These tests indicate that the methane monitor was properly calibrated but that the dust cover on the sensor assembly was significantly obstructed by dust. It was not possible, however, for MSHA electrical personnel to determine how much of this dust was deposited during the explosion.

In summary, MSHA electrical personnel found no evidence to indicate that the loading machine provided the ignition source for the explosion.

Roof-Bolting Machine. At the time of the explosion, the permissible roof-bolting machine was located approximately 25 feet from the face of No. 63 crosscut to the right of No. 3 entry in the 003 section. The investigation revealed the following information regarding the status of the machine at the time of the explosion:

1. The main circuit breaker in the roof-bolting machine controller was in the closed position;

2. The spring-loaded, push-button start switch in the main control station was in the open position;

3. The spring-loaded, push-button stop switch in the main control station was in the closed position;

4. The spring-loaded, remote emergency stop switch was in the closed position;

5. The light switch was in the on position; and

6. The roof-bolting machine was not in position to install roof bolts.

It was not possible for MSHA electrical personnel to definitely determine which circuits and components, if any, of the roof-bolting machine were energized at the time of the explosion due to the undervoltage release mechanism in the

circuit breaker protecting the machine's trailing cable and the type of spring-loaded start/stop and emergency stop controls on the machine. Consequently, MSHA electrical personnel carefully tested and examined the roof-bolting machine in its entirety to determine if it could have provided the ignition source for the explosion.

The locations of the victims in the 003 section indicate that none of the victims was in a position to operate any of the controls on the machine at the time the explosion occurred. Tests and examinations conducted during the investigation revealed no evidence of short circuits or ground faults in the roof-bolting machine trailing cable, cable reel or controller enclosure. Several permissibility deficiencies were found on the roof-bolting machine; however, none of these deficiencies rendered the machine capable of igniting an explosive methane-air mixture. The inside of the controller enclosure on the roof-bolting machine was carefully examined by MSHA electrical personnel. No evidence that a methane-air ignition had occurred within the enclosure was found.

In summary, MSHA electrical personnel found no evidence to indicate that the roof-bolting machine provided the ignition source for the explosion.

Standard-Drive Shuttle Car. At the time of the explosion, the standard-drive shuttle car was located in No. 61 crosscut between Nos. 1 and 2 entries in the 003 section. The investigation revealed the following information regarding the status of the standard-drive shuttle car at the time the explosion occurred:

1. The spring-loaded, emergency-stop switch (panic bar switch) was in the closed position;

2. The pump motor control switch was in the run position;

3. The conveyor motor direction switch was in the forward position and the conveyor motor control switch was in the off position. The conveyor was empty;

4. The headlight switch was in the on position for the inby direction;

5. The self-centering tram control switch was in the off (center) position;

6. The manually operated parking brake was not set; and

7. It could not be determined if the automatic parking brake was set.

It was not possible for MSHA electrical personnel to definitely determine which circuits and components of the shuttle car, if any, were energized at the time of the explosion due to the undervoltage release mechanism in the circuit breaker protecting the shuttle car's trailing cable and the type of spring-loaded, emergency-stop switch on the shuttle car. Consequently, MSHA electrical personnel carefully tested and examined the shuttle car in its entirety to determine

if it could have provided the ignition source for the explosion.

The locations of the victims in the 003 section indicate that none of the victims was in a position to operate any of the controls on the shuttle car at the time the explosion occurred. Tests and examinations conducted during the investigation revealed that the shuttle car trailing cable, cable reel and power cable from the cable reel to the off-side controller enclosure were free from short circuits.

The shuttle car was of a permissible type but was not maintained in permissible condition. The following permissibility deficiencies were observed:

1. The hose conduit was not secured to the entrance gland nut on the emergency-stop switch;

2. The conveyor motor cable entrance gland nut on the operator's side controller was not secured;

3. The tram switch control cable entrance gland was not properly packed and the gland nut was tightened down flush with the gland and was not secured;

4. The hose conduit was not secured to the entrance gland nut on the operator's side traction motor; and

5. Both cable entrance glands for the pump motor junction box were improperly packed with less than 1/8-inch clearance between the gland nut and the enclosure. The entrance gland nuts were not secured.

The permissibility deficiencies listed in Nos. 1 and 2 did not render the shuttle car capable of igniting an explosive methane-air mixture. The shuttle car components on which the permissibility deficiencies listed in Nos. 3, 4 and 5 were found were carefully examined by MSHA electrical personnel. No evidence that any of these components provided the ignition source for the explosion was found. In addition, the insides of the operator's side controller enclosure, the off-side controller enclosure, and the resistor assembly enclosure were carefully examined by MSHA investigators. None of the enclosures showed any evidence of an internal methane-air ignition.

In summary, MSHA electrical personnel found no evidence to indicate that the standard-drive shuttle car provided the ignition source for the explosion.

Off-Standard-Drive Shuttle Car. At the time of the explosion, the off-standard-drive shuttle car was located in No. 2 entry near the intersection of No. 2 entry with No. 62 crosscut in the 003 section. The investigation revealed the following information regarding the status of the off-standard-drive shuttle car at the time the explosion occurred:

1. The spring-loaded, emergency-stop switch (panic bar switch) was in the closed position;

2. The pump motor control switch was in the run position;

3. The conveyor motor direction switch was in the forward position and the conveyor motor control switch was in the off position. The conveyor was empty;

4. The self-centering tram control switch was in the off (center) position;

5. The headlight switch was in the on position for the inby direction;

6. The manually operated parking brake was not set; and

7. It could not be determined if the automatic parking brake was set.

It was not possible for MSHA electrical personnel to definitely determine which circuits and components of the shuttle car, if any, were energized at the time of the explosion due to the undervoltage release mechanism in the circuit breaker protecting the shuttle car's trailing cable and the type of spring-loaded, emergency-stop switch on the shuttle car. Consequently, MSHA electrical personnel carefully tested and examined the shuttle car in its entirety to determine if it could have provided the ignition source for the explosion.

The locations of the victims in the 003 section indicate that one or more victims may have been in a position to operate the controls on the shuttle car at the time the explosion occurred. Tests and examinations conducted during the investigation revealed that the shuttle car trailing cable, cable reel and power cable from the cable reel to the off-side controller were free from short circuits.

The shuttle car was of a permissible type but was not maintained in permissible condition. The following permissibility deficiencies were observed:

1. The gland nut for the entrance gland on the resistor assembly enclosure was not secured; and

2. The gland nut for the entrance gland on the operator's side traction motor was not secured.

Neither of these deficiencies rendered the shuttle car capable of igniting an explosive methane-air mixture. In addition, the insides of the operator's side controller enclosure, the off-side controller enclosure, the resistor assembly enclosure and the tram control switch enclosure were carefully examined by MSHA electrical personnel. None of the enclosures showed any evidence of an internal methane-air ignition.

In summary, MSHA electrical personnel found no evidence to indicate that the off-standard-drive shuttle car provided the ignition source for the explosion.

Low-Voltage Equipment and Cables Not Connected to a Source of Supply

Welding Machine. A nonpermissible electric welding machine was found near the intersection of the No. 0 entry and the No. 57 crosscut in the 003 section. At the time of the explosion, the welding machine was not connected to a source of supply and both the supply cable and the welding cables were coiled up on the machine. Consequently, the welding machine could not have provided the ignition source for the explosion.

Battery Charger. A nonpermissible battery charger was found adjacent to the section power center in the No. 2 entry between Nos. 60 and 61 crosscuts in the 003 section. The battery charger had been provided on the section to charge the batteries on the section personnel carrier. At the time of the explosion; however, the supply cable was not connected to the power center and the charging cable was not connected to the battery on the personnel carrier in the section. Consequently, the battery charger could not have provided the ignition source for the explosion.

Battery-Powered, Rubber-Tired Equipment

The results of the examinations of the battery-powered, rubber-tired equipment located inby the No. 44 crosscut in the 003 section at the time of the explosion are as follows:

Battery-Powered Scoop. At the time of the explosion, the battery-powered scoop was located in the No. 62 crosscut between Nos. 0 and 1 entries. The investigation revealed the following information regarding the status of the battery-powered scoop at the time of the explosion:

1. The batteries were connected to the machine;
2. The main circuit breaker was closed;
3. The master control switch was in the off position;
4. The hydraulic brake solenoid was deenergized and the automatic parking brake was set;
5. The tram control switch was in the off position;
6. The light switch was in the off position; and
7. The scoop bucket was in the down position.

Consequently, MSHA electrical personnel conclude that, at the time of the explosion, the battery-powered scoop was parked with the pump motor, tram motor, and headlights deenergized and with the automatic parking brake set.

The locations of the victims in the 003 section indicate that none of the victims was in a position to operate any of the controls on the battery-powered scoop at the time the explosion occurred.

The battery-powered scoop was of a permissible type but was not maintained in permissible condition. The following permissibility deficiences were observed:

1. The battery cable plugs were not padlocked to the receptacles;

2. The left-rear headlight was not secured to the machine frame and the lens ring was not secured in place;

3. The right-rear headlight lens was loose in the lens ring, and the lens ring was not secured in place. The fixture was loose from the machine and was not grounded by a conductor in the power cable; and

4. The right-front headlight lens ring was not secured in place.

Although the battery cable plugs were not padlocked to the receptacles, the plugs were properly mated with the receptacles and the threaded rings on the plugs were screwed onto the receptacles. The other permissibility deficiencies (Nos. 2, 3 and 4) did not involve components of the battery-powered scoop that were energized at the time of the explosion.

The battery tray covers, battery cell terminals and battery connectors were carefully examined for evidence of electrical arcing or short circuits. No evidence of arcing or short circuits was found on any of these components.

The battery-powered scoop was not used as a coal-loading machine and therefore was not equipped with a methane monitor.

In summary, MSHA electrical personnel found no evidence to indicate that the battery-powered scoop provided the ignition source source for the explosion.

Battery-Powered Personnel Carrier. At the time of the explosion, the battery-powered personnel carrier was located in No. 62 crosscut between Nos. 2 and 3 entries. The investigation revealed the following information regarding the status of the personnel carrier at the time the explosion occurred:

1. The battery was connected to the machine;

2. The direction and headlight control switch was in the off position; and

3. The spring-loaded, tram control switch was in the off position.

Consequently, MSHA electrical personnel conclude that, at the time of the explosion, the battery-powered personnel carrier was parked with the headlights and tram motor deenergized.

The locations of the victims in the 003 section indicate that at least one victim could have been in a position to operate the controls on the personnel carrier at the time the explosion occurred. However, the position of the

direction and headlight control switch indicates that no one was attempting to operate the personnel carrier at the time the explosion occurred.

The battery-powered personnel carrier was of a permissible type but was not maintained in permissible condition. The following permissibility deficiencies were observed:

1. A bushing was not provided in the controller tram motor cable stuffing box to prevent the packing material from being forced out between the stuffing box and cable jacket when the packing gland nut was tightened. The cable would slip freely through the entrance gland and stuffing box;

2. The protective hose conduit had slipped back, exposing approximately three inches of the tram motor cable adjacent to the entrance gland;

3. The direction and headlight control switch enclosure had an opening in excess of 0.004 inches (plane flange joint). All 6 bolts securing the enclosure cover were loose and a 0.012-inch feeler gauge could be inserted between the cover and the enclosure flange;

4. The front headlight was loose, with the mounting brackets broken off;

5. The battery tray cover was not secured in place; and

6. The insulating material was missing from one-half of the inside of the battery tray cover.

The observed deficiences compromised the explosion-proof integrity of the main controller enclosure and the direction and headlight control switch enclosure. Consequently, MSHA electrical personnel carefully examined the insides of both enclosures. No evidence of an internal methane-air ignition was found in either enclosure. The battery tray cover and the battery cell terminals were carefully examined for evidence of electrical arcing or short circuits. No evidence of arcing or short circuits was found on these components. The other permissibility deficiencies (Nos. 2 and 4) did not involve components of the personnel carrier that were energized at the time of the explosion.

In summary, MSHA electrical personnel found no evidence to indicate that the battery-powered personnel carrier provided the ignition source for the explosion.

Belt Control and Fire Detection Cables and Equipment

Belt Control Switch. A manually-operated, nonpermissible, 2-pole, 30-ampere disconnect switch was found mounted on a crib approximately 3 feet outby the tail roller for the 003 section belt conveyor in No. 3 entry between Nos. 58 and 59 crosscuts in the 003 section. The disconnect switch was used as a remote stop switch for the 003 section belt conveyor and was connected into the 120-volt ac remote control circuit for the 003 section belt conveyor controller by means of a No. 12 AWG, 3-conductor, type SO cord. The disconnect switch was of a nonpermissible type and, in the opinion of MSHA electrical

personnel, was capable of initiating an explosion if the switch contacts were opened in an explosive methane-air atmosphere. However, the switch contacts were found in the "closed" position and the locations of the victims in the 003 section indicate that none of the victims was in a position to operate the switch at the time of the explosion. An examination of the disconnect switch did not reveal any evidence of a short circuit or ground fault. Finally, an evaluation of the flame travel (See Appendix D-1) indicates that the explosion was initiated inby the location of the switch. Consequently, MSHA electrical personnel conclude that the disconnect switch did not provide the ignition source for the explosion.

Fire Detection Cable. A 2-conductor fire detection cable was installed along the 003 section belt conveyor (No. 3 entry) from the belt drive to within approximately 10 feet of the belt feeder-breaker in the 003 section. The fire detection cable was connected into the mine belt fire detection system. The control unit for the system was approved by MSHA as permissible and was located in the surface guardhouse. As originally approved, the entire belt fire detection system (including the heat detection cables connected to the control unit) was incapable of releasing sufficient electrical energy to ignite an explosive methane-air mixture. MSHA electrical personnel observed no evidence to indicate that the system had not been maintained as approved. Consequently, MSHA electrical personnel conclude that the fire detection cable did not provide the ignition source for the explosion.

APPENDIX C-3

I. INTRODUCTION

On December 22, 1981, fifteen items of battery operated mine equipment were delivered to the Approval and Certification Center for evaluation by the Center's technical personnel. The equipment was recovered from Grundy Mining Company's No. 21 Mine following an apparent underground explosion that occurred there on December 8, 1981. The objective of this investigation was to determine if any of the recovered equipment may have been responsible for or related to the mine explosion. The MSHA investigators assigned to this project were Robert A. Bradburn, Electrical Engineer, Timothy Wetzel, Electrical Engineering Technician, and Edward Vensko, Electrical Engineering Technician, all of the Intrinsic Safety and Instrumentation Branch (Division of Electrical Safety, Approval and Certification Center). This is a report of their conclusions.

II. IDENTIFICATION OF MINE:

COMPANY: Grundy Mining Company
MINE: No. 21 Mine
SECTION: 003
LOCATION: Whitwell, Marion County, Tennessee
MINE ID: 40-00524
DATE OF EXPLOSION: December 8, 1981

III. EQUIPMENT EVALUATED:

The equipment that was evaluated in this investigation is listed in Table 1 and includes the following:

1. Nine (9) cap lamps, A&CC assigned Exhibit Nos. 1, 6, 7, 8, 10, 11, 12, 13, and 14.
   MSHA Approval No. 6D-36.
   Date of Approval: June 28, 1967.
   Manufacturer: Koehler Manufacturing Company
   Marlborough, MA 01752

2. Four (4) cap lamps, A&CC assigned Exhibit Nos. 3, 4, 5, & 9.
   MSHA Approval No. 6D-30.
   Date of Approval: November 19, 1958.
   Manufacturer: Koehler Manufacturing Company
   Marlborough, MA 01752

3. One (1) methane detector, "Mine Spotter", A&CC assigned Exhibit No. 2.
   MSHA Approval No. 8C-24.
   Date of Approval: June 29, 1970.
   Manufacturer: Mine Safety Appliances Company
   Pittsburgh, PA

4. One (1) Mine Paging Telephone, A&CC assigned Exhibit No. 15.
MSHA Approval No. 9B-25.
Date of Approval: November 29, 1977.
Manufacturer: Mine Safety Appliances Company
Pittsburgh, PA

VIII. CONCLUSIONS:

1. All of the evaluated equipment was approved by MSHA and had valid approval labels.

2. All of the equipment was built in accordance with applicable approval drawings and specifications on file at the Approval and Certification Center.

3. The evaluated methane detector appeared to have been intentionally altered by cutting off a protective guard that fitted over the methane sensing component.

4. The evaluated mine page phone may have been intentionally altered by detaching a cable entry grommet.

5. Except for the two apparent alterations, all of the observed discrepancies and defects were believed to have been unintentional and most were attributable to that which can be expected under conditions of normal usage.

6. None of the discrepancies, defects, or apparent alterations, uncovered in the inspections, introduced impending electrical safety hazards.

7. None of the equipment was capable of causing an explosion of methane gas or coal dust under normal and reasonably-assumed abnormal conditions.

8. Two items of evaluated equipment - a cap lamp (Exhibit No. 6) and the mine page phone - had the appearance of having been exposed to heat or flame.

9. In the condition that it was delivered to the Approval and Certification Center, the tested methane detector was incapable of detecting methane gas.

10. Upon restoring the battery in the methane detector to a fully charged condition, the instrument responded to the presence of methane gas but was out of calibration since the indications were higher than the actual concentrations of the test gases.

11. Upon recalibrating the methane detector, in accordance with manufacturer's instructions, the instrument readings deviated from calibrated methane samples by no more than 0.1 percent and were all within the accuracy requirements of Title 30 of the Code of Federal Regulations, Part 22.

APPENDIX C-3

EQUIPMENT FROM GRUNDY MINING COMPANY MINE DISASTER
MINE NO. 21, SECTION 003, WHITWELL, MARION COUNTY, TENNESEE, MINE ID 40-00542
DATE OF DISASTER: DECEMBER 8,1981
DATE EQUIPMENT RECEIVED: DECEMBER 22,1981

TABLE I

**EXHIBIT NUMBER	TYPE EQUIPMENT	TAG NO.	RECOVERED FROM	APPROVAL NUMBER	MANUFACTURER	SERIAL NUMBER	*PHYSICAL CONDITION	REMARKS
1	Cap Lamp	2	J. Tate	6D-36	Koehler	-	Good	
2	Methane Spotter	2	J. Tate	8C-24	MSA	36400	Good	
3	Cap Lamp	-	J. W. Rogers	6D-30	Koehler	-	Good	No electrolyte in battery
4	Cap Lamp	99	C. Myers	6D-30	Koehler	-	Good	
5	Cap Lamp	3	R. White	6D-30	Koehler	-	Good	
6	Cap Lamp	116	G. Parson	6D-36	Koehler	-	Good	
7	Cap Lamp	66	D. Rollins	6D-36	Koehler	-	Good	No electrolyte in battery
8	Cap Lamp	77	D. Cooley	6D-36	Koehler	-	Good	No electrolyte in battery
9	Cap Lamp	11	H. Nolan	6D-30	Koehler	-	Good	No electrolyte in battery
10	Cap Lamp	100	F. Wilburn	6D-36	Koehler	-	Good	No electrolyte in battery
11	Cap Lamp	113	C. French	6D-36	Koehler	-	Good	
12	Cap Lamp	51	L. Cooley	6D-36	Koehler	-	Good	No electrolyte in battery
13	Cap Lamp	81	L. Grimes	6D-36	Koehler	-	Good	No electrolyte in battery
14	Cap Lamp	41	J. B. Kilgore	6D-36	Koehler	-	Good	No electrolyte in battery
15	Telephone	22	Section 003	9B-85	MSA	02763	Fair	Bare wires on outby condutors, wires fused to receiver cord, and cable entry retainer for receiver cord not installed at the enclosure

* Preliminary Inspection
** A&CC assigned Exhibit Number.

Origin of Gases

Based on information from the Mine Examiner's records and interrogation of miners who had been in Section 003 prior to the explosion, methane was flowing from the gob area into active workings. It was indicated that the face of No. 2 entry was blasted and holed through into the gob prior to the explosion. The opening had an estimated area of about 28 square feet. With defective bleeders and generally ineffective ventilation in the face area, methane migrated into the intake and return aircourses as surmised and projected (Appendix D-1). With increased methane liberation from the gob after the blast, it is logical that miners would retreat into the intake outby the face until gas was diluted and carried into the returns. Miners congregating in the vicinity of the No. 62 crosscut between Nos. 1 and 3 entries would not have experienced any discomfort in atmospheres containing even as much as 10 percent methane with an oxygen level of about 19 percent.

Potential Ignition Sources

Following a careful review and evaluation of possible ignition sources, four probables are listed. A cigarette lighter in No. 1 entry near No. 62 crosscut, an energized cutting machine with a nonpermissible electrical enclosure in No. 62 crosscut between Nos. 1 and 2 entries, two flame safety lamps in No. 2 entry at Nos. 62 and 63 crosscuts, respectively, and the belt feeder in No. 3 entry near No. 58 crosscut.

It was reported that the belt and feeder were operating at the time of the explosion. It should be noted that the feeder is located near the outby extremeties of the projected gas zone (Appendix D-1). Initiation of the gas by the belt feeder is ruled out because of the extensive flame travel outby the feeder in the belt entry; initiation at the feeder would have resulted in flame traveling inby. It has been established that burning rates and pressures within a gas body are reduced as the point of initiation is moved from the face or origin to its outer limits.

Past experience has shown that under certain conditions, attempts to relight a flame safety lamp in an explosive methane/air concentration may initiate an explosion. An ignition is likely to occur when parts of the lamp are damaged, such as the gaskets or the gauzes. Of the two lamps recovered in the explosion area, the only damage observed was a broken expansion ring on one of the lamps. As noted in Appendix D-3, in six trials with each lamp, methane was ignited within the globe in each instance, but did not propagate through the gauzes to ignite methane outside the lamp.

During the post-explosion inspection of the cutting machine, it was reported that an electrical enclosure did not meet the permissibility requirements. However, an examination of the enclosure interior indicated no evidence that methane had been ignited, that is, the interior was clean with no evidence of soot or other products of combustion.

An open flame from the cigarette lighter appears to be the initiating source of the explosion. From the locations of the victims in the vicinity of the lighter within the projected gas body and the unburned condition of the curtain over the cutting machine, it is evident the flame propagated inby into the richer methane/air mixtures toward the face of No. 1 entry and into No. 63 crosscut. From this point, the flame moved outby in all entries and crosscuts with greater flame and forces moving outby in the No. 3 belt entry.

APPENDIX D-2

Mechanism of a Gas Explosion

As reported by the 003 Section Foreman on the day shift of December 8, 1981, 5 percent methane was detected in the 003 section prior to the explosion. More methane was liberated into active workings after blasting a larger opening into the gob area at the face of No. 2 entry. As stated previously, methane migrated into the intakes and returns and is projected as the shaded area (Appendix D-1). When a body of methane is ignited, it may expand to over five times its original volume and the flame may extend to as much as five times the original zone length. The extent of flame travel is also shown in Appendix D-1.

Formation of Coke

Although coking was evident in rockdust samples collected in the explosion zone as determined by laboratory tests, large deposits were observed at only several locations throughout this zone. Coke is formed by a slow moving explosion flame and remains in place when not accompanied by severe turbulence from dynamic forces and subsequent higher pressures. The presence of coke in rockdust samples collected outside the flame zone may have resulted from changes in direction of wind currents that occur during explosions. Light coke deposits can readily be transported by these wind movements.

Development of Forces

From post-explosion observations, the lack of violence in the 003 section suggests a weak 6 to 7 percent methane/air explosion. There was a very minor involvement of coal dust in the belt entry and returns where mixed concentrations of coal dust and methane were present [1]. Research [2] has shown that to propagate a coal dust explosion, the speed of the air mass preceding the flame from burning and expanding gases must exceed 150 ft/sec (100 mph). Further, the study showed that air and flame speeds are equal for speeds up to 400 ft/sec (270 mph). Above 400 ft/sec, flame speeds exceed the air speeds.

As noted, forces developed by the explosion were minimal. This fact is evident from the general lack of physical mutilation of the casualties as well as damage to mine equipment. Relatively weak overpressures of 1 to 2 lbs/in^2 are sufficient to destroy dry-stacked and plastered stoppings as well as dislodgement of the top conveyor belt. From the direction that the stoppings were blown, it is evident that the major forces traveled outby in the belt entry. The inby segment of the belt was in the return airway which would suggest a possible increase in the extent of the original methane body. This extension would account for the greater forces in the belt entry. A high level of coke in the belt entry dust samples verifies slow flame travel with only minor participation of coal dust. In review, major flame and forces moved outby in the belt entry with static pressures damaging the belt and destroying stoppings on both the intake and return sides. Calculations [2] indicate that for static overpressures of 1 to 2 lbs/in^2, flame and wind velocities range from about 50 to 100 ft/sec, respectively.

1/ Nagy, John, et. al. "Explosibility of Coal Dust in an Atmosphere Containing a Low Percentage of Methane," USBM RI 5815.

2/ Richmond, J. K., et. al. "A Physical Description of Coal Mine Explosions," 15th International Symposium of Combustion, The Combustion Institute.

APPENDIX D-3

U. S. Department of Labor
Mine Safety and Health Administration
4800 Forbes Avenue
Pittsburgh, Pennsylvania 15213
Bruceton Safety Technology Center

February 10, 1982

MEMORANDUM FOR: EDWARD M. KAWENSKI

FROM: STEVEN J. LUZIK Steven J. Luzik
Supervisory Chemical Engineer
Industrial Safety Division

SUBJECT: Gallery testing of flame safety lamps from the Grundy No. 21 Mine

Gallery tests were conducted on two Koehler flame safety lamps taken from the 003 Section in the Grundy No. 21 Mine, Jasper, Tennessee, during post-explosion investigations. The purpose of these tests was to determine if relighting the lamps in a flammable methane/air atmosphere could cause an external ignition to take place. The two lamps were identified as follows:

1. KOEHLER FLAME SAFETY LAMP NO. 209 (EXHIBIT 31)(v-16; 12/15/81; 2:43pm) The expansion ring was broken on this lamp. A 1-1/2-inch section was missing from the ring. No other damage was noted upon examination of the lamp.

2. KOEHLER FLAME SAFETY LAMP NO. 209 (EXHIBIT 32) No other identification appeared on the lamp. The lamp appeared to be fairly new. No damage was noted upon inspection of the lamp.

The lamps were placed in the 420 ft^3 partition of the Gas Ignition Chamber. A plastic curtain was taped in place on the west end to confine the gas body. The relighter of each lamp was removed and replaced by an electric match. The base of the lamp was screwed on only tight enough to engage the magnetic interlock. DUXSEAL^R was used to seal the area around the match both inside and outside the lamp. The partition was filled with the desired percentages of methane and the matches were remotely ignited using a dry-cell battery. Video tapes were made for each trial. Test results were as follows:

Test	Lamp	% CH_4	Results
1	31	8.0	Internal ignition-no external ignition
2	31	8.0	ditto
3	31	9.0	ditto
4	31	9.1	ditto
5	31	9.5	ditto
6	31	9.8	ditto
7	32	8.0	ditto
8	32	8.0	ditto
9	32	9.0	ditto
10	32	9.1	ditto
11	32	9.5	ditto
12	32	9.8	ditto

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A total of twelve tests were performed on the two lamps as tabulated. In no instance was there evidence of any external flaming or glowing from the bonnet or lower gauzes. No external ignitions were observed and all ignitions were confined to the internal combustion chamber of the lamps.

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UNITED STATES DEPARTMENT OF LABOR
Mine Safety and Health Administration

BRUCETON SAFETY TECHNOLOGY CENTER
Industrial Safety Division

LABORATORY REPORT OF MATERIAL(S) SUBMITTED FOR TESTING

Sample Number:	ISB 186
Material:	Denim Jacket
Manufacturer: (or where sample was taken)	Near 003 Section, Mine #21 Grundy Coal Company Jasper, Tennessee
Submitted By:	P. H. Jackson, Trial Attorney Office of the Solicitor Ballston Towers #3 Arlington, Virginia 22203
Description:	Self-explanatory
Laboratory Tests:	FISHER-JOHNS MELTING POINT (Inside lining) Average melting temperature = 543.5°F
Tests Performed by:	Patricia A. Starmack, Engineering Aid
Report Prepared by:	Patricia A. Starmack, Engineering Aid

ISB Sample No.: 186
Date: 1/5/82

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UNITED STATES DEPARTMENT OF LABOR
Mine Safety and Health Administration

BRUCETON SAFETY TECHNOLOGY CENTER
Industrial Safety Division

LABORATORY REPORT OF MATERIAL(S) SUBMITTED FOR TESTING

Sample Number:	ISB 187
Material:	Miner's cap
Manufacturer: (or where sample was taken)	003 Section, Mine #21 Grundy Coal Company Jasper, Tennessee Manufacturer: Mine Safety Appliance Company
Submitted By:	Page Jackson, Trial Attorney Office of the Solicitor Ballston Towers #3 Arlington, Virginia
Description:	Cap taken from one of the victims at the mine.
Laboratory Tests:	FISHER-JOHNS MELTING POINT Average melting temperature = 413.5°F
Tests Performed by:	Patricia A. Starmack, Engineering Aid
Report Prepared by:	Patricia A. Starmack, Engineering Aid

ISB Sample No.: 187
Date: 1/5/82

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UNITED STATES DEPARTMENT OF LABOR
Mine Safety and Health Administration

BRUCETON SAFETY TECHNOLOGY CENTER
Industrial Safety Division

LABORATORY REPORT OF MATERIAL(S) SUBMITTED FOR TESTING

Sample Number:	ISB 188
Material:	Brattice Curtain
Manufacturer: (or where sample was taken)	Manufacturer Unknown Grundy Coal Company Mine #21 Jasper, Tennessee
Submitted By:	Edward M. Kawenski Chief, Industrial Safety Division Bruceton Safety Technology Center Bruceton, Pennsylvania
Description:	Sample of line brattice identical to that used at the 003 Section.
Laboratory Tests:	FISHER-JOHNS MELTING POINT Average melting temperature = 377°F
Tests Performed by:	Patricia A. Starmack, Engineering Aid
Report Prepared by:	Patricia A. Starmack, Engineering Aid

ISB Sample No.: 188
Date: 1/5/82

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UNITED STATES DEPARTMENT OF LABOR
Mine Safety and Health Administration

BRUCETON SAFETY TECHNOLOGY CENTER
Industrial Safety Division

LABORATORY REPORT OF MATERIAL(S) SUBMITTED FOR TESTING

Sample Number: ISB 189

Material: Coal Dust

Manufacturer: (or where sample was taken) Grundy Coal Company
#21 Mine
Jasper, Tennessee

Submitted By: Edward M. Kawenski
Chief, Industrial Safety Division
Bruceton, Pennsylvania

Description: Channel coal sample; front left rib at face of #2 Entry.
Sampled 12/15/81, 3:15 p.m.

Laboratory Tests: PROXIMATE ANALYSIS OF COAL AND COKE - ASTM D3172-73

Test Results*:

Sample No.	% Moisture	% Volatile Matter**	% Fixed Carbon	% Ash
ISB 189	1.9	27.8	61.6	8.7

*Average results from three runs.
**Modified method utilized.

Tests Performed by: Thomas M. Fircak, Electronics Technician
Patricia A. Starmack, Engineering Aid

Report Prepared by: Steven J. Luzik, Supv. Chemical Engineer

ISB Sample No.: 189
Date: 01/05/82

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UNITED STATES DEPARTMENT OF LABOR
Mine Safety and Health Administration

BRUCETON SAFETY TECHNOLOGY CENTER
Industrial Safety Division

LABORATORY REPORT OF MATERIAL(S) SUBMITTED FOR TESTING

Sample Number: ISB 193

Material: Coal Dust

Manufacturer: (or where sample was taken) Grundy Coal Company
#21 Mine
Jasper, Tennessee

Submitted By: Edward M. Kawenski
Chief, Industrial Safety Division
Bruceton, Penna.

Description: Sample taken from rear end deck pan; rubber-tired personnel carrier; Sample #3; 12/15/81 at 3:40 p.m.

Laboratory Tests: PROXIMATE ANALYSIS OF COAL AND COKE - ASTM D3172-73

Test Results:

Sample	% Moisture	% Volatile Matter*	% Fixed Carbon	% Ash
ISB 193	1.3	17.1	57.7	23.9

*Modified method utilized for volatile matter determination.

Tests Performed by: Thomas M. Fircak, Electronics Technician
Anthony Sendek, Mining Engineer

Comments: High ash and low volatile matter content indicate that some coking has taken place and/or sample is contaminated with rock dust or other incombustible (see Lab Report on ISB 189 for proximate analysis of virgin coal sample).

Prepared by: Steven J. Luzik, Supv. Chemical Engineer

ISB Sample No.: 193
Date: 1/5/82

APPENDIX E ANALYSES OF MINE DUST SAMPLES COLLECTED AFTER EXPLOSION

6 RIGHT

ENTRY NUMBER

Sample No.	oo Intake	o Intake	A Intake	B Intake/Track	C Intake/Belt	D Return	E Return
1-1	NS	NS	55.5 N	61.5 N	93.5 N	44.0 N	NS
1-2	NS	NS	55.0 N	66.0 N	95.0 N	65.0 N	NS
1-3	NS	NS	60.0 N	60.0 N	92.5 N	NS	40.0 N
1-3X	NS	NS	NS	NS	NS	NS	NS
1-4	NS	NS	60.0 N	70.0 N	90.0 N	55.5 N	55.0 N
1-5	NS	NS	35.0 N	40.5 N	73.0 N	56.0 N	62.0 N
1-6	NS	45.0 N	52.5 N	72.5 N	76.5 N	71.5 N	NS
1-6X	NS	NS	55.5 N	63.5 N	72.5 N	53.5 N	NS
1-7	NS	NS	41.5 N	74.5 N	89.0 N	63.0 N	NS
1-8	46.5 N	37.5 N	36.0 N	70.0 N	92.0 N	NS	80.0 N
1-9	NS	NS	49.5 N	70.5 N	100.0 N	NS	NS
1-9X	NS	NS	36.5 N	36.0 N	NS	NS	NS
1-10	NS	NS	49.0 N	30.0 N	64.5 N	NS	NS
1-11	NS	NS	35.0 N	25.0 N	65.0 N	40.0 N	NS
1-12	NS	NS	48.5 N	20.0 N	83.5 N	NS	NS

NOTE: Abbreviations - X = Crosscut
NS = No Sample
N = No Coke
oo,o,A,B,C,D,E,F = Entry Number
EH = Extra Heavy Coke
H = Heavy Coke
S = Some Coke
T = Trace Coke

APPENDIX E ANALYSES OF MINE DUST SAMPLES COLLECTED AFTER EXPLOSION

6 RIGHT (Continued)

Sample No.	ENTRY NUMBER oo Intake	o Intake	A Intake	B Intake/Track	C Intake/Belt	D Return	E Return
1-12X	NS	NS	NS	84.0 N	73.0 N	NS	NS
1-13	NS	NS	NS	90.5 N	NS	NS	NS

NOTE: Abbreviations - X = Crosscut
NS = No Sample
N = No Coke

oo,o,A,B,C,D,E,F = Entry Number
EH = Extra Heavy Coke
H = Heavy Coke

S = Some Coke
T = Trace Coke

APPENDIX E ANALYSES OF MINE DUST SAMPLES COLLECTED AFTER EXPLOSION

007 SECTION

ENTRY NUMBER

Sample No.	oo Intake	o Intake	A Intake	B Intake/Track	C Intake/Belt	D Return	E Return
2-1	NS	32.0 N	28.0 N	NS	52.0 N	NS	NS
2-2	NS	24.0 N	22.0 N	77.0 N	52.0 N	NS	NS
2-3	NS	NS	36.0 N	62.0 N	62.0 N	NS	NS
2-3X	NS	NS	25.0 N	NS	NS	NS	NS
2-4	NS	NS	45.0 N	62.0 N	32.0 N	24.0 N	NS
2-5	NS	NS	NS	32.0 N	27.0 N	37.0 N	NS
2-6	NS	NS	57.0 N	12.0 N	25.0 N	NS	NS
2-6X	NS	NS	NS	38.0 N	32.0 N	NS	NS
2-7	NS	NS	67.0 N	17.0 N	13.0 N	NS	NS
2-8	33.0 N	NS	43.0 N	NS	NS	NS	NS

NOTE: Abbreviations - X = Crosscut
NS = No Sample
N = No Coke
oo,o,A,B,C,D,E,F = Entry Number
EH = Extra Heavy Coke
H = Heavy Coke
S = Some Coke
T = Trace Coke

APPENDIX E ANALYSES OF MINE DUST SAMPLES COLLECTED AFTER EXPLOSION

003 SECTION

ENTRY NUMBER

Sample No.	oo Intake	o Intake	A Intake	B Intake/Track	C Intake/Belt	D Return	E Return	F Return
3-1	NS	NS	NS	56.0 T	75.0 N	63.0 N	NS	NS
3-2	51.0 N	58.0 N	44.0 N	78.0 N	88.0 N	65.0 N	NS	73.0 N
3-3	40.0 N	53.0 N	60.0 N	59.0 N	80.0 N	59.0 N	57.5 T	NS
3-3X	NS	44.0 N	69.0 N	53.0 N	79.0 N	NS	51.0 N	NS
3-4	48.0 N	58.0 N	53.0 N	63.0 N	80.0 T	NS	63.5 N	NS
3-5	NS	NS	58.0 N	73.0 N	83.0 N	NS	46.5 N	53.5 N
3-6	NS	62.0 N	63.0 N	63.0 N	81.0 N	59.0 N	46.0 N	43.0 T
3-6X	NS	47.0 N	51.0 N	53.0 N	77.0 N	49.5 N	46.5 T	NS
3-7	NS	82.0 N	60.0 N	80.0 N	87.0 N	NS	54.0 N	NS
3-8	NS	NS	62.0 N	73.0 N	81.0 N	NS	56.5 N	NS
3-9	NS	NS	66.0 N	87.0 N	88.0 N	NS	49.0 N	NS
3-9X	NS	NS	NS	69.0 N	NS	NS	54.0 N	NS
3-10	NS	NS	64.0 N	62.0 N	86.0 N	NS	68.5 N	NS
3-11	NS	NS	50.0 N	59.0 N	74.0 N	56.5 N	NS	NS
3-12	NS	NS	49.0 N	64.0 N	76.0 N	53.0 N	NS	NS

NOTE: Abbreviations - X = Crosscut
NS = No Sample
N = No Coke
oo,o,A,B,C,D,E,F = Entry Number
EH = Extra Heavy Coke
H = Heavy Coke
S = Some Coke
T = Trace Coke

APPENDIX E ANALYSES OF MINE DUST SAMPLES COLLECTED AFTER EXPLOSION

003 SECTION (continued)

ENTRY NUMBER

Sample No.	oo Intake	o Intake	A Intake	B Intake/Track	C Intake/Belt	D Return	E Return	F Return
3-12X	NS	NS	NS	NS	49.0 N	NS	NS	NS
3-13	NS	NS	64.0 N	51.0 T	68.0 N	45.7 H	NS	NS
3-14	NS	NS	34.0 N	45.0 N	61.0 T	52.4 H	NS	NS
3-15	NS	NS	NS	37.0 T	84.1 H	35.3 EH	NS	NS
3-15X	NS	NS	NS	32.0 T	37.2 EH	39.5 T	NS	NS
3-16	NS	NS	NS	49.0 N	62.5 EH	29.6 H	41.0 T	NS
3-17	NS	NS	29.0 N	34.0 S	68.7 EH	32.7 H	43.9 H	NS
3-18	NS	37.0 N	43.0 N	NS	41.4 EH	36.2 H	50.2 EH	NS
3-18X	NS	NS	35.0 T	NS	30.0 EH	NS	NS	NS
3-19	NS	40.0 T	39.0 N	34.0 N	38.2 EH	NS	47.8 EH	NS
3-20	38.0 N	40.0 N	45.0 N	36.0 S	38.6 EH	43.4 EH	36.4 EH	NS
3-21	40.0 N	35.0 N	51.0 S	38.0 S	25.9 EH	35.3 EH	37.9 EH	NS
3-21X	25.0 N	35.0 N	47.0 N	NS	26.8 EH	NS	NS	NS
3-22	49.0 N	69.5 T	45.0 S	NS	26.5 EH	38.5 EH	NS	NS
3-23	29.0 T	41.0 T	46.9 EH	39.0 S	26.2 EH	38.2 EH	NS	NS

NOTE: Abbreviations - X = Crosscut
NS = No Sample
N = No Coke
oo,o,A,B,C,D,E,F = Entry Number
EH = Extra Heavy Coke
H = Heavy Coke
S = Some Coke
T = Trace Coke

APPENDIX E ANALYSES OF MINE DUST SAMPLES COLLECTED AFTER EXPLOSION

003 SECTION (continued)

ENTRY NUMBER

Sample No.	oo Intake	o Intake	A Intake	B Intake/Track	C Intake/Belt	D Return	E Return	F Return
3-24	29.0 T	41.8 EH	43.9 H	40.5 EH	29.2 EH	40.2 EH	NS	NS
3-24X	NS	NS	49.3 H	43.4 H	NS	NS	NS	NS
3-25	37.0 N	36.0 S	44.4 H	36.7 EH	28.5 EH	46.7 EH	NS	NS
3-26	35.0 N	36.0 S	NS	NS	27.9 EH	37.4 EH	NS	NS
3-27	NS	46.8 H	NS	NS	29.1 EH	NS	NS	NS
3-27X	NS	NS	NS	NS	27.9 EH	NS	NS	NS
3-28	NS	39.7 H	37.1 EH	24.3 EH	27.5 EH	NS	NS	NS
3-29	NS	38.6 H	36.2 EH	30.2 EH	32.1 EH	NS	NS	NS
3-30	NS	NS	35.6 EH	39.0 H	52.8 EH	NS	NS	NS
3-30X	NS	NS	39.4 H	24.3 H	38.0 S	NS	NS	NS
3-31	NS	NS	35.6 EH	27.4 EH	30.0 S	NS	NS	NS

NOTE: Abbreviations - X = Crosscut
NS = No Sample
N = No Coke
oo,o,A,B,C,D,E,F = Entry Number
EH = Extra Heavy Coke
H = Heavy Coke
S = Some Coke
T = Trace Coke

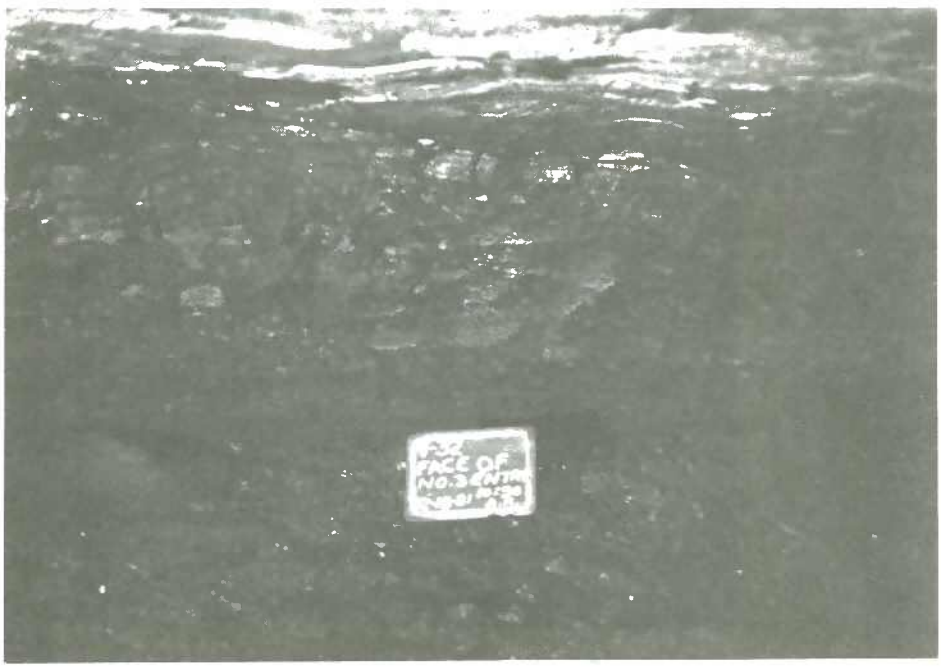
APPENDIX F

PHOTOGRAPH 1. - Cigarette lighter at the inby side of No. 62 crosscut in No. 1 entry of 003 section

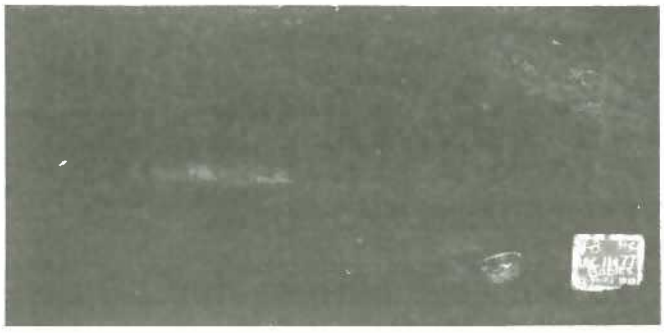
PHOTOGRAPH 2. - Two packages of Winston cigarettes in lunch bucket found in deck of the roof bolting machine on 003 section

APPENDIX F

PHOTOGRAPH 3. - Loading machine at 4 by 7 foot area which was mined into the gob from the face of No. 2 entry of 003 section



PHOTOGRAPH 4. - Boreholes into gob from face of No. 3 entry of 003 section



PHOTOGRAPH 5. - Miner's jacket - with evidence of melting inside lining. Miner's Cap - with bill on cap melted. Located on right side of No. 1 entry inby No. 61 crosscut at location of victims identified as No. 11 and 77

PHOTOGRAPH 6. - Affects of heat on plastic curtain inby last open crosscut in No. 3 entry of 003 section

PHOTOGRAPH 7. - Burned and melted remains of a plastic ventilation check curtain outby the last open crosscut in No. 2 entry of 003 section

APPENDIX G

U.S. DEPARTMENT OF LABOR—MINE SAFETY AND HEALTH ADMINISTRATION
MSHA FORM 7000-3 [Jun 78]

☐ CITATION (SEE REVERSE) ☒ ORDER OF WITHDRAWAL (SEE REVERSE) DATE 12/08/81 TIME 1430 (24 HR CLOCK) 0755486

SERVED TO Mr. Hollis Rogers-Safety Director OPERATOR Grundy Mining Company, Inc.

MINE No. 21 MINE I.D. 40-00524-___ (CONTRACTOR)

TYPE OF ACTION 103-K-_,___-___-___ VIOLATION OF SECTION ___-___-___ OF THE ACT OR

PART AND SECTION ___-___-___-___-___ OF TITLE 30 CODE OF FEDERAL REGULATIONS. OFFICE USE ONLY DATE

TYPE OF INSPECTION AFA ☐ S AND S (SEE REVERSE) ☐ W N CODES __/__P__L__ATD__/__/__

CONDITION OR PRACTICE An Accident has occurred at this mine involving the entrapment of miners in the active underground workings due to an apparent explosion. The mine is hereby closed pending rescue and recovery operations and until an investigation is completed determining the causes of the accident.

AREA OR EQUIPMENT The entire underground workings of the mine

INITIAL ACTION ☐ NOTICE ☐ CITATION ☐ ORDER NO. _____ DATED __/__/__ (MO/DA/YR)

TERMINATION DUE DATE __/__/__ (MO/DA/YR) TIME ____ (24 HR CLOCK) SIGNATURE ▶ John L. McDaniel 3 AR 81

ACTION TO TERMINATE

DATE __/__/__ (MO/DA/YR) TIME ____ (24 HR CLOCK) SIGNATURE ▶ __ AR ☐ SEE CONTINUATION FORM

U.S. DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
MSHA FORM 7000-3a (Jun 78)

(original issue) DATED 12/08/81 No 0755486-1

☒ SUBSEQUENT ACTION ☐ CONTINUATION ☐ CITATION ☒ ORDER DATE 12/09/81 TIME 0900 (24 HR CLOCK)

SERVED TO Mr. Hollis Rogers - Safety Director OPERATOR Grundy Mining Company, Inc.

MINE No. 21 MINE I.D. 40-00524-___ (CONTRACTOR)

JUSTIFICATION FOR ACTION CHECKED BELOW An accident has occurred at this mine involving an apparent explosion in the active underground workings. The 103 K order previously issued is hereby modified to include the following mines in the area which are cut into and adjacent to the No. 21 mine: The No. 24 mine, I.D. No. 40-00577; The No. 25 mine, I.D. No. 40-00579; The No. 27 mine, I.D No. 40-01042; The No. 30 mine, I.D. No. 40-01813. Miners shall be withdrawn from all underground areas of these adjacent mines until an investigation into the causes of the accident is completed

☐ EXTENDED TO: DATE __/__/__ (MO/DA/YR) TIME ____ (24 HR CLOCK) ☐ VACATED OFFICE USE ONLY CODES __/__P__L__ATD__/__/__

☐ TERMINATED ☒ MODIFIED ☐ SEE CONTINUATION FORM DATE

TYPE OF INSPECTION AFA SIGNATURE ▶ John C. Kirkley 1401 AR

APPENDIX G

U.S. DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
MSHA FORM 7000-3a (Jun 78)

(original issue) DATED 12/08/81 No 0755486-2

☒ SUBSEQUENT ACTION ☐ CONTINUATION ☐ CITATION ☒ ORDER DATE 12/12/81 TIME 0745 (24 HR CLOCK)

SERVED TO Mr. Hollis Rogers - Safety Director OPERATOR Grundy Mining Company Inc.

MINE No. 21 Mine MINE I.D. 40-00524-___ (CONTRACTOR)

JUSTIFICATION FOR ACTION CHECKED BELOW The No. 21 Mine has been examined and reventilated and it has been determined that the mine is safe for travel. Therefore, Order No. 0755486 is hereby modified to allow the following adjacent mines to continue normal operations: The No. 24 mine, I.D No. 40-00577; The No. 25 mine, I.D. No. 40-00579; The No. 27 mine, I.D. No. 40-01092; and the No. 30 mine; I.D. No. 40-01813.

☐ EXTENDED TO: DATE ___/___/___ TIME ____ (24 HR CLOCK) ☐ VACATED

☐ TERMINATED ☒ MODIFIED

TYPE OF INSPECTION AFA

OFFICE USE ONLY
CODES ___/___ P L ATD ___/___/___
☐ SEE CONTINUATION FORM DATE

SIGNATURE ▶ Joseph W. Pavlovich 1834 AR

U.S. DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
MSHA FORM 7000-3a [Jun 78]

(original issue) DATED 12/08/81 No 0755486-3

☒ SUBSEQUENT ACTION ☐ CONTINUATION ☒ CITATION ☐ ORDER DATE 01/02/82 TIME 1410 (24 HR CLOCK)

SERVED TO Mr. Hollis Rogers (Safety Director) OPERATOR Grundy Mining Company, Inc.

MINE No. 21 MINE I.D. 40-00524-___ (CONTRACTOR)

JUSTIFICATION FOR ACTION CHECKED BELOW The investigation to determine the causes of the accident has been completed.

☐ EXTENDED TO: DATE ___/___/___ TIME ____ (24 HR CLOCK) ☐ VACATED

☒ TERMINATED ☐ MODIFIED

TYPE OF INSPECTION AAE

OFFICE USE ONLY
CODES ___/___ P L ATD ___/___/___
☐ SEE CONTINUATION FORM DATE

SIGNATURE ▶ John E. Weakley 1401 AR

APPENDIX H

U.S. DEPARTMENT OF LABOR—MINE SAFETY AND HEALTH ADMINISTRATION
MSHA FORM 7000-3 [Jun 78]

☐ CITATION (SEE REVERSE) ☒ ORDER OF WITHDRAWAL (SEE REVERSE) DATE 12/15/81 TIME 1500 (24 HR CLOCK) 0757825

SERVED TO Mr. Hollis Rogers OPERATOR Grundy Mining Company, Inc.

MINE No. 21 Mine MINE I.D. 40-00524-___ (CONTRACTOR)

TYPE OF ACTION 104-D-L,___-___-___ VIOLATION OF SECTION ___-___-___ OF THE ACT OR

PART AND SECTION 75.0308-_____ OF TITLE 30 CODE OF FEDERAL REGULATIONS: OFFICE USE ONLY DATE

TYPE OF INSPECTION AAA ☒ S AND S (SEE REVERSE) ☐ W N CODES __/__ P L __ ATD __/__/__

CONDITION OR PRACTICE More than 1.5 percent methane was present in the 003 section on December 8, 1981. All persons were not withdrawn to a safe area from the area endangered by methane from an interconnected abandoned gob area.

AREA OR EQUIPMENT The 003 working section

INITIAL ACTION ☐ NOTICE ☒ CITATION ☐ ORDER NO. 0757821 DATED 12/15/81 (MO/DA/YR)

TERMINATION DUE DATE 01/02/82 TIME 0700 (24 HR CLOCK) SIGNATURE Joseph W. Pavlovich 1834 (AR)

ACTION TO TERMINATE

DATE __/__/__ (MO/DA/YR) TIME ____ (24 HR CLOCK) SIGNATURE ▶ ____ ____ (AR) ☐ SEE CONTINUATION FORM

U.S. DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
MSHA FORM 7000-3a (Jun 78)

(original issue) DATED 02/24/82 (MO/DA/YR) No 0757825-2

☑ SUBSEQUENT ACTION ☐ CONTINUATION ☐ CITATION ☑ ORDER DATE 03/16/82 (MO/DA/YR) TIME 1230 (24 HR CLOCK)

SERVED TO Hollis Rogers (Safety Director) OPERATOR Grundy Mining Co. Inc.

MINE No. 21 MINE I.D. 40-00524-___ (CONTRACTOR)

JUSTIFICATION FOR ACTION CHECKED BELOW The 104(d)(1) order Number 0757825 dated 12-15-81 is hereby modified to show the condition or practice cited was observed during the multiple fatal accident investigation on the 12-15-81 and the order was actually issued on the 2-24-82.

☐ EXTENDED TO: DATE __/__/__ (MO/DA/YR) TIME ____ (24 HR CLOCK) ☐ VACATED OFFICE USE ONLY CODES __/__ P L __ ATD __/__/__

☐ TERMINATED ☑ MODIFIED ☐ SEE CONTINUATION FORM DATE

TYPE OF INSPECTION AAA SIGNATURE ▶ Tommy D. Frizzell 1369 (AR)

APPENDIX H

U.S. DEPARTMENT OF LABOR—MINE SAFETY AND HEALTH ADMINISTRATION
MSHA FORM 7000-3 [Jun 78]

☐ CITATION (SEE REVERSE) ☒ ORDER OF WITHDRAWAL (SEE REVERSE) DATE 12/15/81 TIME 1500 0757823

SERVED TO Mr Hollis Rogers - Safety Director OPERATOR Grundy Mining Company, Inc.

MINE No. 21 MINE I.D. 40-00524-___ (CONTRACTOR)

TYPE OF ACTION 104-D-1,_____ VIOLATION OF SECTION _____ OF THE ACT OR

PART AND SECTION 75.0316-_____ OF TITLE 30 CODE OF FEDERAL REGULATIONS: OFFICE USE ONLY DATE

TYPE OF INSPECTION AAA ☒ S AND S (SEE REVERSE) ☐ WN CODES __/__ P L __ ATD __/__/__

CONDITION OR PRACTICE A CHECK CURTAIN WAS NOT INSTALLED IN THE No. 61 CROSSCUT ON THE 003 SECTION BETWEEN THE INTAKE AND RETURN ENTRIES ALLOWING THE INTAKE AIR TO SHORT CIRCUIT DIRECTLY TO THE RETURN. THE APPROVED VENTILATION PLAN REQUIRED CHECK CURTAINS TO BE INSTALLED BETWEEN THE INTAKE AND RETURN ENTRIES INBY THE PERMANENT STOPPING LINE EXCLUDING THE LAST OPEN CROSSCUT.

AREA OR EQUIPMENT THE 003 WORKING SECTION

INITIAL ACTION ☐ NOTICE ☒ CITATION ☐ ORDER NO. 0757821 DATED 12/15/81 (MO/DA/YR)

TERMINATION DUE DATE 01/07/82 TIME 0700 (24 HR CLOCK) SIGNATURE Joseph W. Pavlovich 1834 (AR)

ACTION TO TERMINATE

DATE __/__/__ (MO/DA/YR) TIME ____ (24 HR CLOCK) SIGNATURE ▶ ____ (AR) ☐ SEE CONTINUATION FORM

U.S. DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
MSHA FORM 7000-3a (Jun 78)

(original issue) DATEP 02/24/82 No 0757823-2

☑ SUBSEQUENT ACTION ☐ CONTINUATION ☐ CITATION ☑ ORDER DATE 03/16/82 (MO/DA/YR) TIME 1230 (24 HR CLOCK)

SERVED TO Hollis Rogers (Safety Director) OPERATOR Grundy Mining Co. Inc.

MINE No. 21 MINE I.D. 40-00524-___ (CONTRACTOR)

JUSTIFICATION FOR ACTION CHECKED BELOW The 104(d)(1) order Number 0757823 dated 12-15-81 is hereby Modified To Show The Condition or practice Cited was observed during The Multiple Fatal Accident investigation on the 12-15-81 And this order was Actually issued on the 2-24-82.

☐ EXTENDED TO DATE __/__/__ (MO/DA/YR) TIME ____ (24 HR CLOCK) ☐ VACATED OFFICE USE ONLY CODES __/__ P L __ ATD __/__/__

☐ TERMINATED ☑ MODIFIED ☐ SEE CONTINUATION FORM DATE

TYPE OF INSPECTION AAA SIGNATURE ▶ Tommy D. Frizzell 1369 (AR)

APPENDIX H

U.S. DEPARTMENT OF LABOR—MINE SAFETY AND HEALTH ADMINISTRATION
MSHA FORM 7000-3 [Jun 78]

☐ CITATION (SEE REVERSE) ☒ ORDER OF WITHDRAWAL (SEE REVERSE) DATE 12/15/81 TIME 1500 0757822

SERVED TO Hollis Rogers - Safety Director OPERATOR Grundy Mining Company, Inc.

MINE No. 21 MINE I.D. 40-00524-___ (CONTRACTOR)

TYPE OF ACTION 104-D-1,___-___-___ VIOLATION OF SECTION ___-___-___ OF THE ACT OR

PART AND SECTION 75.316-_____ OF TITLE 30 CODE OF FEDERAL REGULATIONS. OFFICE USE ONLY DATE

TYPE OF INSPECTION AEA ☒ S AND S (SEE REVERSE) ☐ W N CODES __/__ P L ATD __/__/__

CONDITION OR PRACTICE The ventilation system and methane and dust control plan was not complied with on the 003 section in that a permanent stopping was not erected between the intake and return airways in the third connecting crosscut outby the faces. The approved plan requires that permanent stoppings be erected between the intake and return airways up to and including the third connecting crosscut outby the face.

AREA OR EQUIPMENT The 003 working section

INITIAL ACTION ☐ NOTICE ☒ CITATION ☐ ORDER NO. 0757821 DATED 12/15/81 (MO/DA/YR)

TERMINATION DUE DATE 01/07/82 TIME 0700 (24 HR CLOCK) SIGNATURE Joseph W. Pavlovich 1834 AR

ACTION TO TERMINATE

DATE ___/___/___ TIME _____ SIGNATURE ▶ ___ AR ☐ SEE CONTINUATION FORM

U.S. DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
MSHA FORM 7000-3a (Jun 78)

(original issue) DATED 02/24/82 No 0757822-2

☑ SUBSEQUENT ACTION ☐ CONTINUATION ☐ CITATION ☑ ORDER DATE 03/16/82 TIME 1230 (24 HR CLOCK)

SERVED TO Hollis Rogers (Safety Director) OPERATOR Grundy Mining Co. Inc.

MINE No. 21 MINE I.D. 40-00524-___ (CONTRACTOR)

JUSTIFICATION FOR ACTION CHECKED BELOW The 104(d)(1) order Number 0757822 dated the 12-15-81 is hereby modified to show the condition or practice cited was observed during the Multiple Fatal Accident investigation on the 12-15-81 and this order was actually issued the 2-24-82.

☐ EXTENDED TO: DATE ___/___/___ TIME _____ (24 HR CLOCK) ☐ VACATED OFFICE USE ONLY CODES __/__ P L ATD __/__/__

☐ TERMINATED ☑ MODIFIED ☐ SEE CONTINUATION FORM DATE

TYPE OF INSPECTION: ABA SIGNATURE ▶ Tommy D. Frizzell 1369 AR

APPENDIX H

U.S. DEPARTMENT OF LABOR—MINE SAFETY AND HEALTH ADMINISTRATION
MSHA FORM 7000-3 [Jun 78]

☐ CITATION (SEE REVERSE) ☒ ORDER OF WITHDRAWAL (SEE REVERSE) DATE 12/15/81 TIME 1500 (24 HR CLOCK) 0757824

SERVED TO MR HOLLIS ROGERS - SAFETY DIRECTOR OPERATOR GRUNDY MINING COMPANY, INC.

MINE No. 21 MINE MINE I.D. 40-00524-___ (CONTRACTOR)

TYPE OF ACTION 104-D-1,_____ VIOLATION OF SECTION _____ OF THE ACT OR

PART AND SECTION 75.0329-_____ OF TITLE 30 CODE OF FEDERAL REGULATIONS. OFFICE USE ONLY DATE

TYPE OF INSPECTION AEA ☒ S AND S (SEE REVERSE) ☐ W N CODES __/__ P L __ ATD __/__/__

CONDITION OR PRACTICE THE BLEEDER SYSTEM FOR THE ABANDONED AREA OF THE 5 RIGHT SECTION WAS NOT FUNCTIONING BECAUSE AN EXPLOSIVE METHANE-AIR MIXTURE THAT HAD ACCUMULATED IN THE GOB AREA MIGRATED INTO THE ACTIVE WORKINGS OF THE 003 SECTION WHEN THE AREA WAS INTERSECTED.

AREA OR EQUIPMENT THE 003 WORKING SECTION

INITIAL ACTION ☐ NOTICE ☒ CITATION ☐ ORDER NO. 0757821 DATED 12/15/81 (MO/DA/YR)

TERMINATION DUE DATE 01/07/82 (MO/DA/YR) TIME 0700 (24 HR CLOCK) SIGNATURE ▶ Joseph W. Pavlovich 1834 (AR)

ACTION TO TERMINATE

DATE __/__/__ (MO/DA/YR) TIME _____ (24 HR CLOCK) SIGNATURE ▶ ____ AR ☐ SEE CONTINUATION FORM

U.S. DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
MSHA FORM 7000-3a (Jun 78)

(original issue) DATED 02/24/82 No 0757824-2

☑ SUBSEQUENT ACTION ☐ CONTINUATION ☐ CITATION ☑ ORDER DATE 03/16/82 (MO/DA/YR) TIME 1230 (24 HR CLOCK)

SERVED TO Hollis Rogers (Safety Director) OPERATOR Grundy Mining Co. Inc.

MINE No. 21 MINE I.D. 40-00524-___ (CONTRACTOR)

JUSTIFICATION FOR ACTION CHECKED BELOW The 104(d)(1) order number 0757824 dated 12-15-81 is hereby Modified To Show the Condition or PRACTICE Cited Was Observed during the Multiple FATAL ACCIDENT investigation on the 12-15-81 and this order was Actually issued the 2-24-82.

☐ EXTENDED TO DATE __/__/__ (MO/DA/YR) TIME (24 HR CLOCK) ☐ VACATED OFFICE USE ONLY CODES __/__ P L __ ATD __/__/__

☐ TERMINATED ☑ MODIFIED ☐ SEE CONTINUATION FORM DATE

TYPE OF INSPECTION AAA SIGNATURE ▶ Jemmy G. Frizzell 1369 (AR)

APPENDIX H

U.S. DEPARTMENT OF LABOR—MINE SAFETY AND HEALTH ADMINISTRATION
MSHA FORM 7000-3 [Jun 78]

☒ CITATION (SEE REVERSE) ☐ ORDER OF WITHDRAWAL (SEE REVERSE) DATE 12/15/81 TIME 1500 0757821

SERVED TO Mr Hollis Rogers - Safety Director OPERATOR Grundy Mining Company, Inc.

MINE No. 21 MINE I.D. 40-00524-____ (CONTRACTOR)

TYPE OF ACTION 104-D-1,_____ VIOLATION OF SECTION _____ OF THE ACT OR

PART AND SECTION 75.1702-_____ OF TITLE 30 CODE OF FEDERAL REGULATIONS: OFFICE USE ONLY DATE

TYPE OF INSPECTION AFA ☒ S AND S (SEE REVERSE) ☐ W N CODES __/__P__L__ATD__/__/__

CONDITION OR PRACTICE The operators program to insure that persons entering the underground area of the No. 21 mine do not carry smoking materials was not being complied with in that; smoking materials were found in the underground areas of the 003 section and on bodies of victims of the explosion. The last recorded date of a search for smoking materials was October 12, 1981. The operators program requires searches to be made at least once each week on each shift.

AREA OR EQUIPMENT

INITIAL ACTION ☐ NOTICE ☐ CITATION ☐ ORDER NO. _____ DATED __/__/__ (MO/DA/YR)

TERMINATION DUE DATE 01/07/82 TIME 0700 (24 HR CLOCK) SIGNATURE ▶ Joseph W. Pavlovich 1831 (AR)

ACTION TO TERMINATE

DATE __/__/__ (MO/DA/YR) TIME _____ (24 HR CLOCK) SIGNATURE ▶ ____ (AR) ☐ SEE CONTINUATION FORM

U.S. DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
MSHA FORM 7000-3a (Jun 78)

(original issue) DATED 02/24/82 No 0757821-2

☑ SUBSEQUENT ACTION ☐ CONTINUATION ☑ CITATION ☐ ORDER DATE 03/16/82 TIME 1230 (24 HR CLOCK)

SERVED TO Hollis Rogers (Safety Director) OPERATOR Grundy Mining Co. Inc.

MINE No. 21 MINE I.D. 40-00524-____ (CONTRACTOR)

JUSTIFICATION FOR ACTION CHECKED BELOW The 104(d)(1) Citation Number 0757821 dated 12-15-81 is hereby modified To show the Condition or practice Cited was observed during the multiple FATAL Accident investigation on the 12-15-81 And This Citation was Actually issued the 2-24-82.

☐ EXTENDED TO: DATE __/__/__ (MO/DA/YR) TIME _____ (24 HR CLOCK) ☐ VACATED OFFICE USE ONLY CODES __/__P__L__ATD__/__/__

☐ TERMINATED ☑ MODIFIED ☐ SEE CONTINUATION FORM DATE

TYPE OF INSPECTION AAA SIGNATURE ▶ Jimmy D. Frizzell 1369 (AR)