UNITED STATES

DEPARTMENT OF LABOR

MINE SAFETY AND HEALTH ADMINISTRATION

REPORT OF INVESTIGATION
UNDERGROUND COAL MINE DUST EXPLOSION

No. 1 Mine (ID No. 15-12624)
RFH Coal Company
Craynor, Floyd County, Kentucky

January 20, 1982

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).

On January 20, 1982, at approximately 9:40 a.m., a coal dust explosion occurred in the 001 section of RFH Coal Company's No. 1 mine. The No. 1 mine is located on Mink Branch near Craynor, Floyd County, Kentucky. All 7 miners working underground at the time of the explosion were killed. The names of the victims, their ages, occupations, and mining experiences are listed in Appendix A. Purvis Hamilton, Mine Manager, was on the surface when the explosion occurred and was not injured.

MSHA investigators concluded that the explosion originated in the No. 5 room of the 001 section. Coal dust was ignited by flames from the explosives when the developing crosscut between the Nos. 5 and 6 rooms shot through into the No. 5 room. Flames from the explosives were not contained within the limits of the coal being shot due to a blown-out or a blown-through shot. Flame and/or major forces of the explosion propagated from the face area of the No. 5 room, traversed the entire mine and traveled to the surface. Surface facilities that were in direct line of the forces coming out of the mine were extensively damaged.

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PART I

GENERAL INFORMATION

General Information

The RFH Coal Company's No. 1 mine is situated about 2 miles northwest of Craynor, Floyd County, Kentucky, off State Route 979. The RFH Coal Company is owned by Rita Faye Hamilton, Joyce Ann Hamilton (widow of Jack Hamilton), Gail Hamilton (widow of Burnis Hamilton), and Dorie Hamilton (widow of Donald Hamilton). Purvis Hamilton, who is the husband of Rita Faye Hamilton, was the mine manager. Thurman Reynolds was the underground foreman at the mine.

The mineral rights of the No. 1 mine were owned by Elk Horn Coal Corporation. Joseph Mining Company had leased the coal rights of the No. 1 mine from Elk Horn Coal Corporation. The RFH Coal Company had subleased the coal rights from the Joseph Mining Company. Elk Horn Coal Corporation, in their lease with Joseph Mining Company, retained the right to approve all mining plans with a stipulation that all engineering services at the mine would be provided by the Elk Horn Coal Corporation.

The No. 1 mine was opened in November of 1980 by 3 drift entries into the Elkhorn No. 3 1/2 coalbed which ranged from 32 to 36 inches in thickness. The coalbed is relatively flat at this location. A total of 8 persons were employed at the mine, 7 of whom worked underground. Reportedly, the average daily production was 200 tons of coal.

During the investigation, a standard channel sample of coal was taken by MSHA personnel in the No. 6 room (Sample No. ISB 206). The location of the sample is shown on the map in Appendix M. The sample was analyzed by the Industrial Safety Division Laboratory, Bruceton Safety Technology Center, Pittsburgh, Pennsylvania. The proximate analysis of the coal was as follows:

	Percent
Moisture	2.3
Volatile Matter	36.7
Fixed Carbon	55.5
Ash	5.5

From this analysis, the volatile ratio is 0.40. Numerous tests by the Bureau of Mines have established that coal dust having a volatile ratio greater than 0.12 is explosive. Therefore, the coal dust at this mine is highly explosive.

The last MSHA inspection of the entire mine was conducted November 3-4, 1981. A spot inspection was conducted on December 21, 1981. During this inspection, the inspector talked with all of the mine employees to discuss the recent mine explosions, blasting practices related to shoot-

ing coal from the solid, the importance of following the company's cleanup program to prevent coal dust accumulations, rock dusting practices, mine ventilation, smoking underground, and drying out of the mine due to changing weather conditions.

Mining Methods, Conditions, and Equipment

The method of mining being followed consisted of an entry-and-room system. The mine had 1 working section (001). The mine was comprised of a set of 7 main entries and 14 rooms. The 7 main entries, were driven in a southeast direction. Three of the entries were started on the surface and 4 were started at various locations underground. The entries were driven on 75-foot centers with connecting crosscuts on 60-foot centers. The pillars created by this development were not extracted. The main entries were stopped after being developed approximately 1,550 feet while a coal lease was being negotiated to obtain additional coal rights. The rooms turned right off the No. 7 entry were being driven on 60-foot centers. The maximum depth that any of the rooms had been developed was approximately 125 feet. Mining was in progress in the rooms at the time of the explosion.

The immediate roof overlying the coalbed was sandstone and the floor was firm shale. Roof bolts, 30 inches in length, were the primary means of roof support used in the mine. The mine roof in the accident area appeared to be adequately supported.

Ventilation and Examinations

Ventilation was induced by a 5-foot propeller-type fan that was operated exhausting. The fan was installed on the surface in a fireproof housing constructed of concrete blocks and sheet metal that was connected to the No. 5 entry. The fan was driven at 1500 rpm by a 20-horsepower electric motor and developed a pressure of 0.3 inches of water in normal operation. During the last inspection of the entire mine conducted November 3-4, 1981, approximately 45,000 cubic feet per minute (cfm) of air was measured at the main fan. During the same inspection, approximately 18,200 cfm of air was reaching the last open crosscut in the 001 section. The analyses of the air samples collected in the immediate return and the main return did not reveal any methane.

The intake air entered the mine through the No. 3 entry and returned out the No. 5 entry. The Nos. 1, 2 and 3 entries (numbering left to right) were used as intake aircourses and the Nos. 5, 6 and 7 entries were used as return aircourses. The main belt conveyor was installed in the No. 4 entry and the air used to ventilate the belt entry was coursed directly into the return aircourse near the section loading point. The faces of the 7 entries were stopped about 2 weeks prior to the explosion and mining was then started in the 14 rooms that had been turned right off the No. 7 entry. A belt conveyor (pony belt) for room development was extended from the main belt conveyor in the No. 4 entry to the No. 7

entry. This belt conveyor was installed in the No. 12 crosscut about 3 days prior to the explosion. Two escapeways were maintained, 1 of which was ventilated with intake air.

Permanent stoppings, constructed of concrete blocks were used to provide the required separation between the various aircourses. The approved ventilation plan required that line brattice and check curtains be used to direct the ventilating air currents into the working places. The mine map which shows the air flow directions, air quantities, and other information gathered from previous inspections, inspectors' notes, and during the investigation is in Appendix K.

According to the mine record books, preshift, on-shift and weekly examinations were made by certified persons. The results of these examinations were recorded in approved books on the surface. A Ventilation System and Methane and Dust Control Plan for the mine was approved June 1, 1981.

Coal Dust

Applications of rock dust were the primary means used for rendering coal dust inert. Rock dust was applied to the mine surfaces by hand. The operator's clean-up program required that coal dust accumulations be shoveled to the middle of the entries or rooms, loaded by scoops and transported from the mine. The approved Ventilation System and Methane and Dust Control Plan required that dust on the roadways be controlled by the application of calcium chloride and/or water.

Mine dust samples were collected on November 4, 1981, during an MSHA inspection of the entire mine. The analyses of the mine dust samples showed that the incombustible content of all 23 samples was 80 percent or more.

Explosives

The type of explosive was Du Pont Tovex 320 water gel, a permissible explosive, in 1-1/2- by 16-inch cartridges. The original paper cartons each contained 50 pounds, with about 42 cartridges in each carton. Electric detonators, manufactured by the Du Pont Company, were used to initiate the explosives. These detonators had 14-foot leg wires. The detonators were fired by a 20-shot permissible shot firing unit. Explosives and detonators were stored on the surface near the mine portal in separate magazines. Reportedly, they were transported underground in a specially designed covered container on skids; the container was pulled by a battery-powered scoop and was used underground as a section storage magazine. The detonators were stored on the section in a separate magazine.

The coal was blasted from the solid faces by a method commonly called "slab shooting." When using this method, the breaker hole is drilled at an angle of about 45 degrees from the face toward the near rib to a depth that would cause the shot to pull the coal and develop a straight rib and a second free face. A sequence of holes are then drilled across

the face continually changing the angle of each successive borehole, until the rib hole on the opposite side is drilled parallel to the existing rib. In preparing the places to be blasted, 8 to 9 boreholes were drilled about 30 inches apart to a depth of approximately 11 feet. Three of the miners at this mine were certified by the State of Kentucky as shot firers. A typical drill hole pattern of slab shooting is shown in Appendix E.

Electricity

Three-phase, 480-volt power was purchased from the Kentucky Power Company at a metering point near the mine portal. A safety center was installed near the metering point to provide the required protective features for the 480-volt, 3-phase underground distribution circuit and the 480-volt, 3-phase circuit supplying the surface belt conveyor drive unit. The safety center contained a zig-zag transformer to derive a neutral for the system. The derived neutral was properly grounded through an 11-ampere, current-limiting resistor. A grounding circuit, originating at the grounded side of the grounding resistor, was used to ground the metallic frames of all electric equipment supplied from the system.

A 400-ampere, molded-case circuit breaker in the surface safety center was equipped with a ground-check circuit and devices to provide short-circuit, grounded-phase and undervoltage protection for the underground distribution circuit. A cable coupler was provided in conjunction with the circuit breaker to provide visual evidence that the power was disconnected when the plug was withdrawn from the receptacle.

The underground distribution circuits entered the mine through the No. 4 entry and supplied 480-volt, 3-phase power to an underground belt conveyor drive unit and a portable power center located in the 001 section. The underground distribution circuit consisted of approximately 900 feet of three No. 2/0 AWG, copper, type THW insulated power conductors; two No. 2 AWG, copper, type THW insulated grounding conductors; and one No. 8 AWG, copper, insulated ground-check conductor. The power conductors, grounding conductors and ground-check monitors were suspended on insulated J-hooks. A one-line diagram of the underground distribution circuit is contained in Appendix D.

The portable power center located in the 001 section contained one 480-volt, 3-phase outlet; a 480/240 volt, 3-phase transformer; a rectifier bridge; and five 300-volt, direct current outlets. At the time of the explosion, only 2 outlets were in use. One outlet was used to supply 480-volt, 3-phase power to the coal drilling machine and the other outlet was used to supply 300-volt, direct-current power to the roof bolting machine. The coal drilling machine circuit was protected by a 150-ampere, molded-case circuit breaker which was equipped with a ground-check circuit and devices to provide short-circuit, grounded-phase and undervoltage protection for the circuit. The roof bolting machine circuit was protected against short-circuits by a 500-ampere contactor, which was equipped with a magnetic overcurrent relay. Cable couplers were provided in conjunction with the circuit breaker and the contactor to provide visual evidence that the power was disconnected when the cable plug was withdrawn from the receptacle.

Three-phase, 480-volt power was conducted to the coal drilling machine by a No. 6 AWG, 3-conductor, type G-GC trailing cable. Three hundred volt, direct-current power was conducted to the roof bolting machine by a No. 4 AWG, 2-conductor, type G trailing cable.

The electric face equipment was of a permissible type and consisted of the following:

1. One Elkhorn Industrial Products Model AR-4 Battery-Powered Scoop, Approval No. 2G-2271;

2. One Elkhorn Industrial Products Model DLE-1 Battery-Powered Scoop, Approval No. 2G-2569-5;

3. One Long-Airdox Company Model TDI-24A Face Drill, Approval No. 2G-2618A; and,

4. One Paul's Repair Shop Incorporated Model Mark 1 Roof Bolting Machine, Approval No. 2G-2430.

The electrical equipment and circuits underground were examined and/or tested during the investigation. The results of these tests and examinations established that the electrical equipment and circuits were not a factor in the explosion.

Transportation

Coal was loaded and transported from the face area by rubber-tired battery-powered scoops to the section loading point where it was discharged onto a belt conveyor which transported the coal to the surface storage area. The coal was transported from the mine property by haulage trucks. Personnel and mine supplies were transported into the mine by rubber-tired battery-powered scoops.

Communication

The mine communication system consisted of 2 pager telephones, one in the mine office and one underground near the section loading point. A commercial telephone was also provided on the surface in the mine office.

Fire Protection

The company's program of instruction for the miners, including the location and use of firefighting equipment, location of escapeways, exits and routes of travel and evacuation procedures and fire drills, was approved by the District Manager on November 24, 1980.

According to mine records, all escapeways were examined weekly by a certified person and the results of the examinations were recorded in a book kept on the surface. Escapeway drills were conducted every 90 days and the escapeways were traveled to the surface by the section foreman and at least 2 miners every 6 weeks.

Reportedly, section fire protection consisted of two 10-pound fire extinguishers and 240 pounds of rock dust in bags. Fire suppression devices were mounted on the mining equipment that used hydraulic fluid. These were manually activated dry chemical devices. A 2-inch water line was installed in the belt-haulage entry with enough fire hose to reach the working places. Fire hose outlets with valves were provided at the required intervals. The belt conveyors were continuously monitored for fire by fire sensor systems utilizing point-type heat sensors. The belt conveyor drives were protected by water sprinkler systems.

Training Program and Medical Assistance Program

The operator had submitted a training and retraining plan, which was approved on November 20, 1980, as required by Part 48, 30 CFR 48. The training was conducted at the Kentucky Department of Mines and Minerals office in Martin, Kentucky, about 20 miles from the mine site. All courses were taught by a certified instructor. The miners at this mine all received their annual retraining in January 1982. During these training sessions, the technique of shooting off the solid, the use of permissible explosives in a permissible manner, and the importance of following the clean-up program and applying adequate rock dust were discussed.

The operator had made arrangements with the Left Beaver Rescue Squad in McDowell, Kentucky, to provide transportation for injured persons. Arrangements for emergency medical assistance were made with the McDowell Appalachian Regional Hospital in McDowell, Kentucky.

Illumination and Smoking

Illumination was provided in the working places by permissible lighting systems mounted on the electric face equipment. Battery-powered permissible cap lamps were worn by each person underground.

An approved search program for smoking articles was in effect at the mine which required a weekly search of all persons before entering the mine. During the investigation, 2 cigarette lighters, 2 cigarette butts, and an unopened package of cigarettes were found underground. Also, a cigarette lighter, 8 cigarette butts and an opened package of cigarettes were removed from the clothing of one of the victims during the examination of the bodies by the State Medical Examiner. These findings indicated that smoking was a practice underground and that the operator's search program was not followed or was inadequate. Smoking was not considered a factor in the explosion.

Mine Rescue

The operator had made arrangements with the Kentucky Department of Mines and Minerals to provide mine rescue capability for the mine while miners were underground. The mine rescue station and all of the required mine rescue equipment for serving the mine was located in Martin, Kentucky. Training of the mine rescue team members was scheduled on a monthly basis.

Each miner was provided with a 1-hour, filter-type self-rescuer and had been trained in its use. A check-in and check-out system was maintained in the mine office using a check board and brass tags with the miners' names corresponding to similar tags worn on the miners' belts.

PART II

EXPLOSION AND RECOVERY OPERATIONS

Participating Organizations

Officials of the organizations which assisted in directing the recovery operations included: Purvis Hamilton, Mine Manager, RFH Coal Company; Willard Stanley, Commissioner, Kentucky Department of Mines and Minerals; and James Begley, Acting District Manager, District 6, Mine Safety and Health Administration.

Four mine rescue teams from the following organizations participated in the recovery operations:

Kentucky Department of Mines And Minerals, Martin Team
Kentucky Department of Mines and Minerals, Pikeville Team
Kentucky Department of Mines and Minerals, Hazard Team
National Mines Corporation, Wayland, Kentucky

The names of the mine rescue team members and the persons who participated in the recovery operations are listed in Appendix B.

Activities of MSHA Personnel

At approximately 10:25 a.m., on January 20, 1982, Stanley Allen, Sr., Coal Mine Inspector (Electrical), who was making an inspection at a nearby mine, notified Danny McCown, Coal Mine Inspection Supervisor, that he heard that an explosion had occurred at RFH Coal Company's No. 1 mine. McCown instructed Allen to go to the No. 1 mine to confirm the report and to obtain as many particulars on the accident as possible. Ronald Hughes, Coal Mine Inspection Supervisor; and Thomas Engle, Ricky Hamilton, Lewis Klayko, Reginald Rice and Gerald McMasters, Coal Mine Inspectors, were dispatched to the mine. James Begley, Acting District Manager, District 6, Pikeville, Kentucky, was notified at 10:30 a.m. Allen, after arriving at the mine, called McCown at 10:45 a.m. and confirmed that an explosion had occurred and informed McCown that 7 miners were unaccounted for. After dispatching other MSHA personnel to assist in the recovery operation, McCown and Rex Music, Coal Mine Inspection Supervisor, traveled to the No. 1 mine. Begley notified Joseph A. Lamonica, Administrator for Coal Mine Safety and Health, and Lawrence D. Phillips, District Manager, District 6, of the accident at about 10:35 a.m. Lamonica and Phillips were in Beckley, West Virginia, at the time of the notification.

The MSHA mine rescue teams in Morgantown, West Virginia, and Pittsburgh, Pennsylvania, were placed on standby status on the morning of January 20, 1982, for possible deployment to the No. 1 mine. Later that day it was determined that there were sufficient mine rescue teams available for the recovery operations; therefore, the MSHA rescue teams were removed from standby status.

The first MSHA official to arrive at the mine following the explosion was Allen. He arrived at about 10:35 a.m. on January 20. McCown and Music arrived at the mine at approximately 11:15 a.m. and assumed direction of MSHA activities. Other MSHA personnel arrived at the mine throughout the recovery operations and were assigned various duties. The mine fan and the mine openings were monitored for methane and carbon monoxide by MSHA personnel. A section 103(k) Order was issued covering the entire mine to insure the safety of any person in the mine, and to require the operator to obtain the approval of MSHA for any plan to recover any person in the mine or to return the affected areas of the mine to normal.

A surface control center was established in the mine office and a system to record all recovery operation activities was started. James Begley arrived at the mine at 12:15 p.m. on January 20 and assumed direction of MSHA activities.

On January 20, 1982, at approximately 11:15 a.m., MSHA's Mine Emergency Operations (MEO) in Pittsburgh, Pennsylvania, was notified of the explosion. The seismic location system, communication van, gas analysis van, and the Emergency Technical Advisory Support Team were immediately deployed to the mine site. The Emergency Technical Advisory Support Team arrived at the mine at about 10:30 p.m., while the other MEO personnel and equipment were standing by at the nearby Jenny Wiley State Park. At 2:25 a.m., January 21, following the removal of the victims from the mine, MEO emergency status was terminated. All personnel returned to their home stations on January 21, except 2 support personnel who remained at the mine site with the communication van to provide technical assistance, communications, and logistics support for the investigation team. The communication van and the 2 support personnel returned to their home station on January 30, 1982.

The Explosion and Recovery Operations

On January 20, 1982, 7 miners entered the mine at 6 a.m. and began mining operations in the rooms that had been turned right off of the No. 7 entry. Purvis Hamilton, Mine Manager, remained on the surface to perform surface related duties. According to Hamilton, mining operations during the shift had progressed normally. Hamilton stated that he had heard 3 or 4 places blasted prior to the explosion. Hamilton estimated that 90 tons of coal had been loaded that shift and that no unusual conditions had been reported by the miners underground.

At approximately 9:40 a.m., an explosion occurred underground. The forces from the explosion traveled to the surface out of all 3 mine openings. The telephones on the surface were destroyed by the forces coming out of the mine. Hamilton, who was not injured, immediately shouted over the hill to a passing truck driver, informed him of the explosion and instructed him to summon help. Shortly thereafter, Phillip Stevens, Elk Horn Coal Corporation, who was on the surface at a nearby underground coal mine, James McKinney and Danny Newsome, who lived near the mine, and Curtis Tackett who worked at a nearby mine, arrived at the mine to give assistance. The forces from the explosion had damaged the

fan housing and had torn down all of the electrical wiring. The mine fan was not running. Hamilton, Stevens, Newsome, Tackett, and McKinney repaired the fan housing and reconnected the power wires to the mine fan. The fan, which normally was operated exhausting, was wired so that the fan would operate blowing. Their reason for reversing the direction of airflow was to provide fresh air more quickly to the miners. The fan was restarted at approximately 10:30 a.m.

After representatives from the Kentucky Department of Mines and Minerals and MSHA arrived at the mine, they decided to reverse the fan to exhausting so that exploration could be started on intake air. The fan was reversed at 12:22 p.m. An air measurement taken near the entrance of the No. 3 entry, main intake, indicated that about 30,257 cfm of air was entering the mine.

The mine rescue teams began arriving at the mine at about 11:30 a.m. The Kentucky Department of Mines and Minerals mine rescue team from Martin, Kentucky, entered the mine under oxygen at 12:50 p.m. through the No. 3 entry. They explored up to the No. 10 crosscut while tying across and behind as they advanced. Only traces of carbon monoxide were detected; no concentrations of methane were encountered. The concrete block stoppings between the Nos. 3 and 4 entries inby the No. 7 crosscut were blown out. The stoppings that had been erected between the return aircourses and the belt haulage entry were all partially or completely blown out except the 3 that had been installed in the Nos. 2, 5 and 6 crosscuts. The team also found that the main belt conveyor had been extensively damaged. Soot was observed throughout most of the areas explored. The team returned to the surface at 2:23 p.m.

A fresh-air base was established underground in the No. 3 entry just inby the No. 7 crosscut at approximately 3:15 p.m. by representatives from the State and MSHA. All activities at the fresh-air base were monitored by Begley and other MSHA and State personnel. The Kentucky Department of Mines and Minerals mine rescue team from Pikeville, Kentucky, went inby the fresh-air base under oxygen at 3:31 p.m. and proceeded to explore the areas inby the No. 10 crosscut. The team detected a maximum of 200 parts per million (ppm) of carbon monoxide at the intersection of the No. 12 crosscut and the No. 6 entry. They detected a maximum of 1.6 percent combustible gas at the tailpiece of the pony belt in the No. 7 entry. At approximately 4:08 p.m., the team found the bodies of Donald Hamilton, Palmer McKinney, and Ronnie Hall in the No. 4 room just off the No. 7 entry. The locations of the bodies were marked on the mine map and the team returned to the fresh-air base.

The Kentucky Department of Mines and Minerals mine rescue team from Hazard, Kentucky, went inby the fresh-air base under oxygen at 4:45 p.m. and had proceeded to the No. 10 crosscut in the No. 3 entry when one of the breathing apparatus malfunctioned. The team immediately returned to the fresh-air base. At that time, it was decided to advance the fresh-air base to the No. 12 crosscut in the No. 3 entry. Temporary stoppings were erected in the Nos. 8 through 11 crosscuts between the Nos. 3 and 4 entries. The new fresh-air base was established at about 8 p.m. The

National Mines Corporation mine rescue team under oxygen went inby the fresh-air base and proceeded across the No. 12 crosscut to the No. 7 entry. The team detected a maximum of 4,000 ppm carbon monoxide and 1.1 percent of combustible gas near the tailpiece of the pony belt in the No. 7 entry. At 9:01 p.m., the team found the body of Jack Hamilton in the No. 3 room just off the No. 7 entry. The bodies of Burnis Hamilton and Wade Hamilton were found at 9:11 p.m. in the No. 7 entry between the No. 2 room and the No. 3 room. The locations of the bodies were marked on the mine map and the team returned to the fresh-air base at 9:21 p.m. At this time, a decision was made by the State and MSHA officials to ventilate the entire mine.

Temporary stoppings were erected by barefaced recovery crews in the Nos. 12 through 20 crosscuts between the Nos. 3 and 4 entries to direct the air currents to the last open crosscut in the main entries. At approximately 10:49 p.m., these stoppings had been erected and the quantity of air being delivered to the last open crosscut was 24,000 cfm. After the area had been ventilated, the recovery team found the body of Thurman Reynolds at 11:37 p.m. in the No. 7 room just off the No. 7 entry. The victims' names, locations where they were found, the locations of the electrical face equipment, and other items of information found during the recovery and investigation are shown in Appendices L and M.

According to the autopsy reports, 2 victims were killed instantly by the forces of the explosion. The other 5 victims died as a result of carbon monoxide poisoning.

The self-rescuers for all of the victims, except the one for the section foreman, were found either on their belts or near the bodies. The self-rescuer for the section foreman could not be accounted for during the investigation. The bottom portion of a filter-type self-rescuer was found along the right rib in the No. 4 room near the location where the body of the roof bolting machine operator was found. The top of the self-rescuer and the sealing clip were found on the mine floor in the left crosscut in the No. 4 room near the operating controls of the roof bolting machine. It could not be determined whether or not the self-rescuer had been used. Three opened self-rescuers were found in the No. 7 entry at the intersections of the Nos. 9 and 11 crosscuts. Apparently, these self-rescuers were torn from the belts of the victims by the forces of the explosion.

The victims were transported to the surface and all personnel were withdrawn from the mine by 2:55 a.m. on January 21, 1982.

PART III

INVESTIGATION, DISCUSSION, AND EVALUATION

Organizations and Interviews

On January 25, 1982, MSHA investigators met in Pikeville, Kentucky, to develop detailed plans and procedures for investigating the explosion. On January 26, the investigation team entered the mine to start a comprehensive investigation and evaluation of existing conditions in the mine. All observed conditions were recorded by the team members either on a map or in a notebook. Maps showing the detailed information gathered in the mine are contained in Appendices L and M. Where necessary, photographs were taken and sketches were made of conditions and equipment. Mine dust surveys were taken throughout the mine using MSHA's standard procedures for making these surveys. In conjunction with the underground portion of the investigation, interviews of mine officials, mine rescue and recovery personnel, and MSHA officials who could furnish information pertinent to the events occurring before and after the explosion were conducted by members of the investigation team.

During the underground portion of the investigation, Curtis Tackett, T&N Coal Company; Bennie Tackett, BJL Coal Company; and Gary Johnson, Ligon Preparation Company, provided underground transportation for the investigation team.

On February 10, 1982, persons with information pertaining to the mine explosion and the recovery operations were interviewed at the Kentucky Department of Mines and Minerals office in Martin, Kentucky. The names of the people interviewed are included in Appendix C.

Persons Who Participated in the Investigation

The underground investigation of the explosion was started January 26, 1982, and continued until January 29, 1982. The following persons participated in the investigation:

RFH Coal Company

Purvis Hamilton	Mine Manager

United Mine Workers of America

James Boyd	Safety Coordinator

Kentucky Department of Mines and Minerals

Willard Stanley	Commissioner
William Clayton	Director, Miner Training and Education
Ralph Perry	Director, Mine Safety Analysis Division

Eddie Akers	Mine Inspector
Richard Watts	Mine Inspector
Clarence Kidd	Safety Analyst

Mine Safety and Health Administration

Lawrence Phillips	District Manager
William Coleman	Subdistrict Manager, Paintsville, Subdistrict
James Begley	Engineering Coordinator
Andy Lycans	Supervisory Coal Mine Specialist (Electrical)
Charles Webb	Senior Special Investigator
John South	Special Investigator
Michael Finnie	Special Investigator
Anthony Webb	Coal Mine Inspector
Ray McKinney	Coal Mine Inspector
Thomas Engle	Coal Mine Inspector
Carlos Duff	Coal Mine Inspector
Jerry Sosebee	Coal Mine Inspector
Robert Fleming	Coal Mine Inspector
Jack Collins	Coal Mine Inspector
Carlos Smith	Coal Mine Inspector
Sherrell Reid	Coal Mine Inspector
Reginald Rice	Coal Mine Inspector
Gerald McMasters	Coal Mine Inspector
Lewis Klayko	Coal Mine Inspector
Ricky Hamilton	Coal Mine Inspector
Stanley Allen, Sr.	Coal Mine Inspector (Electrical)
Glennis Hall	Coal Mine Inspector (Electrical)
Edward Kawenski	Chief, Industrial Safety Division, Technical Support
Steven Sawyer	Chief, Special Projects, Technical Support
Claude Reich	Mine Safety and Health Specialist, Technical Support
James Banfield	Chief, Ventilation Division, Technical Support
Kevin Stricklin	Mining Engineer, Technical Support
Clete Stephan	Mining Engineer, Technical Support
Robert Elam	Mining Engineer
Earnest Teaster, Jr.	Mine Safety and Health Specialist
Michael Yanak	Special Investigator
Steve Kramer	Attorney, Office of the Solicitor

Factors Affecting the Explosion

Explosives

The Tovex 320 water gel explosives at this mine were stored on the surface in an unheated metal magazine near the mine portal. Normally, the explosives taken underground each day were used the same day. The Du Pont Company recommended that their permissible-type water gel explosives not be used in temperatures below 40° F. The Du Pont Company did not specify the amount of time that the explosives should be exposed to temperatures 40° F or higher before being used when the explosives were stored in temperatures below the recommended range. Based on records maintained by the National Weather Service in Jackson, Kentucky, located about 50 miles from the mine, the temperatures averaged 35.3° F during December 1981, with the high and low temperatures averaging 42.7° F and 27.0° F, respectively. During January, the temperatures averaged 30.2° F, with the high and low temperatures averaging 44.4° F and 19.9° F, respectively.

Several undetonated partial cartridges of the Tovex 320 water gel explosives were found on the surface. Purvis Hamilton stated that he had removed these cartridges from the coal being transported on the belt conveyor. Undetonated cartridges of explosives were also observed underground in several boreholes in the faces that had been previously shot. Hamilton stated that it was not unusual to find explosives in the coal being transported on the belt conveyor. The effect, if any, that the low temperatures had on the misfiring of these explosives is not known. Samples of the Tovex 320 explosives at this mine were tested by the Bureau of Mines in Pittsburgh, Pennsylvania. These tests indicated that the explosives were manufactured within the tolerances of the requirements for permissible explosives.

The Du Pont electric detonators used at the mine had millisecond delay periods of 1 through 9. The No. 1 detonator had a nominal delay period of 25 milliseconds and the No. 9 had a delay period of 700 milliseconds. When using millisecond delay detonators in underground coal mines, the total time laspe between the first detonator initiated and the last detonator in the series shall not exceed 500 milliseconds, as outlined in Part 25, 30 CFR 25. The time interval between Du Pont's No. 1 and No. 9 detonators is 675 milliseconds.

When blasting coal from the solid by the "slab shooting method," the delay detonators should be used as a consecutively numbered sequence starting with the shortest delay period. The delay intervals between the detonators are designed to allow sufficient coal movement to create a free face before the next blast hole is detonated. The leg wires of delay detonators are color-coded so that each delay period can be easily recognized.

The investigators found that the faces of the Nos. 7, 8, 9, and 10 rooms and the face of a developing crosscut that had been turned right off the No. 8 room had been drilled, charged with explosives, and were ready for blasting. The detonator leg wires had been wired in series in each

place with the leg wires from the 2 outside boreholes shunted. Stemming materials had not been used in any of the charged holes. There were 8 to 9 charged holes in each face with a total of 43 charged holes in the 5 faces. The explosives were removed from some of the charged holes which revealed that 4 to 6 cartridges were being used per hole. Each cartridge weighed approximately 1.2 pounds. The regulations contained in Title 30, Code of Federal Regulations, places a 3-pound limit on the amount of explosives that may be used in boreholes for the blasting of coal.

Numerous blown-out shots were observed throughout the mine in both the entries and the rooms. Several boxes of clay dummies (stemming material) were found underground, but there was no evidence that they were being used during blasting operations. Company records indicated that 46 boxes of clay dummies (the only type of stemming materials ever used at the mine) and 1,886 cases of Tovex explosives were purchased for mine use from January 1, 1981, through January 20, 1982. This is a clear indication that stemming materials were very rarely used during blasting operations. The regulations require that boreholes in excess of 4 feet in depth be stemmed with at least 24 inches of incombustible material.

Eight 50-pound boxes of Tovex explosives were stored in their original containers along the active roadway in the No. 7 entry between the Nos. 2 and 3 rooms. Approximately 7-1/2 boxes of electric detonators were stored in their original containers in the No. 12 crosscut between the Nos. 6 and 7 entries along the pony belt conveyor. Based on the aforementioned reasons, the investigators concluded that known safe procedures or compliance with the regulations for the use, handling, and storage of explosives at this mine were not normally followed. All the miners at this mine had received training in the proper use, handling, and storage of explosives during their annual retraining session in January 1982. Additionally, these subjects were discussed with the miners during an MSHA inspection that was conducted at the mine on December 21, 1981.

The faces of the No. 6 room and the developing crosscuts turned left and right in the No. 6 room had been blasted. Indications are that these 3 places were shot simultaneously immediately prior to the explosion. The blasting cable extended from the No. 7 entry into the No. 6 room. When these shots were fired, the right crosscut shot through into the No. 5 room. The distance that existed between the face of the crosscut and the left rib of the No. 5 room prior to blasting was estimated to be 5 feet. There were 2 small stumps of coal left intact when the crosscut shot through. A partial cartridge of Tovex was observed in a borehole in the stump on the right rib. The borehole was blown-out on the backside of the stump toward the No. 5 room. The face of the No. 5 room had been developed about 32 feet inby the point where the crosscut shot through.

The investigators concluded that the face of the No. 5 room had been blasted, just before the places in the No. 6 room were shot, placing coal dust into suspension in the No. 5 room. Coal dust put into suspension in a nonventilated area could remain in suspension for an indefinite period of time. The investigators concluded that when the

crosscut between the Nos. 5 and 6 rooms blasted through into the No. 5 room, the flames from the explosives ignited coal dust due to a blown-out or blown-through shot caused by an unconfined shot, excessive explosives per borehole, an overburdened shot or underburdened shot.

Methane and Ventilation

Company mine records did not indicate that methane had been found in the mine. During the four MSHA inspections of the entire mine, of 8 air samples collected in the immediate return and in the main return, 5 samples contained no methane, and 3 samples contained from 0.01 percent to 0.02 percent methane. The highest concentration of combustible gases detected with a permissible detector during recovery operations was 1.6 percent. The analyses of air samples collected at the mine fan during recovery operations indicated a maximum of 0.08 percent methane. The mine rescue team members and others involved in the recovery operation made numerous tests for methane with hand-held methane detectors. While these instruments indicated up to 1.6 percent of combustible gases, laboratory analyses of the air samples collected determined that these combustible gases were predominately composed of hydrocarbons, other than methane, that resulted from the explosion. Therefore, methane was not considered a factor in the explosion. The analyses of all air samples collected during the recovery operation are in Appendix H.

On January 19, 1982, the day before the explosion, Phillip Stevens, Surveyor for Elk Horn Coal Corporation, was in all working places in the No. 1 mine as he surveyed the mine workings. He stated that he did not observe any check curtains or line brattices being used in any of the 14 rooms that had been turned right off the No. 7 entry. During the investigation, evidence indicated that check curtains, temporary stoppings, or line brattices were not used to direct the ventilation currents into these rooms at the time of the explosion. The quantity of air being circulated through the mine was adequate and was not considered a factor in the explosion. However, failure to install ventilation controls to direct the ventilating air currents into the face area of the No. 5 room was a factor in the explosion. Properly installed and adequately maintained line brattice would have directed ventilation to the face areas of the No. 5 room which would have removed the dust clouds created when the coal was blasted. According to the preshift examination book, 24,000 cfm of air was being delivered to the last open crosscut during the preshift examination made on January 20, 1982.

Coal Dust

During the investigation, MSHA conducted mine dust surveys of the mine. A total of 102 samples were taken 100 feet apart in the main entries, beginning just inby the mine openings. Thirteen samples were taken in the rooms that had been turned right off the No. 7 entry. The samples were analyzed for incombustible content, percent of float dust, and the presence of coke.

According to the results of the laboratory analyses, the incombustible content in 111 of the 115 samples collected was less than 65 percent.

The incombustible content in 106 of the samples was less than 50 percent, and 68 of the samples were less than 30 percent in incombustible content. The average incombustible content was 30.8 percent for all samples collected. The incombustible content of the 13 samples collected in the rooms ranged from 6.0 to 30.2 percent and the average incombustible content of these samples was 22.7 percent. The average float dust content of the 115 samples was 7.4 percent. All of the mine dust samples were tested for coke, using the alcohol coke test, which revealed that coke was present in 113 of the samples. A map showing the location of these samples and the results of the analyses are in Appendices J and I.

Dust samples collected after an explosion are not necessarily representative of the mine dust conditions prior to an explosion since mine dust is thrown into suspension and dispersed and transported during an explosion. However, dust samples collected over extensive areas in a mine after an explosion will indicate the average incombustible content prior to the explosion. From visual observations made by the investigators and based on the analyses of the mine dust samples, the applications of rock dust were inadequate.

Accumulations of loose coal and coal dust were observed in depths ranging from 1/2 to 2 inches on the mine floor in the Nos. 4 through 7 entries and the connecting crosscuts for a distance of approximately 1,280 feet, and in the Nos. 1 through 11 rooms. The mine surfaces were extremely dry and dusty. Water, or other no less effective methods, was not applied to coal dust on the ribs, roof, and mine floor in the areas less than 40 feet from the faces to reduce dispersibility and to minimize the explosion hazard. Rock dust had been applied to the mine surface in some areas of the mine. The quantity, however, was obviously inadequate. Company records indicated that between January 1, 1981, and January 20, 1982, only 465 fifty-pound bags of rock dust were purchased for the mine. Approximately 133 bags of the rock dust were still on the surface and had not been taken underground. The mine was started in November 1980; however, almost all underground mine development was done after January 1, 1981.

The Explosion and Propagation

Based on observations and the evidence, it appears that the shot firer blasted the face of the No. 5 room and immediately proceeded to the No. 6 room where the 3 faces were blasted simultaneously. With no line brattice or other devices to direct the ventilating currents to the face area of the No. 5 room, the fine coal dust thrown into suspension when the face of the No. 5 room was blasted would have remained in suspension. When the faces in the No. 6 room were blasted, the crosscut between the Nos. 6 and 5 rooms shot through and flames from the explosives ignited a cloud of coal dust in the No. 5 room. The flames were then propagated into the No. 6 room as well as out of the No. 5 room into other areas of the mine.

Flame and Forces

The extent of the flame and direction of the forces of the explosion have been determined from the underground observations of the investigation team and from the presence of coke in the mine dust samples.

Flame

The analyses of the mine dust samples determined that coke was present in 113 of the 115 samples collected. Partially burned paper, melted plastic brattice material, and soot deposits were visibly evident throughout most areas of the mine. There was soot throughout the entire length of the Nos. 6 and 7 entries. The flame extended outby the face of the No. 5 room to within about 125 feet of the surface and to just inby the last open crosscut of the main entries. The trees near the mine openings were coated with a heavy film of dust with no evidence of charred wood beneath the dust. Hot gases driven from the mine by the explosion forces caused scorching of paper and melting of plastic brattice cloth near the mine portal. The extent of the flame is shown on a map in Appendix K.

Forces

The forces from the explosion damaged or destroyed all of the concrete block stoppings underground except the six that were installed in the Nos. 2 through 7 crosscuts between the Nos. 3 and 4 entries, and three that were installed in the Nos. 2, 5 and 6 crosscuts between the Nos. 4 and 5 entries. The section power center was located in the No. 6 entry near the No. 13 crosscut prior to the explosion. Explosion forces moved the power center, estimated to weigh 2 tons, outby in the No. 6 entry for a distance of about 70 feet. The movement of the power center and accompanying forces extensively damaged the pony belt conveyor and the pony belt conveyor drive that had been installed in the No. 12 crosscut. The main belt conveyor in the No. 4 entry was damaged, distorted, and thrown towards the right rib inby the No. 7 crosscut. The main belt conveyor tailpiece, which was at the intersection of the No. 16 crosscut and the No. 4 entry prior to the explosion, was blown outby for a distance of approximately 150 feet. The main belt conveyor was intact between the Nos. 1 through 7 crosscuts; however, the belt conveyor outby the No. 1 crosscut, including about 30 feet of belt structure and the belt conveyor drive on the surface, was completely dismantled.

The forces from the explosion damaged and scattered numerous detonators and Tovex cartridges throughout the No. 7 entry between the Nos. 6 through 15 crosscuts and in the No. 7 room. The damaged detonators or Tovex cartridges were not detonated by the explosion. Various pieces of the explosives wagon, used to transport the explosives on the working section, were found in the No. 7 entry outby the No. 11 crosscut and in the No. 2 room. Eight 50-pound boxes of Tovex explosives stored along the right rib in the No. 7 entry between the Nos. 2 and 3 rooms and 7-1/2 boxes of detonators stored along the left rib on the No. 12 crosscut between the Nos. 6 and 7 entries were not damaged by the forces from the explosion.

The battery-powered shot firing unit was completely destroyed by the forces of the explosion which scattered the various parts of the unit in the No. 7 entry between the Nos. 5 and 9 crosscuts. A portion of the blasting cable, approximately 15 feet in length, was found near the location where the upper part of the blasting unit was found. The main portion of the blasting cable extended along the right rib in the No. 7 entry between the Nos. 5 and 6 rooms and extended along the right rib for a distance of about 35 feet into the No. 6 room.

Surface facilities that were in direct line with the mine openings were destroyed. The fan housing, which was constructed of concrete blocks and sheet metal, was extensively damaged. All electrical power lines, including the power circuit for the mine fan, were severed and torn down. A 1,000-gallon water tank was blown about 50 feet over the hill. Trees that were in direct line with the forces were coated with dust and debris and had several broken limbs. Some of the mine supplies and debris on the surface were blown to the hillside opposite the mine openings, a distance estimated at 800 to 1000 feet. The direction and extent of forces are shown in Appendix K. Photographs showing damage caused by the explosion are in Appendix E.

Discussion of Point of Origin

Based on the evidence of flame, major forces of the explosion, and the conditions observed, the investigators concluded that the explosion originated in the No. 5 room when a cloud of coal dust was ignited by the flames from a blown-out or blown-through shot that occurred when the crosscut between the Nos. 6 and 5 rooms was blasted. When blown-out or blown-through shots occur, they create a sheet of flame that projects toward the collar or out the end of the borehole into an adjoining room or open area. The common causes for blown-out or blown-through shots are unconfined shots, excessive amount of explosives per borehole, overburdened shots and underburdened shots.

PART IV

FINDINGS OF FACT

Findings

1. The volatile ratio of the coal near the face area of the No. 6 room in the 001 section from an analysis of a standard channel sample of coal is 0.40; therefore, the coal dust at this mine is highly explosive.

2. According to the results of the laboratory analyses, the incombustible content in 111 of the 115 samples collected was less than 65 percent. The incombustible content in 106 of the samples was less than 50 percent, and 68 of the samples were less than 30 percent in incombustible content. The average incombustible content was 30.8 percent for all samples collected. The incombustible content of the 13 samples collected in the rooms ranged from 6.0 to 30.2 percent and the average incombustible content of these samples was 22.7 percent. The average float dust content of the 115 samples was 7.4 percent.

3. Water, or other no less effective methods, was not applied to coal dust on the ribs, roof and floor, particularly in distances less than 40 feet from the face, to reduce dispersibility and to minimize the explosion hazard.

4. Accumulations of loose coal and coal dust were observed in depths ranging from 1/2 to 2 inches on the mine floor in the Nos. 4 through 7 entries and the connecting crosscuts for a distance of approximately 1,280 feet and in Nos. 1 through 11 rooms. The mine surfaces were extremely dry and dusty. Rock dust had been applied to the mine surfaces in some areas of the mine. The quantity, however, was obviously inadequate.

5. The coal was blasted from the solid faces by a method commonly called "slab shooting."

6. The type of explosives was Du Pont Tovex 320 water gel, a permissible explosive, in 1-1/2- by 16-inch cartridges. The original paper cartons each contained 50 pounds, with about 42 cartridges in each carton.

7. The faces of the No. 6 room and the developing crosscuts turned left and right in the No. 6 room had been blasted. Indications are that these 3 places were shot simultaneously immediately prior to the explosion.

8. The investigators concluded that the face of the No. 5 room had been blasted just before the places in the No. 6 room were shot, placing coal dust into suspension in the No. 5 room.

9. The investigators concluded that when the crosscut between the Nos. 5 and 6 rooms blasted through into the No. 5 room, the flames from the explosives ignited coal dust due to a blown-out or blown-through shot, an unconfined shot, excessive explosives per borehole, an overburdened shot or underburdened shot. The distance that existed between the face of the crosscut and the left rib of the No. 5 room prior to blasting was estimated to be 5 feet.

10. There were 2 small stumps of coal left intact when the crosscut shot through. A partial cartridge of Tovex was observed in a borehole in the stump on the right rib. The borehole was blown out on the backside of the stump toward the No. 5 room.

11. The faces of the Nos. 7, 8, 9, and 10 rooms and the face of a developing crosscut that had been turned right off the No. 8 room, had been drilled, charged with explosives, and were ready for blasting. Stemming materials had not been used in any of the charged holes. There were 8 to 9 charged holes in each face with a total of 43 charged holes in the 5 faces. The explosives were removed from some of the charged holes which revealed that 4 to 6 cartridges were being used per hole. Each cartridge weighed approximately 1.2 pounds.

12. Eight 50-pound boxes of Tovex explosives were stored in their original containers along the active roadway in the No. 7 entry between the Nos. 2 and 3 rooms. Approximately 7 1/2 boxes of electric detonators were stored in their original containers in the No. 12 crosscut between the Nos. 6 and 7 entries along the pony belt conveyor.

13. Numerous blown-out shots were observed throughout the mine in both the entries and the rooms. Several boxes of clay dummies (stemming material) were found underground, but there was no evidence that they were being used during blasting operations. Company records indicated that 46 boxes of clay dummies (the only type of stemming materials ever used at the mine) and 1,886 cases of Tovex explosives were purchased for mine use from January 1, 1981, through January 20, 1982.

14. Ventilation was induced by a 5-foot propeller-type fan that was operated exhausting. During the last inspection of the entire mine conducted November 3-4, 1981, approximately 45,000 cubic feet per minute of air was measured at the main fan. During the same inspection, approximately 18,200 cfm of air was reaching the last open crosscut in the 001 section. The quantity of air being circulated through the mine was adequate and was not considered a factor in the explosion.

15. During the investigation, evidence indicated that check curtains, temporary stoppings, or line brattices were not used to direct the ventilating air currents into the rooms at the time of the explosion. Failure to install ventilation controls to direct the ventilating air currents into the face area of the No. 5 room was a factor in the explosion.

16. Company mine records and MSHA inspection records did not indicate that methane had been found in the mine in any appreciable quantities; methane was not considered a factor in the explosion.

17. The miners all received their annual retraining in January 1982. During these training sessions, the technique of shooting off the solid, the use of permissible explosives in a permissible manner, and the importance of following the clean-up program and adequate application of rock dust were discussed.

18. During a spot inspection conducted on December 21, 1981, an MSHA inspector talked with all of the mine employees to discuss the recent mine explosions, blasting practices related to shooting coal from the solid, the importance of following the company's clean-up program to prevent coal dust accumulations, rock dusting practices, mine ventilation, smoking underground, and drying out of the mine due to changing weather conditions.

19. On January 20, 1982, 7 miners entered the mine at 6 a.m. and began mining operations in the rooms that had been turned right off the No. 7 entry. Purvis Hamilton, Mine Manager, remained on the surface to perform surface related duties.

20. According to Hamilton, mining operations during the shift had progressed normally. Hamilton stated that he had heard 3 or 4 places blasted prior to the explosion. He estimated that 90 tons of coal had been loaded on that shift and that no unusual conditions had been reported by the miners underground.

21. On January 20, 1982, at approximately 9:40 a.m., a coal dust explosion occurred in the 001 section of RFH Coal Company's No. 1 mine. All 7 miners working underground at the time of the explosion were killed.

22. The flames extended outby the face of the No. 5 room to within about 125 feet of the surface and to just inby the last open crosscut on the main entries. The trees near the mine openings were coated with a heavy film of dust with no evidence of charred wood beneath the dust. Hot gases driven from the mine by the explosion forces caused scorching of paper and melting of plastic brattice cloth near the mine portal.

23. The analyses of the mine dust samples determined that coke was present in 113 of the 115 samples collected. Partially burned paper, melted plastic brattice material, and soot deposits were visibly evident throughout most areas of the mine. There was soot throughout the entire length of the Nos. 6 and 7 entries.

24. The forces from the explosion damaged or destroyed all of the concrete block stoppings underground except the six that were installed in the Nos. 2 through 7 crosscuts between the Nos. 3 and 4 entries, and three that were installed in the Nos. 2, 5, and 6 crosscuts between the Nos. 4 and 5 entries. The section power center and the

belt conveyors were extensively damaged by the explosion. Explosion forces moved the power center, estimated to weigh 2 tons, a distance of about 70 feet.

25. Surface facilities that were in direct line with the mine openings were destroyed. The fan housing, which was constructed of concrete blocks and sheet metal, was extensively damaged. All electrical power lines, including the power circuit for the mine fan, were severed and torn down. A 1,000-gallon water tank was blown about 50 feet over the hill.

26. The first mine rescue team entered the mine at 12:50 p.m. on January 20, 1982. Mine rescue and recovery teams explored and ventilated the mine and located the 7 victims by 11:37 p.m., January 20, 1982.

27. The mine rescue teams detected a maximum of 4,000 ppm carbon monoxide and 1.6 percent of combustible gas near the tailpiece of the pony belt in the No. 7 entry.

28. According to the autopsy reports, 2 victims were killed instantly by the forces of the explosion. The other 5 victims died as a result of carbon monoxide poisoning.

29. The self-rescuers for all of the victims, except the one for the section foreman, were found either on their belts or near the bodies. The self-rescuer for the section foreman could not be accounted for during the investigation.

30. The bottom portion of a filter-type self-rescuer was found along the right rib in the No. 4 room near the location where the body of the roof bolting machine operator was found. The top of this self-rescuer and the sealing clip was found on the mine floor in the left crosscut in the No. 4 room near the operating controls of the roof bolting machine. It could not be determined whether or not the self-rescuer had been used.

31. Three opened self-rescuers were found in the No. 7 entry at the intersections of the Nos. 9 and 11 crosscuts. Apparently, these self-rescuers were torn from the belts of the victims by the forces of the explosion.

32. The electrical equipment and circuits underground were examined and/or tested during the investigation. The results of these tests and examinations established that the electrical equipment and circuits were not factors in the explosion.

33. During the investigation, 2 cigarette lighters, 2 cigarette butts, and an unopened package of cigarettes were found underground. A cigarette lighter, 8 cigarette butts and an opened package of cigarettes were removed from the clothing of one of the victims during the examinations of the bodies by the State Medical Examiner. It was apparent that smoking was a practice underground; however, smoking was not considered a factor in the explosion.

Contributory Violations

Six of the conditions and/or practices in the "Findings of Fact" contributed to the explosion or were indicative of the blasting practices being followed at the mine and constituted violations of the Federal Mine Safety and Health Act and the mandatory standards contained in Title 30, Code of Federal Regulations. These violations are listed below:

Section 75.316 - During the investigation, evidence indicated that check curtains, temporary stoppings, or line brattices were not used to direct the ventilating air currents into any of the entries or rooms at the time of the explosion.

Section 75.400 - Accumulations of loose coal and coal dust were observed in depths ranging from 1/2 to 2 inches on the mine floor in the Nos. 4 through 7 entries and the connecting crosscuts for a distance of approximately 1,280 feet and in Nos. 1 through 11 rooms. The mine surfaces were extremely dry and dusty.

Section 75.401 - Water, or other no less effective methods, was not applied to coal dust on the ribs, roof and floor, particularly in distances less than 40 feet from the face, to reduce dispersibility and to minimize the explosion hazard.

Section 75.403 - According to the results of the laboratory analyses, the incombustible content in 111 of the 115 samples collected was less than 65 percent. The incombustible content in 106 of the samples was less than 50 percent, and 68 of the samples were less than 30 percent in incombustible content. The average incombustible content was 30.8 percent for all samples collected. The incombustible content of the 13 samples collected in the rooms ranged from 6.0 to 30.2 percent and the average incombustible content of these samples was 22.7 percent.

Section 75.1303 - The faces of the Nos. 7, 8, 9, and 10 rooms and the face of a developing crosscut that had been turned right off the No. 8 room had been drilled, charged with explosives, and were ready for blasting. Stemming materials had not been used in any of the charged holes. There were 8 to 9 charged holes in each face with a total of 43 charged holes in the 5 faces. The explosives were removed from some of the charged holes which revealed that 4 to 6 cartridges were being used per hole. Each cartridge weighed approximately 1.2 pounds. In addition, the crosscut between the Nos. 5 and 6 rooms was blasted through into the No. 5 room, allowing flame from the explosives to ignite coal dust

due to a blown-out or blown-through shot caused by an unconfined shot, excessive explosives per borehole, an overburdened shot or underburdened shot.

Section 75.1306 - Eight 50-pound boxes of Tovex explosives were stored in their original containers along the active roadway in the No. 7 entry between the Nos. 2 and 3 rooms. Approximately 7 1/2 boxes of electric detonators were stored in their original containers in the No. 12 crosscut between the Nos. 6 and 7 entries along the pony belt conveyor.

A copy of these citations is in Appendix G. Other violations were found during the investigation which did not contribute either to the cause or severity of the explosion. Appropriate citations were issued to RFH Coal Company for all violations revealed.

PART V

CONCLUSION

The investigators concluded that coal dust was ignited in the No. 5 room when explosive charges were detonated in the developing crosscut between the Nos. 5 and 6 rooms. The crosscut was being mined from the No. 6 room toward the No. 5 room. Prior to blasting, the coal remaining in the crosscut between the 2 rooms was approximately 5 feet in thickness. When the crosscut was blasted, the place shot through into the No. 5 room. The flames from the explosives were not contained within the boreholes due to either a blown-out or blown-through shot caused by an unconfined shot, excessive explosives used per hole, an overburdened or underburdened shot. The flames resulting from the explosives ignited a cloud of coal dust in the No. 5 room; the flames then propagated into the No. 6 room as well as out of the No. 5 room into other areas of the mine.

The following conditions and practices contributed to the explosion and its propagation:

1. Water, or other no less effective methods, was not applied to coal dust on the ribs, roof and floor, particularly in distances less than 40 feet from the face, to reduce dispersibility and to minimize the explosion hazard;

2. Line brattices, or other approved devices were not used in the No. 5 room to provide adequate ventilation in the face area to remove coal dust that was in suspension.

3. Sufficient quantities of rock dust were not applied to the mine surfaces throughout the mine to render the coal dust inert.

4. Coal dust, including float coal dust, and loose coal was permitted to accumulate along the entries and rooms, and the areas outby the working section.

Respectfully submitted,

Earnest C. Teaster, Jr.
Earnest C. Teaster, Jr.
Mine Safety and Health Specialist

Robert A. Elam
Robert A. Elam
Mining Engineer

Approved by:

Joseph A. Lamonica
Administrator
for Coal Mine Safety and Health

APPENDIX A

Victims of Mine Explosion
No. 1 Mine
RFH Coal Company
January 20, 1982

Name and Social Security Number	Age	Occupation	Mining Experience
Thurman Reynolds 282-58-4198	25	Section Foreman	7 years, 5 months
Donald Hamilton 403-53-1712	39	Coal Drill Operator	11 years
Palmer McKinney 401-84-6637	26	Roof Bolting Machine Operator Helper	1 year, 2 months
Ronnie Hall 406-90-1474	25	Roof Bolting Machine Operator	2 years, 6 months
Jack Hamilton 401-62-9244	36	Shot Firer	11 years
Burnis Hamilton 407-68-8235	31	Scoop Operator	11 years
Wade Hamilton 401-94-0895	23	Scoop Operator	4 years, 3 months

APPENDIX B

Mine rescue teams used during the recovery operations following the mine explosion at RFH Coal Company's No. 1 Mine on January 20, 1982

Pikeville Mine Rescue Team

David Phillips (Captain)
Phillip Burke
Don Wallen
Kenneth Kelley
Charles Hackney

Hazard Mine Rescue Team

William Cantrell (Captain)
Eugene Lewis
Alexander Johnson
Manuel Slone
Darrell Wooten

Martin Mine Rescue Team

Bobby Sexton (Captain)
Larry Sexton
Clarence Kidd
Benny Combs
Dewey Martin

National Mines Corporation

Burl Scott (Captain)
Jack Sparkman
Danny Patton
Bill Sexton
Paul Little
Herman Little

Persons who participated in the recovery operations are as follows:

RFH Coal Company

Purvis Hamilton	Mine Manager

Elk Horn Coal Corporation

Phillip Ray Stevens	Surveyor

Kentucky Department of Mines and Minerals

Willard Stanley	Commissioner
Elihu Coyer	Inspector
Walter Coleman	Inspector
Phillip Burke	Inspector
Richard Watts	Inspector
William Cantrell	Inspector
Eddie Akers	Inspector

Mine Safety and Health Administration

James Begley	Acting District Manager
Douglas Fleming	Coal Mine Technical Specialist (Ventilation)
Rex Music	Coal Mine Inspection Supervisor

Ronald Hughes	Coal Mine Inspection Supervisor
Hargus Ison	Coal Mine Inspection Supervisor
Danny McCown	Coal Mine Inspection Supervisor
Allen Grose	Ventilation Specialist
Russell Tackett	Ventilation Specialist
Michael Finnie	Special Investigator
Charles Webb	Senior Special Investigator
John South	Special Investigator
Foster Justice	Coal Mine Inspector
Ricky Hamilton	Coal Mine Inspector
Reginald Rice	Coal Mine Inspector
Thomas Engle	Coal Mine Inspector
Lewis Klayko	Coal Mine Inspector
Gerald McMasters	Coal Mine Inspector
Stanley Allen, Sr.	Coal Mine Inspector (Electrical)

Others

Curtis Tackett	T & N Coal Company
Danny Newsome	Resident near the mine
James McKinney	Resident near the mine
Fred McKinney	Resident near the mine

APPENDIX C

Persons interviewed in Martin, Kentucky, on February 10, 1982

RFH Coal Company

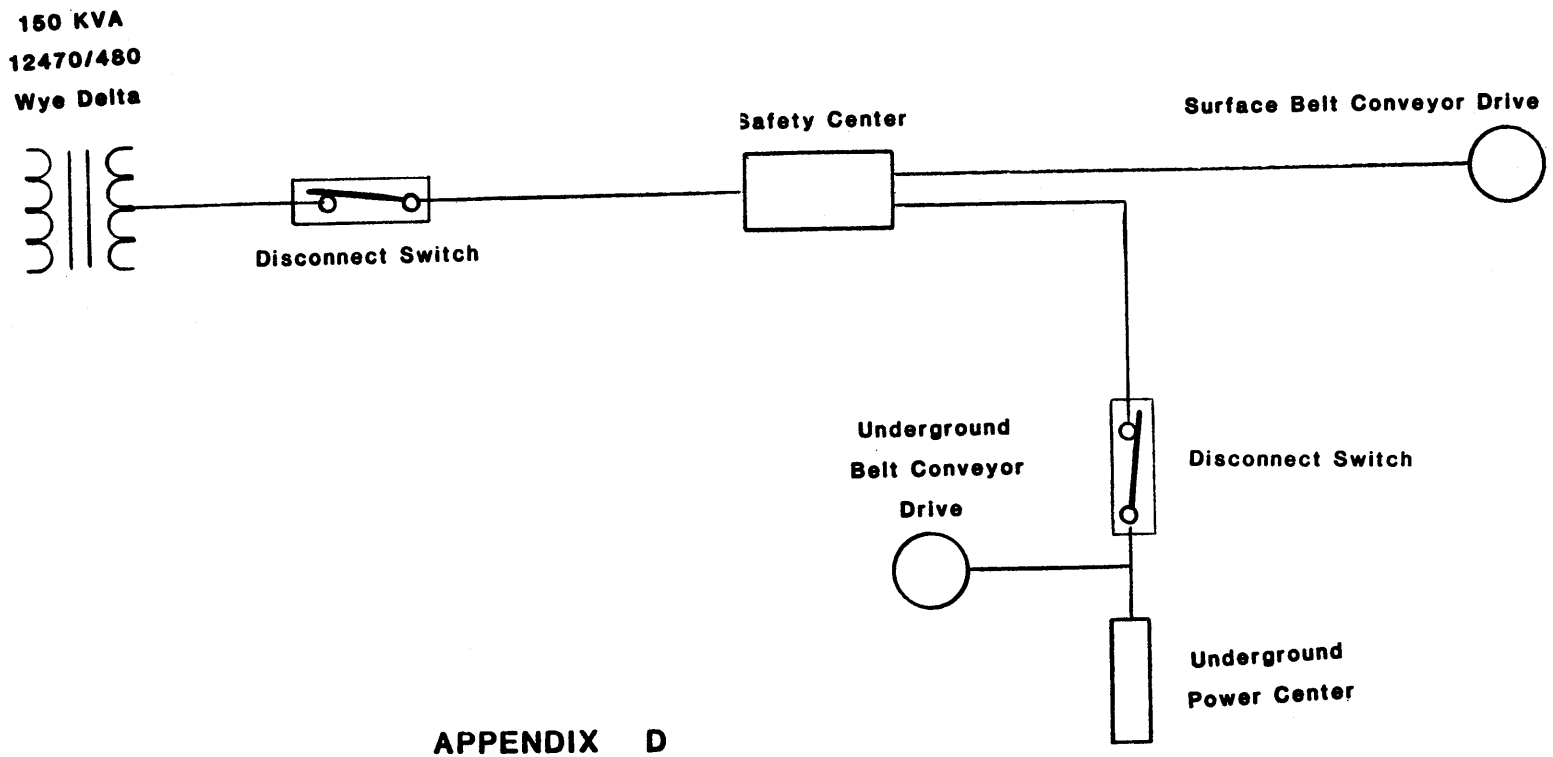
Purvis Hamilton	Mine Manager
Joseph Jacobs	Safety Director

Elk Horn Coal Corporation

Phillip Ray Stevens	Surveyor

Other Persons

Danny Newsome	Resident near the mine
James McKinney	Resident near the mine



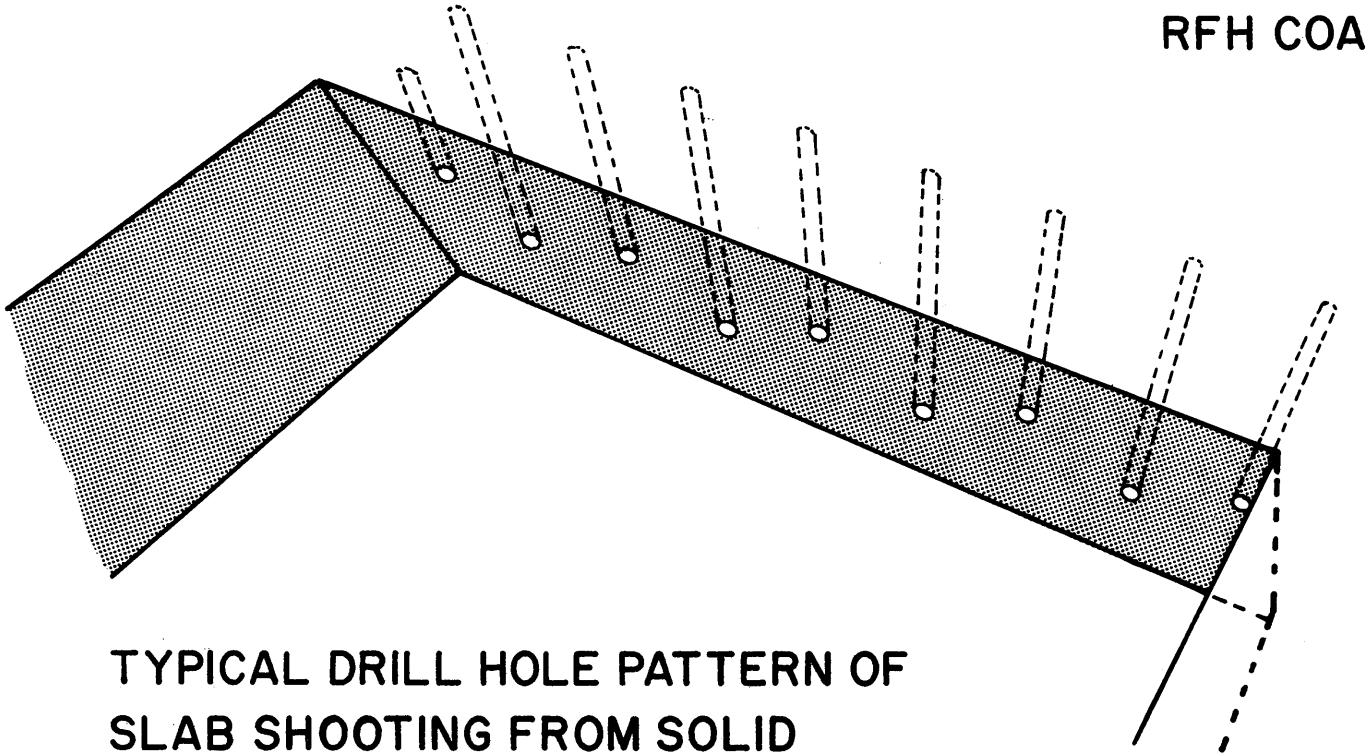
APPENDIX D
NO. 1 MINE ID NO. 15-12624
RFH COAL COMPANY

ONE-LINE DIAGRAM OF UNDERGROUND DISTRIBUTION
CIRCUIT AT TIME OF THE EXPLOSION

APPENDIX E

NO.1 MINE I.D. 15-12624

RFH COAL COMPANY



TYPICAL DRILL HOLE PATTERN OF
SLAB SHOOTING FROM SOLID

APPENDIX F

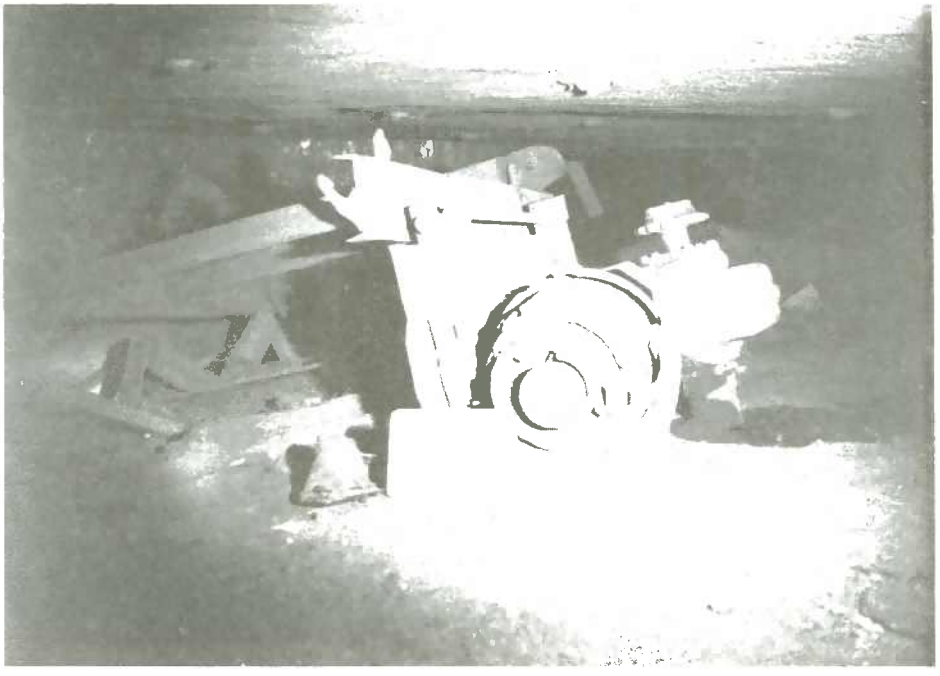


FIGURE 1. - Pony belt conveyor drive in the No. 5 entry between the Nos. 11 and 12 crosscuts.

FIGURE 2. - Section power center in the No. 6 entry between the Nos. 11 and 12 crosscuts.

APPENDIX F

FIGURE 3. - Part of the pony belt conveyor in the No. 12 crosscut between the Nos. 5 and 6 entries.

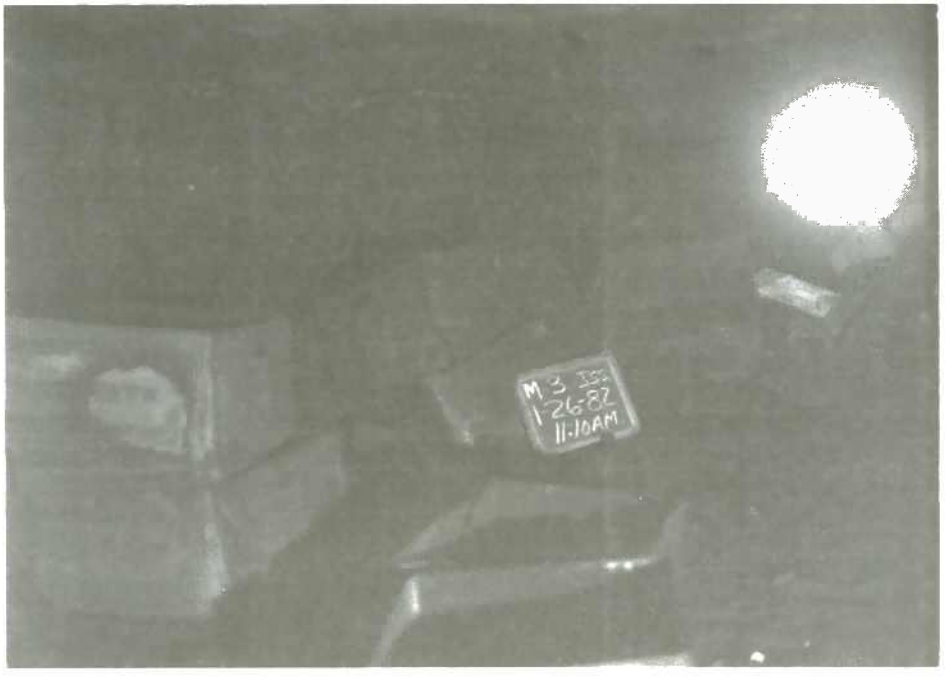


FIGURE 4. - Cases of Tovex 320 water gel explosives being stored along the active roadway in the No. 7 entry between the Nos. 2 and 3 rooms.

FIGURE 5. - Surface areas directly in line with the No. 4 entry.

FIGURE 6. - Portion of structure that had been installed over the main belt conveyor.

APPENDIX G

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

#1

[x] CITATION (SEE REVERSE) [ ] ORDER OF WITHDRAWAL (SEE REVERSE) DATE 04/16/82 TIME 1005 1196101

SERVED TO Arnold Turner (Attorney) OPERATOR RFH Coal Company

MINE No. 1 Mine MINE I.D. 15-12624-___ (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 AFA [x] S AND S (SEE REVERSE) [ ] WN CODES __/__P_L__ATD__/__/__

CONDITION OR PRACTICE The following conditions and practices were observed on January 26 - 29 1982, during the investigation of a coal dust explosion at this mine that occurred on January 20, 1982. Properly installed and adequately maintained line brattice or other approved devices were not continuously used from the last open crosscut to within 10 feet of the faces where coal was being mined, cut, drilled or loaded and in other places of the 001-0 section in rooms No. 1 through 13 to provide adequate ventilation to the working AREA OR EQUIPMENT

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

TERMINATION DUE DATE 04/21/82 (MO/DA/YR) TIME 0900 (24 HR CLOCK) SIGNATURE ▶ Thomas Engle AR 1223

ACTION TO TERMINATE

DATE __/__/__ (MO/DA/YR) TIME _____ (24 HR CLOCK) SIGNATURE ▶ __ AR [x] SEE CONTINUATION FORM

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

(original issue) DATED __/__/__ (MO/DA/YR) No 1196101

[ ] SUBSEQUENT ACTION [x] CONTINUATION [x] CITATION [ ] ORDER DATE __/__/__ (MO/DA/YR) TIME _____ (24 HR CLOCK)

SERVED TO _____ OPERATOR RFH Coal Company

MINE No. 1 Mine MINE I.D. 15-12624-___ (CONTRACTOR)

JUSTIFICATION FOR ACTION CHECKED BELOW faces for the miners and to remove flammable, explosive, and noxious gases, dust and explosive fumes as required by the Operator's Ventilation System and Methane and Dust Control Plan approved June 1, 1981. This is a violation of Section 75.316, 30 CFR, 75.

[ ] 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 ▶ Thomas Engle AR 1223

APPENDIX G

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

#2

☐ CITATION (SEE REVERSE) ☒ ORDER OF WITHDRAWAL (SEE REVERSE) DATE 01/16/82 TIME 1009 (24 HR CLOCK) 1196102

SERVED TO Arnold Turner (Attorney) OPERATOR RFH Coal Company

MINE No. 1 Mine MINE I.D. 15-12624-____ (CONTRACTOR)

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

PART AND SECTION 75.401 _____ 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 following condition and practice were observed on January 26 - 29, 1982, during an investigation of a coal dust explosion that occurred on January 20, 1982. Evidence indicated that water with or without a wetting agent or other no less effective methods approved by the Secretary had not been applied to the coal dust on the ribs, roof, and floor to reduce dispersibility and to minimize the explosion hazards in the working placed in the 001-0 working section, particularly in distances less than 40 feet from

AREA OR EQUIPMENT 001-0 section

INITIAL ACTION ☐ NOTICE ☒ CITATION ☐ ORDER NO. 1196101 DATED 01/16/82 (MO/DA/YR)

TERMINATION DUE DATE __/__/__ (MO/DA/YR) TIME _____ (24 HR CLOCK) SIGNATURE Thomas Engle 1223 (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 __/__/__ (MO/DA/YR) No 1196102-__

☐ SUBSEQUENT ACTION ☒ CONTINUATION ☐ CITATION ☐ ORDER DATE __/__/__ (MO/DA/YR) TIME _____ (24 HR CLOCK)

SERVED TO _____ OPERATOR RFH Coal Company

MINE No. 1 Mine MINE I.D. 15-12624-____ (CONTRACTOR)

JUSTIFICATION FOR ACTION CHECKED BELOW the faces. This is a violation of Section 75.401, 30 CFR 75.

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

☐ TERMINATED ☐ MODIFIED ☐ SEE CONTINUATION FORM

TYPE OF INSPECTION AFA SIGNATURE ▶ Thomas Engle 1223 (AR)

APPENDIX G

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

3

☐ CITATION (SEE REVERSE) ☒ ORDER OF WITHDRAWAL (SEE REVERSE) DATE 04/16/82 TIME 1014 1196103

SERVED TO Arnold Turner (attorney) OPERATOR RFH Coal Company

MINE No. 1 MINE I.D. 15 - 12624 (CONTRACTOR)

TYPE OF ACTION 104(d)-(1) VIOLATION OF SECTION OF THE ACT OR

PART AND SECTION 75.1306 OF TITLE 30 CODE OF FEDERAL REGULATIONS: OFFICE USE ONLY DATE

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

CONDITION OR PRACTICE The following conditions were observed on January 26-29, 1982, during an investigation of a coal dust explosion that occurred at this mine on January 20, 1982. Explosives and detonators were not stored in the section box or magazine in the 001-0 section in that eight 50-pound boxes of Tovex explosives were stored in their original paper containers along the active roadway in the No. 7 entry between Nos. 2 and 3 rooms, Approximately 7-1/2 boxes of electric detonators were stored in their original containers

AREA OR EQUIPMENT Entire mine

INITIAL ACTION ☐ NOTICE ☒ CITATION ☐ ORDER NO. 1196101 DATED 04/16/82

TERMINATION DUE DATE / / TIME SIGNATURE Thomas Engle 1223 AR

ACTION TO TERMINATE Explosives were removed during the investigation

DATE 04/16/82 TIME 1015 SIGNATURE Thomas Engle 1223 AR ☒ SEE CONTINUATION FORM

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

(original issue) DATED / / No 1196103-

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

SERVED TO OPERATOR RFH Coal Company

MINE No. 1 MINE I.D. 15 - 12624 (CONTRACTOR)

JUSTIFICATION FOR ACTION CHECKED BELOW in the No. 12 crosscut between Nos. 6 and 7 entries along the pony belt conveyor. Electric face equipment was being used along the No. 7 entry during the normal working cycle.

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

☐ TERMINATED ☐ MODIFIED ☐ SEE CONTINUATION FORM DATE

TYPE OF INSPECTION AFA

SIGNATURE Thomas Engle 1223 AR

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 04/26/82 TIME 1017 (24 HR CLOCK) 1196112

SERVED TO Arnold Burgess (Attorney) OPERATOR RFH Coal Company

MINE No. 1 Mine MINE I.D. 15-12624-___ (CONTRACTOR)

TYPE OF ACTION 107-A-_, 104-D-1 VIOLATION OF SECTION ___-___-___ OF THE ACT OR

PART AND SECTION 75.1303-_____ OF TITLE 30 CODE OF FEDERAL REGULATIONS. OFFICE USE ONLY DATE

TYPE OF INSPECTION AFA ☒ S AND S (SEE REVERSE) ☐ WN CODES __/__ P__L__ ATD__/__/__

CONDITION OR PRACTICE The following conditions were observed on January 26 - 29, 1982, during the investigation of a coal dust explosion that occurred at the mine on January 20, 1982. During this investigation, 43 boreholes in the Nos. 7 through 10 rooms were charged with explosives and detonators and were ready for blasting. Stemming materials were not being used in any of the 43 boreholes. Evidence indicated that 4.8 to 7.2 pounds of explosives were used per hole. In addition, the crosscut between the Nos. 5 and 6 rooms was blasted -

AREA OR EQUIPMENT Entire mine

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

TERMINATION DUE DATE __/__/__ (MO/DA/YR) TIME ____ (24 HR CLOCK) SIGNATURE ▶ Thomas Engle 1223 (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 __/__/__ (MO/DA/YR) No 1196112-__

☐ SUBSEQUENT ACTION ☒ CONTINUATION ☐ CITATION ☒ ORDER DATE __/__/__ (MO/DA/YR) TIME ____ (24 HR CLOCK)

SERVED TO _____ OPERATOR RFH Coal Company

MINE No. 1 Mine MINE I.D. 15-12624-___ (CONTRACTOR)

JUSTIFICATION FOR ACTION CHECKED BELOW through into the No. 5 room, allowing flame from the explosives to ignite coal dust due to a blown-out or blown through shot, an unconfined shot, excessive explosives per borehole, or an overburdened or underburdened shot. This is a violation of Section 75.1303, 30 CFR 75. and the requirements of 30 CFR 15.19(e), Article IV, Sections 5(b)(6) and (b)(9) of the appendix at the end of Part 15. Accumulations of loose coal and coal dust including float coal dust, were present in depths of 1/2 to 2 inches on the mine floor in entry Nos. 4 through 7 entries and the connecting crosscuts starting 30 feet outby survey stations No. 14 and extending inby for a distance of approximately 1,250 feet, and in the Nos. 1 through 11 rooms and the connecting crosscuts starting 10 feet inby the centerline of No. 7 entry and extending inby for a distance of -

☐ 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 ▶ Thomas Engle 1223 (AR)

APPENDIX G

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

(original issue) DATED __/__/__ (MO/DA/YR) No 1 1 9 6 1 1 2 - __

☐ SUBSEQUENT ACTION ☒ CONTINUATION ☐ CITATION ☒ ORDER DATE __/__/__ (MO/DA/YR) TIME ____ (24 HR CLOCK)

SERVED TO _____ OPERATOR RFH Coal Company

MINE No. 1 Mine MINE I.D. 1 5 - 1 2 6 2 4 - ___ (CONTRACTOR)

JUSTIFICATION FOR ACTION CHECKED BELOW approximately 60 feet in each room. This is a violation of Section 75.400, 30 CFR 75. Inadequate applications of rock dust were observed on the roof, ribs and mine floor, starting 40 feet inby No. 4 portal and extending inby for a distance of about 1,500 feet in entry Nos. 1 through No. 7 and the connecting crosscuts. Inadequate applications of rock dust were observed on the roof, ribs and mine floor in room Nos. 1 through No. 13 starting 10 feet inby the centerline of No. 7 entry and extending inby for a distance of approximately 60 feet in each room. This is a violation of Section 75.403, 30 CFR 75. Mine dust samples were collected on January 27 - 28, 1982, and substantiated the violation. Of the mine dust samples collected, 111 of 115 of the samples contained less than the required incombustible content.

☐ EXTENDED TO: DATE __/__/__ (MO/DA/YR) TIME ____ (24 HR CLOCK) ☐ VACATED

☐ TERMINATED ☐ MODIFIED

TYPE OF INSPECTION A F A

OFFICE USE ONLY
CODES __/__ P L ATD __/__/__

☐ SEE CONTINUATION FORM DATE

SIGNATURE ▶ Thomas Engle 1223 AR

APPENDIX H

Results of air samples taken at main fan on January 20, 1982, during recovery operations at RFH Coal Company's No. 1 Mine

Bottle No.	CO_2	O_2	CH_4	CO
RO 201	0.09	20.88	0.00	222 ppm
RO 202	0.10	20.77	0.03	355 ppm
RO 203	0.10	20.78	0.03	349 ppm
RO 204	0.09	20.77	0.03	372 ppm
RO 205	0.10	20.81	0.03	407 ppm
RO 206	0.10	20.80	0.03	372 ppm
RO 207	0.07	20.85	0.00	172 ppm
RO 208	0.08	20.84	0.02	238 ppm
RO 210	0.08	20.84	0.00	228 ppm
RO 211	0.08	20.86	0.02	248 ppm
RO 212	0.08	20.85	0.02	217 ppm
RO 213	0.08	20.85	0.02	234 ppm
RO 214	0.07	20.57	0.00	190 ppm
RO 215	0.07	20.86	0.02	214 ppm
RO 216	0.07	20.86	0.00	214 ppm
RO 217	0.09	20.82	0.02	379 ppm
RO 218	0.19	20.70	0.03	1,138 ppm
RO 219	0.37	20.40	0.08	2,757 ppm
RO 222	0.33	20.48	0.06	2,108 ppm
RO 223	0.13	20.81	0.01	595 ppm
RO 224	0.16	20.78	0.02	770 ppm
RO 225	0.10	20.84	0.01	486 ppm
RO 226	0.09	20.83	0.01	334 ppm
RO 227	0.08	20.84	0.00	181 ppm
RO 228	0.07	20.84	0.00	192 ppm
RO 229	0.07	20.92	0.00	151 ppm
RO 230	0.07	20.89	0.00	178 ppm
RO 234	0.09	20.88	0.01	554 ppm
RO 235	0.11	20.82	0.01	526 ppm
RO 209	0.08	20.84	0.02	266 ppm

APPENDIX I

UNITED STATES DEPARTMENT OF LABOR
MSHA LABORATORIES - MOUNT HOPE, WEST VIRGINIA

TABLE____ - ANALYSES OF DUST SAMPLES COLLECTED January 27, 1982

MINE No. 1 COMPANY RFH Coal Company

COLLECTED BY Sherrell Reid

CAN NUMBER	SAMPLE OF DUST FROM	LOCATION IN MINE	PERCENT FLOAT DUST	ALCOHOL COKE TEST	PERCENT INCOMBUSTIBLE
		No. 1 entry, intake, main entries, zero point = No. 5 spad in the No. 3 entry			
1A1	band	0 + 1,000'	4.6	large	21.1
1A2	do	0 + 1,100'	4	extra-large	21
1A2X	do	0 + 1,140'	6	extra-large	22.7
1A3	do	0 + 1,200'	5.6	extra-large	25.4
1A4	do	0 + 1,300'	5	extra-large	45.8
1A4X	do	0 + 1,360'	5	extra-large	23.3
1A5	do	0 + 1,400'	7	extra-large	20.7
1A5X	do	0 + 1,445'	7.1	extra-large	22.5

APPENDIX I

UNITED STATES DEPARTMENT OF LABOR
MSHA LABORATORIES - MOUNT HOPE, WEST VIRGINIA

TABLE ____ - ANALYSES OF DUST SAMPLES COLLECTED January 27, 1982

MINE No. 1 COMPANY RFH Coal Company

COLLECTED BY Reginald G. Rice

CAN NUMBER	SAMPLE OF DUST FROM	LOCATION IN MINE	PERCENT FLOAT DUST	ALCOHOL COKE TEST	PERCENT INCOMBUSTIBLE
		No. 2 entry, intake			
1B1	band	0 + 400'	10.7	large	38.4
1B2	do	0 + 500'	7.5	large	39.6
1B2X	do	0 + 550'	17.9	large	41.1
1B3	do	0 + 600'	10.4	large	24.1
1B3X	do	0 + 850'	11.2	extra-large	23.3
1B4	do	0 + 900'	14.7	extra-large	25.3
1B5	do	0 + 1,000'	10.1	extra-large	22
1B6	do	0 + 1,100'	9.6	extra-large	20.3
1B6X	do	0 + 1,140'	6.8	large	22.3
1B7	do	0 + 1,200'	6.9	extra-large	21.3
1B8	do	0 + 1,300'	8.1	extra-large	21.8
1B8X	do	0 + 1,370'	6.9	extra-large	20
1B9	do	0 + 1,400'	4	extra-large	22.1

APPENDIX I

UNITED STATES DEPARTMENT OF LABOR
MSHA LABORATORIES - MOUNT HOPE, WEST VIRGINIA

TABLE____ - ANALYSES OF DUST SAMPLES COLLECTED January 28, 1982

MINE No. 1 COMPANY RFH Coal Company

COLLECTED BY Gerald W. McMasters

CAN NUMBER	SAMPLE OF DUST FROM	LOCATION IN MINE	PERCENT FLOAT DUST	ALCOHOL COKE TEST	PERCENT INCOMBUSTIBLE
		No. 3 entry, intake			
1C1	band	0 + 00, wet, no sample			
1C2	do	0 + 100	7.1	trace	86
1C3	do	0 + 200	12.3	trace	84
1C3X	do	4 crosscuts inby portal	13	trace	43
1C4	do	0 + 300	5.4	small	35
1C5	do	0 + 400	4.2	none	73
1C6	do	0 + 500	4.2	none	62
1C6X	do	8 crosscuts inby portal	6.1	trace	47
1C7	do	0 + 600	3.4	trace	51
1C8	do	0 + 700	4.6	trace	43
1C9	do	0 + 800	5.5	large	32.6
1C9X	do	12 crosscuts inby portal	5.7	large	27.6
1C10	do	0 + 900	7.7	extra-large	28.7
1C11	do	0 + 1,000	9.1	large	26.7
1C11X	do	16 crosscuts inby portal	11.5	extra-large	23
1C12	do	0 + 1,100	6.8	extra-large	21.8
1C13	do	0 + 1,200	5.5	extra-large	17.4
1C14	do	0 + 1,300	4.5	extra-large	20.2
1C14X	do	20 crosscuts inby portal	4.5	extra-large	27.2
1C15	do	0 + 1,400	4	extra-large	20.5
1C16	do	0 + 1,500	5	extra-large	16.5

APPENDIX I

UNITED STATES DEPARTMENT OF LABOR
MSHA LABORATORIES - MOUNT HOPE, WEST VIRGINIA

TABLE ____ - ANALYSES OF DUST SAMPLES COLLECTED January 27, 1982

MINE No. 1 COMPANY RFH Coal Company

COLLECTED BY Gerald W. McMasters

CAN NUMBER	SAMPLE OF DUST FROM	LOCATION IN MINE	PERCENT FLOAT DUST	ALCOHOL COKE TEST	PERCENT INCOMBUSTIBLE
		No. 4 entry, intake			
1D1	band	0 + 00'	7.5	trace	35
1D2	do	0 + 100'	4.4	trace	41
1D3	do	0 + 200'	20.8	trace	47
1D3X	do	4 crosscuts inby portal	10.3	trace	50
1D4	do	0 + 300'	15.9	trace	59
1D5	do	0 + 400'	9.8	trace	67
1D6	do	0 + 500'	14.8	trace	49
1D6X	do	8 crosscuts inby portal	4.7	trace	38
1D7	do	0 + 600'	7	small	32
1D8	do	0 + 700'	6.9	small	20
1D9	do	0 + 800'	8.2	small	27
1D9X	do	12 crosscuts inby portal	7.3	extra-large	21.6
1D10	do	0 + 900'	9	large	37
1D11	do	0 + 1,000'	5.6	large	30.7
1D11X	do	16 crosscuts inby portal	10.3	small	40
1D12	do	0 + 1,100'	9.7	extra-large	35.1
1D13	do	0 + 1,200'	5.3	extra-large	27.4
1D14X	do	20 crosscuts inby portal	6.6	extra-large	26.6
1D14	do	0 + 1,300'	5.6	extra-large	24.2
1D15	do	0 + 1,400'	3.7	extra-large	19.9
1D16	do	0 + 1,500'	4.9	extra-large	17.7

APPENDIX I

UNITED STATES DEPARTMENT OF LABOR
MSHA LABORATORIES - MOUNT HOPE, WEST VIRGINIA

TABLE____ - ANALYSES OF DUST SAMPLES COLLECTED January 27-28, 1982

MINE No. 1 COMPANY RFH Coal Company

COLLECTED BY Carlos Smith, Jack Collins, and Robert Fleming

CAN NUMBER	SAMPLE OF DUST FROM	LOCATION IN MINE	PERCENT FLOAT DUST	ALCOHOL COKE TEST	PERCENT INCOMBUSTIBLE
		No. 5 entry, return			
1E1	band	0 + 00	5.7	trace	17
1E2	do	0 + 100	6.1	large	51.1
1E3	do	0 + 200	6.5	large	40.7
1E4	do	0 + 300	8.5	small	47
1E5	do	0 + 400	10.9	small	27
1E6	do	0 + 500	12.5	small	43
1E7	do	0 + 600	7.6	small	33
1E8	do	0 + 700	9.2	large	32.3
1E9	do	0 + 800	2.9	extra-large	26.8
1E10	do	0 + 900	7.8	large	22.6
1E11	do	0 + 1,000	3.7	extra-large	21.3
1E12	do	0 + 1,100	6.3	extra-large	22.2
1E13	do	0 + 1,200	3.3	extra-large	21.6
1E14	do	0 + 1,300	3.4	extra-large	22.9
1E15	do	0 + 1,400	5.8	extra-large	20.7

APPENDIX I

UNITED STATES DEPARTMENT OF LABOR
MSHA LABORATORIES - MOUNT HOPE, WEST VIRGINIA

TABLE ____ - ANALYSES OF DUST SAMPLES COLLECTED January 27, 1982

MINE No. 1 COMPANY RFH Coal Company

COLLECTED BY Carlos Smith, Jack Collins, and Robert Fleming

CAN NUMBER	SAMPLE OF DUST FROM	LOCATION IN MINE	PERCENT FLOAT DUST	ALCOHOL COKE TEST	PERCENT INCOMBUSTIBLE
		No. 6 entry, return			
F1		0 + 00, no sample, not driven			
F2		0 + 100, no sample, not driven			
F3	band	0 + 200	6.2	extra-large	34.7
F4	do	0 + 300	6.2	large	30.3
F5	do	0 + 400	8.4	large	41.5
F6	do	0 + 500	5.7	small	40
F7	do	0 + 600	15.8	large	40.5
F8	do	0 + 700	4.6	small	33
F9	do	0 + 800	5	large	30.8
F10	do	0 + 900	6.2	large	33.1
F11	do	0 + 1,000	4.6	large	34.9
F12	do	0 + 1,100	6.2	extra-large	22.6
F13	do	0 + 1,200	5.5	extra-large	21.3
F14	do	0 + 1,300	5	extra-large	22.4
F15	do	0 + 1,400	5.7	extra-large	24.7

APPENDIX I

UNITED STATES DEPARTMENT OF LABOR
MSHA LABORATORIES - MOUNT HOPE, WEST VIRGINIA

TABLE ____ - ANALYSES OF DUST SAMPLES COLLECTED January 27-28, 1982

MINE No. 1 COMPANY RFH Coal Company

COLLECTED BY Carlos Smith, Jack Collins, and Robert Fleming

CAN NUMBER	SAMPLE OF DUST FROM	LOCATION IN MINE	PERCENT FLOAT DUST	ALCOHOL COKE TEST	PERCENT INCOMBUSTIBLE
		No. 7 entry, return			
1G1		0 + 00, not developed			
1G2		0 + 100, not developed			
1G3		0 + 200, not developed			
1G4	band	0 + 300	8.2	large	36.1
1G5	do	0 + 400	7.5	small	37
1G6	do	0 + 500	6.4	large	32.8
1G7	do	0 + 600	6.3	small	27
1G8	do	0 + 700	5.3	small	24
1G9	do	0 + 800	8.3	small	33
1G10	do	0 + 900	9	small	15
1G11	do	0 + 1,000	5.7	extra-large	21.4
1G12	do	0 + 1,100	6.5	extra-large	24.2
1G13	do	0 + 1,200	6.5	extra-large	22.7
1G14	do	0 + 1,300	3.3	extra-large	17.2
1G15	do	0 + 1,400	3.1	extra-large	19.3

APPENDIX. I

UNITED STATES DEPARTMENT OF LABOR
MSHA LABORATORIES - MOUNT HOPE, WEST VIRGINIA

TABLE____ - ANALYSES OF DUST SAMPLES COLLECTED January 28, 1982

MINE No. 1 COMPANY RFH Coal Company

COLLECTED BY Carlos P. Smith

CAN NUMBER	SAMPLE OF DUST FROM	LOCATION IN MINE	PERCENT FLOAT DUST	ALCOHOL COKE TEST	PERCENT INCOMBUSTIBLE
		rooms turned off the No. 7 entry zero point = centerline of the No. 7 entry + 20 feet			
2A1	band	No. 13 room	6.1	extra-large	17.9
2B1	do	No. 12 room	8.5	extra-large	26
2C1	do	No. 11 room	7.6	extra-large	22.8
2D1	do	No. 10 room	9	extra-large	26.4
2E1	do	No. 9 room	9.1	extra-large	26.2
2F1	do	No. 8 room	8.6	extra-large	22.4
2G1	do	No. 7 room	8.6	extra-large	22.9
2H1	do	No. 6 room	8.1	extra-large	20
2I1	do	No. 5 room	9.9	extra-large	19.4
2J1	do	No. 4 room	11.2	small	6
2K1	do	No. 3 room	10	small	28.
2L1	do	No. 2 room	10	large	30.2
2M1	do	No. 1 room	9.4	large	27.4