

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 sub-leased 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:

	<u>Percent</u>
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

