

90-0041

UNITED STATES
DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION

DISTRICT 9

COAL FATAL

ACCIDENT INVESTIGATION REPORT
(UNDERGROUND COAL MINE)

NONINJURY FALL OF FACE (COAL OUTBURST) ACCIDENT

Dutch Creek Mine, I.D. No. 05-00301
Mid-Continent Resources, Inc.
Redstone, Pitkin County, Colorado

February 5, 1990

by

Phillip R. Gibson, Jr.
Coal Mine Safety & Health Inspector

Originating Office - Mine Safety and Health Administration
P.O. Box 856, 215 East Main Street, Price, Utah 84501
Jensen L. Bishop, Subdistrict Manager

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Authority—This report is based on an investigation made pursuant to the Federal Mine Safety and Health Act of 1977, Public Law 91-173, as amended by Public Law 95-164.

Section A—Identification Data

1. Title of investigation: Noninjury Fall of Face (Coal Outburst) Accident	2. Date MSHA investigation started: 02/05/90
3. Report release date: March 5, 1990	4. Mine: Dutch Creek Mine
5. Mine ID number: 05-00301	6. Company: Mid-Continent Resources, Inc.
7. Town, County, State: Redstone, Pitkin, Colorado	8. Author(s): Phillip R. Gibson, Jr.

Section B—Mine Information

9. Daily production: 4,400	10. Surface employment: 71
11. Underground employment: 297	12. Name of coalbed: Coal Basin "B" and Dutch Creek "M"
13. Thickness of coalbed: 8 feet	

Section C—Last Quarter Injury Frequency Rate (HSAC) for:

14. Industry: 13.53	15. This operation: 15.04
16. Training program approved: June 3, 1988 and June 27, 1989	17. Mine Profile Rating: n/a

Section D—Originating Office

18. Mine Safety and Health Administration Coal Mine Health and Safety District No. : 9	Address: P.O. Box 856 Price, Utah 84501
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Section E—Abstract

A fall of face (coal outburst) accident occurred on the face, between shield numbers 55 to 97, of the 211 advancing longwall section about 2:30 p.m. on February 5, 1990. The accident resulted in an entrapment of Phillip A. Reed, longwall shearer operator, and asphyxiation of Kevin Lee and Carey Brady, facemen. Reed and Rory Lopez, longwall shearer operator, were cutting coal toward the headgate entry; Lee and Brady were working in the tailgate area when the accident occurred. Reed was entrapped in loose coal up to his neck for about one hour before being freed. Lee and Brady resuscitated without aid when the methane gas dissipated and was replaced by an ample volume of oxygen. Reed was taken to Valley View Hospital for observation and released. None of the miners involved in the accident received any injuries.

Section F—Mine Organization

Company officials:	Name	Address
19. President:	John A. Reeves	P.O. Box 500 Carbondale, Colorado 81623
20. Superintendent:	M. Thomas Scott	P.O. Box 500 Carbondale, Colorado 81623
21. Safety Director:	Jimmie E. Kiser	P.O. Box 500 Carbondale, Colorado 81623
22. Principle officer—H&S:	M. Thomas Scott	P.O. Box 500 Carbondale, Colorado 81623
23. Labor Organization:	non-union	
24. Chairman—H&S Committee:	n/a	

GENERAL INFORMATION

The Dutch Creek Mine, Mid-Continent Resources, Inc., is an underground coal mine located 4 miles west of Redstone, Pitkin County, Colorado, off State Route 133.

Currently, Mid-Continent Resources, Inc., operates one active underground coal mine. Five active mines were operated prior to 1984. On July 1, 1988, the Dutch Creek No. 1 and No. 2 mines were consolidated under a single identification number. Parallel rock adits, popularly called tunnels, were driven from the surface to access the two coalbeds; Coal Basin "B" and Dutch Creek "M". Each tunnel is approximately 3 miles in length. The south rock tunnel is dedicated to the transportation of men and materials. Coal is transported by conveyor belts through the north rock tunnel.

Seven main sloped entries were developed down dip, in a westerly direction in each coalbed. The coalbeds pitch about 10-12 degrees to the southwest. Panels were developed north and south off the main slopes along the strike of the coalbed. Multiple entries, generally in sets of 4, were driven about 18 feet wide on varying center dimensions with connecting crosscuts. Pillars were extracted using a split and fender method with a remote controlled continuous mining machine. Advancing and retreating longwall panels were developed in a northerly direction off the main slopes beginning in 1976.

A total of 368 miners are employed; 297 worked underground on 3 rotating shifts per day, 7 days per week. The average daily production, 4,400 tons of coal, is loaded from two continuous mining machine sections and the two advancing longwall sections. The 211 advancing longwall section had just begun production.

The last regular Federal health and safety inspection was from October 4, 1989, to December 15, 1989.

Ventilation of the mine was induced by two axial-flow fans, number 4 and number 12, properly installed on the surface of Coal Basin "B" coalbed and Dutch Creek "M" coalbed. The two fans were equipped with all necessary safety devices. The fans operate continuously. The fans provide an exhaust system of ventilation with a positive pressure of 7 and 10.8 inches of water gauge, respectively. The volume of air measured in the main returns at the fans was about 343,000 and 753,400 cubic feet a minute, respectively. The mine liberates 6,800,000 cubic feet of methane gas every 24 hours. At the time the 211 longwall section entries were being driven, the section was ventilated by a current of intake air directed through the number 3 (conveyor belt) and number 2 (intake escapeway) entries, and returned through the number 1 entry. Presently, the 211 longwall section is ventilated by a current of intake air directed through numbers 1, 2, and 3 entries. Return air travels through the return and bleeder entries of the worked out 210 longwall section.

The roof control plan approved on May 22, 1989, contains a code of practice for outburst control. The plan requires multiple boreholes to be drilled in the coal face of advancing longwall sections to detect and relieve excessive stress through measured amounts of coal cuttings and loudness of audible cracking sounds. Permissible explosives are then used to destroy the structural integrity of the coal. This action forces the coal stresses and pressures to reconsolidate the blasted coal and allows the distressed coal to be mined safely. The

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boreholes are required to be drilled to a depth of about 15 feet in the face and on 5 foot center distances. The boreholes are charged with three pounds of permissible explosives and stemmed with water dummies. Water dummies are allowed to be used because the destress system is not considered a method of mining. The shots are fired immediately after charging with a permissible blasting unit.

Principal mine officials on February 5, 1990 were:

John A. Reeves, Sr., President

John Turner, Vice-President and General Manager

M. Thomas Scott, Superintendent

Sam Salaz, Assistant Superintendent

Jimmie E. Kiser, Safety Director

DESCRIPTION OF ACCIDENT

The 211 longwall section crew entered the mine about 7:00 a.m., on February 5, 1990. They traveled in a self-propelled personnel carrier and arrived on the section about 7:35 a.m. As the foreman conducted an examination of the section, work was begun to find and repair a power cable for the recording methanometer. About 8:50 a.m. the cable was repaired. A ventilation adjustment was made and a hydraulic hose was repaired before coal production began at 9:00 a.m. Regular work proceeded without incident until about 2:20 p.m.

Rory Lopez, longwall shearer operator, operating the headgate cutting drum, and Phillip A. Reed, longwall shearer operator, operating the tailgate cutting drum, were mining toward the headgate entry. Two small bounces occurred and small concentrations of methane gas were immediately detected. These bounces are accompanied by audible cracking sounds and serve as an immediate warning of a stress release; generally a coal outburst known as a "push". The electric power was immediately shut off to the face equipment by Alvaro Marquez, Sivad operator. Marquez is an experienced miner who has a great deal of knowledge concerning coal outbursts. He has been trained to "kill the power" in all such situations in an effort to remove a possible electrical ignition source. A swift series of bumping sounds followed. Realizing a "push" was imminent, Lopez and Reed began to run toward the headgate area. Reed was about mid-shearer when the coal burst originated from the face. Reed grabbed hold of a leg of the number 86 shield, his back turned toward the coal face, in an effort to hold his head as high as possible. Simultaneous to the series of bumps, two facemen, Kevin Lee and Carey Brady, working near the tailgate area also began running toward the headgate area. Because of the suspected quantity of methane gas, the oxygen was displaced and the two miners were overcome and rendered unconscious. Both miners resuscitated unaided when an adequate supply of oxygen returned and the methane gas dissipated. Once revived, Lee and Brady learned the walkway was blocked with coal and then proceeded to the tailgate area mine phone. They reported that Reed was not accounted for. Ernie Weaver and Randy Dupree, facemen, initiated a search for Reed. When Reed was located, he was buried up to his neck in loose

coal from the burst; only his right shoulder and head were observable above the massive coal pile. Reed was extricated after about one hour, examined for injuries, and transported to Valley View Hospital in Glenwood Springs, Colorado. None of the miners involved in the accident received any injuries. There was no apparent property damage.

The Glenwood Springs, Colorado, Field office of the Mine Safety and Health Administration was notified and an investigation was started the same day.

PHYSICAL FACTORS INVOLVED

1. The coalbed in the 211 longwall section was 9 feet in height and was being totally extracted.
2. The 211 advancing longwall section was developed with three entries and connecting crosscuts. The top entry is used as the conveyor belt entry. The air from the conveyor belt entry is used to provide ventilation to the active working face. The middle entry is a designated intake air escapeway and material haulageway. The bottom entry is used as an intake aircourse to ventilate the idle faces inby the longwall startline. A tailgate entry is maintained along the previously mined panel as a travelway and return aircourse.
3. The longwall assembly consists of 109 shields; 20 Dowty 2-legged and 89 Gullick Dobson 6-legged shields, a Halbrach and Braun armored face conveyor, and an Eichhoff 300 shearer.
4. The company instituted a stress-relief program in 1975. This program consisted of drilling 3-inch holes 40 to 100 feet in length, and placing hydraulic hoses into them. These hoses are then charged with longwall emulsion fluid under high pressure, 3,200 psi, which serves to hydraulically fracture the surrounding coal and lubricate the associated slip planes. This breaking action is intended to relieve the built-up stress in a controlled manner.

The company also "volley fires" the coalbed. The program utilizes boreholes, 50 millimeters in diameter, drilled into the longwall face to a depth of about 15 feet on 5 foot center distances. The holes are loaded with 3 pounds of permissible explosives and detonated simultaneously. The purpose is not to displace the coal, but to fracture it in place. The loose, broken coal forces the energy stored in the coalbed to expand itself while reconsolidating the blasted coal.

5. The water stemming bags used to stem the boreholes were not within 1/4 inch of the diameter of the drill bit used to drill the boreholes. A 50 millimeter borehole is approximately 1.96 inches in diameter. The water stemming bags were approximately 1.4 inches in diameter. The undersized bags may have allowed the explosive gasses to exit the borehole, instead of being contained within it. The loss of such gasses would reduce the effectiveness of the detonation.
6. The 211 longwall section is located next to the mined out 208 and 210 longwall panels and is underlain by the active 103 advancing longwall panel

in the Coal Basin "B" coalbed. The two coalbeds and associated mining activities are not vertically aligned. The interburden about 480 feet in thickness, is composed of a predominantly strong sandstone member which separates the two coalbeds. This member, in conjunction with the overburden ranging from 2,200 feet to 2,500 feet as well as the underlying "B" coalbed, creates severe stress effects on both coalbeds.

7. Abrupt changes of topography had contributed to the stress and pressure load encountered in the 211 longwall section. Mountain peaks of the Elk Mountain Range predominantly figure in the surface area of the Dutch Creek Mine.
8. Historically, the coalbeds of the Dutch Creek Mine are prone to outburst due to their energy storing capabilities. When subjected to stress and pressure, the coals tend to fail; sometimes violently. Destructive coal outbursts are divided into two categories: pushes and bounces. Pushes are the result of stresses acting upon the coalbed and surrounding strata. They are characterized by an orangish color appearing at the roofline, caused by coal being finely pulverized between the face and roof, a rapid release of friable coal in a wave-like action originating from a face or rib in a horizontal movement, and usually accompanied with large concentrations of methane gas. The methane gas acts as a propellant for the crushed coal. Pushes generally give a warning, staccato like sounds, immediately before the built-up energy is instantaneously released.

Bounces are coal outbursts that range from audible sounds, indicating coal is being slowly squeezed and broken, to violent releases of energy that force the mine floor upward in an instantaneous manner that can allow it to contact the mine roof.
9. Emulsion infusion holes were being drilled in the headgate belt entry up dip coal rib. The high pressure hydraulic mixture lubricates the slip planes and fractures in the coalbed and allows them to move in a pressure-releasing motion. There were several identifiable sources of stress that impacted the coal outburst: a) the topography of the surface area; b) the amount of the overburden; c) the previously mined out panels diagonally above the 211 longwall section; d) the stress forced away from the infusion holes may have traveled toward the longwall face and resulted in undetected "islands" of concentrated stress; e) the inconclusive relief from volley firing the face; and f) the underlying Coal Basin "B" bed with its advancing 103 longwall section and associated pressures.
10. The coal outburst, locally known as a push, was of a high range magnitude. This is a subjective scale adopted by those persons familiar with pushes at this mine, based upon experience and accident evidence.
11. The stress relief program of the Coal Basin "B" coalbed was being used in the 211 longwall section located in the Dutch Creek "M" coalbed. The two coalbeds respond differently to stress relief. The stress relief program in the "B" coalbed has lessened the severity and drastically reduced the frequency of coal outbursts.

The coal in the "M" bed has a higher compressive strength. The stress relief plan has been modified to account for this greater strength and is

designed to destroy the structural integrity of the coal.

12. All persons involved with the drilling process either had been trained or were receiving on-the-job training from an experienced driller.
13. The coal outburst accident involved an area 200 feet long between shields No. 55 to No. 97. The displaced coal completely filled the face area to within 7 inches of the roof. At the time of the investigation, the only visible portion of the shearer was 14 inches of the top of the headgate drum.
14. The 211 longwall section had advanced approximately 25 feet from the startline and had not experienced a complete fall of the immediate roof in the gob area. The cantilever action of the hanging cave had been exerting pressure on the face area of the longwall.

CONCLUSION

The methods of stress relief, emulsion infusion and volley firing, being practiced in the face area coupled with the cumulative effects of the six identifiable sources of stress resulted in an uncontrolled instantaneous release of energy accompanied by friable coal. The incident was triggered by the shearing machine as it mined through a high stress area that was undetected by the foreman and crew. The stress relief program is constantly evaluated by Mine Safety and Health, District 9. It is recognized that the program, although very effective in the "B" coalbed, consists of remedial and precautionary measures. Efforts are being taken to control stress in a long range manner on a mine-wide basis through better stress detection and relief measures.

VIOLATIONS

1. A 103(k) Order was issued and held in effect for the duration of the investigation.
2. A 107(a) Imminent Danger Order, No. 2931611, was issued for the following violations.

A 104(a) Citation, No. 2931612, was issued for a violation of 30 CFR, 75.202(a). The face was not controlled adequately to protect persons from the hazards related to coal outbursts.

A 104(a) Citation, No. 2931613, was issued for a violation of 30 CFR, 75.1322(g). The water stemming bags used in used in the volley firing practice were not within 1/4 of an inch of the diameter of the drill bit used to drill the boreholes.

3. A 104(a) Citation, No. 3410471, was issued for a violation of 30 CFR, 75.220(a)(1). The approved roof control plan was not followed. The results of the volley firing procedures were not recorded as required by the approved plan.

4. Additionally, A 104(a) Citation, No. 3410472, was issued for a violation of 30 CFR 75.223(a)(1). The approved roof control plan was not suitable for controlling coal outbursts.

Submitted by:

Phillip R. Gibson, Jr.
Phillip R. Gibson, Jr.
CMS&H Inspector

Approved by:

Jensen L. Bishop
Jensen L. Bishop
Subdistrict Manager

APPENDIX

The investigation was conducted by the Mine Safety and Health Administration and those persons furnishing information and/or were present during the investigation were:

Mid-continent Resources, Inc. Company Officials

John A. Reeves	President
John Turner	Vice-President and General Manager
M. Thomas Scott	Superintendent
Jimmie E. Kiser	Safety Director
Jerry Reed	Section Foreman

Mid-Continent Resources, Inc. Employee

Rory Lopaz	Longwall Shearer Operator
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Mine Safety and Health Administration

Lee H. Smith	Supervisory Coal Mine Safety & Health Inspector
Frank D. Carver	Coal Mine Safety & Health Inspector
Phillip R. Gibson, Jr	Coal Mine Safety & Health Inspector