Report of Investigation
Underground Coal Mine Explosion

U.S. Department of Labor
Mine Safety and Health Administration
1990

Pyro No. 9 Slope
William Station Mine
I.D. No. 15-13881
Pyro Mining Company
Sullivan,
Union County,
Kentucky

September 13, 1989

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

REPORT OF INVESTIGATION
UNDERGROUND COAL MINE EXPLOSION
PYRO NO. 9 SLOPE, WILLIAM STATION MINE - I.D. NO. 15-13881
PYRO MINING COMPANY
SULLIVAN, UNION COUNTY, KENTUCKY

SEPTEMBER 13, 1989

by

Maurice S. Childers
District Manager, District 8

Robert A. Elam
Acting District Manager, District 9

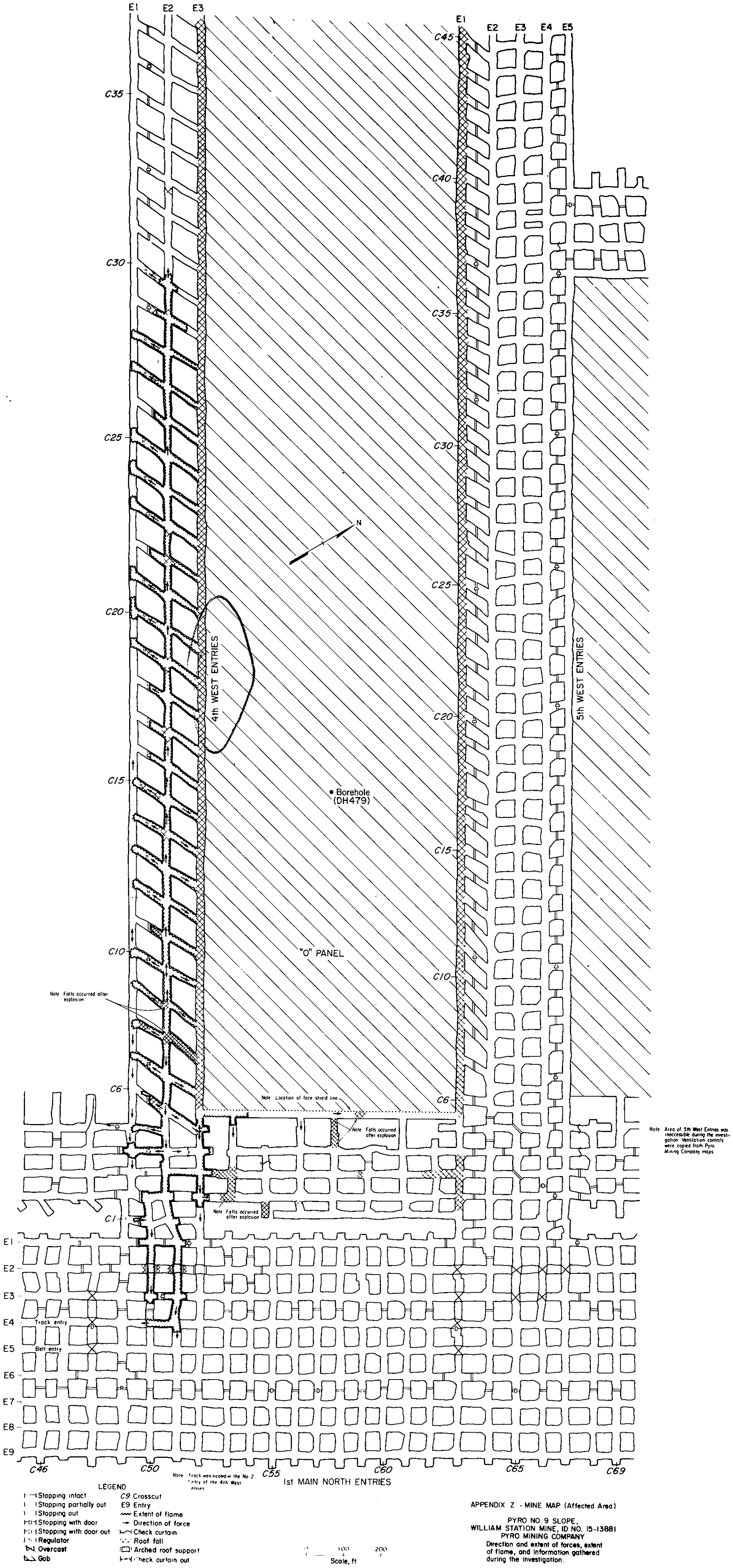
Mark O. Eslinger
Supervisory Mining Engineer

Steven R. Kattenbraker
Supervisory Coal Mine Safety and Health Inspector

Robert L. Phillips
Mine Safety and Health Specialist (Electrical)

Edward B. Ritchie
Coal Mine Safety and Health Inspector

Originating Office
Mine Safety and Health Administration
4015 Wilson Boulevard
Arlington, Virginia 22203
Jerry L. Spicer - Administrator



APPENDIX Z - MINE MAP (Affected Area)

PYRO NO. 9 SLOPE,
WILLIAM STATION MINE, ID NO. 15-13881
PYRO MINING COMPANY
Direction and extent of forces, extent of flame, and information gathered during the investigation.

Abstract of Investigation

U.S. Department of Labor
Mine Safety and Health Administration

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: Underground Coal Mine Explosion	2. Date MSHA investigation started: September 22, 1989
3. Report release date: May 8, 1990	4. Mine: Pyro No. 9 Slope, William Station
5. Mine ID number: 15-13881	6. Company: Pyro Mining Company
7. Town, County, State: Sullivan, Union County, Kentucky	8. Author(s): M. Childers, R. Elam, M. Eslinger, S. Kattenbraker, R. Phillips, E. Ritchie

Section B—Mine Information

9. Daily production: 10,500 tons	10. Surface employment: 7
11. Underground employment: 360	12. Name of coalbed: Kentucky No. 9
13. Thickness of coalbed: 55"	

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

14. Industry: 12.06	15. This operation: 12.61
16. Training program approved: Yes	17. Mine Profile Rating: n/a

Section D—Originating Office

18. Mine Safety and Health Administration Coal Mine Health and Safety District No. : Office of the Administrator	Address: 4015 Wilson Boulevard Arlington, Virginia 22203

Section E—Abstract

At about 9:13 a.m., September 13, 1989, an explosion occurred on Longwall Panel "0", between the 4th and 5th West Entries off the 1st Main North Entries, of Pyro Mining Company's Pyro No. 9 Slope, William Station Mine. Fourteen miners were present in the longwall recovery area at the time of the explosion. Ten of the miners died as a result of the explosion. Four of the miners escaped, despite being exposed to high concentrations of carbon monoxide and smoke. The names of the miners in the longwall recovery area are listed in Appendix A and victim/survivor data is listed in Appendix B.

Changes had occurred during the mining of Longwall Panel "0" in the 4th and 5th West Entries and in the longwall bleeder system that caused a fragile balance of air flows to exist in the longwall bleeder ventilation system. This fragile balance was affected when changes were made to the ventilation controls in the 4th West Entries and the longwall recovery area. The combination of changes significantly decreased the air flow across the longwall face and reduced the air flow in the 4th West Entries. The combination of changes also permitted methane to migrate from the gob and to accumulate in the No. 2 Entry of the 4th West Entries inby the No. 6 Crosscut and near the longwall headgate.

The removal of the stopping in the No. 1 Cut-through Entry between the 4th and 5th West Entries disrupted the separation between the 2nd Main North Entries ventilation system and the longwall bleeder system. This action caused an explosive methane-air mixture to flow toward and into the longwall recovery area where it was ignited by one of the five probable sources identified in this report.

Section F—Mine Organization

Company officials:	Name	Address
19. President:	P. Ron Siler	P.O. Box 267 Sturgis, Kentucky 42459
20. Superintendent:	H. Michael McDowell	P.O. Box 267 Sturgis, Kentucky 42459
21. Safety Director:	P. Bruce Hill	P.O. Box 267 Sturgis, Kentucky 42459
22. Principle officer—H&S:	David L. Steele	P.O. Box 267 Sturgis, Kentucky 42459
23. Labor Organization:		
24. Chairman—H&S Committee:		

TABLE OF CONTENTS

Page

FINDINGS OF FACT

CONCLUSIONS

APPENDICES

APPENDIX S - Laboratory Testing and Evaluation of Blasting Caps Collected During the Investigation (U.S. Bureau of Mines)

APPENDIX T - Laboratory Testing and Evaluation of Mine Atmosphere Monitoring and Sampling Equipment (MSHA - Approval and Certification Center)

APPENDIX U - Selected Photographs Taken During the Investigation

APPENDIX V - Copies of Violations Issued Relative to the Explosion and Investigation

APPENDIX W - Single-Line Diagram of the High-Voltage Circuits Supplying Longwall Panel "O"

APPENDIX X - CAD Drawing of Electric Circuits and Equipment Found in the Explosion Area

APPENDIX Y - Mine Map - Entire Area

APPENDIX Z - Mine Map (Affected Area) - Direction and extent of forces, extent of flame, and information gathered during the investigation

APPENDIX AA - Mine Map (Affected Area) - Major information gathered by the investigation team

APPENDIX BB - Mine Map (Affected Area) - Detailed information of the 4th West Entries, longwall face, and recovery rooms between Nos. 1 and 10 Crosscuts gathered by the investigation team

APPENDIX CC - Mine Map (Affected Area) - Detailed information of the longwall face gathered by the investigation team

APPENDIX DD - Mine Map (Affected Area) - Mine map showing ventilation prior to explosion gathered from voluntary statements and underground observations during the investigation

APPENDIX EE - Mine Map (Affected Area) - Ventilation after explosion as indicated from ventilation survey measurements

APPENDIX FF - Mine Map (Affected Area) - Map showing air quality and quantity measurement locations and readings during recovery and investigation

APPENDIX GG - Mine Map (Affected Area) - Locations of mine dust samples with analysis data and location of coal channel sample collected during the investigation

GENERAL INFORMATION

The Pyro No. 9 Slope, William Station Mine, I.D. No. 15-13881, located near Sullivan, Union County, Kentucky, is operated by Pyro Mining Company. Pyro Mining Company is in partnership with Costain Mining (Pyro) Inc. and WKY Mining (Pyro) Inc.

The principal management officers of Pyro Mining Company and Pyro No. 9 Slope, William Station Mine at the time of the explosion were:

Pyro Mining Company Mine

P. Ron Siler	President
Steven R. Whitsell	Director of Surface Operations and Support
David L. Steele	General Superintendent
P. Bruce Hill	Director of Safety & Human Resources

Pyro No. 9 Slope, William Station Mine

H. Michael McDowell	Superintendent
Frank G. Head	Mine Manager
Roger K. Clifford (victim)	Director of Longwall Operations
Roy J. Head	Director of Maintenance
Donald R. Ramsey	Production Support Director

Pyro No. 9 Slope, William Station Mine is interconnected with Pyro No. 11 Mine. Pyro No. 11 Mine, I.D. No. 15-10339, was developed as a drift mine into the Kentucky No. 11 Coal Seam and began active status on April 13, 1977. Pyro No. 11 Mine entered inactive status on May 6, 1983.

Pyro No. 9 Slope, William Station Mine was opened into the Kentucky No. 9 Coal Seam by three shafts and a slope. An intake shaft, 486 feet deep, and a return shaft, 857 feet deep, were developed from the surface. An 800 foot long slope and a 164 foot deep return shaft were developed from Pyro No. 11 Mine, down to the Kentucky No. 9 Coal Seam. In the longwall mining area of the mine, the Kentucky No. 9 Coal Seam averaged 55 inches in thickness.

Pyro No. 9 Slope, William Station Mine, at an elevation of about 361 feet above sea level, entered active status on January 11, 1983. The mine extends over an area of approximately five square miles. A map of the entire mine is in Appendix Y.

At the time of the explosion, the mine employed 372 miners on three shifts per day. The mine had three different work crews, the Blue Crew, the White Crew, and the Weekly Crew. The Blue and White Crews were primarily the production crews and normally worked 10-hour shifts on four consecutive days and usually a fifth 10-hour shift. The Weekly Crew was the support crew and normally worked 10-hour shifts on five consecutive days. Production averaged 10,500 tons of coal per day.

Mining Methods

A block system of mining was employed. Mining was conducted using longwall, continuous, and conventional mining methods. Continuous mining equipment was used to develop longwall mining panels and conventional mining equipment was used to develop main entries. Main entries, rooms, and crosscuts were normally developed 18-20 feet wide. The longwall panels utilized retreat mining methods using two single-drum shearers in conjunction with shield-type roof supports. The entries and rooms are numbered for identification from left to right.

The longwall, continuous mining, and conventional mining units produced coal on two 10-hour shifts with one staggered shift for maintenance.

At the time of the accident, there were two active continuous mining units and two active conventional mining units. Also, there was one set of longwall mining equipment that was in the process of being recovered from Longwall Panel "O" and moved to Longwall Panel "P". Longwall Panel "O" (between 4th and 5th West Entries) had finished production and was in the equipment recovery stage. Longwall Panel "P" (between the 3rd and 4th West Entries) was in the equipment set-up stage.

Longwall Panel "O" was developed 3,730 feet in depth with a face width of 670 feet. Longwall Panel "P" was developed 4,980 feet in depth with a face width of 535 feet.

The type of mining performed on each of the active units/panels was as follows:

Active Units/Panels	Location	Mining Type
Panel "O"	Between 4th and 5th West Entries off 1st Main North Entries	Longwall Mining (Recovery)
Panel "P"	Between 3rd and 4th West Entries off 1st Main North Entries	Longwall Mining (Set-up)
No. 1 Unit	2nd West Entries off 1st Main North Entries	Continuous Mining
No. 2 Unit	9th Main North Entries off 2nd East Entries	Conventional Mining
No. 3 Unit	3rd North Entries off 1st Main West Entries	Conventional Mining
No. 4 Unit	2nd West Entries off 2nd Main North Entries	Continuous Mining

Federal Mine Inspections

A complete MSHA Safety and Health Inspection (AAA) of the entire Pyro No. 9 Slope, William Station Mine was conducted from June 6, 1989, through July 5, 1989. During the inspection, 23 citations and five orders were issued.

Another MSHA Safety and Health Inspection (AAA) began on August 8, 1989, and at the time of the explosion was nearly complete. A total of 35 citations and one order were issued. During the day shift on September 13, 1989, two federal inspectors were on the surface at the mine preparing to perform inspection activities when the explosion occurred. This last Safety and Health Inspection (AAA) was terminated on September 13, 1989 because of the explosion.

Pyro No. 9 Slope, William Station Mine was under a 5-day, 103(i) inspection program, based upon two previous explosions within the last five years.

Roof Support

The roof control plan in effect for the mine was approved by the MSHA District Manager on July 20, 1989.

Generally, the immediate roof over the coalbed consisted of three feet of black shale. The main roof consisted of 20 feet of gray shale. The roof was supported throughout the mine with various types of roof bolts.

Conventional roof bolts, resin roof bolts, Double Lock roof bolts, #7 tension rebar roof bolts, and High-Tech roof bolts were all used in the mine. Six-foot resin roof bolts, installed on 5-foot centers, were the most commonly used type of roof support in the mine. Supplemental roof support materials consisted of wooden posts, timbers, and cribs. Also, steel straps and truss bolts were used. In certain instances, steel arches were installed in lieu of roof bolts.

On the longwall sections, two-leg, 595-ton shields were used to support the roof on the longwall face, and 40-ton hydraulic jacks were used at the headgate and stageloader. Also, wooden cribs were installed as additional roof support for the bleeder entries and headgate entries that would serve as future tailgate entries.

Ventilation / Examinations

There were four openings into the mine, three shafts and one slope. Ventilation was induced by three main fans located on the surface. An exhaust fan was located at the top of the Mitchell Station shaft and a blowing fan was located at the top of the William Station Portal, a double-compartment shaft. Another exhaust fan was located at a drift opening of the Pyro No. 11 Mine and utilized the shaft between the two mines to exhaust air from Pyro No. 9 Slope, William Station Mine. These fans provided ventilation utilizing a push-pull system. The exhaust fan installations included automatic-closing and explosion-relief doors.

The exhaust fan located at Mitchell Station shaft was a Joy Axivane Model M96-58DS direct-drive fan operated at 1,180 rpm by a 1,000-horsepower electric motor. Pressure and air quantity measurements made at this fan during the investigation indicated the fan was operating in the 22-degree blade position, at a negative pressure of 13.80 inches of water. An air measurement made during the investigation indicated 339,000 cubic feet per minute (cfm) was being exhausted from the Mitchell Station shaft.

The intake fan located at William Station Portal was a Joy Axivane Model M84-50 direct-drive fan operated at 1,180 rpm by an 800-horsepower electric motor. Pressure and air quantity measurements made at this fan during the investigation indicated the fan was operating in the 32-degree blade position, at a positive pressure of 6.60 inches of water. An air measurement made during the investigation indicated 364,000 cfm was being forced into the mine.

The exhaust fan located at Pyro No. 11 Mine drift opening was a Jeffrey Model 8HU-84 Aerodyne, belt-driven fan operated at 1,180 rpm by a 700-horsepower electric motor. Pressure and air quantity measurements made at this fan during the investigation indicated the fan was operating in the 1B-1S blade position, at a negative pressure of 6.16 inches of water. An air measurement made during the investigation indicated 194,000 cfm was being exhausted from the drift opening.

The methane liberation was 1.73 million cubic feet per 24-hour period as measured during the last MSHA Safety and Health Inspection (AAA) prior to the explosion.

Permanent stoppings, overcasts, and undercasts were used to provide the required separation between the various aircourses. All were constructed of incombustible materials. Most stoppings were constructed of concrete blocks, dry-stacked and sealed.

The ventilation plan in effect at the mine was approved by the MSHA District Manager on March 13, 1989. The plan required a minimum of 4,000 cfm of air to be maintained at each working face where coal was being cut, mined or loaded. When a continuous mining machine was operated, the plan required a minimum of 5,000 cfm of air to be maintained at the end of a blowing line curtain. On longwall sections, the plan required a minimum of 15,000 cfm of air to be directed across the face.

Respirable dust created by mining in the face areas was controlled by water sprays on the equipment, including the longwall equipment, and by the use of ventilation directed to the working faces by line curtains.

A wrap-around type bleeder system was developed around the block of coal being mined by the longwall. The ventilation plan required that the maximum allowable concentration of methane anywhere in the bleeder system shall not exceed 2 percent. Methane drainage boreholes equipped with surface mounted pumps were also used to drain methane from longwall gob areas.

Preshift, onshift, and weekly examinations were to be made by certified persons. The results of these examinations were to be recorded in approved record books on the surface.

Combustible Material / Rock Dusting

The operator established a program to prevent the accumulation of loose coal, coal dust, float coal dust, and other combustible materials in the active workings and on electric equipment.

The application of rock dust was the primary means used for inerting coal dust. Rock dust was applied to the underground areas of the mine including all working places within 40 feet of the face and all crosscuts less than 40 feet from the working faces. Rock dust machines were used to apply rock dust in outby areas and on the working sections.

Water lines and sufficient hose to reach each working face was provided on each working section. Coal dust created by mining in the face areas was controlled by water sprays on the equipment, including the longwall equipment, and by the use of ventilation directed to the working faces by line curtains. The continuous mining machines were also equipped with wet-bed scrubbers to control generated dust. Dust at conveyor belt transfer points was controlled by water sprays.

Electricity

Electric power was purchased from the Henderson-Union Rural Electrical Cooperative at 69,000 volts alternating current (AC) and transmitted to surface substations located at the Mitchell Station Fan and the William Station Portal. The 69,000 volts AC was reduced to 7,200-volt, AC three-phase power at the Mitchell Station Fan by a 5,000 kVA delta-wye connected three-phase transformer and three, 1,000 kVA delta-delta connected single-phase transformers. These transformers supplied two underground circuits that entered the mine through a borehole adjacent to the substation.

The 5,000 kVA transformer secondary neutral was properly grounded through a 25-ampere, current-limiting resistor to a safety ground field. A zig-zag grounding transformer provided a secondary neutral for the three, 1,000 kVA single-phase transformers and was properly grounded through a 25-ampere, current-limiting resistor to a safety ground field.