CAI-2008-09

UNITED STATES DEPARTMENT OF LABOR MINE SAFETY AND HEALTH ADMINISTRATION

COAL MINE SAFETY AND HEALTH

REPORT OF INVESTIGATION

Fatal Underground Coal Mine Electrical Accident May 16, 2008

> Aracoma Alma # 1 Mine Aracoma Coal Company, Inc. Stollings, Logan County, West Virginia I.D. No. 46-08801

> > Accident Investigators

James Maynard Coal Mine Safety and Health Inspector

> James Honaker Electrical Engineer

Originating Office Mine Safety and Health Administration District 4 100 Bluestone Road Mount Hope, West Virginia 25880 Robert G. Hardman, District Manager

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DRAWING OF ACCIDENT SCENE

OVERVIEW

On Friday, May 16, 2008, Nathan Dove, a 24-year old electrician with approximately four years of mining experience, was fatally injured at the Aracoma Alma #1 Mine, ID No. 46-08801, Aracoma Coal Company, Inc. While starting repairs on the No. 2 Joy Shuttle Car, he cut into an energized 480 volt phase lead in the trailing cable at the reel area of the car. The victim was in the process of re-entering the cable into the reel where two phase leads had been damaged due to electrical arcing.

GENERAL INFORMATION

Aracoma Alma # 1 Mine is an underground coal mine located on Bandmill Hollow Road, approximately 1.5 miles off Route 17, near Stollings, Logan County, West Virginia. Production at the mine began on October 1, 1999. The mine has been owned and operated by Massey Energy Company throughout its history. The mine is accessed through multiple drift openings at a box cut, located at Melville, and multiple drift openings located on Rum Creek. The mine is ventilated with two blowing fans and one exhaust fan. The mine liberates approximately 269,244 cubic feet of methane every 24 hours. Coal is being extracted from the Alma coal seam.

The mine employs approximately 178 persons, and is not represented by a labor organization. An average of 9,991 tons of coal is produced daily from three sections with continuous mining machines. Coal is transported from the working sections to the surface via a series of belt conveyors. The mine produces coal two shifts per day, five days per week. Track and rubber-tired equipment is used to transport miners, supplies, materials, and equipment into and out of the mine.

The principal officers for the mine at the time of the accident were:

John Jones	President
Lawrence Lester	Superintendent
Dusty Dotson	
Lewis Sheppard	Director of Safety

Prior to the accident, the Mine Safety and Health Administration completed the last regular safety and health inspection (E01) on March 17, 2008. The non-fatal day's lost (NFDL) injury incidence rate for the mine in year 2007 was 0.00, compared to a National NFDL rate of 4.75 for a mine of this type. The accident occurred on the No. 3 Section, which was developing seven entries. The accident occurred in the No. 4 belt entry near the face.

DESCRIPTION OF ACCIDENT

On Friday, May 16, 2008, at 3:00 p.m., the No. 3 Section second shift crew consisting of Dave R. Runyon, section foreman, Joey Kennedy and Robbie Cantrell, continuous mining machine operators, Greg Hensley and Kevin Justice, roof bolting machine operators, Josh Tomblin and Dave M. Runyon, shuttle car operators, Elbert J. Clay, scoop operator, and Nathan Dove, electrician, left the surface at the Melville box cut and traveled to the No. 3 working section via a rail-mounted personnel carrier. They arrived on the section at 3:20 p.m., and met with the day shift crew that was still on the section. After a brief discussion with the day shift crew, they continued to the face and started their normal mining process.

The day shift crew then left the section and traveled to the surface using the railmounted personnel carrier that the second shift had used to travel to the section. When the second shift crew arrived on the section, the No. 1 shuttle car was located in the 4 right crosscut with all of the cable pulled off the reel and lying on the mine floor. The car had not operated for several hours on the day shift because of electrical problems. The day shift had reported that the shuttle car had been repaired. The second shift discovered that the shuttle car was still having electrical problems and Dove started the repairs.

Jeff Ballintine, the day shift electrician, had just left the section, but forgot his dinner bucket and came back to the section to get it. He then discovered that the No. 1 shuttle car was still down and he decided to stay back and help repair the shuttle car. The day shift crew then left the section.

It was determined that the cable reel needed to be replaced and the No. 1 shuttle car needed to be moved out of the way for production purposes. Dove and Ballintine electrically bypassed the defective reel and the shuttle car was relocated to the No. 5 entry just outby the section loading point. Dove then deenergized the No. 1 shuttle car, disconnected the disconnecting device, and locked it out with his lock.

Dove and Ballintine then began replacing the defective reel. Production began in the No. 1 entry with the left side continuous mining machine. The cut was finished and the mining machine was moved to the No. 3 entry which was then mined. The right side continuous mining machine subsequently mined the No. 7 entry, while the left side continuous mining machine was moved to the 3 left crosscut. The 3 left crosscut was mined and the left side continuous mining machine was then moved to the No. 4 entry. While moving the left side continuous mining machine was backed into the 4 right crosscut, where it ran over the cable for the No. 1 shuttle car, thereby damaging the cable.

Dove came to the 4 right crosscut to repair the No. 1 shuttle car cable. Ballintine came to the crosscut to tell Dove that he was leaving. Ballintine left the section and walked to the surface. While Dove completed the repairs on the No. 1 shuttle car cable, Kennedy, left continuous mining machine operator, and Tomblin, No. 2 shuttle car operator, mined the No. 4 entry. Shortly thereafter, the No. 2 shuttle car lost power and shut down as it was about to leave the left continuous mining machine. The lights on the No. 2 shuttle car went out when the power was lost. Kennedy and Tomblin looked inside the reel compartment of the No. 2 shuttle car where they detected a burning smell from damaged phase conductors.

Dove and Cantrell also came to the No. 2 shuttle car. Tomblin showed Dove the damaged cable inside the cable reel compartment. Tomblin assisted Dove in pulling the remaining 30 to 40 feet of cable from the reel, without first disconnecting, locking out, and tagging the disconnecting device for the No. 2 shuttle car. Cantrell went to the right side continuous mining machine to begin mining in the No. 6 entry. Tomblin and Dove removed the cover from the top of the reel compartment. The strain clamp for the cable was also removed at this time. Dove asked Dave R. Runyon to look at the damaged cable in order to show him the extent of damage. Dove wanted to assure that Dave R. Runyon realized the damaged area would have to be removed and the trailing cable re-entered into the reel. Dave R. Runyon agreed to the needed repair and left the immediate area.

Dove continued making the repairs to the cable without deenergizing the circuit and locking out and tagging the disconnecting device to the No. 2 shuttle car. Kennedy and Tomblin remained in the area.

At approximately 8:45 pm, Dove cut into the white electrical phase conductor. As Dave R. Runyon traveled down the No. 4 entry toward the feeder, he looked back toward the shuttle car and observed Dove leaning over the cable reel compartment, convulsing as if being shocked. Dave R. Runyon yelled for someone to pull the power and yelled for Kennedy to get Dove out of the power. Kennedy attempted to pull Dove by his light cord, but the battery came out of the pouch and his hard hat fell. He then grabbed Dove's mine belt straps, pulled, and they both fell back against the coal rib. Dove appeared to gasp for a couple of breaths, and then was unresponsive. Dave R. Runyon instructed Tomblin to go to the section transformer and deenergize the No. 2 shuttle car. Tomblin rushed to the transformer and tripped an undetermined number of circuit breakers on the side of the transformer, opposite from where the shuttle cars circuit breakers were located. Dave R. Runyon and Kennedy immediately started CPR. As others on the section became aware of the accident, the dispatcher was notified, a backboard and additional first aid supplies were obtained, and additional persons assisted in transporting Dove to the end of the track on the section. During a trip past the section transformer, David M. Runyon noticed that the No. 2 shuttle car circuit breaker was still closed (energized). He pressed the test button to trip the circuit breaker and deenergized the shuttle car.

Tim Dingess, outby electrician, Kennedy, and Dave R. Runyon transported Dove to the surface on a rail-mounted personnel carrier while continuing CPR. Once on the surface, Dove was transported to the Logan General Hospital in Logan, West Virginia, by the L.E.S.A. Ambulance Service. The victim was pronounced dead at 9:30 p.m. by hospital personnel.

INVESTIGATION OF THE ACCIDENT

MSHA was notified of the accident through the National call center at 9:30 p.m., on May 16, 2008. MSHA accident investigators were dispatched to the mine and a 103(K) order was issued to insure the safety of all persons at the mine. The investigation was conducted in cooperation with the West Virginia Office of Miners' Health, Safety, and Training (WVMHST), with the assistance of the mine operator and employees. A list of those persons participating in the investigation can be found in Appendix A. Personnel from MSHA Technical Support and MSHA Educational Field Services participated in the investigation.

DISCUSSION

Section Power Center

The power center is a 2,500 KVA "Trey K", Model PC-12470, with a manufactured date of 10/04 (October 2004). The circuit feeding the No. 2 shuttle car was 480 volt, three-phase, AC. The required grounding resistor for the 480 volt circuits was measured with an ohmmeter and found to be 15 ohms, which limits the current flow during a phase-to-ground fault to a maximum of 18.5 amperes.

No. 2 Shuttle Car Circuit Breaker

The circuit breaker at the power center providing protection for power circuit to the No. 2 shuttle car cable was a Cutler-Hammer 225 ampere, three-pole breaker, equipped with a 120 volt undervoltage release. The breaker had an instantaneous trip range of 200 to 1500 amperes and was set at 200 amperes. The breaker was found in the tripped position. Voltage readings indicated that the three poles in the circuit breaker were open. The circuit breaker would not close when tested with the cable and shuttle car connected, as it was at the time of the accident.

No. 2 Shuttle Car Ground Fault Circuit

Grounded phase protection was provided by a ground fault circuit manufactured by Trey K and consisted of a single pole circuit breaker, current transformer and a test circuit. The three 480 volt phase power conductors were properly wired through the current transformer. During the investigation, the ground fault circuit was tested using a multi-amp circuit tester (variable current source) to pass current through the current transformer on each of the three phases. As each phase was tested, the ground fault circuit tripped at 8.25 amperes, 8.2 amperes, and 8.2 amperes. At the time of the investigation, the ground fault circuit was found to be in the "tripped" position.

No. 2 Shuttle Car Ground Wire Monitor

The ground wire monitor was a Femco GM-8000 (MSHA Acceptance No. 050884FE) and was being used without the pilot wire. The ground wire monitor sensitivity was adjusted to trip at 20 ohms. The ground wire in the No. 2 shuttle car trailing cable was intact and connected to the shuttle car frame.

No. 2 Shuttle Car Trailing Cable

The cable plug for the No. 2 shuttle car trailing cable was installed in the receptacle. A cable cutter was found attached to the white phase conductor at the shuttle car cable reel. The cutting edge of the cutter was through the conductor insulation and was making solid contact with the phase conductor. The white and black conductors were burnt and damaged inby or "down circuit" from this location. The entire cable was tested at 1,047 volts DC and no problems were detected. The ground wire was intact. The trailing cable was inspected along the entire length with no deficiencies found. The damaged area of the No. 2 AWG, 3 Conductor Type G-GC, trailing cable (where the accident took place) was sent to MSHA's Approval and Certification Center (A&CC) for inspection. The findings of the examination and test conducted by the A&CC are as follows:

- The trailing cable appears to have been constructed according to the manufacturer's specifications. Excluding the electrical damage to the black and white phase conductors, the physical damage to the rest of the electrical conductors prior to the accident is judged to have not impaired the electrical or mechanical integrity of the piece of trailing cable.
- The black and white phase conductors of the trailing cable appear to have been damaged significantly by electrical arcing. This was evidenced by melted and charred wire strands of each of the two phase conductors.

- It is estimated that approximately 64% of the black phase conductor was damaged and approximately 96% of the white phase conductor was damaged. The red conductor did not appear to have sustained any electrical arcing damage. Continuity measurements confirmed that there were no open or short circuits within the piece of trailing cable examined and tested during this investigation.
- The laboratory examination and testing could not determine if the electrical damage to the white and black phase conductors occurred immediately prior to the accident, or if the conductor damage happened progressively over a period of time.

The degree of damage present on both the white and black phase conductors was considered sufficient to have disrupted electrical power on the machine during the period of arcing. Under these conditions, the machine lights would most likely flicker or go out and operation of the electric motors would most likely be affected.

The cable on the No. 2 shuttle car was repaired by cutting out the damaged area and reinstalling the cable into the cable reel. The complete circuit was then tested and no problems were found. The shuttle car was loaded with coal and functionally tested and no problems were found.

Main On-board Circuit Breaker on the No. 2 Shuttle Car

The main on-board circuit breaker was a Cutler-Hammer 100 ampere MCP (Motor Control Protection) with a trip range of 100 to 1,000 amperes and was set at 900 amperes. This breaker was found in the tripped position, after the shuttle car was pushed to allow the continuous mining machine to be removed from an unsupported area. When the breaker is in the tripped position, the car will not operate and the lights will be off. If this circuit breaker was tripped at the time of the accident, this may have led persons to incorrectly believe that the circuit breaker at the power center was tripped.

No. 1 Shuttle Car Trailing Cable

The No. 1 Shuttle Car trailing cable plug was disconnected with a lock installed to prevent the cable from being reattached to the receptacle. It was determined that the lock belonged to Nathan Dove. No tag was observed on the cable plug or receptacle.

Fluke Voltage Detector

A voltage detector (commonly called a tic-tracer) was found at the location where CPR was initially performed on Dove. It was reported that Dove carried one inside his shirt collar. The tester was a Fluke "VoltAlert", with a sensitivity range of 90 to 1,000 VAC. The tester was found in a very wet and muddy location on the mine floor. The tester gave an indication that it was operational when it was turned on; however, it would not detect the presence of voltage on an energized 480 volt circuit. Two other Fluke testers were tested on the same circuit and indicated voltage. It could not be determined if the tester worked at the time of the accident. None of the miners reported seeing Nathan Dove using a tester on the subject cable.

Electrical Work on the No. 2 Shuttle Car

Power to the No. 2 shuttle car trailing cable should have been deenergized prior to pulling the remaining cable from the reel. According to a company document regarding West Virginia State Law on lock and tag out policies, Nathan Dove was familiar with the requirements for locking and tagging out equipment. Once Dove, the section qualified electrician, smelled the odor of burning cable and initially observed damage to the cable for the No. 2 shuttle car, the power to the shuttle car should have been disconnected, locked out, and tagged. Neither of the two miners with Dove at the time the damage to the cable was discovered, observed Dove go to the power center, nor did they hear Dove ask anyone else to deenergize the power to the trailing cable. When Dave R. Runyon was shown the damage to the cable, he did not inquire if the power to the cable was deenergized, and he did not direct Dove to ensure that the power was deenergized. The accident investigation team could not determine why the repair to the cable continued without first being deenergized, locked out, and tagged.

ROOT CAUSE ANALYSIS

An analysis was conducted to identify the most basic causes of the accident that were correctable through reasonable management controls. The following root cause was identified:

<u>Root Cause</u>: The qualified person performing electrical work did not deenergize the shuttle car, disconnect the plug from the circuit breaker receptacle, and lock out and tag the disconnected plug. The section foreman, becoming aware that electrical work was to be performed, did not inquire if the power to the cable was deenergized, nor did he direct the qualified electrician performing the electrical work to ensure that the power was deenergized prior to work being performed. <u>Corrective Action</u>: Mine management reinstructed all personnel on proper procedures to be followed when repairing power cables or performing electrical work on equipment. Persons must deenergize equipment or power cables, disconnect at the power source, and lock out and tag the disconnect. Additionally, mine management distributed multiple locks and tags to all persons qualified to perform electrical repairs.

CONCLUSION

The accident occurred when the certified electrician cut into an energized electrical conductor while in the process of re-entering a damaged trailing cable into the cable reel on the shuttle car. The qualified person performing electrical work did not deenergize the shuttle car, disconnect the plug from the circuit breaker receptacle, and lock out and tag the disconnected plug. The section foreman, becoming aware that electrical work was to be performed, did not inquire if the power to the cable was deenergized, nor did he direct the qualified electrician performing the electrical work to ensure that the power was deenergized prior to work being performed.

Approved By:

Robert Hardman District Manager

84/13/2009

Date

ENFORCEMENT ACTIONS

1. A 103(k) Order, No. 4401912, was issued to Aracoma Alma Mine #1, on May 16, 2008, to ensure the safety of persons until an investigation of the accident could be completed.

2. A 104(d)(1) Order, No. 6615807, was issued to Aracoma Alma Mine #1 for a violation of 30 CFR 75.509. On May 16, 2008, a section electrician performed electrical work on the Company No. 2 Shuttle Car SN ET-17065, located on the No. 3 section, without the power circuit being deenergized. Two of the phase conductors in the trailing cable had been damaged where the cable entered the cable reel. The cable was to be re-entered into the reel. The cable had not been deenergized before the repairs were started. While performing this work an energized phase conductor was cut into, causing the section electrician to be electrocuted. When the section foreman was shown the damage to the cable, he did not inquire if the power to the cable was deenergized, nor did he direct the electrician to ensure that the power was deenergized.

3. A 104(d)(1) Order, No. 6615808, was issued to Aracoma Alma Mine #1 for a violation of 30 CFR 75.511. On May 16, 2008, a section electrician performed electrical work on the Company No. 2 Joy Shuttle Car SN ET-17054, located on the No. 3 section, while the disconnecting device was not locked out nor suitably tagged. Two of the phase conductors in the trailing cable had been damaged where the cable entered the cable reel. The cable was being re-entered into the reel. The cable had not been deenergized before the repairs were started. While performing this work, an energized phase conductor was cut into, causing the section electrician to be electrocuted. When the section foreman was shown the damage to the cable, he did not inquire if the cable disconnecting device was locked out and suitably tagged, nor did he direct the electrician to ensure that the disconnecting device was locked out and suitably tagged.

APPENDIX A

List of persons furnishing information and/or present during the investigation:

Aracoma Coal Company, Inc.

President
Superintendent
Chief Electrician
Maintenance Superintendent
Corporate Safety Director
Compliance Assistant
Mine Foreman
Safety Director
Section Foreman
Shuttle Car Operator
Shuttle Car Operator
Day Shift Electrician
Scoop Operator
Roof Bolter
Roof Bolting Machine Operator
Continuous Mining Machine Operator
Chief Electrician
Counsel for Aracoma
Counsel for Aracoma

West Virginia Office of Miners' Health, Safety, and Training

Ron Wooten	Director
Terry Farley	Administrator
Elaine Skorich	Assistant Attorney General
Eugene White	Inspector-at-Large
John Kinder	Assistant Inspector-at-Large
James Dingess	Electrical Inspector
Michael Parley	District Inspector

Mine Safety and Health Administration

James Maynard	Coal Mine Safety and Health Inspector
Richard Kline	Assistant District Manager, Technical Programs
Larry Cook	Supervisory Electrical Engineer
Robert Hatfield	Coal Mine Safety and Health Inspector
James Honaker	Electrical Engineer
Sharon Cook	Mine Safety and Health Inspector

APPENDIX B

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