CAI-2011-04

UNITED STATES DEPARTMENT OF LABOR MINE SAFETY AND HEALTH ADMINISTRATION

COAL MINE SAFETY AND HEALTH

REPORT OF INVESTIGATION

Underground Mine

Fatal Machinery Accident March 25, 2011

Mine No.1 Matrix Energy LLC Lovely, Martin County, Kentucky ID No. 15-18575

Accident Investigators

Dwight Bostic Coal Mine Safety and Health Specialist (Electrical)

Chalmer Williamson Coal Mine Safety and Health Specialist (Electrical)

> Martin Holbrook Coal Mine Safety and Health Inspector

Chad D. Huntley Electrical Engineer, MSHA Technical Support

Akik Fawaz Electrical Engineer, MSHA Technical Support

Originating Office Mine Safety and Health Administration District 6 100 Fae Ramsey Lane Pikeville, Kentucky 41501 Norman G. Page, District Manager

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Photograph of Accident Scene

OVERVIEW

On March 25, 2011, at approximately 8:10 a.m. a 54 year old scoop operator was killed when he was caught between the conveyor boom of a remote controlled continuous mining machine and the coal rib. Robert L. Cook (victim) was substituting for the continuous mining machine operator. Cook was in the process of positioning the continuous mining machine in order to begin mining a crosscut when he became pinned between the end of the conveyor boom and the coal rib. The accident occurred primarily because the victim operated (trammed) the machine while he was located between the right side of the conveyor boom and the coal rib. The administrative controls and policies in place at the time of the accident were not adequate to control the practice of operating continuous mining machines from an unsafe location.

GENERAL INFORMATION

The No. 1 mine is an underground mine operated by Matrix Energy LLC and controlled by James H. Booth. The mine is located in Martin County, Kentucky and is being developed in the Alma seam. The mining height ranges from forty two inches to 84 inches, with access to the mine provided by three openings: a single slope (with a belt conveyor and track); an intake escape shaft; and a fan shaft. The mine operates six days per week, nine and one half hours per shift, and employs a total of 200 miners. The mine normally operates two production shifts and one maintenance shift. Coal is extracted from the face by continuous mining machines and is transported to the section loading point by shuttle cars and to the surface by conveyor belts. The five active sections produce approximately 13,500 raw tons per day. Materials, supplies, and miners are transported primarily by track-mounted brake cars, personnel carriers, locomotives, and supply cars. Rubber-tired personnel carriers are also used to transport persons in the mine.

The principal officials for the mine are:

James Booth	President
Charles Leonard	Superintendent
Elbert Fletcher	Mine Foreman
Estill Jarvis	Mine Foreman
Marty Slone	Safety Director

The last regular safety and health inspection (E01) conducted by the Mine Safety and Health Administration was completed on December 29, 2010. At the time of the accident, an E01 inspection event was ongoing, although an MSHA inspector was not present at the time of the accident. The Non Fatal Days Lost (NFDL) incident rate for the No. 1 mine for 2010 was 4.52, compared to the National NFDL rate of 3.58 for the same period.

DESCRIPTION OF ACCIDENT

On the day of the accident Robert Cook started work at approximately 7:00 a.m. along with the rest of the #2 Section day shift production crew. The crew entered the mine at the slope portal and traveled to the #2 Section. The crew arrived on the section at approximately 7:45 a.m. and walked from the end of the track to the section to begin production. Although it was not his normal occupation, Cook was assigned to operate the left side continuous mining machine. Steven Alley, the person normally assigned to the continuous mining machine, was absent. Cook had operated continuous mining machines intermittently during

his mining career and was generally regarded by foremen and co-workers as proficient at the task.

After arriving on the working section, Cook traveled to the left side continuous mining machine, which had been parked on the previous shift in the last open crosscut between entries #3 and #4. Cook and two shuttle car operators, Timothy Osborne and James Sisco, made preparations to begin cutting the #2 left crosscut. Cook trammed the continuous mining machine through the last open crosscut and positioned it to start cutting the #2 left crosscut. It was a practice at this mine to cut all crosscuts straight ahead, except for #3 left and #3 right crosscuts.

During the process of pulling up the slack in the continuous mining machine trailing cable and water line, the wrong rope pulling cable was attached to the machine. This caused a knot in the mining machine trailing cable. Cook trammed the mining machine backwards and attached the correct rope. He then pulled up the cable slack by swinging the conveyor boom fully to the right side (to keep the cable next to the rib and out of the roadway) and tramming the machine forward until the cutter head contacted the solid coal rib of the #2 entry. Sisco was located approximately thirty feet behind the continuous mining machine at this time, watching the trailing cable to ensure that it was positioned correctly.

Cook trammed the machine a short distance in reverse to remove the rope for cable pulling and to position it to start cutting the #2 left crosscut. While the machine was being trammed, Sisco heard it shut off. At approximately 8:10 am, he looked up and saw Cook pinned between the continuous mining machine conveyor boom and the coal rib. He immediately began yelling for help.

At the time of the accident, James Kendrick and David Litton, Roof Bolting Machine Operators, were installing bolts in the #3 right crosscut. Milton Marcum, Section Foreman, and Estill Jarvis, Mine Foreman, were located in the #4 entry. They all heard Sisco yelling for help and each responded. Jarvis attempted to free Cook, but was unable to do so. Litton retrieved the battery powered scoop, which was located in the #6 entry, and used it to push the left rear corner of the continuous mining machine. On the second attempt, the continuous mining machine moved a small distance and Cook was released. Sisco retrieved a shuttle car from the #3 entry and, unaware that Cook had already been freed, used it to push on the cutter head of the continuous mining machine. When Sisco realized that Cook had already been freed, he backed the shuttle car outby into the #2 entry and parked it. Osborne retrieved the first responder kits from the power center as the section crew gathered to help with first aid. Cook's airway was cleared, oxygen was administered, and CPR was started. Cook was taken to the end of the track outby the section, where he was placed on a rubber-tired personnel carrier and transported to the bottom of the slope. He was then taken out of the mine where he was attended to by NetCare Ambulance personnel. Cook was pronounced dead at 9:01 a.m. at the mine site by the Martin County Coroner's Office.

INVESTIGATION OF THE ACCIDENT

Marty Slone, Safety Director for Matrix Energy LLC, notified the MSHA call center of the accident at 8:24 a.m. on Friday, March 25, 2011. The call center notified the Pikeville District office. The District office immediately notified the Martin field office of the accident and a 103(j) Order was issued verbally at 8:50 a.m. to ensure the safety of the miners and to preserve the accident scene.

MSHA accident personnel from the Pikeville and Martin offices were dispatched to the mine site immediately. The 103(j) Order was modified to a 103(k) Order after MSHA officials arrived at the mine site. The accident investigation was conducted in cooperation with the Kentucky Office of Mine Safety and Licensing (KOMSL) with the assistance of the mine operator and employees. A list of those persons participating in, or present, during the investigation is included in Appendix A.

MSHA accident investigators gathered preliminary information and conducted an investigation of the existing physical conditions. Photographs and measurements were taken of the scene. Chad Huntley and Akik Fawaz, Electrical Engineers from MSHA Technical Support, Approval and Certification Center (A&CC), Triadelphia, West Virginia, also participated in the accident investigation. Officials from KOMSL also participated in the investigation.

Formal interviews were conducted on March 29, 2011, at the MSHA office in Pikeville, Kentucky. A list of persons interviewed is provided in Appendix B.

DISCUSSION

Accident Scene

The accident occurred in the crosscut between the No. 2 and No. 3 entries on the #2 Section; approximately 25 feet from Survey Station No. 25218 (see Appendix C). The mining height in the immediate area was seven feet and the width of the crosscut was approximately 20 feet. The working section consisted of seven entries, mined on 60-foot centers.

When investigators first arrived at the accident scene, the continuous mining machine was positioned nearly parallel with the inby coal rib in the crosscut and the boom was fully extended to the right, as viewed from the rear of the machine as shown in Appendix C. The cutting head of the machine was located approximately 40 inches from the solid left rib of the No. 2 entry. The tip of the machine conveyor boom was 18 inches from the inby coal rib. Based on evidence and measurements taken at the scene, it was evident that the boom had been moved approximately 13 inches away from the inby coal rib to free the victim at the time of the accident.

The mine floor on the left side of the continuous mining machine was relatively dry. The floor on the right side of the machine was generally wet and slightly muddy. The mine floor was uneven in the area under the machine and both crawlers had portions that were not making contact with the floor. The machine was leaning forward with approximately 80 per cent of the left crawler in contact with the mine floor and approximately 42% of the right crawler in contact with the floor. During interviews, both Litton and Sisco indicated that during operation the mining machine slewed or turned on the mine floor with relative ease.

Equipment

The continuous mining machine involved in the accident was manufactured by Joy Mining Machinery (Model No. 14CM15-11GX, Serial No. JM5199B, MSHA Approval No. 2G-4159A-0). The nominal input power specification for the machine was 950 volts, 3-phase, and 60 hertz. Power was delivered to the machine through a 2/0 AWG (American wire gage) trailing cable. The onboard controls in the master station were set to allow the machine to be operated remotely. All onboard circuit breakers were engaged.

The radio remote control being used at the time of the accident was manufactured by Matric Limited (Model TX3, Part No. 100112672, Serial No. 75212AK008E, MSHA Approval No. 2G-4096-0). The remote control was programmed to operate at 458.525 MHz (mega-hertz) and was being powered by the victim's cap lamp (Koehler Model 5200, MSHA Approval No. 6D-36-0) at the time of the accident. The radio receiver installed on the continuous mining machine was also manufactured by Matric Limited (Model RX1, Part No. 100017329, Serial No. 83505AH026E, MSHA Evaluation No. IA-18528-0).

Another remote controlled continuous mining machine (Serial No. JM5499A) was located in the No. 7 entry. The remote control for this machine was programmed to operate at 458.600 MHz. The approved ventilation plan in effect

at the time of the accident allowed only one continuous mining machine to be operated at a time on this working section.

Testing and Examination

The continuous mining machine involved in the accident was examined and functional tests were performed onsite with the same remote control transmitter that was used by the victim. All critical functions were tested, with emphasis on the tram and conveyor boom swing operations. No operational irregularities or deficiencies were observed during functional testing.

An examination of the remote control transmitter revealed that the right tram lever was bent slightly. This may have been caused during the accident. In all subsequent testing this damage did not affect the proper operation of the remote control. All toggle switches on the remote control operated properly, with no sticking or restrictions observed. All switches returned to the neutral position when released. Small tears were present in the dust boots covering the right and left tram levers. The dust boots on the other covers were undamaged. The emergency stop and power center "trip" functions on the remote control transmitter operated properly when tested. The continuous mining machine would not start if the tram or conveyor boom swing switches on the remote control were activated when startup was attempted. The pump motor on the continuous mining machine deenergized when the remote control was moved approximately 78 feet away from the machine.

An evaluation was made to determine if other radio frequencies present at the mine affected the operation of the continuous mining machine. The remote control transmitter (458.600 MHz) for the continuous mining machine in the No. 7 entry was brought to the accident scene to determine whether it would interfere with the operation of the machine involved in the accident. The remote control was energized and various functions were attempted. These attempts had no affect on the mining machine involved in the accident.

Miner mesh handset radios (L-3 Communications, Accolade) were used at the mine for both communication and tracking purposes. When the radios were operated in proximity to the remote control they had no effect on the operation of the continuous mining machine or the remote control. The victim was reportedly not wearing or carrying a miner mesh radio at the time of the accident.

No large magnets, which could affect the operation of the Hall effect switches on the remote control, were found on the continuous mining machine or in the vicinity of the accident. A Hall effect is the production of a voltage difference (the Hall voltage) across an electrical conductor, transverse to an electric current in the conductor and a magnetic field perpendicular to the current. A clamp (non-magnetic) was installed on the mining machine to hold a portable methane detector.

The remote control transmitter involved in the accident was taken into custody by MSHA and tested at the Matric Limited facility in Seneca, Pennsylvania. The cap lamp being worn by the victim at the time of the accident was also taken into custody and was used to power the remote control during testing.

The results of the testing indicated that each switch on the remote control transmitter would properly activate or deactivate the corresponding machine function. No sticking of the switches was observed and all switches returned to the center position when released. The neutral position calibration on both tram switches and the conveyor-swing switch was tested and found to be within the acceptable range given by the manufacturer. The neutral position calibration on several other switches was not within the manufacturer's limits, but this did not affect the proper operation of the switches during functional testing. The full-range calibration of each switch was tested and found to be within acceptable limits. The neutral position calibration process ensures that switches in the neutral position do not generate sufficient output to activate a machine function. The full-range calibration process ensures that switches moved to the full extent of travel will generate sufficient output to activate the associated machine function.

All of the mining machine's remote control operational switches were examined during the investigation. Several of the switch wells contained foreign material in the form of dust and small clumps of dirt. Several of the switch wells also contained moisture. In all testing, both onsite and offsite, the foreign material/moisture did not appear to affect the proper operation of the switches on the remote control transmitter.

Roof Control Plan

Precautions for remote control operation of continuous mining machines were included in the mine' approved roof control plan in effect at the time of the accident. The following statements were included in the plan:

During mining and place changing, all persons shall be positioned in an area outby the tail (boom) of the miner at all times while the miner is being trammed. The pump motors shall be turned off prior to hanging the cable on the front or the boom of the machine. (page 5)

When the continuous miner is being trammed anywhere in the mine, other than when cutting or loading coal, no person shall be allowed along either side of the continuous mining machine. (page 6)

During mining and place changing with remote control miners: all persons shall be positioned in an area that will afford maximum protection to themselves and others from unsupported roof and moving equipment. (page 12)

During place changing, all persons involved in the move shall be positioned in an area outby any part of the miner at all times while the miner is being trammed. (page 12)

Examinations

The preshift and on-shift examinations required by 30 CFR, §§ 75.360 and 75.362 were conducted by an agent of the operator, and no hazardous conditions were recorded. The preshift examination for the shift on which the accident occurred was conducted by Wallace Sartin, Section Foreman on the third shift, prior to beginning coal production on the day shift.

Training

The task training and annual refresher training records for Robert Cook were examined and found to be up-to-date. The record documenting the annual demonstration of proficiency for equipment operators (required by KOMSL) was also on file at the mine office. The training records and demonstration of proficiency records were examined for all other continuous mining machine operators and scoop operators at the mine. All records were up-to-date and no violations were observed.

As an additional follow up measure before resuming normal mining operations, management trained all miners on safe work practices and procedures related to moving and operating continuous mining machines.

ROOT CAUSE ANALYSIS

An analysis was conducted to identify the underlying cause or causes of the accident that were correctable through reasonable management controls. Listed below is the root cause identified during the analysis and corresponding corrective actions implemented to prevent a recurrence.

Root Cause: The mine operator did not ensure compliance with provisions of the approved roof control plan, requiring that all persons be in a safe location, away from the continuous mining machine and away from pinch points created by either the mining machine or haulage equipment, when the mining machine is in operation.

Corrective Action: Management trained all miners on safe work practices and procedures related to moving and operating continuous mining machines. This training was accomplished before normal mining operations resumed.

The company also adopted a plan to install the Joy Mining Machinery (Joy) proximity detection system on two continuous mining machines used at the mine. The company also developed a long-term plan, based on the availability and reliability of the Joy system, to address proximity protection on the remaining continuous mining machines at the mine. The Joy system is expected to become commercially available later this year. These provisions were included in a revision to the roof control plan on March 31, 2011.

CONCLUSION

The mine operator's administrative controls, training, and policies in place at the time of the accident were not adequate to prevent the practice of operating continuous mining machines from an unsafe location. The continuous mining machine operator received fatal crushing injuries when he was caught between the conveyor boom of the continuous mining machine and the coal rib. The accident occurred because the victim operated (trammed) the machine, while being located between the right side of the conveyor boom and the coal rib.

Tanter Morman G. Page

District Manager

<u>9-7-2011</u> Date

ENFORCEMENT ACTIONS

1. 103(j) Order No. 8254187 was issued verbally to Matrix Energy LLC on March 25, 2011. The order was modified to a 103(k) action when MSHA inspectors arrived at the mine site.

Condition or Practice: "At approximately 08:10 hours a serious accident occurred at this mine. The continuous miner operator was setting the miner up in the No. 2 left crosscut and was pinned between the coal rib and the conveyor boom of the machine. This order is issued to preserve evidence at the scene of the accident and prohibits all persons from entering the 002-0 section. The order was issued orally to the mine operator, and has been reduced to writing. "

2. 104(a) Citation No. 8242279 was issued to Matrix Energy LLC for a violation of 30 CFR § 75.220(a)(1).

Condition or Practice: "The operator failed to ensure that the approved roof control plan developed for this mine was being followed on the No. 2 section. On March 25, 2011, a continuous mining machine operator was fatally injured when he was caught between the conveyor boom of the machine and the coal rib. The roof control plan in effect at the time of the accident required that all persons be positioned in an area outby the tail (boom) of the miner at all times while the miner was being trammed during mining and place changing.

Standard 75.220(a)(1) was cited 3 times in two years at mine 1518575 (3 to the operator, 0 to a contractor)."

APPENDIX A List of Persons Participating in the Investigation

Matrix Energy LLC

Paul Horn	President
Jill Bruner	Company Attorney
Charles Leonard	Superintendent
Elbert Fletcher	Mine Foreman
Estill Jarvis	Mine Foreman
Marty Slone	Safety Director
Derick Mahon	Maintenance Chief
Milton Thomas Marcum	Section Foreman
Wallace Sartin III	Section Foreman
Dewey Osborne	Continuous Miner Operator
Gene B. Moore	Continuous Miner Operator
William M. Smith	Roof Bolter Operator
David Eugene Litton	Roof Bolter Operator
Jason Russell Kindrick	Roof Bolter Operator
Timothy Clayton Osborne	Shuttle Car Operator
James Harold Sisco	Shuttle Car Operator
Johnny Ray Spence	Mechanic
Justin Paul Maynard	Electrician
Michael Dwayne Crum	Outside Man

Kentucky Office of Mine Safety and Licensing

Deputy Chief Accident Investigator
Accident Investigator
District Supervisor
Chief Electrical Inspector
Electrical Inspector
Electrical Inspector
Mine Inspector

Mine Safety and Health Administration

District Manager
Assistant District Manager Technical
Staff Assistant
Accident Coordinator
Electrical Supervisor
Accident Investigator

Chalmer Williamson	Electrical Inspector
Martin Holbrook	Electrical Inspector
Chad Huntley	Electrical Engineer, Technical Support
Akik Fawaz	Electrical Engineer, Technical Support
Willow Fort	Attorney, Solicitor's Office

APPENDIX B List of Persons Interviewed

Wallace Sartin III	Section Foreman
Milton Thomas Marcum	Section Foreman
Estill Jarvis Jr.	Mine Foreman
Dewey Osborne	Continuous Miner Operator
Gene B. Moore	Continuous Miner Operator
William M. Smith	
Jason Russell Kendrick	
David Eugene Litton	
Timothy Clayton Osborne	
James Harold Sisco	
Johnny Ray Spence	
Justin Paul Maynard	Electrican
Michael Dwayne Crum	Outside man

APPENDIX C



Fatal Accident Sketch Matrix Energy LLC Mine No.1 (I.D. 15-18575) March 25, 2011

APPENDIX D

Victim Information: 1									
. Name of Injured/III Employee: 2. Sex 3. Vict	m's Age	4. Last Four Dig	gits of SSN:	5. Degree of I	njury:				
Robert L. Cook M	54	7031		01 Fatal					
Date(MM/DD/YY) and Time(24 Hr.) Of Death:		7. Da	te and Time Star	ted:					
a. Date: 03/25/2011 b.Time: 9:01			a. Date: 03/25	2011 b.Time: 7	00				
Regular Job Title:	9. Work Act	ivity when Injured	t:		10. Was this	work activity par	t of regular job	o?	
028 Scoop Operator	041 Tram	ing Continuous M	liner			Yes No X			
1. Experience Years Weeks Days a. This b. Reg	Years	Weeks Day	rs Yea c:This	ars Weeks	Days d.	Years Total	Weeks	Day	
Nork Activity: 30 0 0 Job Tit	e: 6	0 0	Mine: 6	0	0 Mi	ning: 35	0	0	
2. What Directly Inflicted Injury or Illness?			13. Nature of Inj	jury or Illness:					
077 Conveyor boom of continuous miner			170 pinne	d between convey	or boom & coal	rib			
4. Training Deficiencies:				2.1.1	Testa	1			
Hazard: New/Newly-Employed Expe	rienced Miner:		Annu	ai:	Task:				
 Company of Employment: (If different from production op Operator 	erator)			Independent C	ontractor ID: (if	applicable)			
3. On-site Emergency Medical Treatment:									
Not Applicable: First-Aid: X	CPR: X	EMT:	Medical Pr	ofessional: X	None:				
7. Part 50 Document Control Number: (form 7000-1)		18. Un	ion Affiliation of V	ictim: 9999	None (No	Union Affiliation)		
ictim Information:									
Name of Injured/III Employee: 2. Sex 3. Vi	ctim's Age	4. Last Four Dig	gits of SSN:	5. Degree of I	njury:				
Date(MM/DD/VV) and Time(24 Hr.) Of Death:			ate and Time Sta	rted:				-	
Date(MNDD/TT) and Time(24Th.) Of Death.		1.0		100.					
	0.141-1-1-1								
Regular Job Title:	9. Work Act	ivity when Injured			10. Was this	work activity pa	rt of regular jo	ıb?	
						Yes No			
1. Experience: Years Weeks Days Po	Years	Weeks Days	Ye Ye	ars Week	Days	Total Years	Weeks D	ays	
. This D. Re lock Activity lob T	jular		C: I IIS		U. Mir	nina:			
2. What Directly Inflicted Injury or Illness?			13.Nature of Inju	ury or Illness:					
Hazard: New/Newly-Employed Exce	rienced Miner:	1	Annu	al:	Task:	1			
5. Company of Employment: //f different from production or	verator)								
o. Company of Employment. (If unletent nom production of	orator)		Independent	t Contractor ID: (if	applicable)				
6. On-site Emergency Medical Treatment:					ad ad - th i may the				
Not Applicable: First-Aid:	CPR:	EMT:	Medical Pro	ofessional:	None:				
7.Part 50 Document Control Number: (form 7000-1)		18 Un	ion Affiliation of V	ictim:	4				
Victim Information:		10. 011						_	
Name of Injured/III Employee: 2 Sex 3 \	ictim's Age	4. Last Four D	Digits of SSN:	5. Degree of	Iniury				
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Date(MM/DD/YY) and Time(24 Hr.) Of Death:		7.0	Date and Time St	arted:					
Regular Job Title:	9. Work Ad	tivity when Injure	ed:		10. Was this	work activity pa	rt of regular ig	b?	
		,				Yee N			
1 Evnerionee						ies No	<u> </u>		
a. This Years Weeks Days b. Re	Years gular	Weeks Days	s Y c:This	'ears Week	Days d.	Years Total	Weeks	Days	
Vork Activity: Job	Title:		Mine:		N	lining:			
2. What Directly Inflicted Injury or Illness?		A 14 A 20 A 2	13. Nature of I	njury or Illness:					
4. Training Deficiencies:				nual:	Task:	1			
4. Training Deficiencies: Hazard: New/Newly-Employed Exp	erienced Miner:	1 1	Anr						
Training Deficiencies: Hazard: New/Newly-Employed Exp Company of Employment:(If different from production open)	erienced Miner: rrator)	<u> </u>	Anr	Contractor ID: //f	applicable				
	erienced Miner: arator)		Ann	Contractor ID: (if	applicable)				
	erienced Miner: rator)	EMT:	Independent	Contractor ID: (if	applicable) None:	1			

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