CAI-2016-05

UNITED STATES
DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION

COAL MINE SAFETY AND HEALTH

REPORT OF INVESTIGATION

Underground Coal Mine

Fatal Machinery Accident
June 6, 2016

The American Coal Company New Era Mine
The American Coal Company
Harrisburg, Saline County, Illinois
I.D. No. 11-02752

Accident Investigators

Brandon Naas
Coal Mine Safety and Health Inspector

Michael R. Tite
Coal Mine Safety and Health Inspector (Electrical)

Ronald Medina
Mechanical Engineer, MSHA Technical Support

Originating Office
Mine Safety and Health Administration
District 8
2300 Willow Street
Vincennes, Indiana 47591
Ronald W. Burns, District Manager

TABLE OF CONTENTS

OVERVIEW

On Monday, June 6, 2016, at approximately 1:05 p.m., Robert E. Clark (victim), a 34-year-old contract laborer, was fatally injured when he was pinned between an underground diesel end loader and the mine floor. The victim and another miner had raised the end loader frame by tilting the bucket forward against the mine floor and crawled under the end loader to locate a hydraulic leak. A leak in the boom lift cylinder caused the bucket tilt cylinder to trip the stabilizer link which caused the machine to drop suddenly. The victim was trapped underneath the operator's compartment.

The accident occurred because the mine operator failed to ensure that the raised end loader had been securely blocked in position before performing work under it. An indirect cause was that the mine operator had not task trained miners on the hazards associated with the stabilizer link feature when using the end loader bucket to raise the machine. An additional indirect cause was that the mine operator failed to maintain the end loader in safe operating condition.

GENERAL INFORMATION

The New Era Mine is located approximately 10 miles west of Harrisburg, Saline County, Illinois, and is operated by The American Coal Company. Coal is mined from the Herrin No. 6 coal seam, which averages 6 feet in height and has a depth-of-cover of approximately 700 feet. At the time of the accident, the mine employed 150 personnel. The mine operates five days per week, two production shifts each day, and produces an

average of 15,626 tons of raw material per day. The mine operates one longwall mining section.

The mine has a dual-purpose slope. The upper compartment of the slope is a conveyor belt system used to transport coal to the surface, and the lower compartment of the slope is used to transport material into and out of the mine. Employees are transported into and out of the mine via the dual compartment shaft at the Main Portal. The mine is ventilated by two exhausting main mine fans connected to the mine via vertical shaft openings from the coal seam to the surface. One fan is located at the Main Portal and the other is located in the Main Northwest entries. Air enters the mine by the slope, the Main Portal shaft, and the Main Northwest intake shaft. The Main Northwest intake shaft also contains a hoist by which material is lowered into the mine. The mine liberates 5,105,566 cubic feet of methane in a 24-hour period and is on a 5-day spot inspection schedule for excessive methane in accordance with Section 103(i) of the Mine Act.

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

Carson Pollastro…….. Vice President/General Manager
Vern Brotherton…….. General Mine Manager
Brad Pate…….. Mine Manager
Joe Myers……. Safety Manager

A regular (E01) safety and health inspection of the mine was initiated on April 5, 2016, and was ongoing at the time of the accident. The previous E01 inspection was completed on March 31, 2016. Non-Fatal Days Lost (NFDL) injury incidence rate for the mine operator in 2015 was 2.58, compared to the National NFDL rate of 3.15 for mines of this type.

DESCRIPTION OF THE ACCIDENT

On Monday, June 6, 2016, Robert E. Clark, Contract Laborer, reported to work on the day shift at the New Era Mine. Brad Pate, Mine Manager, assigned Clark to operate the Atlas Copco Wagner ST-2D diesel end loader, company number EL-08, at the slick line area to move and load gravel for travelway maintenance. The slick line is a cased drill hole which extends from the surface to the underground area of the mine through which gravel, rockdust, and bed ash can be transferred into the mine. Clark entered the mine at approximately 8:00 a.m. at the Main Portal shaft with the production crew. Pate, Clark, Kyle Wilkerson, Outby Laborer, and Jarad Cummings, Contract Laborer, then traveled underground on a diesel mantrip to the Main Northwest mains.

Pate drove the miners into the mine and took each one to the equipment they were assigned to operate on this shift. Pate dropped off Wilkerson along the Main West travelway at a diesel scoop and continued inby, dropping Clark off at the end loader near the Main Northwest intake shaft and Cummings at a diesel ram car further inby.

Clark performed a pre-operational check and fueled the end loader. He was assigned to fill two lube-centers (mobile diesel fuel tanks used to fuel other equipment) while waiting for longwall parts to be sent down the Main Northwest intake shaft. After completing the fueling of the lube-centers, Clark assisted Wilkerson in moving sleds out of a crosscut so gravel could be stockpiled. Wilkerson then traveled to the slick line with the diesel scoop and pushed the existing gravel to the sides allowing more room for gravel to be dropped. During this time, the longwall parts were lowered down the Main Northwest intake shaft. Pate returned and helped Wilkerson load the parts before sending him to the longwall section. Pate then traveled back to the supply area at the Main Portal shaft bottom.

Clark began stockpiling gravel in the crosscut which he and Wilkerson had cleared earlier in the shift (crosscut 56A/7760W). Cummings arrived with the ram car and Clark started to load it. Cummings stated Clark was having trouble raising the bucket and steering the end loader. Cummings noticed the end loader was leaking oil and notified Clark. Clark then checked the hydraulic oil reservoir, which was empty, which caused the difficulty in raising the bucket. Clark and Cummings walked to the Main Northwest intake shaft and retrieved 20 gallons of hydraulic oil which they added to the hydraulic system of the end loader. Clark loaded the ram car and drove the end loader inby to the Main Northwest intake shaft where he called for Terry Butler, Repairman, and Pate on a mine phone to let them know he had an oil leak.

Pate was at the North West belt drive eating lunch when he received the call from Clark. He traveled to the Main Northwest intake shaft to examine the end loader. Pate noticed an oil leak on the bucket end operator's side wheel, inside the wheel well. Unable to determine the source of oil leak, Pate told Clark to move the end loader into a crosscut and raise it and block it against motion with wood cribs so they could see what parts and/or maintenance would be needed. As Clark traveled to the crosscut, Pate stopped to get oil in case the end loader ran out. Unable to find any oil, he drove his diesel mantrip to the crosscut where Clark was located.

When Pate arrived, Clark had raised the end loader by lowering and tilting the bucket against the mine floor and Clark was under the end loader. Pate asked Clark if he had seen anything yet and Clark replied "No." Pate then grabbed his screwdriver and pick hammer and got under the loader with Clark to find the source of the oil leak. At some point following this, Pate stated he did not see any material to prevent movement of the raised end loader and instructed Clark to get out from under the end loader. Before they could get out, the end loader fell suddenly.

Both miners were trapped on their backs. Clark was located underneath the operator's compartment up to his waist with his legs extended out between the center-section and the operator's compartment. Pate was pinned at his abdomen between the bucket and the front operator's side tire with his legs out between the tire and bucket. Pate, who could move his arms, started flagging the travelway with his cap light trying to get the attention of anyone who might be traveling by.

Vernon Webb, Mine Examiner, was traveling the Main Northwest travelway and noticed Pate's parked mantrip. As Webb got closer he could see a light and hear someone calling for help. Webb stopped at the crosscut and went to the side of the end loader and noticed Pate underneath it. Pate asked Webb to start the loader and raise it off them. Webb went to get in the operator's compartment and noticed Clark's legs extending out from under the end loader. As Webb started the end loader, Brad Phillips, Contract Laborer, walked into the crosscut from inby. Phillips' mantrip had gotten stuck one crosscut inby the Main Northwest intake shaft and he had come to where Pate's mantrip was parked to get help. Webb had Phillips watch the bucket to see if he was going in the right direction as he operated the bucket tilt lever. As Webb moved the lever slowly he heard both Pate and Phillips yelling. Unable to hear what they were saying, he shut off the end loader. Phillips said to go the other way because the end loader was lowering onto Pate. Webb started the end loader and moved the lever in the opposite direction. This raised the end loader enough to allow Pate to roll out.

Webb shut the end loader off and told Phillips to go call for help. Phillips ran inby to a mine phone and informed Mine Control to call for an ambulance. Pate and Webb pulled Clark out from underneath the end loader. Clark was unresponsive and blue in color. Webb, who is an emergency medical technician (EMT), and Pate started cardiopulmonary resuscitation (CPR). Mike Hazelwood, Contract Laborer, arrived at the accident scene and started helping with compressions. At this time, Wilkerson had completed his trip to the longwall and returned to the area. They placed Clark on the back seat of Pate's mantrip and Pate drove while Webb and Hazelwood continued CPR where the mine height would allow. On the way to the Main Portal shaft bottom, Pate told Webb they were under the machine for approximately 20 minutes. Pate and Webb transported Clark to the surface. Clark was taken by Med Force Ambulance service to Ferrell Hospital. Clark was pronounced dead by Jerry Watson, Saline County Coroner, at 2:32 p.m. Pate received contusions and bruising to his abdomen area with internal swelling. Pate was transported to Harrisburg Medical Center where he was admitted for observation. He was released from the hospital on Wednesday, June 8, 2016.

INVESTIGATION OF THE ACCIDENT

Med Force Ambulance service was notified of the accident at 1:42 p.m. on June 6, 2016. Scott Webb, Compliance Manager for New Era Mine, notified the Mine Safety and Health Administration (MSHA) Call Center at 2:11 p.m. to report the accident. MSHA issued a non-contributory citation for a violation of 30 CFR § 50.10 because the mine operator did not notify MSHA immediately, at once, without delay, and within 15 minutes.

At 2:29 p.m., the MSHA Call Center contacted John Hohn, Supervisory Coal Mine Safety and Health (CMS&H) Inspector, to convey that an accident had occurred. Mary Jo Bishop, Assistant District Manager (Enforcement), contacted Nick Lands, Acting

Supervisory CMS&H Inspector, at the Marion, Illinois Field Office, to notify him of the accident. Lands directed Brandon Naas, CMS&H Inspector, and Dean Cripps, Supervisory CMS&H Inspector (Electrical), to investigate the accident. Cripps and Naas traveled to the mine where they met Bishop.

The accident investigation was conducted in cooperation with the Illinois Department of Natural Resources, Office of Mines and Minerals (IDNR), and The American Coal Company personnel. Appendix A lists the persons participating in the accident investigation.

Prior to traveling underground, preliminary interview statements were obtained from persons having knowledge of the facts and circumstances surrounding the accident. The accident investigation team then traveled underground and arrived at the accident scene at approximately 6:00 p.m. on the day of the accident.

On June 8 and 9, 2016, Ronald Medina, Mechanical Engineer from MSHA Technical Support, cooperated with other investigators to mechanically evaluate the diesel end loader involved in the accident.

Denzil Hughes, MSHA Supervisory Training Specialist, reviewed training records on June 9, 2016.

Formal interviews were conducted on June 10 and 13, 2016, at the IDNR building located in Benton, Illinois. Persons interviewed are listed in Appendix B.

DISCUSSION

Accident Scene

The accident occurred on the Main Northwest travelway near the Main Northwest intake shaft, at crosscut 56/7675W between the number 3 and number 4 entries. The crosscut was 7 ½ feet high and 18 feet wide. Other materials located in the crosscut were seven 36 inch wood crib blocks, two empty 5 gallon hydraulic oil cans, one full 5 gallon can of gear oil, and a pipe sled which was located behind the end loader.

The end loader was observed backed into the crosscut with the bucket facing the travelway. The end loader's bucket was tilted forward in contact with the mine floor and no cribs were observed under any portion of the machine. Oil was observed on the mine floor from crosscut 56/7675W along the number 4 entry inby to crosscut 56A/7760W, a distance of 85 feet. Three empty 5 gallon hydraulic oil cans, a large area of oil soaked mine floor, and pools of oil in the operator's side tire track were observed in this crosscut. The trail of oil continued inby along the number 4 entry to crosscut 57A/7880W. Tire tracks were compared with the tires on the end loader and matched the tire pattern left in the mud and oil at both areas. See Appendix C for a drawing of the accident scene.

Evidence gathered during the investigation does not support Pate's claim that Clark was already underneath the end loader when he arrived at the crosscut. The mine's tracking system shows Clark and Pate arrived at the crosscut at approximately the same time. MSHA investigators concluded that Pate would have been present when Clark raised the end loader using only the hydraulics of the bucket. Additionally, Pate stated he did not see any cribbing installed to prevent movement of the end loader. Due to the narrow design of the end loader, any reasonably prudent foreman would have known it was not blocked against motion. If cribbing had been installed it would have been located under the frame of the end loader in the area where Pate and the victim were trapped.

Evaluation of the Company No. EL-08 Diesel End Loader

The 1996 Atlas Copco Wagner ST-2D end loader, Serial Number DA03P0008 is a 4-wheel drive, articulated, rubber tired vehicle powered by a Deutz, F6L-912W, 93 HP at 2,500 rpm diesel engine. It is equipped with a 2 cubic yard bucket. The vehicle consists of two major sections: the load frame front section and the power frame rear section. The rated operating weight is 25,440 pounds empty and 33,440 pounds loaded. The separate braking, boom lift and bucket tilt, and steering systems are each hydraulically operated using a common hydraulic reservoir.

When the machine was operated during the investigation, a large quantity of hydraulic oil escaped each time the service brake foot pedal was depressed. The leak was at the front operator's side wheel. The mine operator was in the process of locating the leak to repair it when the accident occurred.

A single boom lift cylinder and a single bucket tilt cylinder control the movement of the boom and bucket. The boom pivots about a pinned connection in the load frame and the bucket pivots about a pinned connection at the end of the boom arm. A stabilizer link is attached to the end of the bucket tilt cylinder. It is designed to go over center and pop up if the bucket is tilted forward far enough to allow the back of the bucket structure to push against the stabilizer link.

When the stabilizer link pops up, the bucket is free to tilt back to the extent that the stabilizer link allows. After the stabilizer link goes over center and pops up, the bucket tilt hydraulic cylinder must be retracted to reset the stabilizer link to allow normal bucket tilt operation. If the stabilizer link is not reset, the full stroke of the bucket tilt cylinder is unable to be utilized.

The front tires and center section of the machine can be elevated hydraulically using the boom and bucket. With the bucket tilted forward, if the boom arm is lowered until the bucket touches the ground and then is lowered further, the front tires will lift off the ground and the center section of the machine will rise. The boom continues to pivot after the bucket is against the ground and this causes the machine frame and front tires

to be elevated. Increasing the amount of forward tilt while the bucket is on the ground will further elevate the front tires and center section. Tilting the bucket back and pivoting the boom in the "raise" direction causes the tires to be lowered back onto the ground.

The machine was elevated hydraulically at the time of the accident while Clark and Pate were underneath to assess the oil leak in the braking system. Clark was under the machine at the articulation area between the two axles and Pate was located nearby, under the machine in front of the front axle. Both were under the left side of the machine.

During the investigation, another hydraulic leak was found at the upper port of the boom hoist cylinder at the rod end of the cylinder. It was much smaller than the brake leak. When the machine was elevated using the boom and bucket, the boom lift circuit leak allowed the center section of the machine, where Clark was located, to lower ⅞ inch over a twenty minute period. This test was done with the engine stopped and with the boom and bucket hydraulics at normal operating temperature. The lowering rate at Pate's location was approximately the same.

Pate stated the machine dropped suddenly.

Testing showed the slow rate of lowering of the hydraulically elevated machine, due to the leaking boom lift cylinder, could potentially change to a sudden drop if the bucket was tilted forward sufficiently at the start of the test to allow the stabilizer link to make contact with the back of the bucket structure. With the stabilizer link against the bucket in this manner, and with the engine off, a test was performed where the boom lift control lever was gradually actuated to allow the center section of the machine to slowly lower, simulating the effect of the leaking boom lift cylinder that existed when the accident occurred. At the start of the test, the machine had been elevated enough with the boom and bucket to clearly allow sufficient ground clearance where Clark and Pate had been. The test was also done at the same location where the accident occurred. The boom arm slowly pivoted as the machine slowly lowered. This caused the stabilizer link to be slowly pushed upward. Finally, the upward displacement became large enough to push the stabilizer link over center, and suddenly pop up. This allowed the bucket to tilt back and the center section of the machine to suddenly drop. The front tires also fell from the elevated position and landed hard on the ground. After the end loader fell, the ground clearance was measured at 8 ½ inches at Clark's location and 10 inches at Pate's location in this test.

The end loader was not being maintained in safe operating condition due to the oil leak in the boom lift cylinder. MSHA issued a non-contributory citation for a violation of 30 CFR § 75.1914(a). Even though the oil leak in the boom lift cylinder caused the

stabilizer link to trip, the end loader would not have fallen if it had been properly blocked in position.

Securely Blocking in Position

When performing work under machinery or equipment that has been raised the machinery or equipment is required to be securely blocked in position. Instead of properly blocking the end loader in position prior to working underneath it, Pate and Clark depended on the hydraulics of the bucket to support the end loader.

Examinations

The last weekly examination on the EL-08 diesel end loader was conducted on June 2, 2016. Two defects were recorded; a right front light was out, and the hand pump was frozen up. Both defects were corrected and recorded by the operator. The record book did not list any leaks of hydraulic fluid.

Training and Experience

Clark had 7 years and 31 weeks of total mining experience, with 5 weeks as a contract laborer for David Stanley Consultants, all at the New Era Mine. Training records indicated Clark had received task training on the operation of diesel end loader in November 2009. However, this training did not cover the hazards associated with the stabilizer link feature. MSHA issued a non-contributory citation for a violation 30 CFR § 48.7(c). Even though Clark had not been task trained on the stabilizer link feature, the accident would not have occurred if the end loader had been properly blocked in position.

Clark did not receive Experienced Miner Training prior to being given a work assignment. MSHA issued a non-contributory citation for a violation of 30 CFR § 48.6. Clark received annual refresher training on January 6, 2015.

Pate has 19 years of total mining experience, with 14 years at the New Era Mine. He had been mine manager at this mine for 6 years and 42 weeks. He holds mine manager and mine examiner certifications from the State of Illinois. He last received Annual Refresher training on January 19, 2016, and had not been task trained on the end loader involved in the accident.

ROOT CAUSE ANALYSIS

The accident investigation team conducted an analysis to identify the underlying cause of the accident that was correctable through reasonable management controls. The team identified a root cause that, if eliminated, would have either prevented the accident or mitigated its consequences.

Listed below is the root cause identified during the analysis and the corresponding corrective action implemented to prevent a recurrence of the accident:

1. Root cause: The mine operator failed to ensure that the raised end loader had been securely blocked in position before performing work under it.

   Corrective action: The mine operator developed a written blocking policy to comply with 30 CFR § 75.1726 when miners work on or under equipment or machinery that is in a raised position. Miners have been trained in this policy. This policy will be reviewed during new task training and be covered in annual refresher training.

CONCLUSION

The accident occurred because the mine operator failed to ensure the raised end loader had been securely blocked in position before performing work under it. An indirect cause was the mine operator had not task trained miners on the hazards associated with the stabilizer link feature when using the end loader bucket to raise the machine. An additional indirect cause was the mine operator failed to maintain the end loader in safe operating condition.

Approved By:

Ronald W. Burns

Ronald W. Burns
District Manager

01/18/2017

Date

ENFORCEMENT ACTIONS

1. A 103(k) Order, No. 9038848 was issued to protect the safety of all persons on-site. It affected all areas inby the Main Northwest entries from spad # 7102W, and the Company No. EL-08 Wagner diesel end loader.

2. 104(d)(1) Citation No. 9038849 was issued for a violation of 30 CFR § 75.1726 (b). On June 6, 2016, at approximately 1:05 p.m., a miner was fatally injured while working underneath the Company No. EL-08 Wagner diesel end loader in a raised position that was not securely blocked in position. The end loader was not blocked at all. The victim received fatal injuries when the end loader fell and pinned him between the end loader and the mine floor. The end loader was elevated hydraulically with the bucket, and the victim and mine manager were underneath working to find a hydraulic leak when the end loader suddenly fell. The mine manager received nonfatal injuries. The fact that the end loader was not blocked was obvious to both miners before they crawled under the end loader, because any blocking material would be located where the miners were positioned under the machine. The mine operator has engaged in aggravated conduct constituting more than ordinary negligence. This violation is an unwarrantable failure to comply with a mandatory standard.

APPENDIX A

Persons Participating in the Investigation

Mine Safety and Health Administration

Mary Jo Bishop	Assistant District Manager (Enforcement)
Dean Cripps	Supervisory CMS&H Inspector (Electrical)
Brandon Naas	CMS&H Inspector (Accident Investigator)
Michael R. Tite	CMS&H Inspector (Electrical)
Ron Medina	Mechanical Engineer MSHA Technical Support
Denzil Hughes	MSHA Supervisory Training Specialist

State of Illinois Department of Natural Resources, Office of Mines and Minerals

Bill Patterson	Inspector at Large
Mike Simpson	Inspector

The American Coal Company New Era Mine Management Personnel

Joe Myers	Safety Manager
Scott Webb	Compliance Manager
Dan Couch	Corporate Maintenance Manager

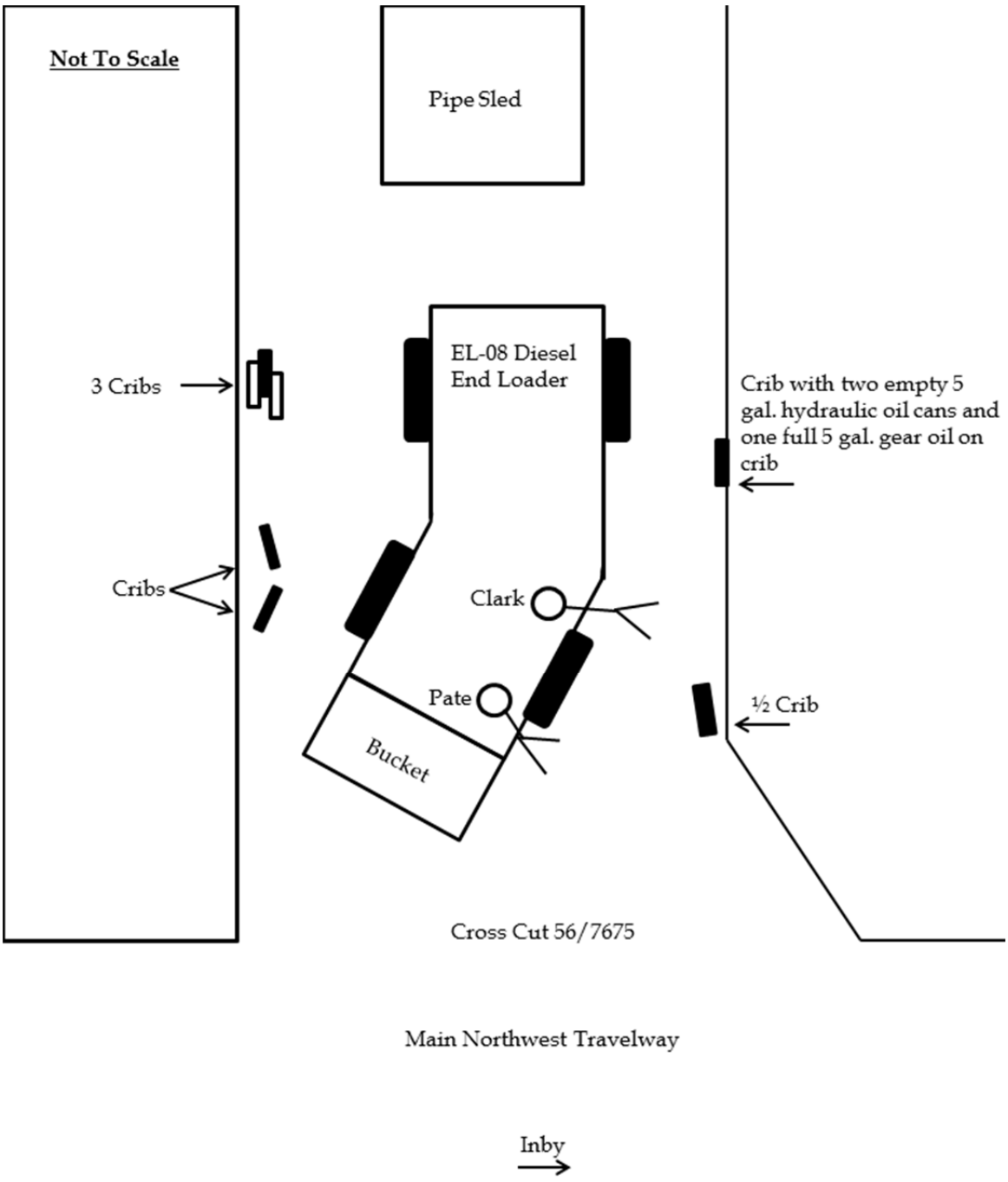
APPENDIX B

Persons Interviewed

Vernon Webb	Mine Examiner
Brad Phillips	Contract Laborer
Mike Hazelwood	Contract Laborer
Brad Pate	Mine Manager

APPENDIX C

Accident Scene Drawing



APPENDIX D

Victim Information

Accident Investigation Data - Victim Information
Event Number: 4 2 5 0 5 6 9

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

Victim Information: 1

1. Name of Injured/Ill Employee:	2. Sex	3. Victim's Age	4. Degree of Injury:
Robert E. Clark	M	34	01 Fatal

5. Date(MM/DD/YY) and Time(24 Hr.) Of Death:
a. Date: 06/06/2016 b.Time: 14:32

6. Date and Time Started:
a. Date: 06/06/2016 b.Time: 8:00

7. Regular Job Title:	8. Work Activity when Injured:	9. Was this work activity part of regular job?
016 Laborer	058 Operate load-haul-dump	Yes: No: X

10. Experience	Years	Weeks	Days		Years	Weeks	Days		Years	Weeks	Days		Years	Weeks	Days
a. This Work Activity:	0	5	4	b. Regular Job Title:	0	5	4	c: This Mine:	0	5	4	d. Total Mining:	7	31	6

11. What Directly Inflicted Injury or Illness?
077 Underground mining machines

12. Nature of Injury or Illness:
110 Asphyxia/strangulation/drowing/suffocat

13. Training Deficiencies:
Hazard: | New/Newly-Employed Experienced Miner: | Annual: X | Task: X

14. Company of Employment: (If different from production operator)
Operator

Independent Contractor ID: (if applicable)

15. On-site Emergency Medical Treatment:
Not Applicable: | First-Aid: | CPR: X | EMT: X | Medical Professional: | None:

16. Part 50 Document Control Number: (form 7000-1)

17. Union Affiliation of Victim: 9999 None (No Union Affiliation)