

UNITED STATES
DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
COAL MINE SAFETY AND HEALTH

REPORT OF INVESTIGATION

Underground Coal Mine

Rib Roll Accident
June 27, 2011

Eagle #1 Mine
Rhino Eastern, LLC
Bolt, Raleigh County, West Virginia
I.D. No. 46-08758

Accident Investigators

Douglas W. Johnson
Coal Mine Safety and Health Inspector

Brian Morris
Coal Mine Safety and Health Inspector
Roof Control Specialist

Originating Office:
Mine Safety and Health Administration
District 4
100 Bluestone Road
Mt. Hope, West Virginia 25880
Charles Carpenter, District Manager

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OVERVIEW

On June 27, 2011, at approximately 1:10 a.m., Joseph Cassell, Crew Leader (Victim), was killed, after receiving crushing injuries, when a portion of the rib comprised of coal and rock, fell and struck him. The victim was in the process of cleaning the mine floor to install a wooden support timber, because of a deteriorated rib, when the accident occurred. The piece of material that fell was approximately 100 inches long, 32 inches thick, and 37 inches in height. The accident occurred one crosscut outby the loading point of the mechanized mining unit 004 (MMU-004) mining section.

The accident occurred because the rib bolts installed previously in the top portion of the rib were insufficient to stabilize the rib of the entry and prevent material from falling when the mine floor was being cleaned.

GENERAL INFORMATION

The Eagle #1 Mine is an underground coal mine, located near Bolt, in Raleigh County, West Virginia. The mine employs 88 underground coal miners and 7

surface personnel. The mine has two active mining sections, with one continuous mining machine on each section engaging in the room and pillar method of coal extraction, which mine on advance. The mine operates in the Lower Eagle bituminous coal seam and is accessed by four drift portals. Mining heights range from seven to ten feet throughout the mine. The Mechanized Mining Unit 003 section (MMU-003) operates in the northeastern portion of the mine. The MMU-004 section operates in the southern portion of the mine. The mine produces approximately 250,000 clean tons of coal per year with two production shifts on the day and afternoon shifts. Maintenance activities are conducted on the midnight shift.

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

Tim ColemanGeneral Manager
Rick Hodge..... Superintendent
Don McKenzie Safety Director

At the time of the accident, the Mine Safety and Administration (MSHA) was in the process of completing the required quarterly safety and health inspection (E01). The Non-Fatal (NFDL) injury incidence rate for the mine in 2010 was 4.51, compared to the National NFDL rate of 3.17.

DESCRIPTION OF THE ACCIDENT

Eric Beller, Foreman, conducted a pre-shift examination for the MMU-004 mining section for the oncoming midnight shift, on Sunday, June 26, 2011. Beller conducted the pre-shift examination between 8:15 and 8:39 p.m. and brought his report outside, prior to the midnight shift entering the mine. Beller briefed Cassell on the surface, informing him that the ribs needed to be addressed outby the power center.

The midnight shift began with a safety meeting at 11:00 p.m. At about 11:10 p.m., Cassell and four other miners mounted a rubber-tired personnel carrier and began their trip to the MMU-004 mining section. On the personnel carrier were Steve Cole, Electrician, Anthony Halstead, Mechanic, and Tony Lester and Guy Brunty, Beltmen. Lester and Brunty each had less than three months total mining experience. Ben Stovall, another crew member, trammed a scoop from the surface to the section.

While traveling to the section, the crew stopped to clean up several areas where loose material had sloughed off the ribs. At about 11:30 p.m., they arrived at the section power center, which was located adjacent to the section loading point in the No. 2 Entry of the sub-mains. At that time, Cassell and the crew began their

assigned rib rehabilitation work, while Cole and Halstead proceeded to perform maintenance on the section mining equipment.

The MMU-004 mining section was mining in a new panel called the 1D Belt Panel, which was developed off the left side of the sub-mains. The new panel had advanced approximately 150 feet from the sub-mains. The crew first performed rib rehabilitation work near the section in the connecting cross-cut between the No. 2 and No. 3 Entries of the sub-mains, one cross cut from the section power center, and between Survey Station (Spad) Nos. 2701 and 2700. Timbers were installed previously along the outby rib of the crosscut. The crew removed the timbers and placed them on the opposite side of the crosscut to allow the scoop access to clean up loose material, which had accumulated along the rib. The loose material was deposited in the No. 6 face of the 1D Belt Panel. Thereafter, timbers were re-installed in approximately the same location from which they were removed.

Six timbers had been installed along the outby rib line of the connecting crosscut, between the No. 3 and No. 4 Entries (of the sub-mains) and at the corner of the coal pillar adjacent to the intersection marked by Survey Spad No. 2700 in the No. 3 Entry. The timbers had been knocked down prior to the start of the shift. It is likely that a battery-powered scoop machine dislodged the timbers.

The coal pillar corner was broken previously and the area cleaned up. After the coal from the pillar was cleaned, additional roof support, including conventional-type rib bolts and wooden timbers were installed. The collapse of the pillar corner created a newly rounded "face" of the pillar corner that was approximately eleven feet wide. The opening to the crosscut adjacent to the No. 3 Entry of the 1C Belt Panel was approximately 40 feet wide.

The scoop, operated by Ben Stovall, cleaned up as much material as possible, without attempting to disturb the rib and cause further deterioration. Manually, Cassell, Lester, and Brunty moved the larger chunks of rib material into the roadway for removal by the scoop. They also used a shovel to clean areas and allow for the installation of wooden timbers.

The fallen rib material was nearly cleaned up, when suddenly; Tony Lester heard the sound of material falling and called out a warning. Cassell was working between Lester and Brunty. Lester and Brunty narrowly escaped the falling material as it struck Cassell.

Co-workers rushed to remove the material, which had pinned Cassell. However, the weight of the material prohibited its movement by hand. Brunty informed Cole and Halstead, who were on the mining section, that help was needed immediately.

Cole called for assistance using a mine phone. Eric Beller, Foreman, who was working at the 3B conveyor belt drive, responded immediately with the help of three additional miners. Beller called to the surface of the mine and requested an ambulance.

Stovall used the bucket of a scoop to lift the rock and coal mass from Cassell. Other miners, including Tony Lester, Brunty, Halstead, Cole, Denny Lester, and Barker assisted Stovall by administering first aid to Cassell and preparing him for transport out of the mine. Miners on the section transported the victim via mantrip, along with Beller, who joined them at 1C belthead. Denny Lester and Barker traveled on another mantrip, just ahead of the victim to assist with opening the airlock ventilation doors. At 1:40 a.m., Beller and several other miners met the victim's mantrip near the 1C conveyor belt drive. Beller boarded the mantrip and assisted with the transport to the surface.

A West Virginia State Medical Examiner pronounced the victim dead at the mine. Best Ambulance Service transported him from the mine.

INVESTIGATION OF THE ACCIDENT

At 2:01 a.m., on June 27, 2011, the Mine Safety and Health Administration (MSHA) Call Center was notified that a serious injury had occurred at the mine at 1:50 a.m. The Emergency Call Center notified District 4 personnel at 2:15 a.m. A verbal 103(j) Order was issued at 2:30 a.m., to protect miners from hazardous rib conditions and to preserve evidence relative to the accident. An MSHA Inspector from the Mt. Hope Field Office, an MSHA Accident Investigator, and Roof Control Specialists, traveled to the mine. MSHA personnel reduced the 103(j) Order to writing and modified the action to a 103(k) Order.

MSHA conducted the investigation in cooperation with the West Virginia Office of Miners' Health, Safety and Training (WVOMHS&T), the mine operator, and employees of the mine. The investigation team investigated physical conditions on site and took photographs and measurements. On June 28, 2011, the team conducted interviews with persons considered to have knowledge of the facts concerning the accident. On July 14, 2011, the on-site portion of the investigation was completed. A list of persons who participated in the investigation is contained in Appendix A.

DISCUSSION

Accident Scene

The Lower Eagle Coal seam consists of a lower split, which ranges in thickness from the low 20-inch, to a high 30-inch range. A middle band of gray shale, ranging in thickness from a few inches, to nearly 40 inches, is present throughout the mine. An upper split of coal approximately 40-inches thick exists above the gray shale.

The 1C Belt Panel was driven in a south-southwest direction, with an approximate azimuth (the angle measured from north, eastward along the horizon) of 198 degrees, on 70 foot, by 70 foot centers, and was stopped four cross cuts in by the accident location. The accident occurred in the No. 3 Entry of the 1C Belt Panel.

MSHA issued a Program Information Bulletin No. P11-29 on April 21, 2011, which states, "The two most significant geologic conditions that contribute to hazards related to falls of ribs are the *seam height* and the *depth of cover*. Analysis of the fatal accident reports from the 23 rib fall fatalities that have occurred since 1995 indicates that 22 fatalities (96 per cent) occurred where the mining height was at least seven feet, and 18 of those fatalities (78 per cent) occurred where the depth of cover was at least 700 feet. The reports indicate that rock partings (rock layers contained within the coal seam) or rock brows (rock layers above the coal seam) were present in nearly every instance."

Abandoned mine workings exist above the mine in the Main Eagle, Peerless, and No. 2 Gas coal seams. Approximately 200 feet of interburden is present between the active mine and the nearest overlying mine workings. The area of the accident has a depth of cover of approximately 300 feet.

The mining height at the accident scene exceeded 7 feet. The strata measurements at the scene of the accident from the bottom of the coal seam extending upwards were: bottom rock - 15 inches; bottom split of coal - 36 inches; gray shale rock - 12 inches; upper split of coal - 36 inches; and gray shale top rock - 6 inches. The total seam height was 105 inches, or 8 feet, 9 inches.

MSHA conducted an analysis to determine if the pillar sizes were adequate to support the amount of overburden, or if the sizes of the pillars were too small and subsequently, contributed to the poor rib conditions. The analysis was conducted using the National Institute for Occupational Safety and Health (NIOSH) program, Analysis of Multiple Seam Stability (AMSS), which indicated the pillars in the area of the accident had a pillar stability factor of 3.07. The pillar stability factor required for the depth of cover and for the No. 2 Gas seam

overmining was 1.50. The actual pillar stability was more than double the suggested NIOSH stability factor. An additional analysis was conducted utilizing NIOSH's ARMPS (Analysis of Retreat Mining Pillar Stability), which provides stability analysis for advancing sections in addition to retreat mining, indicated a pillar stability factor of 3.59. Again, this value exceeded recommended pillar stability factors of safety.

However, an examination of rib conditions in the mine indicates that the thickness of the lower split is most likely the determining factor contributing to adverse rib conditions. Historically, when the lower split is less than 26 inches, the ribs normally remain intact. As the thickness of the lower split increases, the softer bottom coal material begins to deteriorate and roll, or slough off, creating an overhang of gray shale rock and the upper split of coal. As the overhang becomes larger and deeper, the rib material above becomes unstable.

The top portion of the rib was bolted with 42-inch long, conventional bolts with rib boards. The mine did not have a roof bolting machine capable of installing bolts horizontally into the rib. The bolts were installed manually, using a hydraulically-powered drill. The bolts were installed into the rib approximately 6 inches above the gray shale middle band. The hydraulic drilling process requires miners to apply pressure physically to drill the holes and install the rib bolt. Subsequently, holes were drilled in the softest areas of the rib to make installation easier.

The top portion of the rib that struck the victim had three rib bolts installed near the bottom of the top split of coal. The location of the rib bolts was inadequate to support the weight of the broken rib material properly. As the material fell, two of the three bolts pulled out of their expansion shells. The remaining bolt was bent at a downward angle, and the rib material broke around the rib support.

The rib material broke when it separated from the coal pillar. The largest intact portion had dimensions of 100 inches long, 32 inches thick, and 37 inches in height. The fallen material was composed of coal with several thin shale streaks and weighed approximately 90 pounds per cubic foot. A calculation of the total weight of the intact piece of material was approximately 6,000 pounds.

The area near the accident scene was damp, and no standing water or mud was present.

Mine Examinations

Eric Beller, Midnight Shift Foreman, conducted the required preshift examination from 8:15 p.m., to 8:39 p.m., Sunday evening, for the mechanized mining unit (MMU) 004 Section. Dates, times, and initials were found in all six MMU faces

by the accident investigation team. The six faces were developed a distance of two crosscuts inby for the new panel. The travelway onto the section was located in the #2 Entry and the feeder was located in the #3 Entry. Both of these areas were examined. Hazards for the examination of the MMU recorded in the preshift examination record included (corrective actions in parentheses):

1. #1 entry needs a spot bolted (reported),
2. #2 needs additional dusting,
3. #3 entry "needs bolted outby rib roll," (D-tag (danger tag)),
4. Entries 4, 5 and 6 need additional dusting and cleaning.

The report of examination was brought out of the mine by Beller and recorded prior to the midnight shift. Interviews during the investigation revealed that, at the start of the shift, Beller informed Cassell that a big rib roll had occurred just outby the power center, in line with the #4 Entry of the new panel, and that he and his crew needed to take care of it. This information substantiates that an examination was conducted, which included observation of the hazardous area outby the section power center; however, no hazardous rib conditions were recorded in the mine examination records for this area. MSHA issued a citation, non-contributory to the accident, for a violation of 30 CFR § 75.360, for failure to record the hazardous conditions at this location and at other areas identified during the investigation.

Victim Information and Training

Cassell was 33 years old and was considered to be in good physical condition and health.

Cassell began employment at this mine as a contract miner working for Appalachian Security, Inc., and received Experienced Miner Training on September 18, 2009. The mine hired Cassell as a full time employee on February 25, 2010, for a general inside laborer. Cassel's training records were examined. He received his West Virginia apprentice card, # 4-19642, on November 9, 2009 and his Underground Miner # 4-13087, was issued on May 17, 2009. Cassel received Experienced Miner training on May 12, 2010, Task Training on May 31, 2010 for equipment operation, Annual Refresher Training on August 4, 2010 and supplemental Hazard Training on June 14, 2011, which included Hazard Recognition.

The mine's approved training plan (approved on June 12, 2008) required training to be provided on ground and roof control, health and safety aspects of the tasks to which the experienced miner is assigned, and hazard recognition and avoidance. The certified trainers are required to cover and discuss severe rib

conditions that exist in the mine. Additionally, the approved plan required Task Training of miners on the following tasks and duties: work place examination, scaling of roof and ribs, drilling, machine operation, and other tasks for miners classified as general inside laborers

ROOT CAUSE ANALYSIS

A root cause analysis was conducted to identify the cause(s) of the accident that were correctable through reasonable management controls. Listed below are root causes identified during the analysis and the corresponding corrective actions implemented to prevent a recurrence of the accident.

Root Cause: The rib support installed at the accident location was inadequate to support the weight of the material. The 42-inch conventional bolts were anchored inadequately to hold the upper portion of the 90-inch high coal rib.

Corrective Action: The mine operator revised the roof control plan and obtained walkthrough roof bolting machines to install rib bolts from a safe location. The revised plan now specifies five-foot long fully grouted rib bolts, and multiple rib bolts when the mining height exceeds seven feet.

Root Cause: Fallen rib material was removed routinely to install wooden timber supports. This practice exposed miners to hazardous rib conditions and increased the risk of being struck by falling material. Miners performed this work on a recurring basis and were exposed to rib hazards unnecessarily.

Corrective Action: The operator was provided a copy of MSHA's enforcement policy regarding CFR 30, § 75.400, which states, "...loose coal...shall be cleaned up and not permitted to accumulate in active workings..." MSHA's Program Policy Manual regarding this requirement states, "Experience has demonstrated that the loading of loose coal caused by sloughing ribs creates a hazardous condition in that the pillar size can be substantially reduced and the width of the entry or room dangerously increased; therefore, such loose coal shall not be considered accumulations of combustible material if such material is rendered inert by heavy applications of rock dust. However, such loose coal shall not be permitted to accumulate in the roadways or outby timberlines." All miners were trained in the MSHA policy requirements and a record of the training was documented.

CONCLUSION

The installed 42-inch conventional rib bolts were inadequate to support, or otherwise control and protect persons from the hazard of falling material. A practice existed, which allowed miners to position themselves near hazardous overhanging broken ribs in order to install wooden posts. The mine operator did not provide adequate guidance or oversight to an inexperienced crew, which was assigned to hazardous job tasks.

Approved By:

Charles E. Carpenter
District Manager
Coal Mine Safety and Health, District 4

Date

ENFORCEMENT ACTIONS

1. A 103(j) Order, Number 8135344, was issued over the telephone verbally at approximately 4:14 a.m., to Rhino Eastern LLC, to prevent the destruction of any evidence, which would assist in the investigation of the cause or causes of the accident. The Order was modified on June 27, 2011, to a 103(k) Order and was reduced to writing at 4:31 a.m.

A 104(a) Citation, No. 8120837, was issued for a violation of 30 CFR § 75.202(a), because the ribs of areas where persons work or travel were not supported adequately or otherwise controlled to protect persons from hazards related to falling rib material. Inadequately supported ribs existed on the #2 South Panel at the following locations:

1. From 1B belt drive, extending twelve crosscuts to survey station 2726;
2. From the 1B conveyor belt entry at survey station 2674, to the active mining section of MMU-004, a distance of six crosscuts; and,
3. Adjacent areas near survey stations 2614, 2676, and 2673.

The operator's attempts to support the ribs with timbers and/or 42-inch conventional bolts were inadequate, as evidenced by loose, broken and hanging ribs, and broken supports at numerous locations. The presence of these hazardous conditions served to put the operator on notice that greater efforts were required to support the ribs in the affected areas.

This condition contributed to a fatal rib roll accident on June 27, 2011. While working beneath a rib supported previously with 42-inch rib bolts, Joseph Cassell received fatal, crushing injuries when the supports failed and he was struck by falling rib material.

APPENDIX A
Persons Participating in the Investigation

Rhino Eastern LLC

Tim Coleman General Manager
Rick Hodge..... Mine Superintendent
Cathy Frazier Rhino Resources, LLC Manager of Health and Safety
Don Mckenzie..... Safety Director
Wes Ayers Maintenance Manager
Eric Beller Foreman, Midnight Shift
Steve Cole..... Electrician
Anthony Halstead..... General Laborer
Ben Stovall..... Move Crewman
Tony Lester Move Crewman
Guy Brunty..... Move Crewman
Eugene Cook..... Outby Foreman

New River Engineering

Phil Kurzyna..... Crew Chief
James Gill Engineer Technician

West Virginia Office of Miners' Health, Safety and Training

McKennis Browning Inspector-at-Large
Randy D. Smith Assistant Inspector-at-Large
Larry Wine District Inspector
Clarence Dishmon..... District Inspector

Mine Safety and Health Administration

Douglas W. Johnson Mining Engineer/ Accident Investigator
William Bane..... CMS&H Inspector
Brian Morris Civil Engineer/District Roof Control Specialist
Frank Hartenstein District Roof Control Specialist

APPENDIX B Victim Information

Accident Investigation Data - Victim Information

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



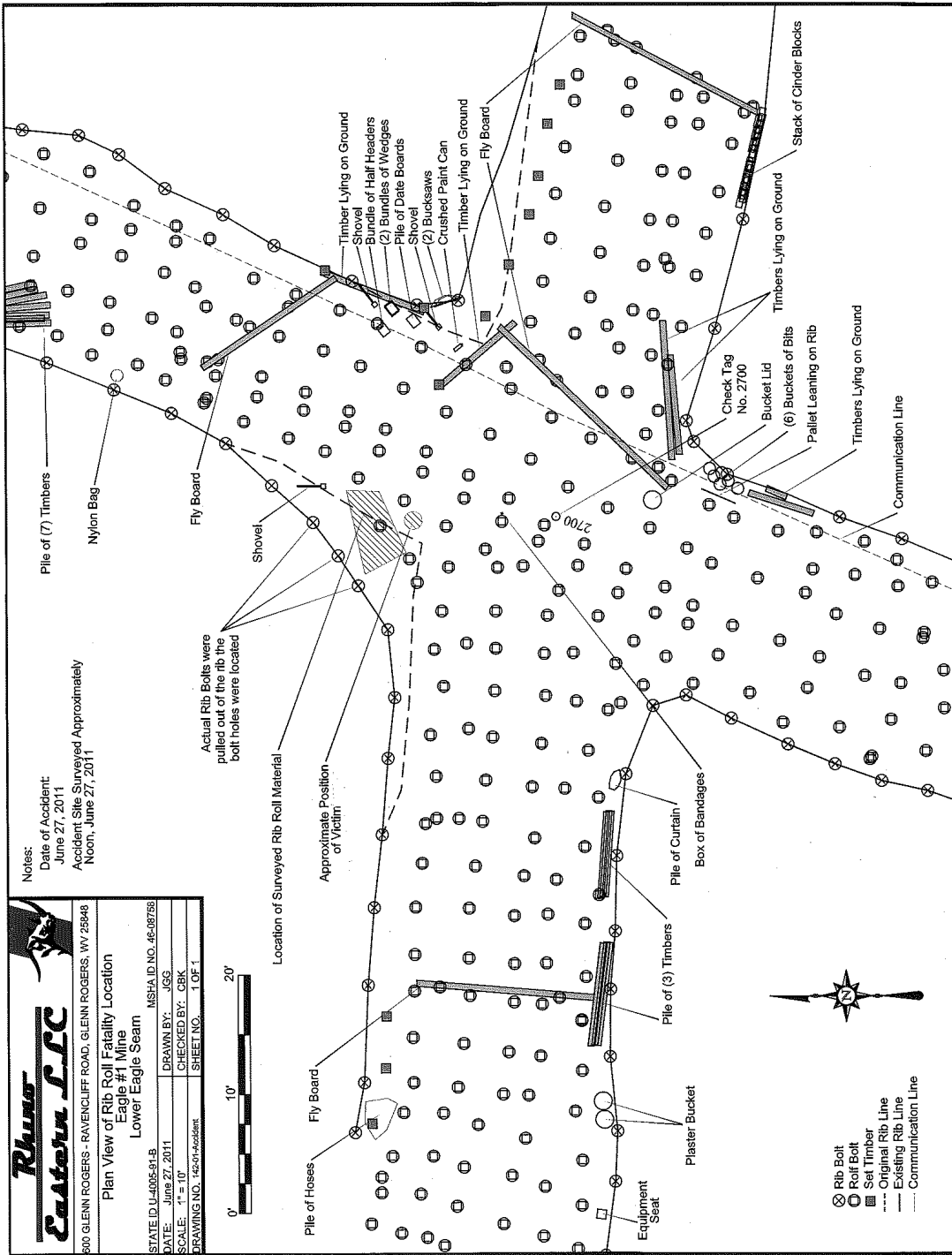
Event Number: 6 2 8 7 9 5

Victim Information: 1														
1. Name of Injured/III Employee: <i>Joseph Cassell</i>				2. Sex: <i>M</i>		3. Victim's Age: <i>33</i>		4. Degree of Injury: <i>01 Fatal</i>						
5. Date(MM/DD/YY) and Time(24 Hr.) Of Death: <i>a. Date: 06/27/2011 b. Time: 1:50</i>						6. Date and Time Started: <i>a. Date: 06/26/2011 b. Time: 23:00</i>								
7. Regular Job Title: <i>001 Belt Crew</i>				8. Work Activity when Injured: <i>010 timberman</i>				9. Was this work activity part of regular job? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>						
10. Experience			a. This			b. Regular			c. This			d. Total		
Years	Weeks	Days	Job Title:	Years	Weeks	Days	Years	Weeks	Days	Years	Weeks	Days		
<i>0</i>	<i>10</i>	<i>2</i>	<i>1</i>	<i>16</i>	<i>2</i>	<i>1</i>	<i>16</i>	<i>2</i>	<i>1</i>	<i>16</i>	<i>2</i>	<i>1</i>	<i>16</i>	<i>2</i>
11. What Directly Inflicted Injury or Illness? <i>112 Rib</i>						12. Nature of Injury or Illness: <i>170 Crushing</i>								
13. Training Deficiencies: Hazard: <input type="checkbox"/> New/Newly-Employed Experienced Miner: <input type="checkbox"/> Annual: <input type="checkbox"/> Task: <input type="checkbox"/>														
14. Company of Employment: (If different from production operator) <i>Operator</i>						Independent Contractor ID: (if applicable)								
15. On-site Emergency Medical Treatment: Not Applicable: <input type="checkbox"/> First-Aid: <input type="checkbox"/> CPR: <input type="checkbox"/> EMT: <input checked="" type="checkbox"/> Medical Professional: <input type="checkbox"/> None: <input type="checkbox"/>														
16. Part 50 Document Control Number: (form 7000-1)						17. Union Affiliation of Victim: <i>9999 None (No Union Affiliation)</i>								

Victim Information:														
1. Name of Injured/III Employee:				2. Sex:		3. Victim's Age:		4. Degree of Injury:						
5. Date(MM/DD/YY) and Time(24 Hr.) Of Death:						6. Date and Time Started:								
7. Regular Job Title:				8. Work Activity when Injured:				9. Was this work activity part of regular job? Yes <input type="checkbox"/> No <input type="checkbox"/>						
10. Experience			a. This			b. Regular			c. This			d. Total		
Years	Weeks	Days	Job Title:	Years	Weeks	Days	Years	Weeks	Days	Years	Weeks	Days		
11. What Directly Inflicted Injury or Illness?						12. Nature of Injury or Illness:								
13. Training Deficiencies: Hazard: <input type="checkbox"/> New/Newly-Employed Experienced Miner: <input type="checkbox"/> Annual: <input type="checkbox"/> Task: <input type="checkbox"/>														
14. Company of Employment: (If different from production operator)						Independent Contractor ID: (if applicable)								
15. On-site Emergency Medical Treatment: Not Applicable: <input type="checkbox"/> First-Aid: <input type="checkbox"/> CPR: <input type="checkbox"/> EMT: <input type="checkbox"/> Medical Professional: <input type="checkbox"/> None: <input type="checkbox"/>														
16. Part 50 Document Control Number: (form 7000-1)						17. Union Affiliation of Victim:								

Victim Information:														
1. Name of Injured/III Employee:				2. Sex:		3. Victim's Age:		4. Degree of Injury:						
5. Date(MM/DD/YY) and Time(24 Hr.) Of Death:						6. Date and Time Started:								
7. Regular Job Title:				8. Work Activity when Injured:				9. Was this work activity part of regular job? Yes <input type="checkbox"/> No <input type="checkbox"/>						
10. Experience			a. This			b. Regular			c. This			d. Total		
Years	Weeks	Days	Job Title:	Years	Weeks	Days	Years	Weeks	Days	Years	Weeks	Days		
11. What Directly Inflicted Injury or Illness?						12. Nature of Injury or Illness:								
13. Training Deficiencies: Hazard: <input type="checkbox"/> New/Newly-Employed Experienced Miner: <input type="checkbox"/> Annual: <input type="checkbox"/> Task: <input type="checkbox"/>														
14. Company of Employment: (If different from production operator)						Independent Contractor ID: (if applicable)								
15. On-site Emergency Medical Treatment: Not Applicable: <input type="checkbox"/> First-Aid: <input type="checkbox"/> CPR: <input type="checkbox"/> EMT: <input type="checkbox"/> Medical Professional: <input type="checkbox"/> None: <input type="checkbox"/>														
16. Part 50 Document Control Number: (form 7000-1)						17. Union Affiliation of Victim:								

APPENDIX C Sketch of the Accident



Rhino Slaton S.L.C.
 800 GLENN ROGERS - RAVENCLIFF ROAD, GLENN ROGERS, WV 25948

Plan View of Rib Roll Fatality Location
 Eagle #1 Mine
 Lower Eagle Seam

STATE ID: J4005-SL-B	MSHA ID NO. 46-08755
DATE: June 27, 2011	DRAWN BY: JGG
SCALE: 1" = 10'	CHECKED BY: CBK
DRAWING NO. 142-01-Accident	SHEET NO. 1 OF 1