CAI-2013-08

UNITED STATES
DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION

COAL MINE SAFETY AND HEALTH

REPORT OF INVESTIGATION

Underground Coal Mine

Fatal Fall of Roof Accident
March 22, 2013

Castle Valley
#4 Mine

Huntington, Utah
I.D. No. 42-02335

Accident Investigators

Phillip R. Gibson, Jr.
Mine Safety and Health Inspector

Tain Curtis
Roof Control Specialist

Sandin Phillipson
Geologist, Roof Control Division
Pittsburgh Safety and Health Technology Center

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OVERVIEW

On Friday, March 22, 2013, at approximately 3:05 p.m., a 29-year-old continuous mining machine operator with 9-years of mining experience suffered fatal crushing injuries when a portion of the mine roof fell during retreat mining in the 5th Left C panel. The victim was operating a continuous mining machine by remote control at the time of the accident. The victim and the continuous mining machine helper were positioned along the right side of the continuous mining machine. They were taking the second left-hand pillar-lift from the No. 3 entry between the No. 16 and No. 17 crosscuts when they were struck by a section of fallen mine roof measuring approximately 7 to 8-feet in width by 16-feet in length, and from 16 to 20-inches in thickness, with an estimated weight of nearly 7-tons. The entire section of roof material that fell was approximately 20-feet long by 25-feet wide.

GENERAL INFORMATION

Castle Valley Mining LLC Mine #4 is an underground coal mine owned and operated by Castle Valley Mining LLC. The parent company is Rhino Resource Partners LP. The mine is located in Emery County, Utah, near the town of Huntington. The mine produces approximately 1,200 raw tons daily. The mine is developed in the Tank coal seam, which averages 101-inches in height. The mine is accessed by two drift openings which constitute the Nos. 1 and 3 entries. The mine developed a No. 2 entry, that was started approximately 450-feet inby the Nos. 1 and 3 portals. The mine drilled a 10-feet diameter up-cast shaft at the beginning of the No. 2 entry. The mine is ventilated by an exhausting nine-foot diameter Joy axial vane fan located at the No. 1 portal. Coal is transported from the working places to the loading point by shuttle cars, then via conveyor belts, to the shaft, where it drops approximately 210-feet into the underlying Mine # 3. The coal continues on conveyor belts to the surface. The approved Roof Control Plan stipulates entries and crosscuts are to be developed to a maximum width of 20 feet. The entry centers are to be a minimum of 50-feet and the crosscut centers are to be a minimum of 80-feet. The roof is supported during development by 60-inch, fully-grouted, Grade 75 Special Rolled Dimension bolts, four bolts per row, with rows on 5-foot centers. Two continuous mining machine units operate two shifts per day using room-and-pillar and retreat mining methods. Maintenance and support work is performed on the third shift. Miners and supplies are transported underground using rubber-tired diesel vehicles. The mine employs 102 persons underground and 23 persons on the surface.

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

Corey Heaps	Vice President
Tony Welch	Mine Manager
Ken Defa	Safety Manager

The Mine Safety and Health Administration (MSHA) completed the last regular safety and health inspection (E01) of the mine on December 6, 2012, and another was on-going at the time of the accident. The Non-Fatal Days Lost (NFDL) injury incidence rate for this operator in 2012 was 1.39 compared to a national NFDL rate of 3.25.

DESCRIPTION OF ACCIDENT

On Friday, March 22, 2013, the afternoon-shift began at 2:30 p.m. Elam Jones (Victim), Continuous Mining Machine Operator, and Dallen McFarlane (Injured), Continuous Mining Machine Helper, entered the mine at approximately 2:40 p.m. with the production crew under the direction of Louis Biondich, Section Foreman, via a diesel-powered rubber-tired personnel carrier. The crew traveled the primary escapeway to the 001 MMU section, arriving at approximately 2:50 p.m. to continue retreat mining in the 5th Left C Panel. This was the third panel retreat-mined from the 5th Left Submains. Retreat mining had progressed to nearly mid-panel. Pillar extraction was being conducted between crosscuts 16 and 17, with lifts being taken left and right from the coal pillars in the No. 3 entry.

The crew had mined lifts to the left and right near the No.17 crosscut (inby end of the pillars) on the afternoon shift of the previous day. Approximately half of the 100-feet long, left-hand pillar in the No. 3 entry had been extracted. The day shift crew did not work on the 001 MMU on this date. When the afternoon crew returned to the section, Jones, McFarlane, and Biondich discussed roof conditions and the sagging sections of wire mesh in the No. 3 entry prior to mining. To avoid catching equipment on the sagging wire mesh, they decided to back down the entry to begin mining lifts left and right just inby No. 16 crosscut (see Appendix C).

At approximately 3:05 p.m., Jones was operating the continuous mining machine in the left hand lift near the outby end of the pillar, just inby the No. 16 crosscut. Jones was located just inby McFarlane. McFarlane was positioning the trailing cable and water hose alongside the continuous mining machine. McFarlane was facing toward the left-hand cut. McFarlane stated he heard the roof pop and roof bolts break and he was hit from behind by the falling roof material. McFarlane was pushed forward against the continuous mining machine, where he was entrapped in a triangular pocket between the floor, the side of the mining machine, and the angled rock slab. Jones was also entrapped by the falling roof material at that time.

The off-standard shuttle car operated by Brandon Wilde had just been loaded and had left the face area. Bill Tidwell, Standard Shuttle Car Operator, was parked in the No. 4 entry, just outby the No. 16 crosscut when he heard the roof strike the continuous mining machine. Kenny Gressman, Faceman, was relocating the conveyor belt feeder when he felt a rush of air resulting from the roof fall. He went to the continuous mining machine and heard McFarlane calling for help. Gressman attempted to get McFarlane

free from under the fallen roof material, but had to cut roof mesh and install temporary roof supports prior to being able to move the roof material.

McFarlane was extricated at approximately 3:30 p.m. Jones could not be immediately removed from under the material. First-aid was administered on-site to McFarlane, who was placed on a backboard, loaded onto a personnel carrier and taken to the surface of the mine where he was treated by Emery County EMS Personnel. The Emery County EMS Personnel had been contacted by the mine at 3:14 p.m. McFarlane was transported to Castleview Hospital in Price, Utah, where he received additional treatment for his injuries.

Jones was later removed from under the fallen roof material, placed on a backboard, loaded onto a personnel carrier, and taken to the surface of the mine where he arrived at approximately 6:30 p.m. The victim was transferred to Emery County EMS Ambulance Personnel. He was then transported to the Emery County Sheriff's office where the decision was made to transport the victim to the Medical Examiner's office in Salt Lake City, Utah. Dr. Joseph White, Certifying Medical Examiner, stated the time of death at 3:05 p.m., which was the time the accident occurred.

INVESTIGATION OF THE ACCIDENT

The MSHA National Call Center was notified on March 22, 2013, at 3:36 p.m. by Kenny Defa that a serious accident had occurred involving two miners; one individual was responsive, but the other individual was not responsive. A non-contributory citation was issued because MSHA was not notified immediately within 15-minutes as required by 30 CFR § 50.10. MSHA District 9 was notified by the National Call Center at 3:53 p.m. the same day. A verbal 103(j) Order was issued by Peter Saint, District 9 Staff Assistant, at approximately 3:55 p.m. Saint then contacted the MSHA Field Office, in Price, Utah. Phillip Gibson, MSHA Accident Investigator, was contacted and instructed to report to the Price Field Office. MSHA personnel arrived at the mine at approximately 5:00 p.m. The 103(j) Order was modified to a 103(k) Order to ensure the safety of the miners until an investigation could be conducted.

Representatives of MSHA, the Office of Coal Mine Safety in the State of Utah, and the Mine Operator traveled underground to the accident site to examine the scene and begin an investigation of the existing physical conditions. The mine had no miners' representative elected. A list of the individuals participating in the accident is located in Appendix A.

Formal interviews were conducted with several miners on March 22, 2013, at the mine. The injured miner was interviewed on March 25, 2013, at the Price Field Office. A list of those interviewed is in Appendix B.

DISCUSSION

At the time of the accident, the crew on the 001-0 MMU was engaged in retreat mining in the 5th Left C panel. A site-specific roof control plan was approved on January 4, 2013, for this panel. Typical mining consisted of mining 35-feet deep slab cuts in the coal barrier between 5th Left, C and B panels on the left side, extracting the pillars in sequence left to right, then making another 35-feet deep slab cut into the coal block on the right side. The section was driven with six entries developed on 80-feet centers and crosscuts on 120-feet centers, utilizing a continuous mining machine and shuttle cars. Four mobile roof support units (MRS) were being used during retreat mining.

Pillar extraction began in the 5th Left C pillar section panel inby crosscut 24. The approved site-specific roof control plan required the final 9-foot by 9-foot pillar stump be left in-place. There were large un-mined pillar remnants inby the active pillar line. The mine operator reported that pillar recovery became progressively worse, over the course of a week and a half prior to the accident, due to contamination from the cap rock as the rows of pillars were mined.

In the previous row of pillars (inby crosscut 17), pillar extraction from the Nos. 2, 4, and 6 entries was not mined because of adverse roof conditions. Slab cuts on the right side of that pillar row were also not taken. This caused large remnants of coal to be left in place. Excessive bagging of the roof mesh was occurring in places. Mining from the No. 3 entry was only partially completed with approximately half of the left-hand pillar having been removed, with respect to the No. 3 entry. During his interview, Biondich stated additional roof bolts were installed inby the accident site in the No. 3 entry where rib-sloughage created excessive width.

The roof and rib conditions were either corrected, or the mine operator elected not to mine pillars from areas that could have affected safety or coal quality. The mine operator stated as reasons for partially mining the rows of pillars, the roof was not properly caving, the loose cap rock created quality problems, and coal from the development section was needed at times to maintain acceptable coal quality.

It should have been apparent to the mine operator that the site-specific roof control plan for retreat mining in 5th Left C pillar panel was not adequate for the hazardous conditions that were being encountered. The operator was aware of worsening conditions, but elected to continue mining.

MRS units are moved into position in pairs, located side by side to each other during retreat mining. At the location of the accident, it was found that the two inby MRS units in the No. 3 entry were located 24-feet inby the rib line at the beginning of the cut (See appendix C). The measurement was taken where the cut began which was where

the outby bit-ring of the continuous mining machine contacted the rib line, to the location of the MRS units. This placed the units approximately four-feet inby the required location. This condition created a large span (distance) from the MRS units to where the cut began.

At the accident site, rib sloughage had increased the actual entry width to 23 feet, for a distance extending from the back of the continuous mining machine to the pillar corner at crosscut No. 16. The distance of this excessive width condition was at least 10 feet. During the investigation, it could not be determined if this condition existed prior to the accident.

Jones and McFarlane were located inby the continuous mining machine, in positions that are typical for retreat mining during left-handed cuts.

Geology and Roof Conditions

The immediate roof of 5th Left C panel is characterized by an 8-inch layer of black shale that hosts carbonized plant fossil fragments and is very susceptible to moisture degradation. Mesh was installed on the roof of entries and crosscuts to control weathering. Where mesh does not cover the roof for approximately two-feet from each rib, the moisture-susceptible immediate roof has flaked out. The next-highest layer of immediate roof is approximately 10-inches thick and exhibits a delamination horizon in some areas (delamination is a mode of failure for composite materials).

At the accident site, the immediate roof transitioned from weak shale into a 16-inch thick layer of hard, fine-grained, dark gray sandstone. The sandstone extended rib to rib for a distance of 24 feet. The sandstone hosted a series of prominent joints oriented N 47° E that were located at each rib line and which is within 25° of the entry orientation.

The sandstone layer failed adjacent to the location of the left-hand cut, where the roof span was locally increased and where the N 47° E-striking joint dissected the sandstone beam. A series of prominent joints cut in to the hard sandstone but were not present in the shale. During the accident, several roof bolts were bent and sheared off by the falling roof. The bolts were bent in a direction perpendicular to the strike of the joints, indicating a cantilevering style of failure. It is possible that the increasing span of the entry resulting from mining the left lift may have allowed the sandstone roof to cantilever and break the roof bolts. If not for the levering effect of the hard sandstone, the strength of the bolts was such that they should have been able to support the dead weight of the fallen sandstone slab. The vertical tension fractures that developed in the brow above the unbolted cut may also be an indication that the resulting span was too great for the sandstone beam to bridge.

The sandstone layer broke into several smaller pieces as it fell, one of which was the fatal slab. As viewed inby, the same layer of sandstone that failed in relation to the fatality had separated from the roof along a very prominent bedding parting, showing a 3-inch gap that extended for several feet over the separated slab. This layer was suspended as a dead load by the existing roof bolts.

Pillar Stability

MSHA Technical Support had reviewed the stability aspects of the plan for 5th Left C panel prior to retreat mining. The depth of cover in this area was approximately 1,350 feet. ARMPS pillar stability factors of 1.37 met the NIOSH recommended value of 1.3 for panels less than 425 feet wide. Pillars are defined by entries and crosscuts on 80-foot by 120-foot centers, resulting in 60-foot by 100-foot pillars. 5th Left C panel was developed with 6 entries with a 35-foot slab cut taken from the far left and right entries. The right side of the panel was against solid coal, while the left side was against a 160 foot wide barrier that separated it from previously extracted 5th Left B panel.

At the accident site, rib deterioration was present for at least four crosscuts outby the pillar line, and was attributed to the relatively deep cover and the well-developed coal cleat (natural fractures in the coal) rather than from excessive frontal abutment stress. There were no signs of pillar failure, and both the production and barrier pillars appeared to be performing as designed.

The mine has previous experience with pillar extraction, and had conducted retreat mining in the block of coal defined by the former 4th Left longwall panel, as well as the 5th Left panels A and B off 5th Left Submains. The mine roof remained intact for an estimated 200-feet inby the pillar line, although the lack of caving did not appear to have adversely affected pillar stability.

Training

A representative of MSHA's Educational Field Services (EFS) reviewed company training records. A determination was made that training records for the victim were current. The training records for McFarlane were also reviewed and found to be current. The training records for the mine examiners were reviewed during the investigation and found to be up to date.

ROOT CAUSE ANALYSIS

An analysis was conducted to identify the underlying root causes 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.

1. *Root Cause* – The site-specific approved Roof Control Plan was not adequate for the conditions encountered. The mine operator was aware that the 20-feet cut width and ensuing rib sloughage exposed miners to the hazards excessive widths created by inadequate roof support in the mining place. The bolt spacing and entry width were too wide to prevent the failure of the roof bolts. The accident occurred when several roof bolts broke, allowing the roof to fall.

   Corrective Action – The mine operator submitted a revision to the approved Roof Control Plan to narrow the maximum width of the entry to 18-feet instead of 20-feet; to install bolt rows on 4-feet centers and closer spacing between bolts in the row; and to reduce the pillar cut width from 20-feet to a maximum of 15-feet. MSHA approved this revision. The operator trained all miners in these changes. The proposed revision to the approved roof control plan also requires supplemental support installed on-cycle where rib sloughing is anticipated, to control excessive spans of roof.

2. *Root Cause* – The investigation found that the Mobile Roof Supports (MRS) was positioned too far from the Continuous Mining machine in the # 3 entry. The distance was 24-feet from the beginning of the lift to the MRS units. The mining diagrams in the approved Roof Control Plan required the MRS be positioned immediately inby the 20-feet wide lift being cut. Because the MRS units were located too far inby, they were unable to perform their function of providing supplemental support.

   Corrective Action- The revised Roof Control Plan will show more detail in the diagrams with closer tolerances for the placement and location of the MRS units in relation to the pillar-lifts.

CONCLUSION

The site-specific approved Roof Control Plan was not adequate for the conditions encountered. This fatal accident occurred when several bolts broke and allowed a slab of the roof to fall. The roof support system was inadequate for the large spans that had developed. The roof bolts and position of the MRS units were inadequate in supporting the immediate roof where the miners were working.

APPROVED BY:

for Russell J. Riley

District Manager

12-05-2013

Date

ENFORCEMENT ACTIONS

1. A 103(j) Order, No. 8462237, was issued over the phone verbally at approximately 3:55 p.m. on March 22, 2013, to Castle Valley Mining LLC.

   A fatal accident occurred at this mine on 03/22/2013 at approximately 3:05 p.m. This 103(j) Order is issued to assure the safety of all persons at this operation. In addition, it prevents the destruction of any evidence which would assist in the investigation of the cause or causes of the accident. It prohibits all activity at the mine until MSHA has determined that it is safe to resume normal mining operations at this mine. This order was initially issued orally to Kenny Defa at 3:55 p.m. this date and has now been reduced to writing.

   The 103(j) Order, No. 8462237, was modified to a 103(k) Order at 5:45 p.m., to insure the safety of workers until the investigation could be completed.

   The initial Order 8462237 is modified to reflect that MSHA is now proceeding under the authority of Section 103(k) of the Federal Mine Safety and Health Act of 1977. This Section 103(k) Order is intended to protect the safety of all persons on-site including those involved in the investigation of the accident. The mine operator shall obtain prior approval from an Authorized Representative of the Secretary for all actions to restore the mine to normal operations. Additionally, the mine operator is reminded of its existing obligations to prevent the destruction of evidence that would aid in investigating the cause or causes of the accident.

2. 104(d)(1) Citation, No. 8482242 is being issued to Castle Valley Mining LLC for a violation of 30 CFR § 75.223(a)(1). The Roof Control Plan for the mine has been determined to be inadequate for the conditions encountered. For multiple shifts, the operator was aware that the 20-foot cut width and ensuing rib sloughage exposed miners to excessive widths on the 5th Left C pillar section - 001 MMU. A fall of roof accident occurred on March 22, 2013, resulting in a fatality. The accident occurred when several roof bolts broke allowing the roof to fall. The bolt spacing was too wide to prevent the failure of the roof bolts. The entry width was also too wide for conditions encountered.

3. 104(a) Citation, No. 8482244, is being issued to Castle Valley LLC for a violation of 30 CFR §75.220(a)(1). The mobile roof support (MRS) machines were too far from the continuous mining machine in the # 3 entry. The distance was 24 feet from the beginning of the lift to the MRS.

   The mining diagrams in the approved plan required that the MRS be positioned just inby the 20 foot wide lift being cut.

Appendix A
Persons Participating in the Investigation

Corey Heaps .....Vice President

Tony Welch .....Mine Manager

Ken Defa .....Safety Manager

Utah State

David "Kent" Houghton.....Director of Office of Coal Mine Safety

Mine Safety and Health Administration

Donald E. Gibson .....Assistant District Manager

Donnie Durrant .....CMS&H Supervisor

Sandin Phillipson .....Geologist, RCD PSHTC

Tain Curtis.....Roof Control Specialist

Russell Bloomer.....CMS&H Inspector/Family Liaison

Phillip R. Gibson, Jr .....CMS&H Inspector/Accident

Kent Norton .....Educational Field Services

Appendix B

List of Persons Interviewed

March 22, 2013

Louis Biondich.....001-0 Section Foreman

Brandon Wilde.....Off-Side Shuttle Car Operator

Kenny Gressman.....Timberman/Faceman

Nick Konakis.....Timberman

Bill Tidwell.....Standard-Side Shuttle Car Operator

Kelly Taylor.....Section Mechanic (Fill-in)

Guy Allred .....Afternoon Shift Foreman

Smokey Tweddell .....Roof Bolter Operator (Mains)

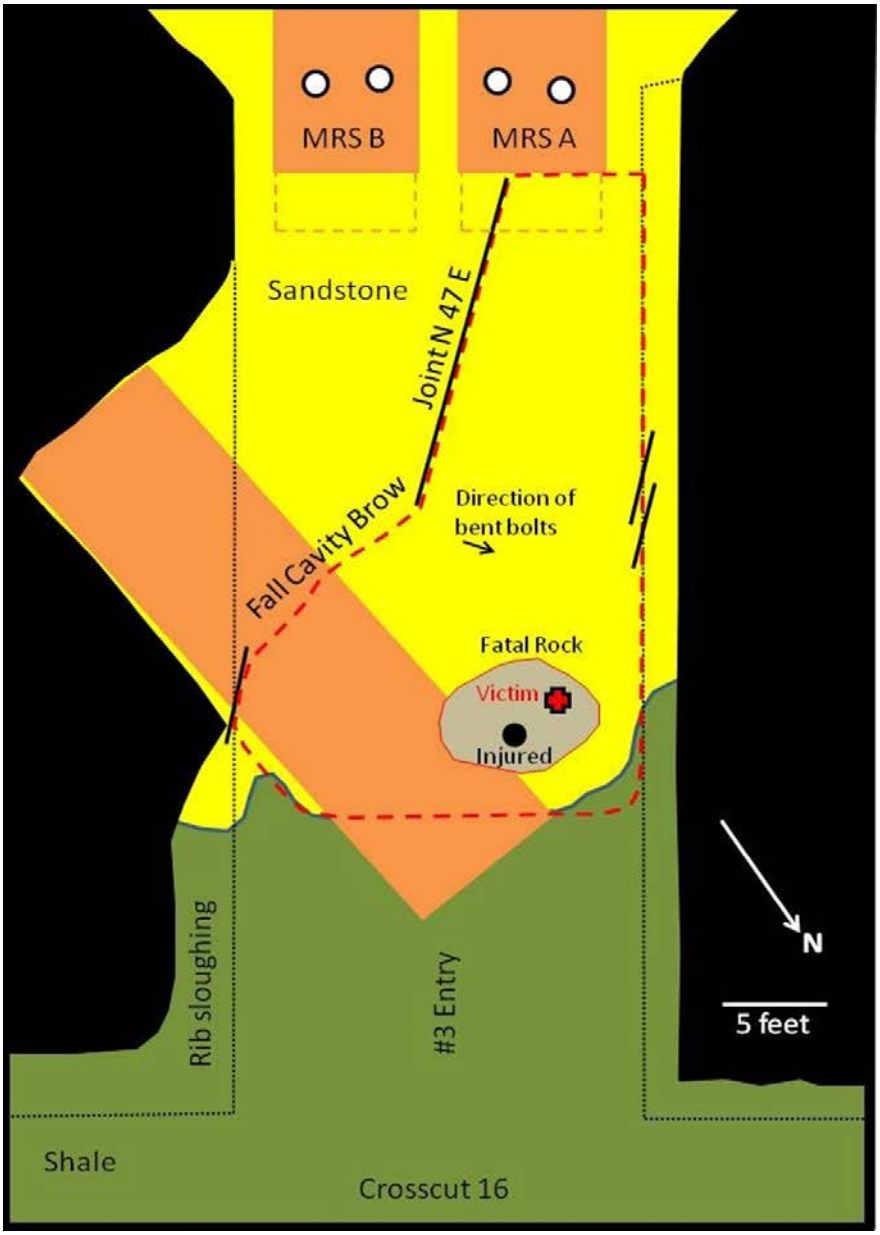
Brian Evans .....Section Mechanic (Mains)

March 25, 2013

Dallan McFarlane ..... Injured/Continuous Mining Machine Helper

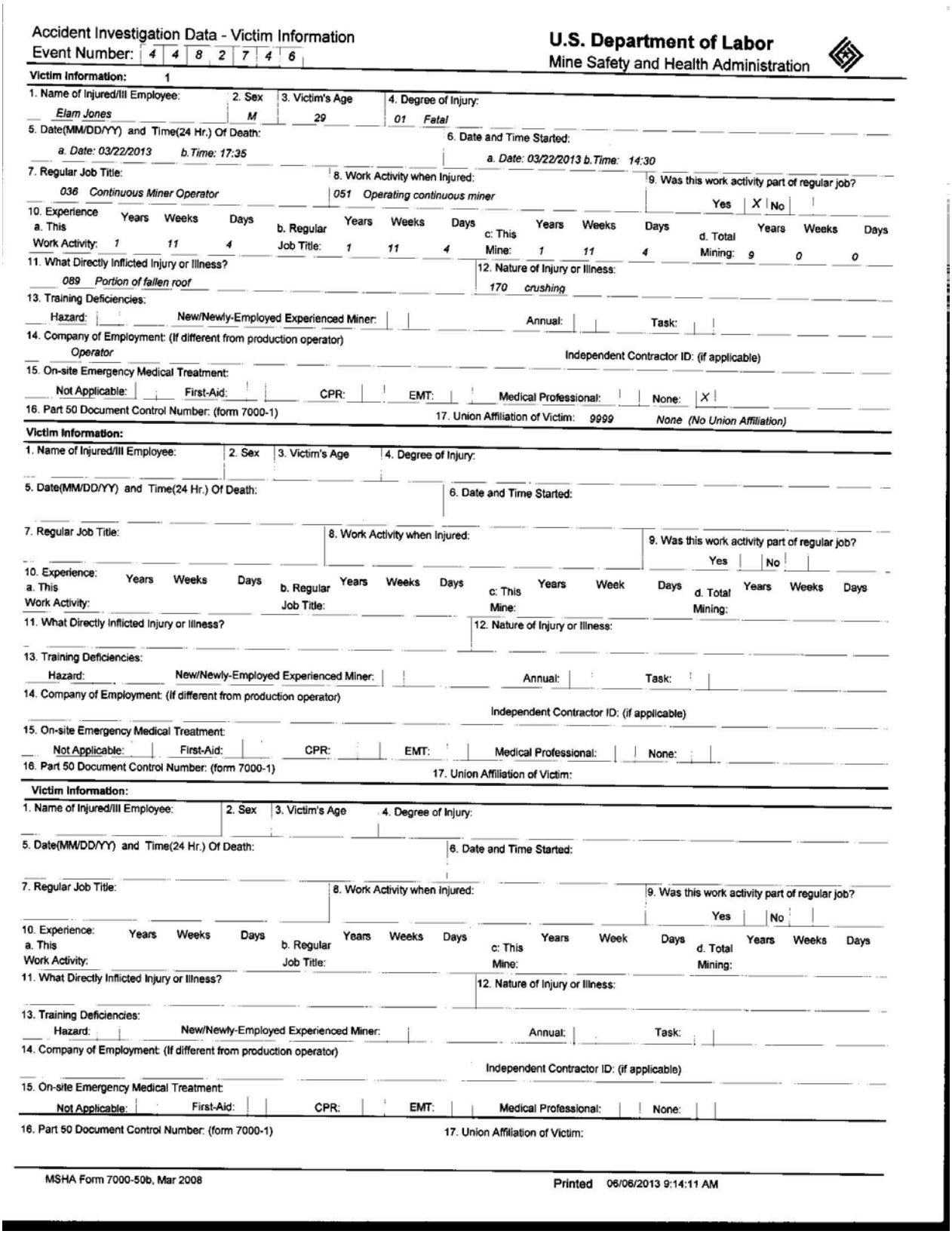
Appendix C
Castle Valley Mining LLC
Castle Valley Mine #4
Mine ID 42-02335
001-0 Section
The Accident Scene –
No. 3 Entry

Sketch No. 1 after the Accident



Appendix D
Photograph of Accident Scene

Appendix E
Victim Information



Accident Investigation Data - Victim Information
Event Number: 4 4 8 2 7 4 6

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

Victim Information: 1

1. Name of Injured/Ill Employee: *Elam Jones*
2. Sex: *M*
3. Victim's Age: *29*
4. Degree of Injury: *01 Fatal*
5. Date(MM/DD/YY) and Time(24 Hr.) Of Death: *a. Date: 03/22/2013 b.Time: 17:35*
6. Date and Time Started: *a. Date: 03/22/2013 b.Time: 14:30*
7. Regular Job Title: *036 Continuous Miner Operator*
8. Work Activity when Injured: *051 Operating continuous miner*
9. Was this work activity part of regular job? Yes: X No:
10. Experience

	Years	Weeks	Days
a. This Work Activity:	1	11	4
b. Regular Job Title:	1	11	4
c: This Mine:	1	11	4
d. Total Mining:	9	0	0

11. What Directly Inflicted Injury or Illness? *089 Portion of fallen roof*
12. Nature of Injury or Illness: *170 crushing*
13. Training Deficiencies: Hazard: New/Newly-Employed Experienced Miner: Annual: Task:
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: EMT: Medical Professional: None: X
16. Part 50 Document Control Number: (form 7000-1)
17. Union Affiliation of Victim: *9999 None (No Union Affiliation)*

Victim Information:

1. Name of Injured/Ill 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: No:
10. Experience

	Years	Weeks	Days
a. This Work Activity:			
b. Regular Job Title:			
c: This Mine:			
d. Total Mining:			

11. What Directly Inflicted Injury or Illness?
12. Nature of Injury or Illness:
13. Training Deficiencies: Hazard: New/Newly-Employed Experienced Miner: Annual: Task:
14. Company of Employment: (If different from production operator) Independent Contractor ID: (if applicable)
15. On-site Emergency Medical Treatment: Not Applicable: First-Aid: CPR: EMT: Medical Professional: None:
16. Part 50 Document Control Number: (form 7000-1)
17. Union Affiliation of Victim:

Victim Information:

1. Name of Injured/Ill 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: No:
10. Experience

	Years	Weeks	Days
a. This Work Activity:			
b. Regular Job Title:			
c: This Mine:			
d. Total Mining:			

11. What Directly Inflicted Injury or Illness?
12. Nature of Injury or Illness:
13. Training Deficiencies: Hazard: New/Newly-Employed Experienced Miner: Annual: Task:
14. Company of Employment: (If different from production operator) Independent Contractor ID: (if applicable)
15. On-site Emergency Medical Treatment: Not Applicable: First-Aid: CPR: EMT: Medical Professional: None:
16. Part 50 Document Control Number: (form 7000-1)
17. Union Affiliation of Victim:

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