MAI-2011-12

UNITED STATES
DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
Metal and Nonmetal Mine Safety and Health

Report of Investigation

Underground Metal Mine
(Platinum)

Fatal Powered Haulage Accident
October 31, 2011

Stillwater Mine
Stillwater Mining Company
Nye, Stillwater County, Montana
ID No. 24-01490

Investigators

Mike Tromble
Mine Safety and Health Inspector

Ronald Medina
Mechanical Engineer

Fred Sanchez
Mine Safety and Health Specialist

Originating Office
Mine Safety and Health Administration
Rocky Mountain District
P.O Box 25367, DFC
Denver, Colorado 80225
Richard Laufenberg, District Manager

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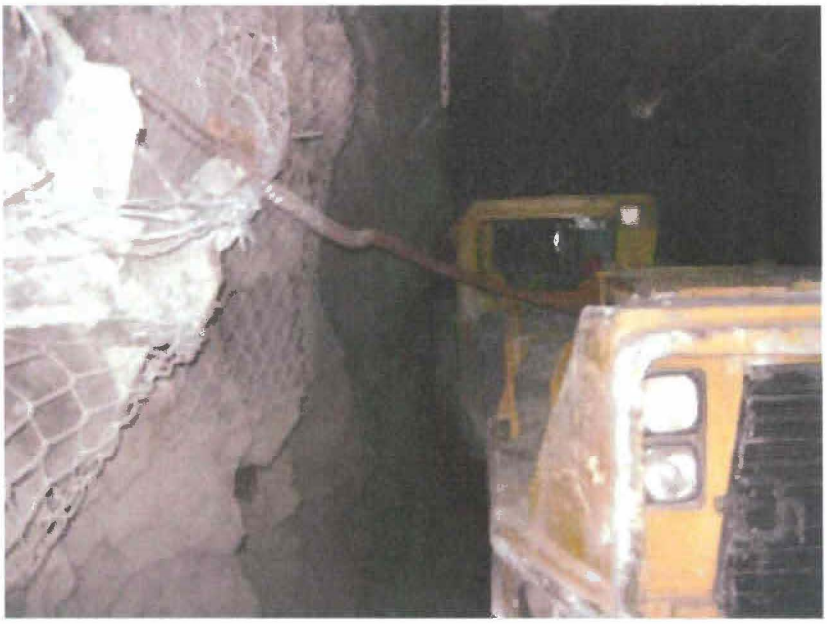

OVERVIEW

Dale A. Madson, muck haul leadman, age 42, was killed on October 31, 2011. Madson was operating a 4-yard Load-Haul-Dump (LHD) on an underground haul road when he lost control of the LHD on an "S" curve. The right rear corner of the LHD struck the right rib of the 38W heading between 4500 and 5500 Foot Wall Lateral (FWL). The LHD traveled across the haul road to the left side for approximately 49 feet, striking the rib several times with the left side of the cab. At that time, a spieling (rebar anchored in the rib for ground control), penetrated the top left corner window, entered the cab, and struck the victim.

The accident occurred because management's policies and procedures failed to ensure equipment operators maintained control of mobile equipment while operating equipment.

GENERAL INFORMATION

Stillwater Mine, a multi-level underground platinum mine, owned and operated by Stillwater Mining Company, is located near Nye, Stillwater County, Montana. The principal operating official is Francis R. McAllister, CEO of operations. The mine is normally operated two, 11.5-hour shifts a day, 7 days a week. Total employment is 940 persons.

Ore is extracted using the ramp-and-fill mining method. Sub-level stoping and cut-and-fill stoping are also used. Mine access drifts are driven at different elevations going east and west from the shaft. Approximately 60 percent of the ore is transported to the mill via a 1,950-foot vertical shaft. The remainder of the ore is transported to the mill by trucks and a rail system which extends about three miles. The ore is then transported to a smelter and base metals refinery located at a company-owned facility in Columbus, Montana.

The last regular inspection of the operation was completed on August 17, 2011.

DESCRIPTION OF ACCIDENT

On the day of the accident, October 31, 2011, Dale A. Madson (victim) reported to work at 7:00 a.m., his scheduled start time, and attended a crew meeting. Billy Hodge, leadman, gave Madson his daily assignment. Madson then assigned work to Victor Mangus, John Getz, and Travis Stovall, truck drivers.

At 7:30 a.m., the miners boarded a mantrip and traveled underground to the 53 lunch room. Madson conducted an inspection on an LHD and went to the 44W-1100 dumps. The truck drivers conducted inspections on their haul trucks and followed behind. Madson arrived at the 44W-1100 dumps and conducted a work place examination for this area. The truck crew hauled 30 loads of waste material from the 44W-1100 FWL to 44W-1100 dumps. At 11:30 a.m., Madson and the truck crew traveled to the 38 shop and ate lunch.

At 12:00 p.m., they traveled east on 38E to 8900-9000 FWL. Madson loaded three trucks with waste material and three trucks with ore. At 12:45 p.m., the area was cleaned out and the crew traveled to the 38 shaft. At 1:45 p.m., they left the shaft and headed west to 38W-14300 FWL. Mangus was in the lead with his haul truck followed by Madson's LHD and the other two haul trucks. Mangus pulled over at the 38W 2200 lay down area to let Madson pass him. Madson was leading and as he moved away his vehicle's lights disappeared on an "S" curve.

At approximately 2:20 p.m., Mangus saw that Madson's LHD was stopped in the drift at 5342 FWL. The LHD was against the left rib and the engine was still running. Mangus noticed that it appeared a rebar spieling had entered the cab of

the LHD. Mangus checked on Madson but he was nonresponsive. Mangus went back to his haul truck and called Hodge for assistance. Mine Emergency Medical Technicians (EMTs) and a Medcor Paramedic arrived. They found Madson nonresponsive. At 3:10 p.m., the victim was pronounced dead at the accident site by the Medcor Paramedic. The cause of death was attributed to blunt force trauma.

INVESTIGATION OF THE ACCIDENT

The Mine Safety and Health Administration (MSHA) was notified of the accident at 3:27 p.m. on October 31, 2011, by a telephone call from Matt Knight, Human Resources Manager, to MSHA's National Call Center. Michael Dennehy, Assistant District Manager, was notified and an investigation was started the same day. An order was issued under the provisions of Section 103(j) of the Mine Act to ensure the safety of the miners.

MSHA's accident investigation team traveled to the mine, conducted a physical inspection of the accident scene, interviewed employees, and reviewed documents and work procedures relevant to the accident. MSHA conducted the investigation with the assistance of management, employees, union officials, and miners' representatives.

DISCUSSION

Location of the Accident

The accident occurred in the 38W FWL at 5342 west. The victim was operating an LHD, traveling west, on a haulage road with a 1.3% uphill grade. The road was approximately 11.75 feet high and 11 feet wide and had a 5.4% slope from right to left.

Equipment Involved in the Accident

The loader, an articulated machine, involved in the accident was a Caterpillar R1300G Load-Haul-Dump (LHD) Underground Mining Loader. The operator's compartment was transversely oriented on the left side of the machine with the operator seated perpendicularly to the direction of travel. The door was on the operator's left side and opened into the articulation area. As specified by Caterpillar, the empty weight of the machine was 46,187 pounds and the loaded weight was 61,178 pounds. The overall length was 352.1 inches, the overall width at the tires was 74.8 inches, and the height to the top of the Rollover Protective Structure (ROPS) was 83.5 inches as specified by Caterpillar. This four-wheel drive LHD was powered by a Caterpillar 3306B, 141 horsepower, turbocharged and aftercooled diesel engine. It was equipped with a four-speed transmission for both the forward and reverse directions; however, fourth gear was electronically locked out, thus allowing only three speeds for both the forward and reverse directions.

The gages on the front dashboard panel included an engine coolant temperature gage, a converter/transmission temperature gage, and a hydraulic oil temperature gage. When the engine is shut down, the gage needles retain the readings that existed at that time. All three were found to be in the normal operating range. The transmission rotary control switch was found in the "manual" position with the rocker switch set for the forward direction of travel. No obstructions prevented the free movement of the throttle pedal, service brake pedal, and neutralizer pedal. All three pedals moved freely and spring-returned upon release.

The first responders found the engine running and shut it down using the remote engine stop control at the rear portion of the engine compartment. The operator cab was tight against the rib after the accident. After the accident, the LHD was estimated to have approximately 200 to 300 pounds of rock in the bucket.

The LHD was equipped with full hydraulic, enclosed, wet disc service brakes at each wheel. The service brake could be applied using either of two brake pedals. The service brake pedal was located to the left of the throttle pedal in standard automotive orientation. The service brake/transmission neutralizer pedal was located farther to the left on the other side of the service brake control valve console. Pushing down the service brake/transmission neutralizer pedal shifted the transmission into neutral in addition to applying the service brake.

The service brake system was tested and found to pass the manufacturer's recommended pull thru test of 2nd gear forward, full throttle. The machine was trammed back and forth in a shop area and stopped quickly in both directions when the service brake was applied.

The service brake application pressure was measured according to the procedure specified by Caterpillar. This brake application pressure was found to be 1000 psi which was within the acceptable range specified by Caterpillar.

The parking brake system consisted of a spring-applied, hydraulic-released, enclosed wet disc brake system controlled by a push/pull type button (push to apply and pull to release) mounted on the right side of the dashboard panel. When applied, spring force engaged the brakes at all four wheels. The machine was designed to automatically shift the transmission into neutral if the parking brake was applied while the transmission was in first gear and the engine was running.

The feature that automatically neutralized the transmission, if the parking brake was applied while the transmission was in first gear, functioned when tested. The parking brake system was tested and found to pass the manufacturer's recommended pull thru test of 2nd gear forward, full throttle.

Testing showed that when the machine was allowed to coast to a stop, the parking brake action light would illuminate and the parking brake would apply when it slowed to approximately 2 mph. This indicated that the machine was equipped with a Caterpillar Custom Product Parking Brake Control Gp (Automatic) System that is designed to engage the parking brake if the following conditions are active for three seconds or more: the ground speed is less than 3.1 mph, engine rpm is between 550 rpm and 800 rpm, the neutralizer pedal is released, and the service brake is released.

The articulated steering was controlled by a Caterpillar STIC joystick control. The joystick was spring centered and provided right and left machine articulation movement with the speed of articulation being proportional to the lever displacement. Two types of steering interlocks were present on the machine, a mechanical interlock and a hydraulic interlock.

The mechanical interlock was controlled by the steering and transmission lock lever located below the STIC steering joystick on the door. When the door was shut, the lever could be placed in either the "locked" position, (almost parallel to the door), or moved into the "unlocked" position (perpendicular to the door). When the door was opened, the lever automatically moved into the "locked" position by mechanical linkage tied into the door hinge. Placing the lock lever into the "locked" position prevented steering action by mechanically locking the STIC steering joystick into the neutral position. In addition, the transmission was also neutralized through the use of the electrical transmission interlock switch. This switch was actuated by a roller on the top of a plunger assembly. When the lock lever was placed into the "locked" position, the plunger assembly was actuated which electronically locked the transmission in neutral.

In addition to the mechanical steering interlock, a hydraulic steering interlock was provided. The hydraulic interlock was designed to disable the steering by blocking the pilot pressure for the STIC steering control when the door was opened approximately 8 inches.

The spieling entered the cab through the top left corner window located behind the operator on his left side. After it entered the cab, the forward motion of the LHD bent the spieling, causing it to sweep through the cab as the LHD went by. Opposite the corner of the cab from where the spieling entered, two brake pressure gages were broken away from the fiberglass dashboard panel they were mounted in. Additionally, the fiberglass door panel on the inside of the door was broken off. The steering and transmission lock lever on this inside door panel was bent and the interlock linkage that it operated was damaged; including the roller on the top of the transmission interlock switch. As a result, the STIC steering joystick did not freely return to center upon release.

After the damage to the steering interlock linkage was repaired, the mechanical steering interlock, the hydraulic steering interlock, and the transmission interlock

functioned as described in the manufacturer's operation and maintenance manual and the STIC steering joystick operated freely and returned to center upon release. The steering system was tested according to the manufacturer's service manual. The steering time to fully articulate the machine was measured with the hydraulic oil in the normal operating pressure range, as specified in the service manual. The same test was repeated with the hydraulic temperature at the beginning of the red range on the temperature gage indicating a hot oil temperature. In both tests, the time to fully articulate the machine for a left or right turn was three seconds. This time was within the specification in the service manual. The machine was also trammed in both the forward and reverse directions in a shop area and no steering defects were found.

The LHD was equipped with a four-speed transmission for both the forward and reverse directions; however, 4th gear was electronically locked out, making 3rd gear the highest gear attainable. The transmission could be controlled either manually or automatically. A rotational control switch mounted on the dashboard panel allowed the operator to select one of four positions: "manual", "4th", "3rd", or "2nd." In the "manual" mode, the operator controlled all upshifts and downshifts with two thumb operated push buttons mounted on the STIC steering control, one button for upshifts and one button for downshifts. If the transmission control was placed into the "4th", "3rd" or "2nd "position, the transmission automatically shifted as needed but would limit the highest gear to that indicated by the switch position unless "4th" was selected. In this case, 3rd gear would be the highest gear attainable since 4th gear was electronically locked out. The forward, neutral, and reverse directional control was a three position finger operated rocker switch in the trigger area of the STIC steering control. As specified by Caterpillar, the maximum speed in Forward 1 was 3.1 mph; in Forward 2, 5.6 mph; in Forward 3, 10.6 mph; and in Forward 4 (locked out and not applicable for this machine), 14.9 mph. The maximum rated speeds in reverse were 3.1 mph, 5 mph, 9.3 mph, and 14.3 mph (locked out), respectively, for the four gear speeds.

The transmission was shifted into 1st, 2nd, and 3rd gears during testing and no defects were found.

The Cat Electronic Monitoring System on the machine was accessed through a data link port and connected to a laptop computer using Cat Electronic Technician software. The readout on the laptop computer verified that the machine was electronically configured to limit the maximum forward and reverse gears to 3rd gear.

The front and rear headlights were checked and functioned properly except for one of the rear headlights on the right side of the machine. Investigators found the front headlight switch in the "on" position and the rear headlight switch in the "off" position which would be consistent with the direction the victim was traveling. The back-up alarm and horn functioned when tested. The throttle

pedal operated freely and returned to the neutral position when released. The seat belt latched when tested.

Rebar Spieling

The 1.5 inch rebar spieling, which was protruding from the left rib, was installed in this area during development in September, 2000. The spieling was approximately 80 inches above the floor of the road. The rebar was installed on 6-foot centers parallel to the floor to control rib movement when advancing the drift. The spieling that entered the cab was held in place with a 9-inch wide by 6-foot long mat and two split set rock bolts. The tip of the spieling was covered by approximately 1 inch of mat. The mat and spieling were covered with chain link mesh wire.

Training and Experience

Dale Madson (victim) had 3 years and 28 weeks of mining experience, all at this mine. Investigators reviewed the training records for the victim and found the task training and annual refresher training records to be up-to-date. However, the investigators found that the training provided did not specifically address the hazards resulting in the accident. After the accident, management established procedures and policies to ensure that equipment operators operate mobile equipment safely. All persons that operate mobile equipment were trained regarding these new policies and procedures.

ROOT CAUSE ANALYSIS

A root cause analysis was performed and the following root cause was identified:

Root Cause: Management's policies and procedures failed to ensure equipment operators were specifically trained to maintain control of mobile equipment while operating equipment. The victim did not maintain control of the LHD he was operating.

Corrective Action: Management established policies and procedures to ensure that equipment operators operate mobile equipment safely. The new policies and procedures require in part that:

1. Persons at all times maintain control and operate equipment at a safe speed for conditions.
2. Walking speed is required at areas that are signed and demarcated as "slow to walking speed" areas (some supply areas, shops & intersections where deemed necessary).
3. Equipment shall be operated at a reduced speed in all haulageways with reduced clearance, corners, curves or damp road conditions.
4. Equipment shall be operated at speeds that minimize contact with ribs.

5. When traveling around blind corners or entering FWL from ramps or crosscuts, sound horn or flash lights to warn others before entering.
6. Whether operating transportation, utility, haulage, or LHD equipment, the operator must be aware of size, visibility, mechanism of steering, task at hand, and operate the equipment according to conditions.

All persons that operate mobile equipment were trained regarding these new policies and procedures.

ENFORCEMENT ACTIONS

Issued to Stillwater Mining Company

Order No.6592787 was issued on October 31, 2011, under the provisions of Section 103(j) of the Mine Act:

An accident occurred at this operation on October 31, 2011, at approximately 3:00 p.m. As rescue and recovery is necessary this order is being issued under section 103(j) of the Federal Mine and Safety Act of 1977, to assure the safety of all persons at this operation. This order is also being issued to prevent the destruction of any evidence which would assist investigating the cause of the accident. It prohibits all activity from the 38 west 4500 to 5000 area of the foot wall lateral, except to the extent necessary to rescue an individual or prevent or eliminate an imminent danger until MSHA has determined that it is safe to resume normal mining operations in this area. This order applies to all persons engaged in the rescue and recovery operation and any other persons on site. This order was initially issued orally to the mine operator at 3:45 p.m.

This order was modified to a Section 103(k) when an authorized representative arrived at the mine.

This order was terminated on November 7, 2011, after conditions that contributed to the accident no longer existed.

Citation No. 6591466 was issued on December 1, 2011, under the provisions of Section 104(a) of the Mine Act for a violation of 30 CFR 57.9101:

A fatal accident occurred on October 31, 2011, when the operator of a LHD contacted the left rib of the 38W haulage between the 4500 – 5500 FWL. The accident occurred as the operator was in a sweeping "S" curve. The operator of this self propelled equipment failed to maintain control of the equipment while it was in motion.

The citation was terminated on December 19, 2011. All equipment operators have received additional training regarding the safe operation and control of mobile equipment.

CONCLUSION

The accident occurred because management's policies and procedures failed to ensure equipment operators maintained control of mobile equipment while operating equipment.

Richard Laufenberg
District Manager
Rocky Mountain District

February 13, 2012

LIST OF APPENDICES

Appendix A-Persons Participating in the Investigation

Appendix B-Victim Data Sheet

APPENDIX A

Persons Participating in the Investigation

Stillwater Mining Company

Kevin Shiell	Vice-President of Operations
Dee Bray	Mine Manager
Ryan Morris	Safety Manager
Matt Knight	Human Resources Manager
Rodney Younggren	Service Superintendent
Lori Stewart	Corporate Safety
Kris Koss	Vice-President of HR and Safety
Alan Longley	Safety Coordinator
Dave (David) Crabtree	General Foreman
Phil (Phillip) Hovis	Maintenance Superintendent
Karen Johnston	Legal Counsel (Jackson & Kelly)

United Steel Workers L.U. 11-0001

Scott McGinnis	U.S.W. Local President
Eddie Lorash	U.S.W. Local V.P. President
Jeremy Andrews	Miners' Representative

Mine Safety and Health Administration

Mike Tromble	Mine Safety and Health Inspector
Fred Sanchez	Mine Safety and Health Specialist
Ronald Medina	Mechanical Engineer
Michael Okuniewicz	Family Liaison

APPENDIX B

Accident Investigation Data - Victim Information

Event Number: 1 1 0 7 2 4 3

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:
Dale A. Madson	*M*	*42*	*01 Fatal*

5. Date(MM/DD/YY) and Time(24 Hr.) Of Death:	6. Date and Time Started:
a. Date: 10/31/2011 b.Time: 14:20	*a. Date: 10/31/2011 b.Time: 7:00*

7. Regular Job Title:	8. Work Activity when Injured:	9. Was this work activity part of regular job?
028 LHD operator	*058 Operating LHD*	Yes X No

10. Experience	Years	Weeks	Days		Years	Weeks	Days		Years	Weeks	Days		Years	Weeks	Days
a. This Work Activity:	*3*	*27*	*0*	b. Regular Job Title:	*3*	*27*	*0*	c: This Mine:	*3*	*28*	*0*	d. Total Mining:	*3*	*28*	*0*

11. What Directly Inflicted Injury or Illness?	12. Nature of Injury or Illness:
048 1.5 inch diameter rebar spieling	*180 Blunt trauma*

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: X | CPR: X | EMT: X | Medical Professional: X | None: |

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

17. Union Affiliation of Victim: *2605* *United Steel Workers of America*