MAI-2018-12

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

REPORT OF INVESTIGATION

Surface Nonmetal Mine
(Dimension Stone N.E.C.)

Fatal Powered Haulage Accident
October 19, 2018

Montana Rockworks Inc.
MCGREGOR
Marion, Flathead County, Montana
Mine ID No. 24-02226

Investigators

Ernesto A. Vasquez
Mine Safety and Health Inspector

Peter A. Del Duca
District Staff Assistant

Originating office
Mine Safety and Health Administration
Rocky Mountain District
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David Weaver, District Manager

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OVERVIEW

Jerry Baller, a 63-year-old Quarry Manager with 17 years' experience, died on October 19, 2018, when the haul truck he was operating traveled through a berm while descending a ramp at the bottom of the quarry road.

The accident and fatality occurred because the mine operator did not: (1) maintain the haul truck's retarder system in a functional state; (2) ensure miners wear seatbelts at all times when operating equipment, and (3) inspect equipment prior to placing it in service.

GENERAL INFORMATION

McGregor, owned and operated by Bill Carter and Brad Mercord, is located in Marion, Flathead County, Montana. The principal operating official is Brad Mercord, Owner and Production Division Supervisor of Montana Rockworks, Inc. Montana Rockworks, Inc. operates five quarries in Montana. The mine normally operates one ten-hour shift, four days per week, and occasionally operates on Fridays. The mine's total employment is eleven miners.

Material is drilled and blasted and then loaded by excavator onto a haul truck. The raw material is transported to a saw shop at the top of the quarry, where it is cut to make stone veneer for building construction. Material is mined from multiple benches in the quarry. Raw material is also trucked in from other quarries, dumped at the lower landing, loaded onto a haul truck, and transported to the saw shop. Other material from the blast is used for the oversize dry stack.

The Mine Safety and Health Administration (MSHA) completed its last regular inspection of the operation on August 16, 2018.

DESCRIPTION OF THE ACCIDENT

On October 19, 2018, at 9:30 a.m., Jerry Baller (victim) arrived at the retail yard, in Kalispell, Montana on an unscheduled work day to pick up his check. At 10:00 a.m., Mercord asked Baller to transport an excavator to the Montana Rockworks, Inc.'s Meadows Saw Shop, located a few miles from McGregor, and then transport a haul truck from McGregor to the Montana Rockworks, Inc.'s retail yard for repairs.

At 12:45 p.m., Baller left the retail yard operating a tractor-trailer carrying the excavator and, after stopping at the fuel station, drove to the saw shop, arriving at 1:50 p.m. Baller met with Mercord, who travelled there separately, and they unloaded the excavator. Mercord and Baller then loaded a roll of conveyor belt onto the tractor-trailer.

At 2:15 p.m., Baller left the Meadows Saw Shop in the tractor-trailer to proceed to McGregor. Baller arrived at McGregor at 2:30 p.m. and parked the tractor-trailer on the truck loop, leaving it idling. He walked 3/10 of a mile up the haul road to get Truck 103, a Volvo A30C articulated haul truck and was unaware the truck's retarder system did not work. The grade of the winding haul road ranged from 10.5% to 21%, with an average grade of 14%. Baller drove the haul truck down the hill, negotiating several curves, but failed to make the final turn. The truck ran through a berm and travelled 39 feet through the air before hitting the ground 12 feet below. After impact, the haul truck rolled forward 49 feet uphill and then rolled backwards 84 feet downhill. The rear tires travelled up a berm and caused the dump bed to fall on its side while the cab remained upright.

At approximately 9:15 p.m., Mercord saw that he had a voicemail message from Baller's wife. Mercord called Baller's wife and found out Baller had not come home. Mercord then called Ben Henshaw, Quarry Manager for Montana Rockworks, Inc., to meet him at McGregor. Mercord travelled to McGregor, arriving around 10:00 p.m., and found the damaged haul truck. Mercord climbed up on the side of the haul truck and found Baller inside, unresponsive, suffering from

extensive injuries, and not wearing a seatbelt. At 10:15 p.m., Henshaw arrived and Mercord and Henshaw drove to the top of the haul road due to poor cell reception and called 911. At 10:30 p.m., the two men went down the hill and drove to McGregor Lake Lodge to escort Emergency Medical Services personnel to the scene. Baller was pronounced dead at the scene at 11:58 p.m.

INVESTIGATION OF THE ACCIDENT

Brad Mercord called the Department of Labor National Contact Center (DOLNCC) at 11:45 p.m. on October 19, 2018, and notified MSHA of the accident. DOLNCC notified Sidney Garay, Supervisory Inspector in MSHA's Rocky Mountain District. MSHA issued an order under provisions of Section 103(k) of the Mine Act to ensure the safety of the miners and began the investigation.

MSHA's accident investigation team travelled to the mine, conducted a physical examination of the accident, interviewed miners, and reviewed conditions and work procedures relevant to the accident. MSHA's Technical Support also assisted in examining and conducting tests on the haul truck. MSHA conducted the investigation with the assistance of mine management, miners and their representatives, Montana Safety and Health Bureau, and the Marion Police Department and Marion Fire Department.

DISCUSSION

Location of the Accident

The accident occurred near the lower landing of the haul road that leads from the saw shop staging area. The overall road is approximately 18 feet wide and 3/10 of a mile long, and varies in grade from 10.5% to 21%, with an average grade of approximately 14%.

Weather

Weather reports on the day of the accident indicated mostly clear, sunny, with a high of 63°F. Investigators did not consider weather as a factor in the accident.

Articulated Haul Truck

The haul truck involved in the accident was an unloaded Volvo A30C, a six-wheel articulated haul truck. It had one drive axle on the tractor (tractor axle) and two drive axles on the trailer (front and rear bogie axles). Product information indicated the haul truck had an overall width of 9 feet 7 ½ inches and an empty weight of approximately 44,755 pounds.

General Condition of the Haul Truck

The trailer of the haul truck overturned during the accident, but the tractor remained upright. The haul truck sustained damage to the underside of the front of the tractor, the cab interior and the right side trailer tire and rim assemblies. The operator righted the trailer and towed the haul truck a short distance so MSHA Technical Support, with the assistance of mine maintenance

personnel, could conduct a field inspection of the haul truck. The accident damaged the engine oil pan assembly which caused the engine oil to drain out. Therefore, investigators were unable to operate the engine during the inspection.

Transmission and Drivetrain Design

The haul truck had an automatic transmission with 6 forward speeds, 2 reverse speeds, and a neutral position. The transmission also had an integral hydraulic retarder. There are 4 driver-selected transmission control positions in the forward direction: D, 3, 2 and 1. Investigators found the transmission's gear selector lever in the "D" position. In this position, the transmission automatically shifts through the forward gears and allows the haul truck to travel at maximum speed. Product information indicates the maximum machine speed on level ground is approximately 32 ½ MPH.

The haul truck can operate in 4-wheel drive, 6-wheel drive, and full 6-wheel drive (all longitudinal and transverse differentials locked for maximum traction force). Operating the haul truck in full 6-wheel drive can adversely affect the steering of the truck. Investigators could not determine the haul truck's operating mode at the time of the accident because modes can change when electrical power or air system pressure is lost. However, they found the haul truck was unable to operate in the full 6-wheel drive mode because the floor button in the cab had been disconnected, indicating the drive mode was not a factor in the accident.

All of the drivetrain components were visibly intact and all 6 wheels rotated freely while towing the haul truck with the parking brake released.

Service Brake and Parking Brake Systems

The haul truck has an air-over-hydraulic service brake system with two air circuits – one for the tractor service brakes and one for the trailer service brakes. An engine-driven air compressor maintains air pressure. Actuators convert air pressure to hydraulic pressure to apply the disc brakes when the foot pedal is depressed.

In order to test the haul truck's service brake system, investigators used a remote air supply from a truck tractor in lieu of the haul truck's air compressor.

Investigators encountered two defects: The left side tractor service brake could not be locked on level ground with the truck bed empty; and overstroke sensors, which indicate when hydraulic pressure is low, were disconnected. However, investigators determined that these defects did not contribute to the accident. Five of the six service brakes were still capable of skidding the tires in the accident area, and no conditions were found that would have triggered the overstroke sensors.

The haul truck has an air release parking brake system. To help control a moving haul truck in the event of an emergency, the parking brake design allows the truck driver to apply the parking brake while the truck is moving. Investigators tested the parking brake and found that it was capable of skidding four of the six tires of the empty truck, as designed. However, the parking

brake control was found in the release position and there was no indication it had been applied during the descent.

Exhaust Brake System

Investigators found that the haul truck's exhaust brake switch had been set to the "arm" or activate position. In that position, the exhaust brake would apply when the driver released the accelerator pedal to the idle position.

Investigators were unable to test the performance of the exhaust brake system due to damage incurred during the accident, but they conducted tests on some components of the control circuit for the system. The components tested were functional, including the spring return feature of the accelerator foot pedal. Investigators did not identify any defects that would have prevented the exhaust brake from functioning while the truck descended the haul road if the transmission was in gear and the truck driver released the accelerator pedal.

Retarder System

The haul truck is also equipped with a hydraulic transmission retarder, which acts inside the transmission to slow the truck when an Electronic Control Unit (ECU) determines certain operational conditions exist. It is activated in three ways: 1) by applying a foot pedal mounted on the left side floor of the cab; 2) by applying the service brake when the retarder switch on the dash has been turned on; or 3) automatically when the transmission reaches 6^{th} gear and the engine surpasses 2,400 RPM. Regardless of how the transmission retarder is activated, it can only function when the MA8 air valve is opened by the ECU.

Figure No. 1 shows the components of the ECU and how they interconnect.

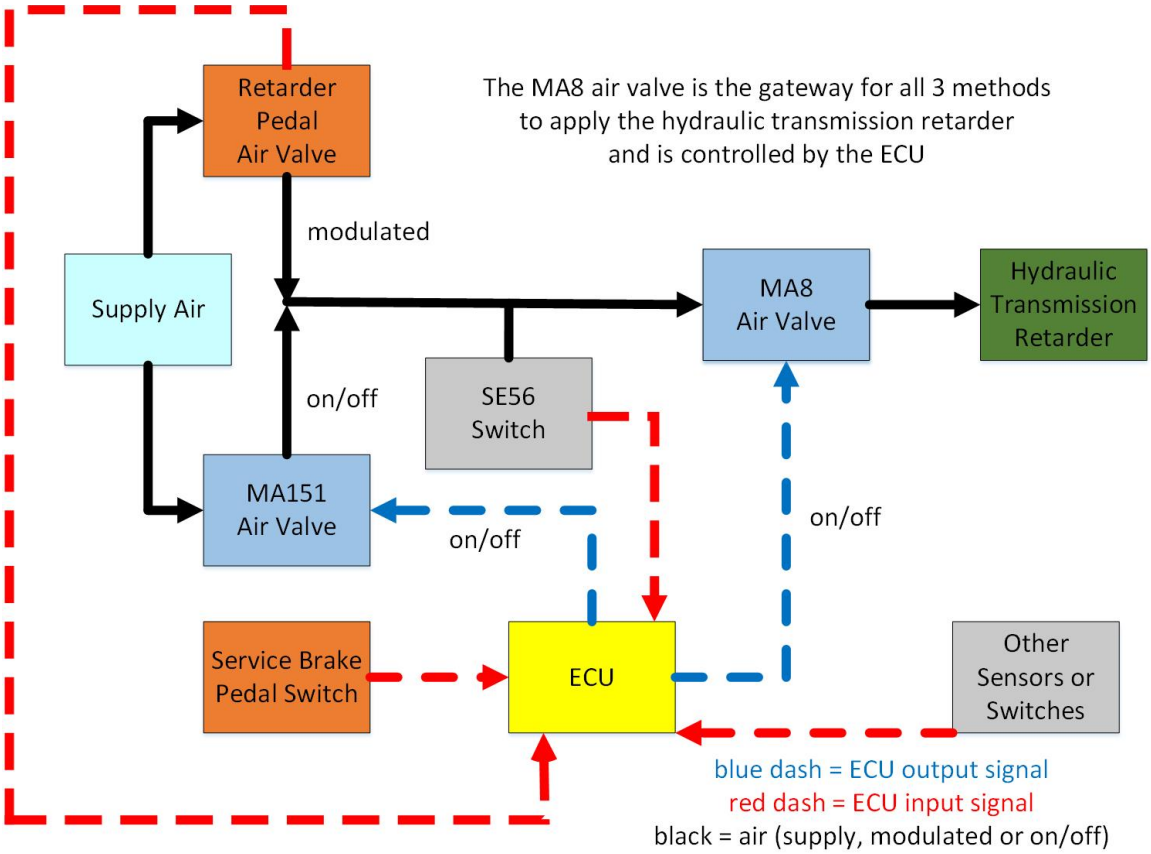

Figure 1: Illustration of the Retarder Control Circuit

Investigators were not able to test the performance of the retarder system due to damage to the truck, but they did test some components of the system's control circuit.

Investigators encountered the following defects with the retarder system: the inability of a solenoid to correctly control the MA8 air valve made all three methods of applying the transmission retarder ineffective; and a defective SE56 switch that would not allow the ECU to recognize that the truck driver was pushing the retarder pedal, making that option ineffective even if the MA8 air valve operated properly. The defects in the Retarder System contributed to the accident.

Steering System

The haul truck had an articulated steering system that used mechanical linkages to actuate a hydraulic steering control valve which then modulated two hydraulic cylinders, one on each side of the haul truck's articulation joint. A series of engine driven pumps provided hydraulic pressure to the steering valve. In addition to providing approximately 45 degrees of steering in either direction, the articulation joint arrangement had an oscillating hitch. This allowed complete independence of tractor rotation on the longitudinal axis, theoretically allowing the tractor to rotate 360 degrees with respect to the trailer. The steering wheel used mechanical linkage to provide steering inputs to the hydraulic steering valve mounted beneath the rear portion of the haul truck's cab. The trailer also used mechanical linkage to provide position

feedback of the trailer to the steering valve. The trailer position feedback linkage caused the steering valve to automatically adjust to certain operating conditions to minimize driver workload.

All of the mechanical steering linkages for the steering assembly and the hydraulic lines from the steering valve to the steering cylinders were visibly intact. Manual cycling of the steering wheel verified the spool valve for the hydraulic steering valve appropriately modulated with the steering wheel without sticking or binding with the engine off.

The haul truck also had a secondary steering pump in the event the primary steering system's pumps failed to supply adequate pressure and flow. The secondary steering pump is ground driven and the haul truck needs to move at least 2 miles per hour in the forward direction for it to operate properly.

Due to the inability to run the haul truck engine, investigators could not test either the primary or secondary steering pumps for adequate pressure and flow nor could they test the hydraulic functions of the steering valve itself while on the haul truck. Investigators did not conduct bench tests of these components.

Suspension System

All of the haul truck's suspension components were visibly intact.

Seatbelt Assembly

The operator's seat had a self-retracting lap type seat belt assembly. Both the latching mechanism and the self-retracting feature of the seat belt assembly functioned when tested. However, the seatbelt was not in use at the time of the accident, contributing to the severity of the operator's injuries.

Pre-operational Inspections of Haul Truck

Investigators reviewed the pre-operational inspection books for the haul truck. The transmission retarder pedal was documented as non-functional in 23 pre-operational inspections since August 9, 2018, but the truck continued to be used for over 260 hours. No documentation of a pre-operational inspection was found for the day of the accident.

TRAINING AND EXPERIENCE

Jerry Baller worked at this mine for 17 years and 26 weeks. A representative of MSHA's Educational Field and Small Mine Services (EFSMS) staff conducted a review of the operator's training plan and records. EFSMS determined Mr. Baller received all required training, including annual refresher training according to 30 CFR Part 46.

Investigators reviewed company policies and procedures in relation to the work being performed. The operator had inadequate policies in place at the time of the accident to address removing equipment from service when a safety defect is found.

ROOT CAUSE ANALYSIS

The accident investigation team conducted a root cause analysis to identify the underlying cause of the accident. The team identified the following root causes and the corresponding corrective actions implemented to prevent a recurrence of the accident.

Root Cause: Management did not have policies, procedures, and controls for removing equipment from service when a defect affecting safety is found.

Corrective Action: The Company developed policies and procedures for removing equipment from service when a defect is found. The workforce at the mine was retrained using the new policies and procedures.

Root Cause: Management did not enforce its written policies, procedures, and controls for ensuring all miners wear seatbelts while operating mobile equipment.

Corrective Action: The Company retrained the workforce at the mine in the use and requirements of wearing seatbelts while operating mobile equipment.

Root Cause: Management did not enforce its written policies, procedures, and controls for ensuring mobile equipment operators complete pre-operational examinations prior to operating equipment.

Corrective Action: The Company retrained the workforce at the mine in performing pre-operational examinations of mobile equipment prior to operating any equipment.

CONCLUSION

Jerry Baller, Quarry Manager, died when the haul truck he was operating traveled through a berm while descending a ramp at the bottom of the quarry road. The accident and fatality occurred because the mine operator did not: (1) maintain the haul truck's retarder system in a functional state; (2) ensure miners wear seatbelts at all times when operating equipment, and (3) inspect equipment and review maintenance logs prior to placing it in service.

ENFORCEMENT ACTIONS

Order No. 9307909 – Issued October 19, 2018, under the provisions of Section 103(k) of the Mine Act:

> *A fatal accident occurred at the McGregor Quarry on 10/19/2018. This order is being issued to protect miners and preserve evidence to facilitate the investigation. This order prohibits all activity at the McGregor Quarry until MSHA has conducted an investigation and determined that it is safe to resume normal mining activities in the area. The mine operator shall obtain approval from an authorized representative prior to resuming activities in the quarry. The 103 (k) order was issued verbally at 0011 on 10/20/2018.*

Citation No. 9392822 – Issued January 30, 2019 under the provisions of 104(d)(1) of the Mine Act for a violation of 56.14101(a)(3):

> *A fatal accident occurred at this operation on October 19, 2018 when a quarry manager operating a haul truck travelled through a berm at the bottom of the ramp on the quarry road. The transmission retarder was not functional. The retarder had been identified in the pre-operational inspection books 23 times since August 9, 2018 as non-functional. The Quarry Manager and the Mechanic Shop Manager review the pre-operational inspections of mobile equipment after every shift. This is an unwarrantable failure to comply with a mandatory standard.*

Citation No. 9392823 – Issued January 30, 2019 under the provisions of 104(a) of the Mine Act for a violation of 56.14131(a):

> *A fatal accident occurred at this operation on October 19, 2018 when a quarry manager operating a haul truck travelled through a berm at the bottom of the ramp on the quarry road. The victim was found in the haul truck without wearing a seatbelt.*

Citation No. 9392824 – Issued January 30, 2019 under the provisions of 104(a) of the Mine Act for a violation of 56.14100(a):

> *A fatal accident occurred at this operation on October 19, 2018 when a quarry manager operating a haul truck travelled through a berm at the bottom of the ramp on the quarry road. No pre-operational inspection of the haul truck was performed. No obvious defects were noted or documented in the pre-op book. No other information indicating an inspection had been completed prior to operating the equipment was found.*

Approved By: _____ Date: _____

David Weaver, District Manager

Appendix A
Persons Participating in the Investigation
(Persons interviewed are indicated by a * next to their name)

Montana Rockworks Inc.

Brad Mercord*	Owner, Production Division Supervisor
Westen Super	Health and Safety Manager
Cyndee Carter	Director of Government and Safety Compliance
Kayla Jordan	Human Resources Manager
Trevor Hewitt*	Quarry Manager
Wayne Tinkler*	Mechanic Shop Supervisor
Mickey Young	Miners' Representative

Montana Safety and Health Bureau

Jerry Laughery	Compliance Supervisor

Mine Safety and Health Administration

Ernesto A. Vasquez	Mine Safety and Health Inspector
Timothy F. Jones	Mine Safety and Health Inspector
Peter A. Del Duca	District Staff Assistant
Phillip Dahl	Mine Safety and Health Specialist (Training)
Fred T. Marshall	Mechanical Engineer

Appendix B
Victim Information

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

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:
Jerry Baller	*M*	*63*	*01 Fatal*

5. Date(MM/DD/YY) and Time(24 Hr.) Of Death:	6. Date and Time Started:
a. Date: 10/19/2018 b.Time: 15:00	*a. Date: 10/19/2018 b.Time: 10:00*

7. Regular Job Title:	8. Work Activity when Injured:	9. Was this work activity part of regular job?
149 Quarry Manager	*055 Operating a Haul Truck*	Yes	No *X*

10. Experience:	Years	Weeks	Days		Years	Weeks	Days		Years	Weeks	Days		Years	Weeks	Days
a. This Work Activity:	*17*	*26*	*4*	b. Regular Job Title:	*17*	*26*	*4*	c: This Mine:	*17*	*26*	*4*	d. Total Mining:	*17*	*26*	*4*

11. What Directly Inflicted Injury or Illness?	12. Nature of Injury or Illness:
076 Haul Truck	*370 Blunt Force Trauma from Accident*

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: *X* | First-Aid: | CPR: | EMT: | Medical Professional: | None:

16. Part 50 Document Control Number: (form 7000-1)
17. Union Affiliation of Victim: *9999* *None (No Union Affiliation)*