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

Report of Investigation

Surface Nonmetal Mine
(Limestone)

October 12, 2004

Douds Stone, Inc.
Portable Rip Rap Plant
Selma, Van Buren County, Iowa
Mine ID No. 13-02266

Investigators

William G. Dethloff III
Mine Safety and Health Inspector

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Mechanical Engineer

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OVERVIEW

On October 12, 2004, Ted W. McCarty, stockpile truck driver, age 58, was fatally injured when the truck he was operating went through a berm, traveled down a 21 foot embankment, and overturned. He was traveling down an inclined haulage road, returning from a stockpile dump with the haul truck box still full of material.

The accident was caused by the failure to maintain the braking systems on the truck in a functional condition. Policies, standards, and controls were inadequate in that examinations of the haul truck had not identified the leaking wedge-type hydraulic brake actuators and oil coated drums as a safety defect. The victim was not wearing a seat belt at the time of the accident.

GENERAL INFORMATION

Portable Rip Rap Plant, a limestone operation owned and operated by Douds Stone, Inc., was located at the Gardner Quarry in Selma, Van Buren County, Iowa. The principal operating officials were Gary L. Yates, president; and Randy J. Cox, secretary. The mine normally operated one, 12-hour shift, five days a week. Total mine employment was three persons.

Limestone was drilled and blasted from a single bench. A front-end loader placed the broken rock into a portable rip rap plant. The fines material was loaded into a stockpile truck parked under the fines conveyor. The truck hauled the fines material to the fines stockpile for further processing with a portable crushing plant. Rip rap and erosion rock were stockpiled at the plant until there was enough material to be hauled to three stockpile areas. The finished material was sold for use in the construction industry.

The last regular inspection at this operation was completed October 8, 2003.

DESCRIPTION OF THE ACCIDENT

On the day of the accident, Ted W. McCarty (victim) reported for work at 5:00 a.m., his normal starting time. McCarty, Carl L. Garrett, front-end loader operator and lead man, and Dustin J. Durflinger, excavator operator, conducted their usual duties of operating the rip rap plant.

McCarty hauled fines material to the fines stockpile. He hauled four loads to the stockpile. Garrett finished cleaning up and was waiting for McCarty to arrive back at the rip rap plant after hauling his fifth load. Garrett was parked near the rip rap plant and noticed McCarty traveling slowly down the haul road with his truck still loaded.

Garrett drove to Durflinger and told him apparently something was wrong because McCarty was returning to the plant with a loaded truck. They waited a few minutes but McCarty failed to arrive. Garrett drove to an area where he could view the haul road and saw that McCarty's haul truck had gone through the berm and was lying on its side. He went back to pick up Durflinger and drove to McCarty's truck.

Durflinger went to the haul truck and saw McCarty pinned under it. Durflinger told Garrett to go to the truck scale to call for emergency assistance.

Emergency medical personnel arrived but could not detect the victim's pulse. A wrecker, bulldozer, and an excavator were used to lift the truck during the recovery. The Van Buren County medical examiner was summoned and pronounced the victim dead at the scene. The cause of death was attributed to compressional asphyxia and multiple blunt force injuries.

INVESTIGATION OF THE ACCIDENT

MSHA was notified at approximately 8:40 a.m. on October 12, 2004, by a phone call from Carl L. McRoy, director of environmental and safety, to Chris Willett, mine safety and health inspector. An investigation was started the same day. An order was issued pursuant to Section 103(k) 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 site and equipment involved, interviewed employees, and reviewed training records, conditions, and work procedures relevant to the accident. MSHA conducted the investigation with the assistance of mine management, miners, and a haul truck service representative.

DISCUSSION

Location of the Accident

The accident occurred on the haul road leading from the quarry perimeter to the quarry floor. The road was approximately 950 feet long and 48 feet wide, with grades varying from 10 to 13 percent. The haul truck left the road and traveled beyond the bermed edge approximately 680 feet from the quarry perimeter, near the end of a 90 degree curve. The berm, constructed of broken quarry rock, was approximately 40 inches high.

Weather Conditions

The temperature at the time of the accident was 48 degrees with overcast skies.

Haul Truck

The truck involved in the accident was a 1980 Euclid Model 301TD haul truck with a gross vehicle weight of approximately 125,700 pounds that included 70,000 pounds of maximum rated payload. The truck, powered by a Detroit Diesel, 420 horsepower, Model 12V-71N, diesel engine, was equipped with an Allison automatic transmission with six speeds forward, one reverse speed, and an integral retarder.

The truck came to rest on its left side but the interior of the cab was not damaged. The broken front windshield and left side vent window were lying near the truck. The fuel and hydraulic tanks were leaking due to the position of the truck. Reportedly, the engine was not running after the truck overturned.

Subsequent testing showed that if the ignition key was turned “off” while the engine was running, the engine would continue to run. The fuel shutdown knob had to be pulled out to stop the engine.

The service brake, accelerator, and retarder foot pedals moved freely. The engine fuel shutdown control knob near the steering column was in the “pushed in”, “run” position. The transmission gear selector control was in neutral and the supplementary steering control switch on the dashboard was in the “off” position. The parking brake control knob was in the “pulled out”, “applied” position. The hand brake control on the steering column was in the “full forward”, “fully released” position. The two ends of the seat belt were not buckled together.

The truck was placed back on its wheels and the batteries were reconnected. The engine started immediately when the ignition key was turned to the start position.

Brakes

The service brake system consisted of air-over-hydraulic, drum brakes at each of the four wheels. There were four air tanks: a wet tank that received air from the compressor, a dry tank, and two brake tanks. The dry tank received air from the wet tank through a check valve and a relay valve. The two brake tanks received air from the dry tank. A dashboard air pressure gauge displayed the air pressure in the wet tank. The rated operating pressure of the air system was 105 psi to 125 psi.

The air pressure was converted to hydraulic pressure in three brake pressure converters located to the right of the operator’s cab. Each brake pressure converter consisted of an air cylinder section and a hydraulic cylinder section. The area of the air piston was approximately 15 times larger than the area of the hydraulic piston so the pressure multiplication ratio was approximately 15:1. An individual hydraulic reservoir supplied each brake pressure converter.

The hydraulic output from the brake pressure converters supply wedge-type brake actuators at each wheel. The brake actuators expand the brake shoes out against the drum when the service brake is applied. Each wheel had two wedge-type actuators, one toward the front and one toward the rear of each brake shoe assembly. The brake pressure converter near the operator’s cab supplied both the left hand and right hand front brakes. Each of the two remaining brake pressure converters supplied one brake actuator at the right rear wheel and one brake actuator at the left rear wheel in a hydraulically split arrangement.

The front right and rear left brake drum inside surfaces and brake linings were coated with oil. Since no fluids leaked onto these two drums as a result of the accident, these two brake drums were previously contaminated with oil. A crust of dirt and grit mixed with oil was present on these two brake drums and

corresponding brake linings, indicating oil had been present for some time. The source of the leakage on these two drums was the hydraulic brake actuators that leaked brake fluid onto the drums. These actuators were not damaged in the accident. Due to the oil coated drums, the service brakes at two wheels out of four (50% of the braking system) provided no functional braking at the time of the accident. This greatly reduced the stopping and holding capability of the truck, especially when it was loaded.

Immediately after the truck was placed back on its wheels in its post-accident condition, tests showed that the service brake and parking brake failed to hold the empty truck on an approximately 5 percent grade. These tests were conducted with the engine running and the air pressure in the normal operating range, as indicated by the dashboard air gauge.

Additionally, the brake line fitting connected to the rear brake actuator at the front left wheel visibly dripped brake fluid onto the inside of the brake drum near the open end of the drum when the service brake was applied. The investigators could not determine if the leaking brake fluid coated the entire drum prior to the accident because diesel fuel leaked into this drum after the truck came to rest on its left side, altering the pre-accident condition.

The oil level in the brake reservoirs was checked and showed that 10 weight oil was used. The center brake reservoir was empty and the two on the ends were almost full. The brake lining thicknesses were inspected and all were within the manufacturer's required specifications.

After the truck was up righted, the engine was started. The air pressure in the two brake air tanks and in the dry tank would build to no more than 15 psi while the dashboard gauge indicated 120 psi. The only tank pressurized to 120 psi was the wet tank. This was determined by reading the pressure in each tank with a calibrated pressure gauge. The drain valves in the air tanks were opened and over a gallon of water and sludge escaped from the wet tank.

The check valve and relay valve assembly between the wet and dry tanks was removed, inspected, and found to be full of sludge. After cleaning and reinstalling the valves, air pressure built up to the rated operating pressure of 105 psi to 125 psi in all four air tanks.

With 110 psi of air pressure established in all four tanks, the hydraulic pressure delivered to the brake actuators when the service brake was fully applied, was measured. The brake actuators for the rear axle brakes were receiving the correct operating pressure of approximately 1600 psi.

The hydraulic pressure to the front brake actuators was 450 psi instead of the expected 1600 psi. Since braking force is proportional to the hydraulic pressure, the low pressure in the actuators reduced the truck's stopping and holding

capability. Brake fluid was added to the center brake reservoir and the front brakes were bled at three of the four brake actuators on the front axle; however, low hydraulic pressure still continued. The front brake actuator at the front right wheel could not be bled due to a seized bleeder fitting so the line to this actuator was disconnected and plugged. When the system was re-bled, the remaining wheel cylinders on the front axle received the correct operating pressure.

Sludge in the check valve and relay valve assembly between the wet and dry tanks was cleaned out. The truck was operated in a level area to bring the brake system to the normal operating temperature. Stall tests and grade holding tests were then conducted with the system at a normal operating pressure of 110 psi. A stall test specified in the Euclid Service Bulletin, E-H 01, dated 11/96, stated that the service brake system must have the capability to hold the truck stationary at full throttle in third gear to meet the minimum performance standard. The truck pulled through the applied brake during this test, indicating the brake system did not meet the minimum performance level specified by the manufacturer. The grade holding test was repeated. With the empty truck facing downhill on a 5 percent grade, the service brake system marginally held the truck stationary when the transmission was in neutral, but not when the transmission was placed into first gear with the engine at low idle.

The parking brake consisted of a spring-applied, air-released, drum brake on the output shaft of the transmission. The parking brake was applied by pulling a knob on the dashboard outward or could be actuated automatically if the air pressure fell below 40 psi.

A stall test specified in the Euclid Service Bulletin, E-H 01, indicated the parking brakes must have the capability to hold the truck stationary at full throttle in fifth gear to meet the minimum performance standard for operation on grades exceeding 8 percent. The truck moved during this test, indicating the brake system did not meet the minimum performance level specified by the manufacturer. A grade holding ability test showed that the parking brake did not have the capability to hold the empty truck on an approximate 3 percent grade. After the parking brake was adjusted according to the procedure described in the service manual, the parking brake held the truck stationary when the stall test was repeated. The parking brake automatically applied when the air pressure fell to 40 psi.

Steering

The primary steering system was operated by two steering cylinders for the steering linkage that turned the front wheels. This system was inspected during the investigation and operational testing revealed that no defects were found.

As described in the service manual, a supplementary steering system was provided. The service manual instructed the operator to turn the supplementary

steering control toggle switch on the dashboard to the “on” position after the engine was started. When the supplementary steering control was placed in the “on” position, the electrically driven supplementary steering pump was designed to automatically supply emergency steering pressure for the steering system if the engine stopped or the primary steering pump failed, causing a loss of hydraulic steering pressure. The recommended testing procedure for the emergency steering system described in the service manual was to place the supplementary steering switch in the “on” position while the engine was shut down. If the emergency steering pump failed to operate, the system was not functioning.

The supplementary steering system was tested according to the procedure in the service manual and did not function. Several wires from the supplementary steering pump drive motor and the flow sensing valve, which is a part of the supplementary steering system, were found to be broken.

Truck Dump Body

With the engine at low idle, the truck dump body was raised and a full load of crushed limestone was dumped. No defects were found with the dumping system.

Transmission

No transmission defects were found. With the engine idling and the transmission in neutral, the retarder was fully applied and the engine did not stall or noticeably slow down.

Seat Belt

The seat belt was found intact and operable. The belt latched and unlatched when tested.

Training and Experience

McCarty had a total of 17 years mining experience and had worked at this mine for two weeks and two days. He had received training in accordance with 30 CFR Part 46.

ROOT CAUSE ANALYSIS

A root cause analysis was conducted and the following causal factor was identified:

Causal Factor: Management policies, standards, and controls were inadequate. Examinations of the truck failed to identify the leaking wedge-type hydraulic

brake actuators and oil coated drums as a safety defect. Maintenance procedures were deficient and didn't ensure the service brake system was maintained according to the specifications required by the manufacturer.

Corrective Action: Procedures should be established that require service brake components to be inspected and maintained on a scheduled basis by a mechanic. Truck drivers should be instructed to identify visual safety defects on their truck and should routinely test the service brakes. Defects affecting the service brake system should be corrected prior to placing the truck into service.

CONCLUSION

The accident was caused by the failure to maintain the braking systems on the truck in a functional condition. Maintenance on the brake system was deficient and the truck had not been repaired or removed from operation. The victim was not wearing a seat belt at the time of the accident.

VIOLATIONS

Order No. 6154761 was issued on October 12, 2004, under the provisions of Section 103(k) of the Mine Act:

> A fatal accident occurred at this operation on October 12, 2004, when a haul truck operator traveled through a berm on the pit ramp, overturning the truck and pinning the operator beneath the truck. This order is issued to ensure the safety of all persons at this operation. It prohibits all activity on the pit ramp until MSHA has determined that it is safe to resume normal mining operations in this area. The mine operator shall obtain prior approval from an authorized representative for all actions to recover and/or restore operations to the affected area.

This order was terminated on November 30, 2004, after conditions that contributed to the accident no longer existed.

Citation No. 6174701 was issued on November 15, 2004, under the provisions of Section 104(a) of the Mine Act for violation of 30 CFR 56.14101(a)(3):

> A miner was fatally injured at this operation on October 12, 2004, when the haulage truck he was operating traveled over the berm and rolled off the elevated edge of a roadway. All braking systems installed on the truck were not maintained in functional condition. The defects included but were not limited to: the right front and left rear wheel cylinders were leaking brake fluid oil that coated the brake shoes.

This citation was terminated on November 30, 2004, when the truck was removed from the mine site for repairs.

Citation No.6174706 was issued on November 15, 2004, under the provisions of Section 104(a) of the Mine Act for violation of 30 CFR 56.14131(a):

> A miner was fatally injured at this operation on October 12, 2004, when the haulage truck he was operating traveled over the berm and rolled off the elevated edge of a roadway. The victim was not wearing the seat belt and was fatally injured when the overturned truck landed on him.

This citation was terminated on November 30, 2004, after the mine operator conducted company-wide retraining in the use of seat belts. Employees of each mine site were re-instructed that seat belts must be worn at all times while in mobile equipment.

Approved by: Date:

Steven M. Richetta
District Manager
North Central District

APPENDIX A

Persons Participating in the Investigation

Douds Stone, Inc.

Carl L. McRoy	director of environmental and safety
Darrell E. Clubb	superintendent–crew No. 2

Spreitzer, Inc.

Ira Richards	service representative

Mine Safety and Health Administration

William G. Dethloff III	mine safety and health inspector
James A. Hines	mine safety and health inspector
Ronald Medina	mechanical engineer
Belinda G. Parsons	mine safety and health specialist