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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
(Crushed & Broken Sandstone)

Fatal Powered Haulage Accident
November 25, 2014

Edwards Sand & Stone
South Sterling Quarry
Greene Township, Pike County, Pennsylvania
Mine I.D. No. 36-08183

Investigators

Thomas J. Shilling
Mine Safety and Health Inspector

Kenneth R. Jacobs
Mine Safety and Health Inspector

George H. Gardner
Civil Engineer

Ronald Medina
Mechanical Engineer

Gregory J. Mehalchick
Mine Safety and Health Specialist (Training)

Originating Office
Mine Safety and Health Administration
Northeast District
178 Thorn Hill Road, Suite 100
Warrendale, Pennsylvania 15086
Donald J. Foster Jr., District Manager

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OVERVIEW

On November 25, 2014, James P. Crane, Truck Driver, age 67, was killed while operating a haul truck. Crane backed the haul truck to the edge of an overburden dumpsite and started to raise the truck's bed to dump a load of material. The bank failed, causing the truck to overturn and fall 30 feet below.

The accident occurred due to management's failure to ensure examinations were conducted periodically at the dumping location throughout the shift as changing conditions warranted. Management also failed to ensure that loads were dumped a safe distance back from the undercut edge of the overburden stockpile.

An excavator removed material from the toe area of the overburden stockpile as material was being dumped from the haul truck at the top. Removing material from the pile steepened the slope angle from 30 to 39 degrees, creating an unstable condition at the dump site. The loaded haul truck backed very close to the edge of the overburden stockpile where the weight from the truck caused a localized failure and loss of ground under the back wheels of the loaded truck. As the rear of the truck dropped, the downward and lateral momentum caused it to flip over onto the cab, landing approximately 30 feet down the slope of the overburden stockpile.

GENERAL INFORMATION

South Sterling Quarry, a surface crushed sandstone operation owned and operated by Edwards Sand & Stone, is located in Greene Township, Pike County, Pennsylvania. The principal operating official is George F. Edwards Jr., President. The mine typically operates one 9-hour shift, five days per week. Total employment is 17 persons.

Sandstone is drilled and blasted from a multiple-bench quarry. A front-end loader is used to load haul trucks which transport the broken sandstone to a primary plant for processing. There the material is crushed, sized, washed and sold as construction aggregates.

Stripping overburden is included as part of the mining cycle at the quarry. An excavator is used to remove overburden from an elevated bench and load it into a haul truck which transports the material to an established dump site on top of an overburden stockpile. A second excavator is used on a bench located on the downstream slope of the overburden stockpile about ten feet above the toe. It removes material from the slope directly below the dump site and feeds it into a remotely-controlled mobile screening plant located near the toe. The portable plant is used to separate the material into three sizes which are placed in respective stockpiles using a front-end loader.

The Mine Safety and Health Administration (MSHA) completed the last regular inspection at this operation on October 17, 2014.

DESCRIPTION OF ACCIDENT

On November 25, 2014, James P. Crane (victim) reported for work at 7:00 a.m., his normal starting time. Michael R. Nebraski, Plant Manager, instructed Crane to operate a haul truck to transport material from the overburden bench to the overburden dump site. Afterward, Crane began hauling successive loads of material as instructed. At approximately 1:15 p.m., Crane hauled a load of material from the overburden bench to the top of the overburden stockpile and backed the haul truck into the dump site. At that time, Egon E. Hussman, Excavator Operator, was feeding material into the portable screening plant located at the base of the overburden stockpile. Hussman noticed Crane's haul truck was not approaching the dump point squarely. He sounded the excavator's horn and raised its bucket, attempting to stop Crane; however, Crane's truck continued to back up. The bank collapsed and Hussman turned the excavator and trammed it away from the falling haul truck.

Ronald C. Heffner, Front-end Loader Operator, was stockpiling sorted material from the portable screening plant when he saw Crane's haul truck falling over the dump site. Heffner immediately radioed for assistance and parked his machine. When Hussman swung his excavator around, he saw Heffner running toward the overturned haul truck. When Heffner arrived at the truck, he found Crane attempting to crawl out of the window of the cab and helped him get out of the cab.

When Mark L. Courtright, Front-end Loader Operator, heard Heffner's call for help, he radioed the mine office and asked George F. Edwards III, Asphalt Plant Manager, to call 9-1-1 for emergency assistance. Courtright drove to the overburden stockpile where he and Heffner assisted Crane until emergency medical services arrived at 1:23 p.m. At 2:24 p.m., Crane was transported by a life flight helicopter to a hospital in Scranton, Pennsylvania. Crane died en route to the medical facility. The cause of death was attributed to multiple blunt force trauma injuries.

INVESTIGATION OF THE ACCIDENT

MSHA was notified of the accident at 2:34 p.m. on November 25, 2014, by a telephone call from George F. Edwards Jr., President, to the National Call Center. The National Call Center notified Kevin T. Hardester, Staff Assistant, and an investigation was started the same day. An order was issued under provisions of Section 103(j) of the Mine Act. This order was later modified to Section 103(k) of the Mine Act after the arrival of an Authorized Representative at the mine site.

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 mine management, employees, and local and State law enforcement.

DISCUSSION

Location of the Accident

The accident occurred at an overburden dump site. Stripping overburden is included as part of the mining cycle at the quarry (see Figure 1). An excavator is used to remove overburden from an elevated bench and load it into a haul truck on a bench below (see Figure 2). The loading area is approximately 800 feet from the established dumping location. The first 525 feet is predominantly level and the remaining 275 feet is sloped downward between 16.5 and 21.5 percent toward a dumping area (see Figure 3).

As a haul truck approaches the dump site, it must turn at least 90 degrees to the right, reverse direction, back to the edge, and dump (see Figures 4 and 5). The haul truck has to back to the dump point on a radius of approximately 25 feet (as measured from tire rutting shown in Figure 5) and then begin to dump material. The immediate approach to the dump site is sloped downward approximately 1.5 percent toward the edge.

A second excavator is used on a bench located on the downstream slope of the overburden stockpile about ten feet above the toe. It removes material from the slope and feeds it into a remotely-controlled mobile screening plant located near the toe (see Figure 6). The plant is used to separate the material into three sizes (cobbles, gravel, and fine soil). After separation, the materials are placed in stockpiles using a front-end loader (see Figure 7).

The overburden material consists primarily of cohesive soil material. Cobbles and gravel comprise relatively smaller fractions of the material. Though loose and cohesive, the materials on the slopes of the stockpile naturally repose to an angle of approximately 30 degrees. Where it had been loaded out the toe area, the slope had steepened to about 39 degrees extending to the immediate dump site (see Figures 8 and 9).

The material directly beneath the back tires of the haul truck at the dump point failed, sliding away approximately 6 to 8 feet back from the edge, 18 feet across the dump, and 10 feet down the steepened slope (see Figure 10). The weight of the loaded haul truck triggered this localized failure beneath the haul truck's back wheels, causing the haul truck to overturn and land on its roof approximately 30 feet down the slope at a slight angle, with the operator side slightly further downslope.

The remaining berms on each side of the dump site were approximately 18 inches high. The material comprising the berms (which was the same as the loose overburden material being dumped) was soft, loose, and cohesive. On the day before the accident, the area had received approximately 1.4 inches of rain. Deep tire rutting at the surface of the dump area indicated the overburden material was still wet. Tire imprints remaining on the surface of the dump area clearly indicated the material used to construct the berms had little strength and could be easily penetrated by the tires of the moving truck. A noncontributory citation was issued. Cracking of the ground surface in the dump area was also evident (see Figure 11).

Equipment

1. **General Information:** The haul truck involved in the accident was a 1994 Euclid Model R35 324TDC, rigid frame, off-highway truck. The truck was powered by a 6-cylinder, Cummins 18.8 liter, turbocharged diesel engine. The truck was 26-feet 11-inches long, 12-feet 1-inch wide and 13-feet 5-inches high. The rated maximum gross machine weight was 146,000 pounds, the empty weight was 65,100 pounds, and the payload capacity was 80,900 pounds.

2. **Truck Conditions Found:** Immediately after the truck was up righted, the control positions were noted. The transmission selector lever was in D (Drive). The emergency and load/dump brake toggle switch was found in the "brake applied" position. The park brake, which was designed to automatically apply when the air pressure dropped below 40 psi, was found in the "brake applied" position. The service brake pedal, retarder pedal, and throttle pedal operated freely.

3. **Repairs Made to Allow Testing:** After the truck was recovered, damage caused by the accident was repaired to allow operational testing. Mine personnel replaced the batteries and added fluid to the brake reservoirs, the transmission, and the hydraulic system to replace fluid that leaked out while the truck was upside down.

4. **Transmission Design and Testing:** The truck had an electronically controlled, automatic transmission with six forward speeds, neutral, and two reverse speeds. The shift control lever provided automatic shifting up to the gear position selected by the operator, but no higher. In the "D" position, the transmission started in first gear and automatically upshifted as the speed increased. When tested, the transmission gear selector operated to shift the truck into forward and reverse gears as described in the operator's manual.

5. **Steering System Design and Testing:** Two double-acting cylinders acted to steer the front wheels. Supplementary steering was provided by an automatic, electric-battery driven pump circuit that supplied hydraulic pressure to steer the front wheels if engine power was lost. A supplementary steering on-off switch was provided inside the operator's cab. The operator's manual instructed the operator to turn this switch to the "on" position immediately after starting engine and to turn it to the "off" position just prior to shutting the engine down when parking the truck. The truck was maneuvered through a number of left and right turns and no steering deficiencies were found. The supplemental steering system functioned when tested and operated as described in the operator's manual.

6. **Throttle Pedal Testing:** The throttle pedal operated freely and returned to the low idle position when released.

7. **Braking System Overview:** The truck was equipped with a service brake, an emergency and load/dump brake, a parking brake, and a retarder.

8. **Service Brake System Design and Testing:** A foot-operated valve controlled a dual circuit, air-over-oil service brake system. It had one circuit for the front dry disc brakes and another

circuit for the rear axle wet disc brakes. The service brake pedal moved freely throughout its range of motion and returned to the brake released position when foot pressure was released. When tested, the service braking performance was above the minimum acceptable performance level and was in the preferred performance range as specified by Euclid for an R35 truck with dry caliper-disc front brakes and wet disc rear brakes. The brake linings on the dry disc front brakes exceeded the minimum lining thickness specified by Euclid. Both of the front axle brake discs exceeded the minimum Euclid disc thickness specification. No braking system leaks were found. The brake discs were dry and clean with no oil contamination. No service brake deficiencies were found when the truck was operated and numerous stops were made. An additional test showed the service brake had the ability to stop and hold the empty truck on a 15% test slope.

9. **Emergency and Load/Dump Brake Design and Testing:** The truck was equipped with an on-off toggle switch for the emergency and load/dump brake. This switch was designed to apply the rear brakes at full pressure. The Euclid operator's manual stated that this switch should be used to hold the attended machine stationary for loading, dumping, and waiting. The emergency and load/dump brake control functioned to apply and release the emergency and load/dump brake. When tested, the emergency and load/dump brake had the ability to hold the empty truck on a 15% test slope.

10. **Parking Brake Design and Testing:** The parking brake was a spring actuated, air released, driveline drum brake mounted on the rear of the transmission. A push-pull hand control for the parking brake was located on the dashboard. The parking brake was also designed to automatically actuate if the air pressure dropped to 40 +/- 5 psi. The parking brake control functioned to apply and release the parking brake. When tested, the parking brake had the capability of holding the empty truck on a 15% test slope.

11. **Retarder System Design and Testing:** A foot operated valve controlled the air/oil actuation of the same wet disc brakes used by the service braking system. The operator could vary the retarding force by varying how far the retarder pedal was depressed. The retarder pedal functioned to apply and release the retarder. When tested, the retarder had the capability of holding the empty truck on a 15% test slope.

12. **Compressor Governor and Low Air Warning Tests:** The compressor cut-in and cut-out pressures, when tested, were 105 psi and 130 psi which was in the correct operating range as specified by Euclid. The truck was equipped with a wig-wag low air pressure warning device at the top of the windshield. When tested, the wig-wag arm dropped into the operator's field of view when system pressure was reduced to 95 psi, which was in the correct operating range as specified by Euclid.

13. **Seat Belt:** The seat belt latched and unlatched when tested. The investigators could not determine if Crane was wearing a seat belt at the time of the accident because he climbed out of the cab after the accident.

Summary

No problems were found with the haul truck's transmission, steering system, throttle pedal, braking systems, or the retarder that would have restricted the ability of the driver to control the truck at the time of the accident.

Weather

On the day of the accident, weather conditions were clear with an average temperature of 46 degrees Fahrenheit. Sunrise was 6:59 a.m. Average wind speed was 14 mph with gusts up to 39 mph. On November 24, 2014, the day before the accident, the recorded total rainfall for the area was 1.42 inches. The investigators determined that the resultant wet conditions present at the overburden dump site, due to previous rainfall in the area, was a contributing factor in the accident.

Examinations

Management failed to inspect the dump area periodically throughout the shift as changing conditions warranted. Persons responsible for visually inspecting the dump area prior to work commencing did not recognize clear evidence the ground would not support the mobile equipment. This evidence included loose, wet, cohesive material that had been significantly steepened by excavating material from the toe of the overburden dump area. Cracks were also found on the surface at the top of the dumping location. The person examining the dumping location should have recognized the instability of the dump area and should have required that loads of overburden material be dumped a safe distance back from the edge.

TRAINING AND EXPERIENCE

James P. Crane had 10½ years of mining experience as a truck driver, all at this mine. A representative of MSHA's Educational Field Services reviewed the mine operator's Part 46 training records for Crane. He had received all required training.

ROOT CAUSE ANALYSIS

The investigators conducted a root cause analysis and identified the following root causes:

Root Cause: Management failed to inspect the dumping location periodically throughout the shift as changing conditions warranted. Material had been loaded from the stockpile directly below the dump location which steepened the slope angle and reduced the stability.

Corrective Action: Management established policies and procedures to ensure that dumping locations are inspected at the beginning of the shift and during mining operations for signs of slope instability. The top of the dump area is to be examined for cracks, unstable ground, and sunken or soft areas. The load-out area is to be examined for signs of undercutting and over steepening of the slope. All mobile equipment operators were trained in these new policies and procedures.