MAI-2012-01

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

REPORT OF INVESTIGATION

Surface Nonmetal Mine
Cement

Fatal Powered Haulage Accident
January 27, 2012

Security Quarry
Holcim (US) Inc.
Hagerstown, Washington County, Maryland
Mine I.D. No. 18-00019

Investigators

Reecle C. Horn
Mine Safety & Health Inspector

Gary C. Merwine
Mine Safety & Health Inspector

F. Terry Marshall
Mechanical Engineer

Rick Swartz
Mine Safety and Health Specialist

Originating Office

Mine Safety and Health Administration
Northeast District
Thorn Hill Industrial Park
178 Thorn Hill Road, Suite 100
Warrendale, Pennsylvania 15086-7573
Donald J. Foster, Northeast District Manager

OVERVIEW

On January 27, 2012, Herman L. Weaver, Equipment Operator, age 69, was killed when the skid steer loader he was operating traveled into a 5-foot deep water hole. He was using a 10-foot scraper, mounted on the front of the loader, to clean a tailpiece on a belt conveyor when he backed the loader into a stream bed. Weaver could not drive the loader back to the road because he was unable to gain the traction needed to exit the stream bed. He then backed up the loader, attempting to get back to the road at another location. The loader traveled in reverse about 150 feet, went into the water hole, and overturned. Weaver was trapped in the loader's cab and drowned.

The accident occurred due to management's failure to provide berms where the skid steer loader went over a drop-off into the stream bed. Additionally, management failed to provide barricades or warning signs at the water hole where the hazard was not immediately obvious to the victim.

GENERAL INFORMATION

The Security Quarry is a cement operation, owned and operated by Holcim (US) Inc., located in Hagerstown, Washington County, Maryland. The principal operating officials are Bernard Terver, Chief Executive Officer, James Joyce, Corporate Manager of Occupational Health, and Fernando Valencia, Plant Manager. The mine operates three eight hour shifts, seven days per week. Total employment is 91 persons.

Material is mined from a four bench open pit and extracted by drilling and blasting. Material is loaded into haul trucks, with a front-end loader, and transported to a primary crusher. The material is transported from the primary crusher on belt conveyors for additional processing. Material is then used in the production of cement. The final product is transported from the mine by rail and bulk trucks.

The Mine Safety and Health Administration (MSHA) completed the last regular inspection at this operation on January 26, 2012.

DESCRIPTION OF ACCIDENT

On the day of the accident, Herman L. Weaver Jr., (victim) reported to work at 6:00 a.m., his normal starting time. Weaver spent the day operating a skid steer loader, cleaning around the plant. At approximately 4:30 p.m., Dale Hurd, Yard Supervisor, instructed Robert E. Lockley, Terry L. Kinzer, and William T. Keith, Yard Laborers and Thomas R. Schellhase, Dust Truck Driver, to clean the material buildup at the #1 belt tailpiece. When they arrived at the tailpiece, Weaver was already cleaning up using the scraper on the loader.

While removing the material, Weaver backed the loader 23 feet on the road and traveled off the road dropping off approximately 18–20 inches into a stream bed. The water in the stream measured approximately one foot in depth. Unable to gain the traction necessary to exit the stream bed, Weaver decided to travel to another location in an attempt to re-enter the road. Weaver traveled in reverse for approximately 67 feet and stopped the loader.

Weaver's coworkers thought he would attempt to drive the skid steer out of the water at this location however, he began to travel in reverse once again. Hurd began yelling at Weaver to stop but apparently he did not hear Hurd's calls. The loader traveled an additional 54 feet in reverse and into an approximately 5-foot deep water hole previously dug in April 2011. The loader overturned onto its side and completely submerged into the water.

Keith and Hurd arrived first at the scene and attempted to extricate Weaver from the loader. Their attempts were unsuccessful due to the loader's lifting arms blocking the front door of the loader. A pickup truck was used unsuccessfully in an attempt to pull the

skid steer loader from the water hole. Another front-end loader was brought to the scene and pulled the submerged skid steer loader from the water.

Weaver was removed from the cab of the loader and Schellhase immediately started Cardiopulmonary Resuscitation (CPR). Emergency medical personnel arrived and transported Weaver to the Meritus Medical Center in Hagerstown, Maryland, where he was pronounced dead at 5:46 p.m. by Dr. Jonathan Lee. The cause of death was attributed to drowning.

INVESTIGATION OF THE ACCIDENT

MSHA was notified of the accident on January 27, 2012, at 4:51 p.m. by a telephone call to MSHA's National Call Center from Peter Nassif, Human Resources Manager. The National Call Center notified Victor Lescznske, Supervisory Special Investigator, and an investigation started the same day. To ensure the safety of all persons, an order was issued pursuant to 103(j) of the Mine Act. Upon the arrival of the first authorized representative at the mine site, the order was modified to section 103(k) of the Mine Act.

MSHA investigators traveled to the mine, conducted a physical inspection of the accident scene, interviewed employees, and reviewed conditions and work procedures relevant to the accident. MSHA conducted the investigation with the assistance of mine management, mine employees, miners' representative, Maryland State Police, and Washington County Sherriff's Department.

DISCUSSION

Location of Accident

The accident occurred at a 5-foot deep water hole in a stream bed located on the east side of the #1 belt conveyor. The water hole, excavated for a sump, measured approximately 11 feet wide by 13 feet long. The stream bed is used to drain water from the quarry area of the mine.

Weather

The conditions on the day of the accident were partly cloudy, light winds and temperatures in the mid-40 degrees Fahrenheit. Weather was not considered a factor in the accident.

Equipment

1) Machine Information

The skid steer loader involved in the accident was a 2000 Caterpillar model 226 rubber tired loader equipped with a Caterpillar 3034 diesel engine with a gross rating of 58 horsepower at 2,600 RPM. The loader had a hydrostatic drive system with two hydraulic drive motors and chain type final drives, one for each side of the machine, and a rated operating capacity of 1,500 pounds (material capacity) with a 60-inch dirt bucket. The machine had a maximum speed of approximately 7 miles per hour in both the forward and reverse directions.

The loader was equipped with an enclosed roll-over protective structure (ROPS) cab, a Level I falling object protective structure (FOPS), a lap type seat belt, a quick attach hitch, and a mine design had installed a working tool (scraper) attachment. The operating weight of the machine at the time of the accident was approximately 6,400 pounds. This weight included a quick attach mounting plate on the loader arms and a homemade scraper attachment weighing 400 pounds. The overall length of the scraper attachment was approximately 10 ½ feet. The center of gravity of the homemade scraper attachment was generally along the radial axis of the scraper tube and was determined to be approximately 40 inches (approximately 3 ½ feet) forward of the quick attach hitch.

The measured weight and the approximate location of the center of gravity of the scraper attachment were compared to the specifications of the machine and working tool attachments listed in the Caterpillar Performance Handbook and the Caterpillar Operation and Maintenance Manual. In comparison, the moment loads induced on the machine due to the measured weight and approximate location of the center of gravity of the scraper did not exceed that of other working tool attachments manufactured and offered by Caterpillar for this model machine.

2) Machine Condition

The skid steer loader sustained relatively minor damage during the accident which included structural damage to the FOPS portion of the ROPS and the cab door, a deflated left rear tire, and water damage to the cab interior and engine components.

After a general inspection of the machine, the investigators determined the machine could start and operate with few repairs. The repairs performed during the field investigation included changing the left rear wheel assembly, the engine oil and filter, the hydraulic system filter, the engine intake air filters, the engine starter and the battery. The machine was subsequently started and operated to conduct operational tests on various systems.

3) Power Train and Hydrostatic System (Service Brakes & Steering) Design

Power from the diesel engine was provided to the hydrostatic drive system using independent right and left side drive systems. Each drive system transferred power to its respective side (left or right side wheels) using a hydrostatic pump to supply power to a drive motor which then drives the wheels using a chain drive to each of the front and rear wheels (both at the same speed) on its respective side of the machine.

In the drive system used, the engine speed was typically set at a constant speed using a governor control. The direction and travel speed of the machine was controlled by a single joystick pilot type control lever on the left side of the operator's seat referred to as the speed and direction control (SDC) joystick. The SDC joystick was spring returned from any position to the center (hold) position. With the SDC joystick in the hold position, the hydrostatic brakes (service brakes) were applied.

A governor control lever and an accelerator foot pedal, both located in the forward right portion of the cab, control the engine speed. During operation, the operator can set a constant engine speed using the governor control lever and increase the engine speed using the accelerator foot pedal. Once releasing the accelerator foot pedal, the engine speed returned to the setting of the governor control lever.

Machine travel in a neutral (straight) steer condition was controlled by moving the SDC joystick longitudinally within the cab (front to rear) in the desired travel direction (forward or reverse) and proportional to the desired speed. The SDC joystick moves laterally (side-to-side) to provide spot turn steering (left or right side drive motors rotating with the opposite side drive motor providing maximum hydrostatic braking) in either corresponding direction (left spot turn or right spot turn) and diagonally in four directions. This diagonal action provided forward left and forward right turn steering and reverse left and reverse right turn steering (left and right side drive motors rotating in the same direction but at different relative speeds).

Returning the SDC joystick toward the center (hold) position controlled the hydrostatic service brakes. The degree of which the hydrostatic brakes are applied depended on how fast the loader operator returns the SDC joystick from its original position to center.

4) Power Train and Hydrostatic System (Service Brakes & Steering) Testing

Operational tests, with the skid steer loader engine running, indicated the engine speed proportionally modulated with the governor control lever position. The accelerator foot pedal control moved freely throughout its range, increased engine speed proportionally with downward foot pedal position, and returned to the up position without sticking or binding when released, allowing the engine speed to return to the governor control lever setting.

Various operational tests of the hydrostatic system (service brakes & steering) using the SDC joystick were conducted on level ground during the investigation. The tests

included stopping the machine from various speeds and both travel directions using the SDC joystick, conducting left turn and right turn steering maneuvers, and conducting left spot turn and right spot turn steering maneuvers. The SDC joystick moved freely and returned to the hold position when released from the selected speed and direction positions without sticking or binding. Operational tests of the skid steer loader indicated the hydrostatic system proportionally modulated the drive wheels and proportionally applied the hydrostatic service brakes corresponding to the SDC joystick position.

5) Design and Testing of Starting Interlock

The machine was equipped with a starting interlock that prevents the engine from starting with the key switch without the seat occupied and the operator armrest lowered. After initially starting the engine, the parking brake remained applied until the parking brake switch was manually cycled with the seat occupied and the operator armrest lowered.

Tests conducted during the investigation confirmed that the starting interlock functioned and the parking brake system remained in the applied state after engine startup until the parking brake switch was manually cycled with the seat occupied and the operator armrest lowered.

6) Parking Brake and Hydraulic Interlock Design and Testing

The machine was equipped with spring-applied hydraulic released parking brake assemblies on each drive motor (one each for both the left and right side drives) that were manually controlled using a spring returned rocker type switch located in the upper left portion of the cab (left side overhead control panel near the key switch). The machine had a hydraulic control interlock feature keeping the SDC and implement joysticks disabled whenever the parking brake was applied. The parking brake system was designed to remain applied upon engine startup until the parking brake switch was manually cycled with the seat occupied and the armrest lowered. In addition, the brake system will automatically apply in specified conditions including:

- When the key switch is turned to the off position with the engine running and the park brake released. When automatic application due to this occurs, the parking brake switch must be manually cycled with the seat occupied and the operator armrest lowered to release the parking brake after the key switch is used to restart the skid steer loader.

- When the operator armrest is lifted with the seat occupied, the engine running, and the parking brake released. When automatic application due to this occurs, the parking brake switch must be manually cycled with the seat occupied and the operator armrest lowered to release the parking brake.

- When the operator is out of the seat for approximately 5 seconds with the operator armrest lowered, the engine running and the parking brake released. When automatic application due to this occurs, the parking brake switch must be

manually cycled with the seat occupied and the operator armrest lowered to release the parking brake.

Tests conducted during the investigation confirmed that the hydraulic control interlock feature functioned whenever the parking brake was applied with the engine running. The automatic application features of the parking brake system with the engine running also functioned when tested. The parking brake automatically applied when:

- The key switch was turned to the off position with the seat occupied, the operator armrest lowered, the engine running, and the parking brake released.
- The operator armrest was raised with the seat occupied, the engine running, and the parking brake released.
- The operator raised out of the seat for approximately five to six seconds with the operator armrest lowered, the engine running, and the parking brake released.

Tests conducted during the field investigation confirmed that after the parking brake system automatically applied the parking brake, the parking brake switch had to be manually cycled with the engine running, the seat occupied, and the operator armrest lowered to release the parking brake.

All four tires of the skid steer loader skidded on dry concrete, as the machine was pulled and the engine of the skid steer loader stopped (turned off with the key switch).

7) Seat Belt

The operator's cab had a lap type seat belt assembly installed. The seat belt assembly was visibly intact and the latching mechanism functioned when tested.

Summary of Findings

No machine defects were identified that would have prevented the skid steer loader operator from maintaining control of the skid steer loader or that contributed to the severity of the accident:

- The starting and hydraulic control interlocks functioned.

- The engine could not be started using the key switch without the seat occupied and the operator armrest lowered.

- The parking brake system remained in the applied state after engine startup until the parking brake switch was manually cycled with the seat occupied and the operator armrest lowered.

- The speed and direction control (SDC) joystick would not function with the engine running without the operator armrest lowered and the parking brake released.

- The engine speed proportionally modulated with the governor control lever position. The accelerator foot pedal control moved freely throughout its range, increased engine speed proportionally with downward foot pedal position and returned to the up position without sticking or binding when released, allowing the engine speed to return to the governor control lever setting.

- The hydrostatic system proportionally modulated the drive wheels and proportionally applied the hydrostatic service brakes corresponding to the SDC joystick position. No defects were found with the hydrostatic braking or steering systems or any of the brake or steering control systems to include the hydrostatic service brake, the parking brake and the steering control systems.

- The automatic application features of the parking brake system with the engine running functioned in that the parking brake automatically applied when:

    - The key switch was turned to the off position with the seat occupied, the operator armrest lowered, the engine running and the parking brake released.

    - The operator armrest was raised with the seat occupied, the engine running and the parking brake released.

    - The operator raised out of the seat for approximately five to six seconds with the operator armrest lowered, the engine running and the parking brake released.

- The measured weight and the approximate location of the center of gravity of the home made scraper attachment were compared to the specifications of the machine and working tool attachments listed in the Caterpillar Performance Handbook and the Caterpillar Operation and Maintenance Manual. In comparison, the moment loads induced on the machine due to the measured weight and approximate location of the center of gravity of the homemade scraper did not exceed that of other working tool attachments manufactured by Caterpillar for this model machine.

- A lap type seat belt assembly was installed in the operator's cab. The seat belt assembly was visibly intact and the latching mechanism functioned when tested.

References:

1. Caterpillar Performance Handbook, Edition 32, October 2001, section 4.
2. Caterpillar Operation and Maintenance Manual, Model 226 Skid Steer Loaders, SEBU7468-04, April 2002, pages 33-49.

Training and Experience

Herman L. Weaver Jr., victim, had 48 years, one week, and 3 days of experience all at this mine. A representative of MSHA's Educational Field Services staff conducted an in-depth review of the mine operator's training records. Weaver's training records were examined and found to be in compliance and up-to-date with MSHA training requirements.

ROOT CAUSE ANALYSIS

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

Root Cause: Management failed to install berms on a road near a stream bed. Management failed to post appropriate signage at a water hole where a safety hazard was not immediately obvious to persons.

Corrective Action: Management installed a berm to the mid-axle height of the largest equipment traveling the road and posted signs at the water hole.

CONCLUSION

The accident occurred due to management's failure to provide berms where the skid steer loader went over a drop-off into the stream bed. Additionally, there were no barricades or warning signs at the water hole where the hazard was not immediately obvious to the victim.

ENFORCEMENT ACTIONS

Issued to Holcim (US) Inc.

Order No. 8647882 - Issued on January 27, 2012, under the provisions of Section 103(j) of the Mine Act:

An accident occurred at this operation on January 27, 2012, at approximately 4:51 p.m.. This order is being issued under Section 103(j) of the Federal Mine Safety and Health Act of 1977 to prevent the destruction of any evidence which would assist in

investigating the cause of the accident. It prohibits all activity at the old crusher haul road until MSHA has determined that it is safe to resume normal mining operations in this area. This order was initially issued orally to Peter Nassif, Human Resource Manager, by Victor Lescznske at 5:05 p.m. on this date and has now been reduced to writing.

The order was subsequently modified to Section 103(k) after an Authorized Representative arrived at the mine.

This order was terminated on February 1, 2012, after conditions that contributed to the accident no longer existed.

Citation No. 8647883 - Issued on February 6, 2012, under the provisions of 104 (a) of the Mine Act for a violation of 56.9300(a):

A fatal accident occurred at this operation on January 27, 2012, when a skid steer loader went over an 18 to 20 inch drop off from an existing road to a drainage ditch. The victim was cleaning a tailpiece with a skid steer loader when he backed the loader in the ditch. The loader traveled in reverse about 150 feet and went into a 5-foot deep water hole. There was no berm provided and maintained on the bank of the roadway where a drop-off existed that endangered the operator of the skid steer loader. The missing berm was on the east side of the No. 1 conveyor. The area that required the berm was 39 feet long.

Citation No.8647884 - Issued on January 31, 2012, under the provisions of 104 (a) of the Mine Act for a violation of 56.20011:

A fatal accident occurred at this operation on January 27, 2012, when a skid steer loader went over an 18 to 20 inch drop off from an existing road to a drainage ditch. The victim was cleaning a tailpiece with a skid steer loader when he backed the loader in the ditch. The loader traveled in reverse about 150 feet and went into a 5-foot deep water hole. There were no barricades or warning signs posted to warn persons of a hazard that was not immediately obvious to employees. The water hole was approximately 11 feet wide by 13 feet long by 5 feet deep.

This citation is a "Rules to Live By" priority standard.

Approved by, Donald J Foster

Date: 9-5-2012

Donald J. Foster
District Manager

LIST OF APPENDICES

APPENDIX A

Persons Participating in the Investigation

Holcim (US) INC.

Dale Hurd…….…...Yard Supervisor
Ralph J. Belin……..…….……Safety Manager
James T. Joyce…….……..... Corporate Occupational Health & Safety Manager
Peter Nassif…….…….Human Resources Manager
Tom Yeargan…….….. Maintenance Supervisor
Robert Baker……..……. Quarry Supervisor
Fernando Valencia……..……. Plant Manager
Mark Milani……..……...… Production Manager
John Lewis……..…..... Miners' Representative

Washington County Sheriff's Department

Daniel Faith……..……Sergeant

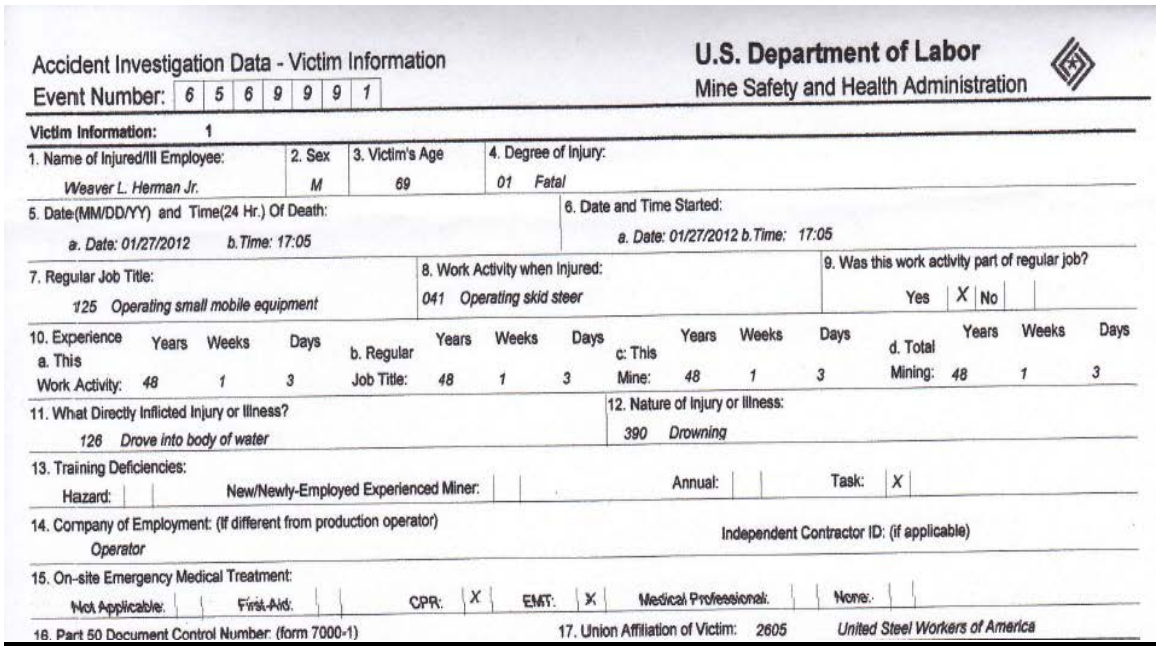
Ogletree Deakins Law Firm

William K. Doran……... Attorney

Mine Safety and Health Administration

Reecle Horn……..…Mine Safety and Health Inspector
Gary Merwine……..….Mine Safety and Health Inspector
Rick Swartz…….....Mine Safety and Health Specialist
F. Terry Marshall…….....Mechanical Engineer

APPENDIX B



Accident Investigation Data - Victim Information

Event Number: 6 5 6 9 9 9 1

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:
Weaver L. Herman Jr.	*M*	*69*	*01 Fatal*

5. Date(MM/DD/YY) and Time(24 Hr.) Of Death: *a. Date: 01/27/2012 b.Time: 17:05*

6. Date and Time Started: *a. Date: 01/27/2012 b.Time: 17:05*

7. Regular Job Title: *125 Operating small mobile equipment*

8. Work Activity when injured: *041 Operating skid steer*

9. Was this work activity part of regular job? Yes X No

10. Experience

	Years	Weeks	Days
a. This Work Activity:	48	1	3
b. Regular Job Title:	48	1	3
c: This Mine:	48	1	3
d. Total Mining:	48	1	3

11. What Directly Inflicted Injury or Illness? *126 Drove into body of water*

12. Nature of Injury or Illness: *390 Drowning*

13. Training Deficiencies: Hazard: | New/Newly-Employed Experienced Miner: | Annual: | Task: X

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: X | EMT: X | ~~Medical Professional:~~ | ~~None:~~

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

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

APPENDIX C

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