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UNITED STATES
DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION

REPORT OF INVESTIGATION

Surface Nonmetal Mine
Limestone

Fatal Machinery Accident

March 23, 2004

Jordanville Plant
Hanson Aggregates New York Inc.
Jordanville, Herkimer County, New York
Mine I.D. No. 30-00048

Investigators

Richard E. Burkley
Mine Safety and Health Inspector

James S. Hull
Supervisory Mine Safety and Health Inspector

William E. Slusser
Mine Safety and Health Specialist

Dale P. Ingold
General Engineer

Originating Office
Mine Safety and Health Administration
Northeast District
Thorn Hill Industrial Park
547 Keystone Drive, Suite 400
Warrendale, Pennsylvania 15086-7573
James R. Petrie, District Manager

OVERVIEW

On March 23, 2004, Dean P. Robertson, general foreman, age 40, was fatally injured when he was struck by an auxiliary hoist ball. Robertson was directing the set up of a 75-ton mobile crane in preparation for scheduled repairs of a feeder and hopper assembly at the primary crusher.

The accident occurred because the crane went into a two-block condition when the hoist ball and hook contacted the end of the boom while the three section boom was being extended. The auxiliary hoist cable broke and the hoist ball and hook detached and fell. The ball struck the victim and a co-worker received minor injuries when he was struck by the severed cable.

GENERAL INFORMATION

The Jordanville Plant, a surface limestone operation, owned and operated by Hanson Aggregates New York Inc., was located north of Jordanville, Herkimer County, New York. The principal operating officials were Daniel M. Meehan, vice-president, Central New York, and David Clapp, operational manager. The mine normally operated one ten hour shift a day, four days a week. Total employment was 20 persons.

Limestone was drilled and blasted from a single bench in the quarry. The blasted limestone was loaded into haul trucks with front-end loaders and transported to the crusher. The crushed rock was conveyed to the mill where it was sized and stockpiled. Finished products were sold for use in the construction industry.

The mine was shutdown for the winter since late November, 2003. No mining or processing of stone had occurred since then; however, maintenance and repair work was performed. Stockpiled material was sold as needed.

The last regular inspection conducted by MSHA at this mine site was on February 26, 2004.

DESCRIPTION OF ACCIDENT

On the day of the accident, Dean P. Robertson (victim) reported to work at approximately 7:00 a.m. His responsibilities included supervising company employees and coordinating repairs at the primary crusher facility.

Robertson met with Robert F. Kimball, crane operator, who was employed at another Hanson mine operation. Kimball had driven a rubber tired crane from Hanson's Oriskany Falls mine to the Jordanville Plant to assist with scheduled maintenance work. Robertson asked Kimball to position the crane on an inclined approach ramp to the primary feed hopper. Robertson told Scott Teachout, primary crusher operator, and Anthony Guzik Jr., quarry truck driver, to help Kimball set up the crane.

About 9:25 a.m., Teachout and Guzik helped Kimball extend the out-riggers and level the crane. Robertson then told Guzik to prepare the front center stabilizing outrigger to be used as a support for the picks.

Kimball asked Teachout to disconnect the auxiliary hoist line and multipart block line from the attached travel position at the front of the crane. Teachout completed the disconnect process and then helped Guzik with the stabilizing outrigger.

Robertson was standing at the front of the crane, directing Kimball's movement of the crane. As the crane rotated to the operator's right, the rear counterweight contacted the hydraulic breaker located at the primary crusher. Robertson directed Kimball to stop the crane and told Teachout to move the hydraulic breaker so it would not be damaged by the counterweight of the crane.

Theodore Dziadik Jr., equipment operator, who had been working at the shop, arrived at the site to take the fuel truck back to the shop. Dziadik walked with Robertson from the front area of the crane to the left side where Robertson could oversee moving the hydraulic breaker. They stopped at a point approximately mid-way between the left front and rear outriggers.

Dziadik saw the crane swing to the left and heard a loud bang. He saw the boom bounce up and down and heard something hit Robertson as the severed cable hit him in the right ear. He immediately checked Robertson and then went to the office to seek help.

As Teachout was returning from the control booth of the primary crusher, he heard a loud bang and saw the boom bounce. He observed the ball fall and strike the victim. Teachout returned to the booth where he used a radio to call the office for help.

Teachout then went back to the accident site to assist the victim but could not detect any vital signs. Realizing there could be a danger from the crane boom positioned over the accident scene, he told Kimball to swing the boom to the operator's right so it would be away from the victim.

New York State Police and local emergency personnel responded but were unable to detect any vital signs for the victim. The coroner arrived a short time later and pronounced the victim dead at the scene. Death was attributed to blunt force trauma. Dizadik was treated at the scene, transported to a local hospital, treated for minor injuries to his right ear, and released.

INVESTIGATION OF THE ACCIDENT

Randall Gadway, MSHA supervisory inspector, was notified of the accident at 10:15 a.m., on March 23, 2004, by a telephone call from David P. Kurz, safety coordinator for Hanson Aggregates New York, Inc. 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 scene, interviewed employees, and reviewed documents and work procedures relevant to the accident. The accident investigation was conducted with the assistance of mine management, employees, and the crane servicing contractor.

DISCUSSION

Location of Accident

The accident occurred on the access ramp to the primary crusher hopper in the plant area. The crane was positioned on the ramp facing in a southwesterly direction with the front outriggers approximately four feet from the berms on the left side and three feet on the right side. The rear of the crane was overhanging the hopper of the crusher.

Weather

Weather conditions at the time of the accident were sunny and about 31 degrees Fahrenheit with a light wind.

Crane Involved in the Accident

The crane was a P&H mobile crane, model number T750, manufactured in 1980. It had a fully powered three section boom comprised of one base section and three extendable sections that could be extended to 105 feet and retracted to 33 feet. The lifting capacity of the main hoist was rated at 75 tons and the auxiliary hoist was rated at 5.18 tons. The crane was hydraulically powered by diesel engine driven pumps.

The boom was equipped with an anti-two-block system. The T750 Operators Manual described the anti-two-block system as follows: "…which, when activated by a two-blocked load, automatically causes the boom hoist, telescope, winch and swing control valves to dump all inlet oil to a tank. Because there is no oil flow to the actuator, further movement of the load is stopped and either hydraulic or structural failure is prevented."

In 1996, Hanson purchased a new anti-two-block system for this crane and had it installed by a service contractor. Motion cut valves, anti-two-block switches, chains and weights, and a transmitter and receiver were installed.

In 1998, Hanson contracted with another service company (Greer) to supply and install a computerized system, MicroGuard 424 Rated Capacity Indicator, on this crane to prevent overloading. This computerized system also included anti-two-block components.

The Operator's Instruction Manual described the system as follows: "The system is intended to aid the crane operator in the efficient operation of his crane by continuously monitoring the load and warn of an approach to an overload or two-block condition. The system monitors crane functions by means of high accuracy

sensors and continuously compares the load suspended below the boom head with a copy of the crane capacity chart which is stored in the computer memory. If an overload is approached, the system warns by means of audible and visual alarms and can be configured to cause function kick out." The crane was configured to cause function kick out when the computerized system was in the "work mode".

Computerized System

Rigging/ Travel Mode

The "rigging/travel mode" was to be used only when the crane was traveling or being rigged. This mode was used to facilitate the travel of the crane or rigging by inhibiting motion-cut and audible alarms. The information screen was restricted to the display of radius, length, angle, height and precautionary messages during the time that this mode was selected.

The operator's manual for the computerized system contains a caution statement regarding the operation of the crane in the "rigging/travel mode". The statement says "The rigging/travel mode is selected as part of the carrier options. This mode is used to facilitate the rigging and travel of the crane by inhibiting motion-cut and audible alarm while selected. The information screen is restricted to the display of radius, length, angle, height and precautionary messages during the time that the mode is selected. To return to normal operation press CRANE SET UP."

Work Mode

When the crane was not traveling or being rigged, the "work mode" was to be used. When the machine was in the work mode, all alarms and motion cut valves were operational. If a two-block or overload condition would occur, the computer would activate the motion cut valves and the audible and visual alarms.

Auxiliary Hoist

The auxiliary hoist rope was rigged over the main boom through a head sheave with plates and pins to prevent the auxiliary hook and ball from being pulled back over the boom. After the accident, the left side plate was found to be bent. The distortion was probably caused by the force of the anti-two-block system weight being pulled into the sheave by the ball. Markings on the weight indicated that a two-block had occurred.

The auxiliary hoist was equipped with ¾ inch 8X19 anti-rotation wire rope which was used as a single part line at the time of the accident. Examination of the rope after the accident indicated the rope broke due to a combination of shear and tension forces. The shear force, a cutting force similar to that of a chisel,

was attributed to the anti-two-block weight being forced into the wire rope as the rope was being pulled into the head sheave.

The auxiliary hoist was equipped with a hoist ball and hook assembly that weighed about 425 pounds. Looking from the operator's cab**,** the main hoist, with its multipart line, was in the line of sight of the auxiliary line when the hoist ball was above the main hook. This configuration made it very difficult for the operator of the crane to determine the exact location of the auxiliary line ball with respect to the head sheave.

Two-Block Condition

A two-block condition occurs when the operator of the crane moves the block (crane hook) into the boom tip. The block locks against the boom tip and, unless the hoisting action is stopped, the cable breaks causing the block and load to fall. In this accident, the forces involved in separating the ball and hook from its line and the reactionary movement of the boom caused the assembly to be thrown out and away from the head sheave.

At the time of the accident, the crane's anti-two-block system hydraulic cut outs didn't function either because of an intermittent two-block switch mechanical defect, friction binding, or because the computer was in the "rigging/travel mode" rather than the "work mode".

When the computer was in the "rigging/travel mode", the red warning light activated when the two-block switch opened even though the anti-two blocking system was disarmed. The crane operator indicated that the crane was in the "work mode" at the time of the accident. Examination of the computer memory during the accident investigation indicated the crane was in the rigging/travel mode when shut down after the accident. The boom of the crane had been rotated after the accident to provide safe access for the medical personnel so the crane's computer may have been switched from the "work mode" to the "rigging/travel mode" prior to shutting it down.

Due to the inconsistent behavior of the anti-two-block switch when subjected to a variety of testing configurations after the accident, investigators could not determine whether the anti-two-block switches worked properly and consistently before the accident. In addition, the crane operator indicated he had not tested the crane's anti-two-block switch the day of the accident.

Testing the Two-Block System

Following the accident, the anti-two-block system was tested. The testing was first done by hand with the boom in a horizontal position. The anti-two-block weights, auxiliary and main, were raised, taking the weight off the switch, to

determine if the alarm would sound. The alarm worked on both hoists at this position but it took more upward movement on the auxiliary hoist weight to activate the signal.

The anti-two-block system was next tested at a 71 degree boom angle, which was the approximate boom angle at the time of the accident. To perform this testing, it was necessary to replace the auxiliary anti-two-block system weight because the weight had visible damage that probably occurred during the accident.

In addition, it was also necessary to restring the auxiliary hoist rope and reattach the ball and hook. To minimize the risk of getting the auxiliary ball into the head sheave during testing, a Styrofoam ball was attached to the rope to lift the two block switch weight. When tested in this manner at the 71 degree boom angle, the anti-two-block system didn't function.

A manlift was used to provide access to the anti-two-block switch with the boom at the 71 degree angle. The two-block switch lever arm was manually pushed which caused the anti-two-block system to activate. The anti-two-block system was then tested at lower boom angles to determine at what elevated boom angle it would cease to function properly. The switch worked at 30 and 40 degree boom angles. The anti-two-block system did not work when tested at boom angles of 50 and 71 degrees. Examination of the two-block switch did not reveal any reason for the inconsistent operation of the anti-two-block system.

Computer System Analysis

Following the accident, the MicroGuard 424 computer was turned on. It was found in the "rigging/travel mode". In this mode, the motion cut out valves and audible alarms were inhibited. Greer personnel stated that when the computer was turned on, it would display the same settings that were on it when it was previously turned off.

It should be noted the crane was rotated clockwise after the accident to move the boom away from emergency personnel. The alarms and cut outs were tested after the accident and found to be functional.

Measurements taken from the MicroGuard 424 computer, approximately two days after the accident, showed the crane boom angle was 70.9 degrees, the boom length was 46.6 feet, and the working radius was 9.9 – 10 feet. Using this information and performing a hydraulic leak test, it was estimated the crane boom angle was 71.4 degrees, the boom length was 48.1 feet, and the work radius was 10.4 feet at the time of the accident. The auxiliary hoist ball was found approximately 13 feet from the rotational center of the crane (refer to Appendix C).

ROOT CAUSE ANALYSIS

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

Causal Factor: A risk analysis to discuss the work task with the crew and identify possible hazards was not conducted before the crane was positioned on the access ramp to the hopper at the primary crusher. The crane was positioned too close to the primary crusher. As the crane was rotated to the operator's right, the rear counterweight contacted the hydraulic breaker located at the primary crusher.

Corrective Action: A job task analysis should be conducted prior to beginning repair or maintenance tasks to allow supervisors and employees to identify possible hazards and establish safe work procedures. Measures should be taken to ensure that persons are properly protected.

Causal Factor: The operator of the crane was unaware that the machine was in a two-block condition when the boom of the crane was being extended. The auxiliary hoist cable severed, causing the auxiliary hoist ball and hook to detach and fall.

Corrective Action: Procedures should be established to ensure equipment operators are knowledgeable of, and follow, the manufacturer's requirements and recommendations while operating equipment. Equipment operators should consult the operator's manual for proper procedures prior to performing tasks.

Causal Factor: No procedures were in place to to ensure persons were clear prior to the crane operator extending the boom. The victim, who had been the signal man for the crane operator, walked out of the crane operator's view. While the operator was extending the boom, he decided to swing the crane to gain visual contact with the signal man. The auxiliary hoist ball and hook contacted the end of the boom, severing the cable, causing the ball to fall and strike the victim.

Corrective Action: Procedures should be established to ensure that safe crane operating procedures are used. Crane operators should be knowledgeable of all procedures regarding safe operation of the crane they are assigned to operate.

CONCLUSION

The accident occurred because the crane operator failed to realize that the auxiliary hoist went into a two-block condition while the three section boom was being extended. When this two-block condition occurred, the hoist ball and hook contacted the end of the boom and the auxiliary hoist cable broke. The hoist ball and hook detached and fell. The ball struck the victim and a co-worker received minor injuries when he was struck by the severed cable.

ENFORCEMENT ACTIONS

Hanson Aggregates New York Inc.

Order No. 6015434 was issued on March 23, 2004, under the provisions of Section 103(k) of the Mine Act.

A fatal accident occurred and another employee was injured at this operation on March 23, 2004, when a miner was struck in the head by a drop ball that was severed from the whip line on the P & H crane, Model # T-750. This order is issued to assure the safety of all persons at this operation. It prohibits all activity at the primary crusher and ramp location until MSHA has determined that it is safe to resume normal mining operations in the area. The mine operator shall obtain prior approval from an authorized representative for all actions to recover and restore operations to the affected area and equipment.

This order was terminated on April 8, 2004. The crane, primary crusher area, and ramp area were allowed to return to normal mining operations.

Citation No. 6002958 was issued on May 12, 2004, under the provisions of Section 104(a) of the Mine Act for violation of 56.16009:

A fatal accident occurred at this operation on March 23, 2004, when a miner was struck by a metal ball and lifting hook that detached from the auxiliary hoist cable of a crane. When the operator of the P & H Crane was extending the boom, the auxiliary hoist cable's weight ball and hook contacted the end of the boom, causing the cable to break (two-block condition). The miner was positioned in the operation area of the crane boom and was not clear of the suspended load created by the weight ball and hook.

Approved by:_____ Date:

James R. Petrie, District Manager

APPENDICES

A. Persons Participating in the Investigation
B. Persons Interviewed
C. Sketch of Accident Scene

APPENDIX A

Persons Participating in the Investigation

Hanson Aggregates New York Inc.

Daniel M. Meeham…….vice president-central NY
Frank Cone……..environmental, safety & health eastern operations
Dave Clapp…….operational manager
Dave P. Kurz……..safety coordinator
William E. Shearer……superintendent of Jordanville Plant

Patton Boggs LLP

Mark N. Savit……..attorney
R. Brian Hendrix……. attorney

New York Department of Labor

Brian A. DeStefanis Jr……..safety and health Inspector
Anthony J. Klimek ……safety and health Inspector

SEI Stephenson Equipment Inc.

Thomas Nichols……technician

New York State Police

Stephen R. Cadwell…….bureau of criminal investigation

Herkimer County, New York Coroners Office

Christopher S. Moser……coroner

Mine Safety and Health Administration

Richard E. Burkley……mine safety and health inspector
James S Hull…….supervisory mine safety and health inspector
William C, Jensen…….mine safety and health inspector
William E Slusser…….mine safety and health specialist
Dale P. Ingold…….general engineer

APPENDIX B

Persons Interviewed

Hanson Aggregates New York Inc.

William E. Shearer…….. superintendent
David Clapp……. regional manager
Theodore Dziadik Jr……equipment operator
Robert F. Kimball……. crane operator
Anthony Guzik Jr……..truck driver
Richard T. Patterson Jr…...equipment operator
Richard T. Patterson Sr……crane operator
Terry Spooner……mechanic
Scott Teachout……..primary crusher operator

Cedarville EMS

Raymond Jones……..…critical care officer
Edward Prenderville…….paramedic

SEI Stephenson Equipment Inc.

Thomas Nichols…….technician