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UNITED STATES

DEPARTMENT OF LABOR

MINE SAFETY AND HEALTH ADMINISTRATION

Metal and Nonmetal Mine Safety and Health

REPORT OF INVESTIGATION

Underground Metal Mine

(Lead-Zinc Ore)

Fatal Exploding Vessels under Pressure Accident

October 2, 2018

Major Drilling Underground

Salt Lake City, Salt Lake County, UT

Contractor ID No. S580

at

Empire State Mines

Empire State Mines LLC**Gouverneur, St. Lawrence County, New York****Mine ID No. 30-01185****Investigators****Gary C. Merwine****Mine Safety and Health Inspector****Thomas J. Shilling****Mine Safety and Health Specialist****Originating Office****Mine Safety and Health Administration****Northeastern District****178 Thorn Hill Road, Suite 100****Warrendale, Pennsylvania 15086****Peter J. Montali, District Manager****OVERVIEW**

Brendan P. DeMasters, a 40-year-old Contract Foreman, died on October 2, 2018, while attempting to clean out a previously blasted, vertical drill hole with a high pressure compressed air line. While kneeling with his torso positioned over the hole, DeMasters tried to push the grout line through an obstruction approximately 30 feet down the hole. A sudden release of pressure propelled remnant stemming material from the hole, striking DeMasters in the chest.

Contract management did not take all necessary precautions to protect persons working with compressed air while cleaning out an obstruction in a vertical drill hole, including ensuring that personnel were safely positioned during the procedure.

GENERAL INFORMATION

Empire State Mines LLC, a subsidiary of Titan Mining Corporation, owns and operates Empire State Mines, a multilevel, underground lead-zinc ore mine, located in Gouverneur, St. Lawrence County, New York. Joel G. Rheault, General Manager, is the principal operating official and person in charge of health and

safety at the mine. The mine operates seven days a week with two, 10-hour shifts per day and employs 161 miners.

Major Drilling Underground is a commercial drilling firm located in Salt Lake City, Salt Lake County, Utah. The principal operating official is Denis Larocque, Director, President and Chief Executive Officer. Empire State Mines LLC contracts Major Drilling Underground to provide a variety of drilling services in the underground mine. Major Drilling Underground has a total of 101 employees with 4 employees working at Empire State Mines at the time of the accident, including the victim. Empire State Mines LLC contracts Hilltop Energy Inc. to provide blasting materials and services in the underground mine. Empire State Mines LLC also contracts with Dumas Contracting Ltd. (Dumas) who performed most of the initial rehabilitation and the initial mining operation upon the reopening of the mine. At the time of the accident there were very few Dumas employees still at the mine.

The Empire State Mines ore deposit is primarily mined using a sub-level, long hole stoping method. A top and bottom drift delineate the stope, and a dedicated long hole drilling machine drills blast holes between the two drifts. The blast holes, typically 3-inch diameter, are drilled in a fan pattern from the top drift to the bottom drift (see Figures 1 and 2). The drill holes are loaded with explosives, the stope is blasted, and the broken material falls to the bottom drift for mucking. Remote controlled load-haul-dump machines are used to remove the blasted material from the drift below the advancing stope. Haul trucks transport material from the active production areas to an underground crusher. After crushing, the broken material is hoisted to the surface via the No. 4 shaft. A surface mill and flotation concentrator produce a zinc concentrate, which is sent to a smelter to extract the base metal. The final product is sold for use in the construction and transportation industries.

The Mine Safety and Health Administration (MSHA) completed its last regular inspection of the operation on July 30, 2018.

DESCRIPTION OF ACCIDENT

On October 2, 2018, Brendan P. DeMasters (victim) began work at 7:00 a.m., his normal starting time. Shortly afterward, DeMasters, Nicholaus J. Floersch, Superintendent for Major Drilling Underground, Corey L. Tracy, Driller, and other employees of Major Drilling Underground attended a safety meeting. At 7:30 a.m., DeMasters, Floersch, Tracy and Derric Dave Paro, Manager for Hilltop Energy Inc. and a licensed blaster, entered the elevator cage and descended to the 3100 level of the underground mine. The four traveled to the MP2730 level to examine the construction of a stope on the MP2805 level.

DeMasters, Floersch and Tracy began checking the area where Empire State Mines initiated a 19-hole shot after the shift on the previous day. They determined four of the holes in the shot did not break through and drop the estimated amount of rock to the drift below, as designed. Therefore, Floersch and DeMasters decided to reload two of the holes, No. 11 and No. 12, with explosives for a subsequent blast. Both holes were cleaned out using a high pressure compressed air line (a 7/8-inch diameter, high density, polyethylene air hose referred to as a grout line), operating at a pressure of approximately 115 pounds per square inch (psi). The No. 11 hole was a wet hole and was loaded with 1.5-inch diameter stick powder emulsion. The No. 12 hole was a dry hole and was loaded with ammonium nitrate/fuel oil. Both

holes were stemmed with approximately 50 pounds of sand. When Robert R. Woodard, Blaster for Dumas, arrived at MP2730, he cleared the surrounding areas for a blast. Paro tested the blasting circuit to ensure all components were properly tied in and functional. At 11:10 a.m., Floersch, DeMasters, Tracy and Paro traveled to a safe area away from the holes and Paro initiated the blast.

After waiting approximately 30 minutes for the smoke to clear, Floersch, DeMasters and Tracy re-entered the area. Again, they decided to clean out the holes to determine if they had broken through to the drift below. Floersch used the grout line to clean the No. 12 hole, while Tracy operated the ball valve for the compressed air line, approximately 15 feet away. After cleaning the No. 12 hole for 15 to 20 seconds, Floersch inserted the grout line into the No. 11 hole. It hit an obstruction approximately 30 feet down the hole. After Floersch failed to push the grout line through the obstruction, Tracy turned off the air. DeMasters then took the grout line from Floersch and instructed Tracy to fully open the ball valve and give it full air. Floersch stepped directly behind DeMasters, while DeMasters kneeled with his torso positioned over the hole, as he tried to push the grout line through the obstruction. Approximately 15 seconds later, a loud pop sounded and the area filled with stemming material propelled from the hole. Tracy immediately closed the ball valve and Floersch ran a short distance from the hole. When Floersch turned around, he saw DeMasters lying over the hole. Floersch and Tracy ran to DeMasters and found him unresponsive, but noted he appeared to be breathing. Floersch then notified Paro and Woodard that DeMasters was badly hurt and needed help. Woodard used a nearby mine phone to notify the hoist man of the accident and request he dispatch the mine rescue team and call for an ambulance. Woodard instructed Tracy to remain at the mine phone while he returned to the accident scene.

Approximately 15 minutes later, three members of the Empire State Mines' mine rescue team arrived and rendered first aid to DeMasters while placing him on a stretcher for transport out of the mine. At 12:00 p.m., DeMasters and the team members were hoisted to the surface where they were met by the Gouverneur Rescue Squad. The rescue squad transported DeMasters to Gouverneur Hospital where he was pronounced dead at 12:33 p.m.

INVESTIGATION OF THE ACCIDENT

David R. Riggleman, Superintendent for Empire State Mines, called the Department of Labor National Contact Center (DOLNCC) at 12:20 p.m. on October 2, 2018, and notified MSHA of the accident. DOLNCC notified Joseph Denk, Staff Assistant at the Northeastern District office. MSHA issued an order under provisions of Section 103(k) of the Mine Act to ensure safety of the miners.

MSHA's accident investigation team traveled to the mine, conducted a physical inspection of the accident site, interviewed miners, and reviewed conditions and work procedures relevant to the accident. MSHA conducted the investigation with the assistance of mine management and contractors. See Appendix A for persons participating in the investigation.

DISCUSSION

Location of Accident

The accident occurred on the MP2730 level of the underground mine where a vertical stope was being developed to the MP2805 level below (see Figure 3).

Equipment Involved

The compressed air for the mine is generated by two compressors that work in tandem to supply compressed air to an approximately 4,200-gallon receiver tank on the surface. The tank has safety valves set to prevent over pressurization. The underground air supply lines are fed from the air receiver tank. A 12-inch diameter steel pipe exits the tank and runs down a shaft into the mine. The piping necks down in diameter several times from the 12-inch diameter pipe to the 7/8-inch diameter grout hose used by the contract employees to clean vertical drilled holes. As a result of the successive reductions in conduit diameter, a very high airflow velocity is created at the end of the hose. The airflow velocity measured exiting the grout hose was approximately 8,250 feet per minute (137 feet/second or 94 miles/hour).

The high-pressure air hose used by the victim to clear the borehole was a high density polyethylene (HDPE) hose used for grouting. The contract employees referred to this hose as the grout line. The 7/8-inch diameter hose had a nominal 3/4-inch internal diameter with a 1/16-inch wall thickness. The specification sheet of the hose listed a working pressure rating of 170 psi and a burst pressure rating of 820 psi. Measurements taken during the investigation showed an approximate pressure of 115 psi at the end of the grout hose. The hose was in a degraded condition with 9 hose splits and multiple kinks in the first 9 feet 4 inches of the hose, as measured from the hose opening (see Figure 4). The hose splits were consistent with a hose burst, as the damage was from the interior of the hose. As shown in Figure 5, the entire working length of the outside of the hose showed very fine, hair-like fibers probably caused by abrasions.

Drill Hole Evaluation

A borescope was used to obtain video footage of the interior of the 3-inch diameter, No. 11 vertical drill hole to evaluate conditions within the hole. The evaluation of the borehole along its entire length found no evidence of residual explosive material left in the hole. The drill hole was clear of obstruction for the first 31.5 feet in a hole that was drilled 34.25 feet below the collar. This indicates at least 2.75 feet of roof and bottom of the borehole fell into the muck in the preceding several days. The borescope showed no large cracks, voids or intersections with another borehole.

Summary

Interviews indicated one 50-pound bag of sand was used as stemming in each borehole, which Major Drilling Underground claimed would fill about 10 feet of a drilled hole. The No. 11 drill hole was a wet borehole and would have caused the sand to bond together, making it harder to clean out the hole. After reportedly blowing out approximately 3 feet of material, the contractor encountered a blockage. As the grout hose was pushed through the blockage, a pressure void was filled with the compressed air until it could no longer be contained (see Figure 6). When the air released, a column of stemming was thrust to the surface of the borehole. This evacuation of air and stemming material struck the contractor foreman,

who was in close proximity to the borehole opening, causing fatal injuries. No evidence of residual explosive material was found in the hole.

Training and Experience

Brendan P. DeMasters had 20 years of mining experience, including over four years as a drill operator for Major Drilling Underground. DeMasters worked as a foreman/drill operator at this mine for 16 weeks. A representative of MSHA's Educational Field and Small Mines Services staff conducted a review of the mine operator's training plan and records. On January 14, 2018, DeMasters completed his most recent annual refresher training, as required by 30 CFR 48.8(a).

On June 16, 2018, DeMasters received hazard training from Empire State Mines, as required by 30 CFR 48.11. However, the contractor could not provide documentation showing DeMasters received task training, as required by 30 CFR 48.7(a), addressing the hazards associated with the cleaning of vertical blast holes using high pressure compressed air and plastic hoses.

The accident investigation team also reviewed the training records for two contract employees (Nicholaus J. Floersch and Corey L. Tracy) working with the victim on the day of the accident. Similarly, the contractor could not provide documentation showing these employees received task training addressing the hazards associated with the cleaning of vertical drill holes. MSHA issued a noncontributory citation during an E16 Spot Inspection for this violation.

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 cause and the corresponding corrective action implemented to prevent a recurrence.

Root Cause: Contract management did not ensure adequate procedures to protect persons working with compressed air while cleaning out an obstruction in a vertical drill hole, including positioning of personnel during this process.

Corrective Action: The contractor developed a plan and procedures and then trained employees on the new plan with procedures for cleaning previously blasted vertical drill holes when an obstruction has been encountered. This plan addresses safe work procedures and where personnel are to be positioned during the various phases of drill hole cleaning process.

CONCLUSION

Brendan P. DeMasters was fatally injured while attempting to clean out a previously blasted vertical drill hole with a high pressure compressed air line. While kneeling, with his torso positioned over the hole, DeMasters tried to push the grout line through an obstruction approximately 30 feet in the hole. A sudden release of pressure propelled remnant stemming material from the hole, striking DeMasters in the chest. Contract management did not take all necessary precautions to protect persons working with

compressed air while cleaning out an obstruction in a vertical drill hole, including ensuring that personnel were safely positioned during the procedure.

ENFORCEMENT ACTIONS

Order No. 4433623 – Issued on October 2, 2018, under the provisions of section 103(k) of the Mine Act.

A fatal accident occurred at this operation on October 2, 2018, when a miner was attempting to clear a thought to be blasted drill hole. This order is issued to assure the safety of all persons at this operation. It prohibits all activity on the 2730 mud pond and any activities associated with explosives, blasting and loading 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 take place at the affected area.

Citation No. 9419029 - issued on January 16, 2019, under the provision of Section 104(a) of the Mine Act for violation of 57.13020. Issued to Empire State Mines (Mine ID No. 30-01185), as follows:

A fatal accident occurred at this operation on October 2, 2018 when a contract foreman (victim) was attempting to clean out a 3-inch diameter vertical drilled hole on the 2730 level of the mine. The hole had been previously blasted on two separate occasions (October 1, 2018 and the day of the accident). Prior to the accident, a contract superintendent attempted to blow out the remaining stemming material from the hole using a 7/8-inch diameter high-pressure plastic hose at an operating pressure of 115 pounds per square inch (psi) but hit an obstruction in the hole. The victim, took the hose from the superintendent and attempted to blow through the obstruction while kneeling and leaning over the hole. After a short time, a sudden release of pressure within the hole propelled stemming material from the hole, striking the victim in the chest. The victim later died from his injuries. Management failed to take all necessary precautions to protect persons working with compressed air while cleaning out an obstruction in a vertical drill hole, including positioning of personnel during the procedure.

Citation No. 9419008 - issued on January 16, 2019, under the provision of Section 104(a) of the Mine Act for violation of 57.13020. Issued to Major Drilling Underground (Contractor I.D. No. S580), as follows:

A fatal accident occurred at this operation on October 2, 2018 when a contract foreman (victim) was attempting to clean out a 3-inch diameter vertical drilled hole on the 2730 level of the mine. The hole had been previously blasted on two separate occasions (October 1, 2018 and the day of the accident). Prior to the accident, a contract superintendent attempted to blow out the remaining stemming material from the hole using a 7/8-inch diameter high-pressure plastic hose at an operating pressure of 115 pounds per square inch (psi) but hit an obstruction in the hole. The victim, took the hose from the superintendent and attempted to blow through the obstruction while kneeling and leaning over the hole. After a short time, a sudden release of pressure within the hole propelled stemming material from the hole, striking the victim in the chest. The victim later died from his injuries. Management failed to take all necessary precautions to protect persons working with compressed air while cleaning out an obstruction in a vertical drill hole, including positioning of personnel during the procedure.

Approved By: _____ Date: _____

Peter J. Montali

District Manager

Appendix A

Persons Participating in the Investigation

(Persons interviewed are indicated by a * next to their name)

Empire State Mines LLC

Joel G. Rheault General Manager

Jamie R. Hance General Mine Foreman

Major Drilling Underground

Russell D. Connett Safety Manager - America

Nicholaus J. Floersch* Superintendent

Ben Graham Vice President – HR & Safety

Rocky O. McLellan Manager Underground Drilling Services

Corey L. Tracy* Driller

Hilltop Energy Inc.

Derric Dave Paro* Manager

Dumas Contracting Ltd.

Robert R. Woodard* Blaster

Orica

Cara Rosen

Technical Services Engineer, Northeast Region

Gouverneur Rescue Squad

Mark A. Deavers

Director

New York State Police

Patrick E. Loveland

Investigator

Jefferson County Medical Examiner

Dr. Samuel A. Livingstone

Medical Examiner / Forensic Pathologist

Mine Safety and Health Administration

Gary C. Merwine

Mine Safety and Health Inspector

Kevin H. Abel

Assistant District Manager

Thomas J. Shilling

Mine Safety and Health Specialist

Michael J. Carey

Mine Safety and Health Inspector

Mark D. Kvitkovich

Mechanical Engineer

Gary S. Rethage

Mechanical Engineer

Lon D. Santis

Physical Scientist