

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

REPORT OF INVESTIGATION

**Surface Nonmetal Mine
(Lime)**

**Fatal Machinery Accident
January 21, 2013**

**Lhoist North America of Arizona Inc.
Apex Quarry and Plant
North Las Vegas, Clark County, Nevada
Mine ID No. 26-00081**

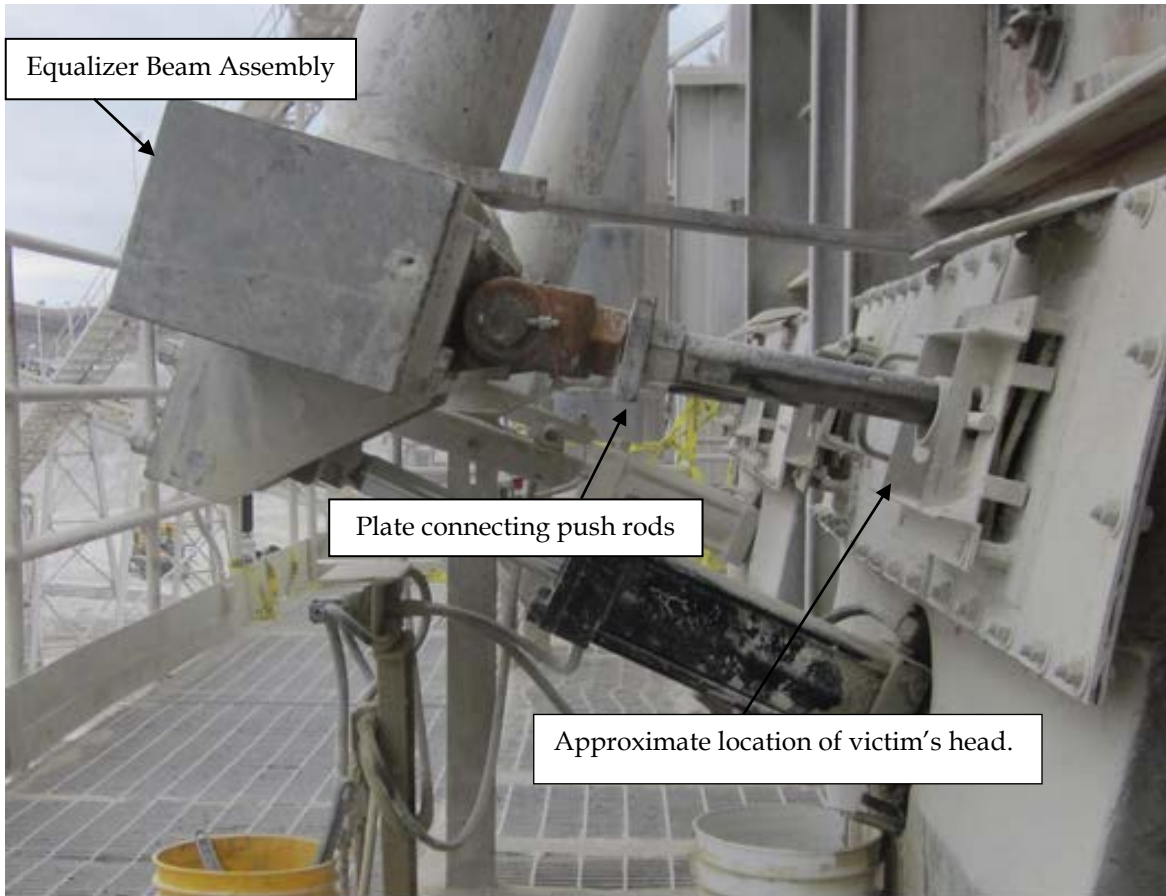
**Investigators
Jerry D. Hulsey
Mine Safety and Health Inspector**

**Jonathan Hall
Mechanical Engineer**

**Eugene Hennen
Mechanical Engineer**

**John O'Brien
Mine Safety and Health Specialist**

**Originating Office
Mine Safety and Health Administration
Western District
991 Nut Tree Road
Vacaville, CA 95687
Wyatt S Andrews, District Manager**



Equalizer Beam Assembly

Plate connecting push rods

Approximate location of victim's head.

OVERVIEW

On January 21, 2013, Kenneth Korakis, Maintenance Leadman, age 54, was killed when he was caught between a push rod connecting plate for a ram and a kiln hood on the kiln preheat deck. Korakis was attempting to repair a leaking hydraulic cylinder that activated a pusher arm on the kiln. He was working on energized hydraulic equipment near moving machine parts when he was caught in a pinch point.

The accident occurred due to management's lack of safe work procedures that ensured Korakis could safely perform work on the kiln deck. He was positioned between the push rod connecting plate and the kiln hood; however, the energy source was not deenergized and the ram was not blocked against hazardous motion. The kiln had three lock-out features but none of them were being used when the accident occurred.

GENERAL INFORMATION

Apex Quarry and Plant, a surface lime operation, operated by Lhoist North America of Arizona Inc., is located in North Las Vegas, Clark County, Nevada. The principal operating official is Rex Simpson, Plant Manager. The mine operates three 8-hour shifts per day, seven days per week. Total employment is 128 persons.

Limestone is drilled and blasted from multi-bench quarry. Front-end loaders load the material into haul trucks which transport it to the primary crusher plant. The material is transported by belt conveyor to the mill, where it is heated and processed into various grades of quicklime. The finished products are sold for cement and agricultural use.

The Mine Safety and Health Administration (MSHA) completed the last regular inspection at this operation on August 16, 2012.

DESCRIPTION OF THE ACCIDENT

On the day of the accident, Kenneth Korakis (victim) began his shift at 6 a.m. Korakis met with Mitch Leavitt, Maintenance Supervisor, to review the daily maintenance work orders. Leavitt and Korakis traveled to the pump area where they worked together changing a defective check valve until about 8:30 a.m. At approximately 9:00 a.m., Korakis obtained work orders for the mill, including one for a leaking hydraulic cylinder at the #4 ram on Kiln #2.

About 10:55 a.m., Kyle O'Hara and Daniel Segura, Miners, were on their way to the lunch room after working in the Kiln #1 preheater. They passed Korakis who was on his way to repair the leaking cylinder.

At approximately 11:50 a.m., O'Hara and Segura were returning from lunch on their way to the Kiln #1 preheater when O'Hara observed Korakis slumped over beneath the #4 ram approximately 30 feet from the adjacent preheater. Both miners approached

Korakis and found him unresponsive and face down between the rod connecting plate and kiln hood.

O'Hara and Segura ran to the preheater tower for help. Sean O'Leary, Maintenance Manager, responded and radioed for Emergency Medical Services (EMS) and began Cardiopulmonary Resuscitation (CPR). EMS arrived and summoned the medical examiner, who pronounced Korakis dead. The cause of death was attributed to blunt force injuries.

INVESTIGATION OF THE ACCIDENT

On the day of the accident, MSHA was notified at 12:15 p.m. by a telephone call from Duane Surman, Production Manager, to MSHA's National Call Center. The National Call Center notified Bart T. Wrobel, Supervisory Mine Safety and Health Inspector, and an investigation was started the same day. An order was issued pursuant to section 103(j) of the Mine Act to ensure the safety of miners. Upon arrival of the first Authorized Representative (AR), MSHA modified the order to section 103(k) of the Mine Act.

MSHA's accident investigation team traveled to the mine, made 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 a miners' representative.

DISCUSSION

Location of the Accident

The accident occurred 30 feet above ground level on the 3rd floor of the Kiln #2 preheater. The area was outdoors where the temperature was 65 degrees Fahrenheit and the sky was clear. Weather was not considered to be a factor in the accident.

Milling Process

Raw materials were fed from a belt conveyor into the top of the preheater. The material traveled down the preheater as hot gasses from the kiln came up, heating the material. At one level of the preheater, material had to be pushed across a nearly flat surface toward the center of the preheater. A device located inside the preheater, called a "plunger", pushed the material in toward the center.

The plunger was moved by two rods, 2 inches in diameter, and connected by a steel plate attached to the pivot arm system. The pivot arm system was attached to a pivot on the outside of the preheater, above the plunger. The pivot arm was moved by a hydraulic cylinder on the outside of the preheater. The double acting hydraulic cylinder pushed the pivot arm away from the kiln when extended and toward the kiln when retracted, causing the plunger inside to move back and forth.

The plungers were operated sequentially by a computerized electronic plant control system. The preheater had four identical hydraulic cylinders and plunger systems.

Ram Plunging System

The ram plunging system activated sequentially, each one starting its cycle 54 seconds after the subsequent one. Operators in the control room could adjust the cycle time up or down to adjust the material flow into the kiln. The control room operators could also enable/lockout individual hydraulic cylinders using a computerized electronic plant control system. Ram #4 was adjusted to travel approximately 13½ inches. The travel distance was controlled by limit switches on the side of the pivot arm assembly.

Hydraulic Cylinders

Each hydraulic cylinder was double acting and pushed the plunger in and pulled it back out. The cylinders were activated by an electric solenoid operated hydraulic valve controlled by the plant control system. A pair of quarter turn ball valves, that could hydraulically isolate the hydraulic cylinder, was located between the hydraulic supply and the solenoid operated valve.

Each kiln preheater had a dedicated hydraulic system supplying its four hydraulic cylinders. This system included two pumps in parallel for redundancy, two relief valves, a supply tank, a filter, a system pressure gauge, and an electrically controlled solenoid valve controlling system flow.

At full retraction of the hydraulic cylinder, there were approximately 4½ inches of space between the push rod plate and the angle iron support for the push rod gaskets. There was less space between portions of the gasket bracket surrounding the point where the push rod entered the preheater.

Lock-out Features

The preheater system included three methods to prevent movement of the hydraulic cylinder and rams. The system could be locked out electronically by the computers for the plant control system; hydraulically by closing the ball valves in the hydraulic circuit feeding the hydraulic cylinder(s), and mechanically by placing a metal fork plate between the preheater wall and equalizer beam assembly.

Work Procedures

The accident occurred on a Monday morning. On the preceding Friday, the hydraulic cylinder on the #4 plunger assembly was replaced due to leakage. When the accident occurred, the victim was troubleshooting a hydraulic leak on the replacement cylinder.

At the time of the accident, the hydraulic systems for the # 4 hydraulic cylinder assembly were operating. The control room operator had not been requested to lockout the cylinder electrically, the victim had not closed the ball valves to hydraulically isolate the hydraulic cylinder he was working on, and the victim did not use the metal plate 'fork' to prevent movement of the moving components surrounding him.

Testing

The kiln hydraulic system was powered and the plant control system operated the four hydraulic cylinders through a full standard cycle. All four hydraulic cylinders moved smoothly through their complete range of motion with no observed jerks or unexpected movements. Investigators observed no visual or audible alarms to warn nearby workers that a hydraulic cylinder was about to activate and move its attached plunger assembly.

The hydraulic pump system relief pressure was tested by closing system valves to isolate the pump system. The system relief pressure was read at 1500 psi. Gauges were placed in the supply and return lines to the #4 plunger assembly. At full retraction, hydraulic pressure was read at 1500 psi and at full extension hydraulic pressure was read at 1500 psi. These tests showed the hydraulic system was not losing pressure and the newly installed hydraulic cylinder was functioning as designed.

Guarding

The moving equalizer, hydraulic cylinders, and push rod assembly were located on a work platform regularly accessed by maintenance personnel. These persons walked past moving components routinely but there were no guards to prevent accidental contact with moving components. A non-contributory citation was issued.

TRAINING AND EXPERIENCE

Kenneth Korakis, victim, had 6 years, 7 weeks, and 4 days of mining experience all at this mine. He had performed maintenance work the entire time at the mine. A representative of MSHA's Educational Field Services staff conducted an in-depth review of the mine operator's training records and determined Korakis's training was up to date in accordance with 30 CFR Part 46.

ROOT CAUSE ANALYSIS

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

Root Cause: Management did not ensure that the mine had appropriate established safe work procedures and that miners were trained in the procedures and the procedures were followed during maintenance activities on the Kiln #2 preheater, ram #4 unit. The energy source was not deenergized and the ram was not blocked against hazardous motion.

Corrective Action: Management revised the lockout, tag out, and blocking procedures and established policies to ensure that safe work procedures are followed when maintenance work is performed. Persons performing the task were trained in the new procedures and policies. Management will monitor maintenance work to ensure the procedures are being followed.

CONCLUSION

The accident occurred due to management's lack of safe work procedures that ensured Korakis could safely perform work on the kiln deck. He was positioned between the push rod connecting plate and the kiln hood; however, the energy source was not deenergized and the ram was not blocked against hazardous motion. The kiln had three lock-out features but none of them were being used when the accident occurred.

ENFORCEMENT ACTIONS

Issued to Lhoist North America of Arizona Inc.

Order No. 8694516 -- issued on January 21, 2013, under the provisions of Section 103 (j) of the Mine Act:

An accident occurred at this operation on 1/21/2013 at approximately 11:50. As rescue and recovery work is necessary, this order is being issued, under Section 103(j) of the Federal Mine Safety and Health Act of 1977, to assure the safety of all persons at this operation. This order is also being issued to prevent the destruction of any evidence which would assist in investigating the cause or causes of the accident. It prohibits all activities at Pre-Heater Company Number 2 until MSHA has determined that it is safe to resume normal mining operations in this area. This order applies to all persons engaged in the rescue and recovery operations and any other persons on-site. This order was initially issued orally to the mine operator at 12:35 and has now been reduced to writing.

This order was terminated after conditions that contributed to the accident no longer existed.

Citation No.8696375 -- issued under the provisions of Section 104(a) of the Mine Act for a violation of 30 CFR 56.14105:

A fatal accident occurred at this operation on January 21, 2013, when a miner was crushed by machinery. The victim was performing maintenance on the hydraulic cylinder that activates the #4 ram of the Kiln #2 pre-heater. He (victim) was positioned between the push rod connecting plate and the kiln hood and was exposed to hazards when the # 4 ram moved. The power was not deenergized and the #4 ram was not blocked against hazardous motion.

Approved: 
Wyatt S Andrews
District Manager

Date: 5/20/13

APPENDIX A

Persons Participating in the Investigation

Lhoist North America of Arizona Inc.

Charles Ross	Western Regional Safety Manager
Sean O’Leary	Maintenance Manager
Duane Surman	Production Manager
Charles Morgan	Attorney
Rex Simpson	Plant Manager

United Boilermakers

Paul Fresquez	Miners' Representative
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State of Nevada

Gary Heinze	Mine Inspector
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Mine Safety and Health Administration

Jerry D. Hulsey	Mine Safety and Health Inspector
Bart T. Wroble	Supervisory Mine Safety and Health inspector
John O’Brien	Mine Safety and Health Specialist
Eugene D. Hennen	Mechanical Engineer
Jonathan Hall	Mechanical Engineer

APPENDIX B

Accident Investigation Data - Victim Information

U.S. Department of Labor

Mine Safety and Health Administration



Event Number: 1 1 3 7 9 6 0

Victim Information: 1															
1. Name of Injured/III Employee: <i>Kenneth Korakis</i>				2. Sex <i>M</i>		3. Victim's Age <i>54</i>			4. Degree of Injury: <i>01 Fatal</i>						
5. Date(MM/DD/YY) and Time(24 Hr.) Of Death: <i>a. Date: 01/21/2013 b. Time: 15:05</i>								6. Date and Time Started: <i>a. Date: 01/21/2013 b. Time: 6:00</i>							
7. Regular Job Title: <i>104 Maintenance Leadman</i>						8. Work Activity when Injured: <i>039 Repairing Hydraulic Leak</i>						9. Was this work activity part of regular job? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>			
10. Experience															
a. This															
Work Activity: 6 7 4 b. Regular Job Title: 6 7 4 c. This Mine: 6 7 4 d. Total Mining: 6 7 4															
11. What Directly Inflicted Injury or Illness? <i>127 Push rod connecting plate</i>								12. Nature of Injury or Illness: <i>170 Blunt force head injury</i>							
13. Training Deficiencies:															
Hazard: New/Newly-Employed Experienced Miner: Annual: Task:															
14. Company of Employment: (If different from production operator) <i>Operator</i> Independent Contractor ID: (if applicable)															
15. On-site Emergency Medical Treatment:															
Not Applicable: First-Aid: CPR: EMT: <input checked="" type="checkbox"/> Medical Professional: None:															
16. Part 50 Document Control Number: (form 7000-1) <i>220130310025</i> 17. Union Affiliation of Victim: <i>2473 Int. B. of Boilermakers</i>															