

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

REPORT OF INVESTIGATION

Surface Nonmetal Mine  
(Sand & Gravel)

Fatal Electrical Accident  
May 21, 2003

J.P. Sand and Gravel Company  
J.P. Sand and Gravel Company  
Lockbourne, Franklin County, Ohio  
Mine I.D. No. 33-02518

Investigators

Fred H. Tisdale  
Mine Safety and Health Inspector

Stephen B. Dubina  
Electronics Engineer

Preston White  
Mine Safety and Health Specialist

Originating Office  
Mine Safety and Health Administration  
North Central District  
515 West First Street, Room 333  
Duluth, MN 55802-1302  
Felix A. Quintana, District Manager

## **OVERVIEW**

On May 21, 2003, Hugh F. Barrett, plant foreman, age 50, was fatally injured while attempting to make a splice on a 480-volt power cable that energized a water pump. As he attempted to remove the insulation, he contacted a live conductor, resulting in a fatal electrical shock.

The accident was caused by the failure to de-energize, lock out, tag out, and test the 480-volt source prior to performing any work on the electrical circuit.

## **GENERAL INFORMATION**

J. P. Sand and Gravel Company, a sand and gravel operation owned and operated by J. P. Sand and Gravel Company, was located in Lockbourne, Franklin County, Ohio. The principal operating officials were Richard A. Roberts, president; and Michael D. Craiglow, vice president. The mine was normally operated one 8-hour shift, five days a week. Total employment was 23 persons.

Sand and gravel was mined using a dredge in one pit and a dragline in another. Sand and gravel was loaded into haul trucks with front-end loaders and hauled to the plant for further processing and stockpiling. The finished products were used in the construction industry.

The last regular inspection of this operation was completed on February 20, 2003. Another inspection was conducted following the investigation.

## **DESCRIPTION OF ACCIDENT**

On the day of the accident, Hugh F. Barrett (victim) reported for work at 6:00 a.m., his normal starting time. Barrett met with Thomas M. Howell, foreman; Timothy E. Stone, mechanic; Jerry J. Hendershot, welder; and James W. Preece, crane operator, to discuss the day's work. He assigned Stone to start the fresh water pumps for the stone plant and the sand plant. Both pumps were needed to supply water for the operation of the plants. The others were assigned to various tasks.

Stone traveled to the lakeside pump starter enclosure, located about 600 feet from the plants, and attempted to start the pump motors. Each motor had its own start/stop controls. When Stone pushed the first start button, the motor did not start; however, a humming noise was observed. Stone then contacted Barrett and Howell, who stated that they would take care of the problem.

Barrett and Howell arrived at the pump motor starter enclosure and started troubleshooting procedures. They found that the center phase of the three-phase 480-volt power feeder was grounded. Both men proceeded back to the substation and de-energized the main power switch for this circuit. This switch had the locking section for the handle broken off and could not be locked in an open position, so they removed the 300 amp fuses inside and then locked the front cover.

Barrett and Howell then used shovels to uncover the three buried feeder conductors that extended from the main disconnect in an area where previous ground fault problems had occurred. They found a defective splice in the 4/0 cable and repaired it.

Barrett and Howell attempted to start the motors but they wouldn't start due to another grounded phase condition. The men returned to the conductors where they repaired several more splices. They attempted to start the pumps after each splice repair but were unsuccessful. Employees interviewed were uncertain as to the number of times this troubleshooting and repair sequence occurred. Eventually they got one motor to start and run, however when the other pump motor was started, the motor single-phased again, indicating another fault. Barrett and Howell decided to have maintenance personnel lay out a single conductor replacement cable over the ground from the disconnect to the starters. This cable was to be used temporarily to get the pumps running so the plants could operate. Barrett and Howell then went to eat lunch while the others laid the replacement cable.

When Barrett and Howell returned from lunch at about 11:45 a.m., the replacement cable was laid out and ready to be installed. Barrett decided to splice the replacement cable to the existing 4/0 cable about 12 feet away from the main disconnect. This section of the 4/0 cable had no splices and looked to be in good shape. According to employees interviewed, he did this so the new cable would not have to be re-entered into the disconnect box. Barrett had a Greenlee cable cutter with rubber grips on the fiberglass handles, gloves, knife and splicing materials. He cut the 4/0 cable with the cutters and then, as he attempted to skin back the insulation with the knife, he contacted the bare cable, yelled, and collapsed to the ground.

Howell was a short distance away getting additional supplies to make the splice, when he heard Barrett yell. Howell then remembered that they had not shut the power off and locked it out after the last attempt to start the pump motors. He then ran to the disconnect, shut the power off, went to the victim's aid, and directed other persons nearby to call 911.

Emergency rescue personnel responded to the scene and transported the victim to a local hospital where he was pronounced dead at 1:50 p.m.

## **INVESTIGATION OF THE ACCIDENT**

MSHA was notified of the accident at 2:00 p.m. on May 21, 2003, by a telephone call from Mike Craiglow, vice president, to Peter Montali at MSHA Headquarters. 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.

An MSHA accident investigation team conducted a physical inspection of the accident, interviewed employees, and reviewed conditions and work procedures relevant to the accident. MSHA conducted the investigation with the assistance and cooperation of mine management and employees.

## **DISCUSSION**

### **Location of the Accident**

The accident occurred about 15 feet from the disconnect device located near the substation. The weather was dry; however, there was some standing water over the cable between the accident scene and the pumps.

### **Electrical System**

Two, 75 horsepower motors were used to drive two, 6-inch water pumps, one for the sand plant and one for the stone plant. The pump motors were supplied with 480 volt, three-phase power through a Cutler Hammer heavy-duty safety switch rated at 400 amps and 600 volts. This switch was located at the plant substation that was supplied with 480 volt, three-phase power from the main substation transformers. A local utility company provided the three-phase, 13,200 VAC power. The secondary of the transformers was wired in an ungrounded delta configuration.

### **Power Cables**

Originally three, 500 MCM USE, underground single cables, with a 4/0 ground wire, were extended about 600 feet underground to the lakeside pump motor starter enclosures as feeder conductors. About 10 years ago, one of the 500 MCM cables was damaged and the 4/0 ground wire was utilized as a phase conductor. During this time period, no ground conductor was being used by the operator for the two pumps and their associated controls. Because it was determined this condition did not contribute to the cause of this accident, the citation that was issued was not included in this report. Tests conducted after the accident revealed that two of the conductors had also faulted.

### **Disconnect Switch**

The disconnecting device was a Cutler Hammer, 400 amp, heavy duty, safety switch. This switch had the locking section for the handle broken off, and the handle could not be locked in an open position. Three, 300 amp fuses were inside the disconnecting device. The lock out procedure for this disconnect was to remove all three fuses and lock the front cover.

### **Training and Experience**

The victim had 29 years mining experience, all at this mine. He had received training in accordance with 30 CFR, Part 46.

## **ROOT CAUSE ANALYSIS**

Causal Factor – The electrical circuit was not de-energized, locked out, tagged out, and tested before attempting to splice the cable. No procedures were in place to ensure that power circuits were de-energized, locked out, tagged out, and tested prior to performing work.

Corrective Action – Procedures should be established to ensure power circuits are de-energized, locked out, tagged out, and tested prior to performing work. Management should review their lock out procedures and implement a job task analysis before electrical work is performed.

Causal Factor – The handle for the disconnect switch was broken and could not be locked in the open position. This required a more complicated procedure to effectively lock out this circuit.

Corrective Action – Procedures should be established to require inspection of electrical switches on a scheduled basis. Defective components found on disconnect devices should be repaired promptly.

Causal Factor – Two phase conductors feeding 480-volt power to the water pumps had faults to ground.

Corrective Action – Install phase indicator lights on the ungrounded delta system. These indicator lights should be periodically monitored to detect phase to ground faults so they can be repaired immediately.

## **CONCLUSION**

The accident occurred because the electrical circuit was not de-energized, locked out, tagged out, and tested before performing repairs to a 480-volt power cable. Earlier in the day, the power was de-energized and the circuit was locked out prior to making repairs to the cable. After each unsuccessful attempt to start the motor, the power supply was de-energized and locked out before a splice was made. The circuit was then energized and the motors failed to start. The sequence was repeated each time the motors did not start. When management made the decision to replace the defective power cable, the electrical circuit was not de-energized, locked out, tagged out, and tested.

## ENFORCEMENT ACTIONS

Order No. 6146261 was issued on May 21, 2003, under Section 103(k) of the Mine Act:

A fatal accident occurred at this operation on May 21, 2003, when the plant foreman cut an energized 480-volt power cable in the stone plant area. This cable feeds power to the water pump. This order is issued to assure the safety of all persons at this operation. It prohibits all activity in the area near the stone plant area 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/or restore operations to the affected area.

This order was terminated on May 23, 2003, after the conditions that contributed to the accident no longer existed.

Citation No. 6155776 was issued on June 30, 2003, under Section 104(a) of the Mine Act for violation of 56.12017:

A fatal accident occurred at this operation on May 21, 2003, when the plant foreman cut into an energized 480-volt power cable. The principal power switch that controls 480 volt, three-phase power to this cable was not locked out and tagged out. No other measures were taken to prevent the power circuit from being energized without the knowledge of the individual working on this cable. No hot line tools were being used at the time of contact with the aluminum cable. This cable and power switch controls 480-volt, three-phase power to the stone and sand plants' fresh water pump motors.

This citation was terminated on July 21, 2003, after the mine operator retrained miners in the use of lock out/tag out procedures and established procedures requiring: 1) electrical disconnects to be individually locked out and tagged out by all persons working on the electrical equipment or the electrical circuit; and 2) tests of electrical circuits to be conducted utilizing the proper test equipment to verify no power is present before work is begun.

Approved by:

Date:

Felix A. Quintana  
District Manager  
North Central District

## **APPENDIXES**

A. Persons Participating in the Investigation

B. Persons Interviewed

## APPENDIX A

### Persons Participating in the Investigation

#### J. P. Sand and Gravel Company

Michael D. Craiglow	vice president
Thomas M. Howell	foreman

#### Ohio Department of Natural Resources

Jerry Stewart	mine safety (inspections)
Steve McKee	mine safety inspector

#### Mine Safety and Health Administration

Fred H. Tisdale	mine safety and health inspector
Donald L. Canfield	mine safety and health inspector
Stephen B. Dubina	electronics engineer
Preston White	mine safety and health specialist

## APPENDIX B

### Persons Interviewed

#### J. P. Sand and Gravel Company

Thomas M. Howell  
Timothy E. Stone  
James W. Preece  
Jerry J. Hendershot

foreman  
miner's representative/mechanic  
crane operator  
welder/mechanic