MAI-2006-07

UNITED STATES
DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION

METAL AND NONMETAL MINE SAFETY AND HEALTH

REPORT OF INVESTIGATION

Surface Nonmetal Mine
(Dimension Limestone)

Fatal Fall of Highwall Accident
April 21, 2006

Maple Hill Quarry
B. G. Hoadley Quarries, Inc.
Bloomington, Monroe County, Indiana
Mine I.D. No. 12-01039

Investigators

George F. Schorr
Supervisory Special Investigator

Stephen E. Alberti
Mine Safety and Health Inspector

Leland R. Payne
Mine Safety and Health Specialist

Christopher J. Kelly
Civil Engineer

Sandin E. Phillipson
Geologist

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

OVERVIEW

Benjamin O. Strunk, driller/breaker, age 35, was fatally injured, and Jonathan R. Day**,** driller/breaker, age 29, was seriously injured on April 21, 2006, when they were crushed under a limestone slab. Strunk and Day were drilling an uneven area of the quarry floor at the base of a limestone block that had been cut from the bench. Subsequent movement of the limestone block caused a cracked section to fracture and fall on top of both men.

The accident occurred because management failed to conduct adequate examinations of equipment to ensure defects that affect miners' safety were recognized and the equipment was repaired or removed from service. The failure to take down or support the hazardous ground conditions that were visible on the limestone block contributed to the accident.

GENERAL INFORMATION

Maple Hill Quarry, a surface dimension limestone quarry, operated by B.G. Hoadley Quarries, Inc., was located in Bloomington, Monroe County, Indiana. The principal operating officials were Mrs. Patsy Fell-Baker, chief executive officer, and David R. Fell, president. The mine normally operated one, 8-hour shift per day, five days a week. Total employment was 15 persons.

At the time of the accident, limestone was being removed from the uppermost bench in the quarry. The limestone was cut vertically by diamond belt saws; cuts were 45 feet long (channel cuts) by 4 feet wide (headline) by 9 feet deep. The resulting limestone pillars were broken from the limestone formation by inserting and then inflating air bladders into the channel cuts, causing the bottom line of the pillar to break. The resulting limestone blocks were then turned on their sides with the aid of a front-end loader. Blocks were cut into sections by drilling a line of holes with handheld pneumatic drills and then manually breaking the block into sections with slips-and-wedges. Cut sections were removed from the quarry by front-end loader to a staging area. The quarried limestone was transported from the mine by a flatbed trailer. The limestone blocks were sold to dimension limestone finishing facilities where they were cut up and finished into numerous products.

The last regular inspection at this operation was completed on November 9, 2005.

DESCRIPTION OF ACCIDENT

On the day of the accident, Benjamin O. Strunk (victim), driller/breaker, reported for work at 7:00 a.m., his usual starting time, and was assigned to the quarry crew. The quarry crew consisted of four persons and was responsible for breaking the pillars from the limestone formation, turning the limestone blocks on their sides, and then manually cutting the turned limestone blocks into usable sections.

Shortly after the beginning of the shift, Nathan Martin, driller/breaker, was working on the upper ledge preparing a limestone block to be turned on its side. Martin placed an inflatable bladder in the channel cut and inflated the bladder to expand the cut to a width that would allow him to insert a pair of inflatable bladders. After inserting the bladder pair, Martin deflated the single bladder by turning the control ball-valve to the off position and disconnecting the quick disconnect from the bladders, allowing the limestone block to move back into a resting position, pinching the two bladders in place. Martin secured the bladders and attached the air hoses to the bladders in preparation for turning the limestone block. Martin then returned to the quarry floor and assisted the quarry crew with the cutting-up of turned limestone blocks.

After conducting preparation duties for the day's work, the quarry crew turned a limestone block on its side and cut it into smaller pieces. They began the process of cutting a second block. Strunk and Day cut a section off the eastern edge of the second block then relocated to the area at the toe of the next vertical limestone block.

During the time that the quarry crew had been performing their duties, the two inflatable bladders that had been set in place earlier that day were slowly inflating. The incidental inflation of the bladders was caused by a defective ball-valve allowing air to leak through the closed valve.

Strunk and Day had moved to the toe area so they could remove an uneven section of the quarry floor (See Appendix B). The section that they were attempting to remove was the bottom of a limestone pillar that had broken unevenly from the formation. Strunk had shoveled loose material away from the uneven area and began drilling horizontal holes along the bottom line while Day was in the area placing slips-and-wedges. At approximately 8:55 a.m., a slab of limestone fractured from the block due to the incidental inflation of the bladders left in the channel cut, and fell on both men.

Emergency personnel were called at 8:59 a.m. by John A. Miller, safety coordinator. Prior to the arrival of emergency personnel, John Wheeler, front-end loader operator, lifted a portion of the slab off Day so Martin and Charlie Cain, driller/breaker, could extract him. At this time, the miners realized that Strunk was also under the limestone slab. They had originally thought that Strunk was working on the upper ledge. Emergency personnel arrived at the scene at 9:06 a.m. and extracted Strunk. Strunk was pronounced dead at the scene at 10:45 a.m. by the Monroe County coroner. The cause of death was attributed to blunt force trauma. Day was transported to the hospital with extensive injuries.

INVESTIGATION OF THE ACCIDENT

MSHA was notified at 9:18 a.m. on April 21, 2006, by a telephone call from David R. Fell, president, to Gene W. Upton, supervisory mine safety and health inspector. An investigation began on 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 conducted a physical inspection of the accident site, interviewed employees, and reviewed conditions and work procedures relevant to the accident. MSHA conducted the investigation with the assistance of mine management and employees.

Location of the Accident

The accident occurred at the toe of the west end of the eastern row of limestone blocks (see Appendix B).

Ground Conditions

The limestone slab measured 13 feet long, 9 feet high, and 9 inches thick; with an estimated volume of 45 cubic feet. Using a limestone density of 155 pounds per cubic foot, the slab weighed approximately 7,027 pounds. It had fractured off from the

limestone block along a joint that ran North 80 degrees East. This joint pattern was prevalent throughout the entire limestone formation. This same joint ran through the previous block that had split and was turned on its side in two pieces.

Weather Conditions

Weather conditions were overcast with dissipating fog, a temperature of approximately 58 degrees Fahrenheit, and a calm wind. Weather was not considered a factor in the accident.

Geologic Conditions

Observations conducted of the geologic structure of the limestone indicated that joints with an orientation and inclination similar to the joint that bounded the fallen slab were present throughout the limestone formation being mined. The joint pattern observed during this investigation was considered a factor in the occurrence of this accident.

Air Lifting Bag System (Inflatable Bladders)

The inflatable bladder system was a Maxi force Air Lifting Bag System, manufactured by Paratech Incorporated, Frankfort, Illinois. The system, as used by Hoadley Quarries, was comprised of an air source (company compressor), controller with safety in-line relief valve, lifting bags, and interconnecting hoses. Bags were 3-ply reinforced Kevlar neoprene covered bladders and were tested to 240 psig. The system was designed to operate at 118 psig. Controller relief valves were variable, with a maximum relief pressure of 118-125 psig. The design of the air lifting system was not considered a factor in the accident. However, the incidental pressurization of the system due to the defective ball-valve was found to be one of the primary contributing factors to the occurrence of this accident.

Ball-Valve

The ball-valve was manufactured by Toyo Valve Company, Tokyo, Japan. Red-White Valve Corporation, who owns rights to Toyo brand in the United States, confirmed that the maximum compressed air rating would be at least the valve's 150 psig working steam pressure rating. The ball-valve was designed and rated for use with water, oil, and gas operations at ambient temperatures of -40 degrees to 150 degrees Fahrenheit. The defective ball-valve was one of four found on the downstream side of the oiler, used to turn the flow of compressed air on-and-off to the pneumatic equipment used by the quarry crew.

The ball-valve, as manufactured, was not considered to be a contributing factor to the occurrence of this accident. However, the ball-valve was found to be defective because it would allow a small volume of compressed air to pass through it when the valve was in the off position. This defect was considered one of the primary factors that contributed to the occurrence of this accident.

Medical Analysis and Findings

A sample of the victim's blood was analyzed for alcohol and controlled substances by an independent laboratory. The active form of Cannabinoid was determined to be 35.8 nanograms/ML. These levels indicate recent use of marijuana. Although impairment could not be ruled out, it was not determined to be a contributory factor in the accident.

Training and Experience

Benjamin O. Strunk had 48 weeks of mining experience, all at this mine. He had received training in accordance with 30 CFR, Part 46 and was performing his regular duties at the time of the accident.

ROOT CAUSE ANALYSIS

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

Root Cause: Management policies and controls were inadequate. Procedures were not in place to require that hazardous ground conditions be taken down or supported before work or travel commenced.

Corrective Action: Management should establish formalized policies and procedures that require ground conditions that may pose a hazard to miners be controlled. All miners should be trained to examine, recognize, and control ground conditions that may pose a hazard.

Root Cause: Management failed to formalize policies and procedures that would require thorough examinations of air control valves to identify defects. The defective air control valve was not removed from service.

Corrective Action: Management should establish formalized policies and procedures that would require equipment be examined prior to use and defective equipment be either repaired or tagged out and removed from service to ensure that it is not used until repairs are made.

CONCLUSION

The accident occurred because management failed to establish procedures that required the defective air control valve to be either repaired, replaced, or removed from service. The defect allowed the bladders placed in the channel cut to inflate. Management failed to establish procedures requiring that hazardous ground conditions be taken down or supported before other work or travel was permitted in the affected area. No action was taken to ensure that the hazardous ground condition was taken down or warnings posted to prevent access to the area, prior to the accident.

ENFORCEMENT ACTIONS

Order No. 6172319 was issued on April 21, 2006, under Section 103(k) of the Mine Act:

> A fatal accident occurred at this operation on April 21, 2006, when a miner was drilling holes for wedges at the base of the ledge in the pit area. This order is issued to assure the safety of all persons at this operation. It prohibits all activity at the ledge area in the pit 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.

The order was terminated on April 24, 2006, after the conditions that contributed to the accident no longer existed.

Citation No. 6135217 was issued on May 23, 2006, under provisions of Section 104(a) of the Mine Act for a violation of 30 CFR 56.3200:

> On April 21, 2006, a driller/breaker was fatally injured at this mine when he was struck by a piece of limestone that fell from a section of highwall that had been cut in preparation for removal. The limestone that fell measured approximately 13 feet long, 9 feet high, and 9 inches thick. This hazardous ground condition was visible prior to the fatal accident, yet no measures were taken to take down or support this unstable material or to post warnings to prevent access to the area.

This citation was terminated on June 1, 2006. Policies and procedures were established by the mine operator for evaluating ground conditions and implementing corrective action. Mine employees were provided training in identifying hazardous ground conditions and of the company policy and procedures. Miners have been instructed that hazards must be immediately reported to the ledge foreman and that miners must be removed from the affected areas. The mine operator has also obtained an excavator and hydraulic hammer attachment so miners can remove loose ground safely.

Citation No. 6135218 was issued on May 23, 2006, under provisions of Section 104(a) of the Mine Act for a violation of 30 CFR 56.14100(c):

> On April 21, 2006, a driller/breaker was fatally injured at this mine when he was struck by a piece of limestone that fell from a section of highwall that had been cut in preparation for removal. The limestone that fell measured approximately 13 feet long, 9 feet high, and 9 inches thick. Inflatable bladders that were used to break the block

from the surrounding ground were put in place behind the cut section. An air hose that provided compressed air to the bladders was connected and the air shut off valve was in the off position. The air shut off valve was defective, allowing air to pressurize the inflatable bladders. This resulted in moving the limestone block, which in turn caused the piece of limestone to fall. This defective valve was not repaired or taken out of service.

This citation was terminated on June 1, 2006. The defective valve has been taken out of service. Policies and procedures were enacted by the mine operator to ensure that the equipment used with inflatable bladders is inspected for defects prior to use. Defective components affecting safety will not be utilized. Miners using the air systems have been provided training regarding the policies and procedures.

Approved By: Date:

Steven M. Richetta
District Manager
North Central District

APPENDIX A

Persons Participating in the Investigation

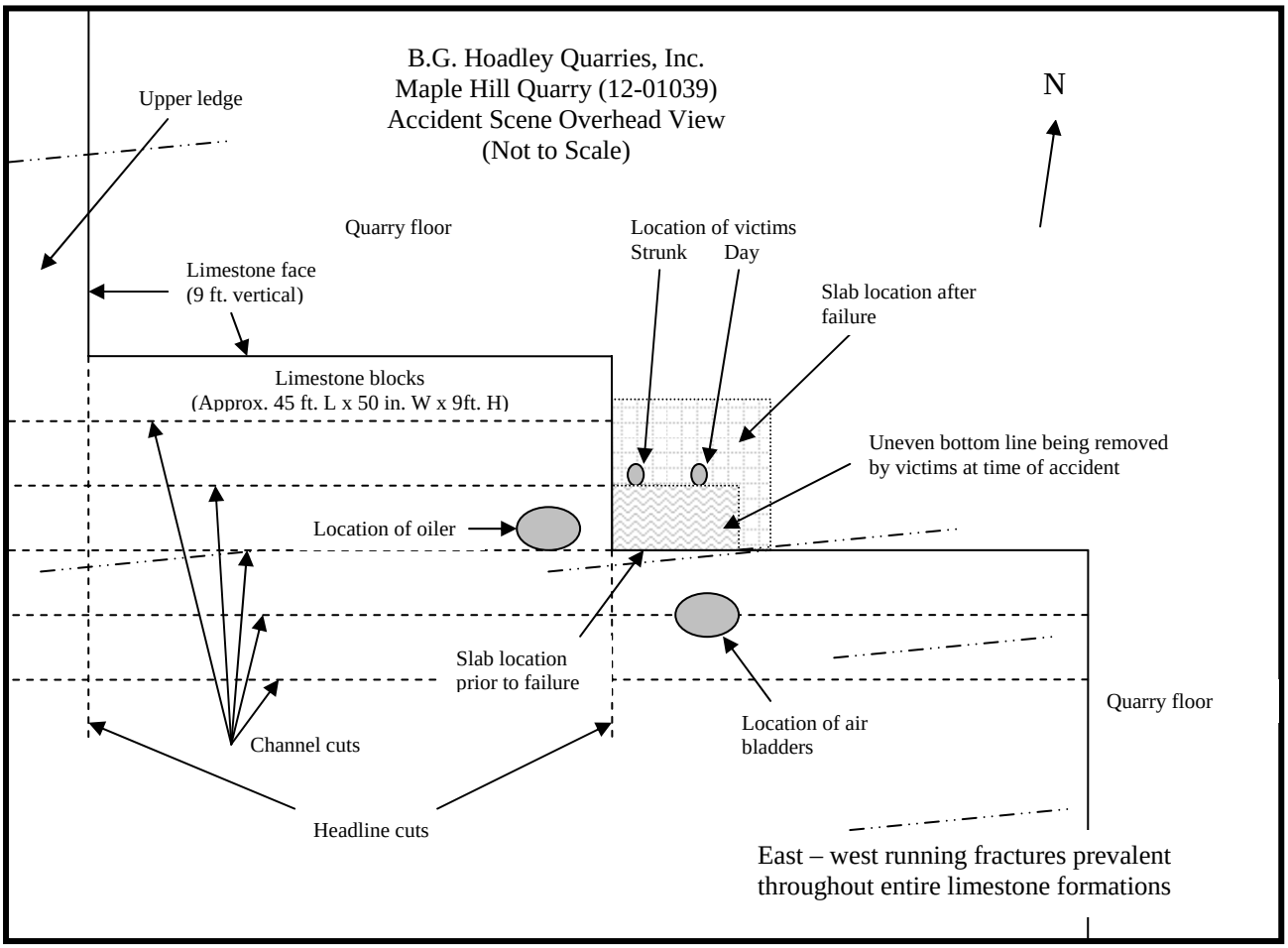
B. G. Hoadley Quarries Inc.

David R. Fell	president
John A. Miller	safety coordinator

Mine Safety and Health Administration

George F. Schorr	supervisory special investigator
Stephen E. Alberti	mine safety and health inspector
Leland R. Payne	supervisory mine safety and health specialist
Sandin E. Phillipson	geologist
Christopher J. Kelly	civil engineer

APPENDIX B


B.G. Hoadley Quarries, Inc.
Maple Hill Quarry (12-01039)
Accident Scene Overhead View
(Not to Scale)
N
Upper ledge
Quarry floor
Location of victims
Strunk
Day
Limestone face
(9 ft. vertical)
Slab location after
failure
Limestone blocks
(Approx. 45 ft. L x 50 in. W x 9ft. H)
Uneven bottom line being removed
by victims at time of accident
Location of oiler
Slab location
prior to failure
Quarry floor
Location of air
bladders
Channel cuts
Headline cuts
East – west running fractures prevalent
throughout entire limestone formations