Fatality Assessment and Control Evaluation Project

Public Health

KY FACE #96KY125

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To:Carl Spurlock, PhD, Director, Kentucky Injury Prevention and Research Center

From:Tim Struttmann, MSPH, KY FACE Project Manager

Subject:Pug mill operator killed after entanglement

SUMMARY

On November 19, 1996, a 25-year-old female pug mill operator at a brick manufacturing plant was killed after her clothing became caught in a rotating shaft. She was strangled as the rotating shaft tightened her clothing around her neck, restricting her airway. In order to prevent similar incidents from occurring, FACE investigators recommend:

- machines with rotating parts should have guards to prevent worker contact
- employers should designate a competent person to conduct regular safety inspections and coordinate routine safety and injury prevention meetings
- employers should provide a kill switch (panic bar) within reach of the pug mill that stops the rotation and allows free movement of the shaft
- employers should install a hand rail around the platform where pug mill operators stand
- employers should instruct employees not to wear loose-fitting clothes near moving parts

INTRODUCTION

On November 21, 1996, KY FACE was notified of an occupational fatality on November 19 involving a 25-year-old female at a brick manufacturing facility. Contact with the employer was made and an investigation initiated. At the employer's request, the on-site investigation did not take place immediately. On February 25, 1997, a site visit was made and photographs were taken of the scene. Interviews were held with the coroner, EMS director, fire and rescue personnel who responded to the scene, a police officer knowledgeable of the case, the OSH compliance officer

and the company vice-president. Copies of the coroner's report and the death certificate were obtained.

This family-owned company has been in operation at this site since 1970. Day-to-day operations are handled by the company founder and his three sons. The company had one previous fatality in the early 1970s when an employee fell from a roof into a clay grinding machine. No other serious injuries have occurred at the facility. The vice-president reported a fairly consistent work crew, with approximately 50 percent earning more than minimum wage. On average, 20 new employees are hired each year. The decedent had been the only female who worked in the plant.

On the morning of the incident, the local fire and rescue squad had done a company inspection of this facility. These inspections are completed once each year at all manufacturing settings in the community to familiarize the rescue squad with the settings, potential hazards, means of access, sources of water, power lines, and other site features or obstacles to performing a rescue.

The victim had been employed at this company for about three months and had worked a variety of laborer jobs in the community prior to beginning work at this plant. She was of average height and weight. She had one child. The normal work shift at the plant is from 7:00 am to 4:00 pm with an hour break for lunch.

INVESTIGATION

The employer in this case was a family-owned brick manufacturer which began operation in 1970 and employed about 45 persons at the time of the incident. Approximately 13 million (2.0" x 7.5' x 3.0") bricks are produced each year. In addition, two million 1/2" x 7.5" x 3.0" bricks are produced primarily for export. The company produces approximately 20 different colors and textures of brick. The brick is used primarily for residential and commercial building in the region. As well, bricks manufactured by other companies are sold by the company.

Raw dry clay delivered to the site from a neighboring county is ground to a powder and transported by conveyer to a pug mill where water is added and the product mixed by a rotating auger and forced through the machine. The moistened clay is sent through an extruder that produces a 3.0" x 7.0" sized continuous rectangle which is put onto a conveyer for cutting. Thin wires then cut the rectangle into the appropriate size brick. The bricks, resting on a continuous conveyer, are moved to the stacking area where the moist firm bricks are stacked into 4' x 4 x 4' stacks on flatbed steel-wheel mobile cars for drying. To remove all the moisture, the brick-filled cars are moved through a 400-degree gas-fired oven. The cars are then moved through the natural gas kiln where the bricks are fired for three days at nearly 2000 degrees. The entire process, from clay delivery to finished bricks, takes five days. One building houses the operation, and about 20 employees are required to work on the line. Natural ventilation in the building results in a cold environment in winter and hot in the summer. Employees must endure cold temperatures while working in winter even though the kiln is in the building.

The victim had been provided with on-the-job training during her first week of work at the company. Her job was to stand on a 2-1/2' x 12' platform that was about four feet off the ground

and made of steel grating. The platform paralleled the pug mill and was accessed by five stairs. Her job was to observe and monitor the amount of moisture added to the clay and periodically spray water with a hand-held garden hose when the clay became too thick and stuck to the sides of the pug mill. Power for the pug mill is controlled by an operator on the ground level about 18 feet away. The control panel is equipped with an emergency shut-off. The victim had mastered her job and was performing satisfactorily. Part of her responsibility was to notify the worker near the controls if the unit was malfunctioning.

The power for the pug mill rotation is transmitted by an approximately 12-foot long, 3-1/2-inch diameter steel shaft with couplings that travels the length of the unit at the level of the operator's feet. This shaft rotates at about 30 rpm and is powered by a 250-hp electric motor. At the time of the incident the shaft was not guarded. The edge of the shaft is about five inches from the walking surface of the platform. At one point along the shaft a coupling measuring about seven inches in diameter comes within three inches of the work platform. When the pug mill is shut off, the shaft continues to rotate for about five seconds. It was reported that once in the past an operator caught his pant leg on the coupling and his pants were torn off.

On the day of the incident, the victim began her shift at the usual time of 7:00 am, taking her position to monitor the pug mill. Work progressed normally until shortly after 2:00 pm, when a co-worker heard her cries for assistance, saw that she was caught in the machinery, and shut it off at the emergency switch located 18 feet away at ground level. He then attempted to free her and cut away some of her clothing. By this time another co-worker had called 911. It appears the victim's clothing on her left arm wrapped around the shaft at the coupling, pulling her arm and torso into the rotating shaft.

Emergency medical services (EMS) received the call at 2:16 pm. One EMT and one paramedic were immediately dispatched and arrived at the scene at 2:45. The fire and rescue squad were already at the scene. CPR was not initiated. The victim was hooked up to the monitor and was asystolic. The coroner was called at 2:43 pm and pronounced the victim dead at the scene. Her clothing, a thick winter coat, was cut from her in order to free her from the unit. She was then taken to the morgue. EMS left the scene at 5:20 pm.

Although the incident was not witnessed, it is thought that the victim dropped her cigarettes or lighter onto the platform and in attempting to retrieve them caught the left sleeve of her heavy overcoat on the exposed rotating drive shaft. Her left arm wound around the shaft as it continued to rotate. Her arm and clothing were wrapped so tightly that her ability to breathe was restricted.

CAUSE OF DEATH

The cause of death on the coroner's report was asphyxiation due to clothing wrapped around neck due to clothing being caught in machine. Toxicology report was negative.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Machines with rotating parts should have guards to prevent worker contact.

Discussion: In this case, the 12-foot long rotating shaft and coupling did not have a safety guard. Although it was rotating at just 30 rpm, it still presented a hazard to the worker. By the time of the investigation, the shaft had a complete guard covering its length. Had this guard been in place at the time of the incident, the tragedy could have been averted. As in the OSH standards for general industry, all exposed parts of horizontal shafting seven feet or less from floor or working platform should be protected by a stationary casing enclosing shafting completely. In this case, the victim came into contact with the exposed rotating coupling. Had the coupling and shaft been covered, she would not have made contact and become entangled. At the time of the site visit, the shaft was covered with a welded steel cage.

Recommendation #2: Employers should designate a competent person [1] to conduct regular safety inspections and coordinate routine safety and injury prevention meetings. As well, employers should encourage workers to actively participate in workplace safety.

Discussion: The employer reported that there was a person on staff to do first aid and CPR, but did not indicate that there was a safety program or policy in place. Employers should designate a person to conduct regular safety rounds to identify potential hazards. In this case, recognition of the rotating shaft and its proximity to the work zone on the platform could have prompted an intervention such as covering the shaft to eliminate the potential for contact.

Employers should encourage all workers to actively participate in workplace safety and ensure that all workers understand the role they play in the prevention of occupational injury. In this instance the victim was working on an elevated work surface which was in close proximity to a hazard. Other workers had likely seen this work setting and were familiar with the hazard. Employers should instruct workers of their responsibility to participate in making the workplace safer.

Recommendation #3: Design a kill switch within reach of the operator to disengage the power and allow free movement of the shaft.

Discussion: Rescue squad workers could not rotate the shaft using a 4-foot pipe wrench to release pressure and free the victim. If the unit had a kill switch close to the platform to stop the machine, this could stop the rotation to minimize continued wrap. More importantly, if the unit had been equipped with a "slip clutch," it could have been rotated in reverse to release the pressure.

Recommendation #4: Construct a horizontal handrail from the top of the stair railing to the edge of the pug mill.

Discussion: The pug mill operator/monitor must climb five stairs to reach the platform. Along the approximately three-foot-wide stairs on the left and right are hand rails for the operator to use while ascending and descending the stairs. At the top of the stairs, along

the right side, is a guardrail to prevent the operator from falling off. On the left, the railing terminates at the stairs. Further to the left, about three and a half feet from the top of the stair railing, is the side of the pug mill, along which the rotating shaft runs at foot level. There is a gap between the top of the left stair railing and the side of the pug mill. An operator who reaches the top of the stairs could lose his/her balance, reach for the expected hand rail, find none, and fall onto the rotating shaft. If the open space between the top of the stairs and the pug mill were protected with a stationary bar, this would offer a place to regain balance once on the surface of the platform.

Recommendation #5: Employers should instruct employees to wear snug-fitting clothing to minimize the chances for loose clothing to get caught in moving parts.

Discussion: In this case, the victim was wearing a heavy, loose-fitting overcoat which may have become caught on the rotating coupling. Snug-fitting clothing might have limited the possibility of the clothing getting caught.

[1] Competent Person: One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous, or dangerous to employees, and who has the authority to prompt corrective measures to eliminate them.

References

U.S Department of Labor, OSHA, Code of Federal Regulations, Labor 29 CFR 1910.219 (i) (2).