THE UNIVERSITY OF IOWA

COLLEGE OF PUBLIC HEALTH
Department of Occupational and Environmental Health

TO: Director, National Institute for Occupational Safety and Health

FROM: Iowa FACE Program **Case No. 2IA57** **Report Date: Aug. 29, 2003**

SUBJECT: Man Crushed Between Skid-Steer Loader and Dump Truck

SUMMARY

During the fall of 2002, a 31-year-old man was killed when a skid-steer loader backed into a dump truck, pinning him between the two machines. The man was part of a construction crew preparing to pour a concrete foundation for a residential garage in a neighborhood. One man was operating a skid-steer loader, leveling the ground when another employee just arrived in a dump truck with a fresh load of gravel (see Photo 1). Two other younger employees, one of whom was the victim, were locking down the tailgate so the truck could dump gravel on the ground.

Photo 1 – View from front of skid-steer showing garage area and truck.

The operator of the skid-steer loader was not aware the dump truck had returned, and continued working with the loader facing in the opposite direction. At one point, the skid steer backed up to get another load of gravel. While working with the tailgate of the truck, with his back to the loader, the victim was struck from behind by the skid steer loader, and was crushed between the back of the loader and the back of the dump truck. The man staggered a bit, then dropped to the ground. He quickly became unresponsive and died shortly after from severe internal injuries. His co-worker was uninjured. The operator of the skid-steer loader was not initially aware of striking the man, for he did not make contact with the truck while backing up.

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RECOMMENDATIONS based on our investigation are as follows:

- *1. Employee safety training and education must be an integral component of every business mission, regardless of size or number of employees.*
- *2. Employers must insure that employees are aware of hazards, limitations, or potentially dangerous conditions associated with using specific equipment on the jobsite.*
- *3. Backup alarms with variable intensity and frequency should be installed on all skid-steer loaders, and owner / operators should ensure that mufflers are working properly to reduce machine noise*

INTRODUCTION

During the fall of 2002, a 31-year-old concrete construction worker was killed while working on a residential garage. The Iowa FACE program was notified two months later by a report from the Iowa Medical Examiner's office and began an investigation. Information and photographs were obtained from a company representative and local police, which included eyewitness statements from co-workers and others at the scene. It was determined that a site visit to the worksite would not be productive and sufficient information had been gathered for this report.

The employer is a family construction business, which at that time employed five individuals. They had been in this seasonal business for the past 12 years doing all types of concrete work in the area. The victim had grown up in the business and had worked there full-time for the past 11 years. Five men were working at the residential location on the day of the accident. It was their first day on this particular job.

There was no safety program or written policies in place at this small business. Family members were accustomed to working together and safety was viewed as a common sense issue. The victim was experienced in all aspects of the business, however operation of the skid-steer loader was reserved for one worker with the most experience.

INVESTIGATION

The concrete construction company was working to pour the foundation and floor for a new single-car garage in a residential neighborhood. It was their first day on this job and the crew was busy leveling and preparing the soil, setting forms, etc. One man was operating the skid-steer loader, moving dirt and gravel around the site with the back of the loader facing the street (vehicle access drive into the construction site). Other workers had just arrived driving a single axle dump truck with a fresh load of gravel (see Photo 2).

Photo 2 – View from sidewalk showing gravel pile and rear of skid-steer loader.

The truck had a back-up alarm, which was functioning, but the skid-loader operator apparently did not hear the alarm, and kept working. The dump truck was backed into position from the street and the victim and a co-worker were in process of locking down the tailgate to dump the gravel in a pile adjacent to the driveway area. The loader operator did not know the truck had returned or was in position to dump, for he was facing away from the dump truck. He continued to move gravel and dirt preparing the foundation on the opposite side of the construction site, assisted by another employee.

The victim, with his back to the loader, had just finished locking down the tailgate. His co-worker had finished doing the same on his side of the truck and had stepped to the side of the truck. At that time, while backing up, the skid-steer loader pinned the victim against the rear end of the dump truck causing fatal internal injuries. Only when he heard cries for help did the skid-steer loader operator realize he had backed into the victim, because the skid steer had not come into contact (collided) with the dump truck.

The victim staggered away from the truck, then fell to the ground clutching his abdomen. He quickly became unresponsive, and other workers and eyewitnesses in the area rushed to his aid. Someone dialed 911, and others administered CPR, for the victim had become pulseless. Rescue arrived within a few minutes and the victim was rushed to a local hospital, but resuscitation failed and he was declared dead.

Photo 3 – View of rear of dump truck.

The skid-steer loader was a Case Model 1840 diesel, about 4-5 years old. It was in normal operating condition and did not have a backup alarm or rear view mirror. In the future, workers with this company agreed to never work directly behind an operating skid-steer loader. Further, all of these workers showed an increased awareness of the potential danger these machines present, and now give such equipment a much larger operating area.

CAUSE OF DEATH

The cause of death taken from the Iowa Medical Examiner's report was, *"exsanguination due to traumatic compression of the chest and abdomen due to industrial accident".* An autopsy was performed, which confirmed the severe internal injuries and bleeding.

RECOMMENDATIONS / DISCUSSION

Recommendation #1 *Employee safety training and education must be an integral component of every business mission, regardless of size or number of employees.*

Discussion: Safety is everyone's responsibility in a workplace or construction site. A small family business, such as this construction company, shares many similarities with the majority of small businesses throughout the United States. Unfortunately, in most small operations safety is usually not addressed in an official manner, nor is employee safety training repeated, reviewed, or updated on a regular basis. Consequently, workers can become complacent over time and slowly develop unsafe work practices.

In larger construction zones, one worker may be assigned the responsibility to spot dangerous situations when machines are moving about or backing up. In this case, each worker present could have prevented this incident. The skid-steer operator could have looked more carefully behind him before backing up. His assistant could have alerted him of the arrival of the dump truck. The truck driver or the younger workers could have whistled or signaled to alert these men they were backing into the work zone with the dump truck. The victim and his co-worker could have exercised more caution working with their backs to the skid-steer. Safety training and communication may be difficult for smaller businesses like this one to initiate, but it is vital to establish safe work practices *before* tragic events occur. Certainly in the future, all workers in this concrete business will have a third eye looking for potentially dangerous situations between machines and workers.

Recommendation #2 *Employers must insure that employees are aware of hazards, limitations, or potentially dangerous conditions associated with using specific equipment on the jobsite.*

Discussion: Skid-steer loaders are designed to make quick movements in all directions, going backwards and forwards and turning every few seconds. Skilled operators can become extremely efficient with these machines, making quick work of soil preparation. Due to their design, skid-steer loaders have compromised vision to the rear with large blind spots at rear corners created by the lift arms, hydraulics, etc. (see Photo 4). Side mirrors are not practical, and rear-view mirrors would still retain the corner blind spots. All work crews using skid steers need renewed awareness of these visual limitations and operational characteristics, and move personnel and equipment to a safe distance, especially from the rear. Also, all skid-steer loader operators need to maintain control of these machines at all times (i.e. according to the manufacturer operator's manual). Overall, these machines must be operated at safe speeds and be given appropriate operating space. Further, due to the inherent visual limitations of these machines to the rear, operators should always look behind before backing up, and drive forward for the best visibility whenever possible.

Recommendation #3 *Backup alarms with variable intensity and frequency should be installed on all skid-steer loaders, and owner / operators should ensure that mufflers are working properly to reduce machine noise*

Photo 4 – View of rear of skid-steer.

Discussion: The use of a backup alarm is an obvious recommendation, however, alarms can easily become ineffective if they are ignored by workers or if their intensity is below that of the background noise level at a jobsite. As mentioned earlier, skid-steer loaders change directions very quickly, and an alarm which is constantly going on and off will soon become an annoyance, which may lead to its removal by workers.

Virtually all skid-steer loaders have inherent blind-spots to their rear due to their design and configuration. This makes the area to the rear of these machines an extremely hazardous place for workers. Backup alarms on loaders should be directed towards the rear of the machines to provide optimal reception by workers in these areas. Further, backup alarms should not produce pure tone sounds. Instead, the backup alarm should be at several different frequencies to prevent them from being canceled out by (indistinguishable from)

other noise sources. Also, the intensity of backup alarms should be 10-15 dB above the surrounding background noise level.[1]

In this particular case, the noise levels emitted from this loader may have been a contributing factor. Workers reported that this loader was load, which may indicate a faulty or worn-out muffler was present on the machine. Although this was a smaller skid-steer loader, its noise level may have been sufficient to drown out, or cancel, the backup alarm from the dump truck. Clearly, if noise levels are elevated to the point that workers cannot hear each other, safety is reduced.

Recent research has found that workers in construction trades suffer elevated levels of hearing loss.[1,2,3] For example, a NIOSH study of carpenters found that by age 25, workers had hearing equivalent to 50-year-old non-noise exposed workers (average 10 - 15 dB hearing loss across 500 - 4000 Hz frequencies). Further, by age 55, most carpenters need hearing aids.[1,4] In turn, it is possible that the victim, who had worked in construction for over a decade, could have had pre-existing hearing loss that reduced his ability to realize the skid-steer was approaching him. Since these machines are frequently used in tight quarters around other equipment, and adjacent to other workers, the issue of equipment noise is a significant factor in machine maintenance, and even for future skid-steer designs.

References:

1. Suter, A.H. 2002. Construction noise: exposure, effects, and the potential for remediation; a review and analysis. American Industrial Hygiene Association Journal 63(4): 768-789.

2. Neitzel, R. 2002. Construction noise strategies. Occupational Health and Safety 71(6): 72-74, 76.

3. Hager, L.D. 2003. Hearing loss prevention regulations. Occupational Health and Safety 71(6): 34, 36, 37, 40, 48.

4. National Institute for Occupational Safety and Health (NIOSH). 2003. NIOSH National Occupational Research Agenda – Update 2003. DHHS (NIOSH) Pub.No. 2003-148. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

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Fatality Assessment and Control Evaluation

FACE

FACE is an occupational fatality investigation and surveillance program of the *National Institute for Occupational Safety and Health* (NIOSH). In the state of Iowa, *The University of Iowa*, in conjunction with the *Iowa Department of Public Health* carries out the FACE program. The NIOSH head office in Morgantown, West Virginia, carries out an intramural FACE program and funds state-based programs in Alaska, California, Iowa, Kentucky, Massachusetts, Michigan, Minnesota, Nebraska, New Jersey, New York, Oklahoma, Oregon, Washington, West Virginia, and Wisconsin.

The purpose of FACE is to identify all occupational fatalities in the participating states, conduct in-depth investigations on specific types of fatalities, and make recommendations regarding prevention. NIOSH collects this information nationally and publishes reports and Alerts, which are disseminated widely to the involved industries. NIOSH FACE publications are available from the NIOSH Distribution Center (1-800-35NIOSH).

Iowa FACE publishes case reports, one page Warnings, and articles in trade journals. Most of this information is posted on our web site listed below. Copies of the reports and Warnings are available by contacting our offices in Iowa City, IA.

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