

TO: Director, National Institute for Occupational Safety and Health

FROM: Iowa FACE Program

SUBJECT: Farmer crushed under a skid-steer loader bucket.

SUMMARY

In the spring of 1997 an Iowa farmer was killed while using his skid steer loader to move rocks and remove bushes from a fenceline. He had attached a chain from the bucket to a shrub, and after partially pulling out the shrub, he apparently leaned forward out of the loader cage to remove or adjust the chain. It appears he slipped or inadvertently stepped on the right foot pedal, which immediately lowered the lift arms and the bucket, pinning him to the frame of the machine. Another possibility is that while pulling out the shrub, the chain slipped or the shrub gave way, causing the loader to buck up and down, throwing the man forward out of his seat. The machine had a seatbelt, but the man was not using it. He was working alone, out of sight from the farmstead; it was two hours before he was found dead at the scene by a family member. The skid-steer loader was still running when the man was found. The farmer's son, who had occasionally operated the machine, observed that it was having jerky movements during the few weeks prior to the injury, movements that could have been a factor in this fatality. A seat-actuated electro-hydraulic interlock had been by-passed long ago, therefore there was nothing to prevent the bucket from falling if the pedals were moved, even if the operator was not in the seat. The machine was manufactured in 1972.

RECOMMENDATIONS based on our investigation are as follows:

- 1. Owners/operators of skid-steer loaders should not disable or alter factory-installed or retrofitted safety features.*
- 2. Operators of skid-steer loaders should be educated regarding safe use of their machines.*
- 3. Manufacturers should provide reliable mechanisms to prevent the loader bucket from falling unintentionally.*
- 4. Machine operators must keep their equipment in proper working order, to ensure its dependability and safety.*

INTRODUCTION

In May, 1997 a 60-year-old Iowa farmer was killed while using his skid-steer loader to remove bushes along a fenceline. The Iowa FACE program became aware of the incident two days later from a newspaper article and began an investigation. A site visit was conducted three weeks later by two investigators from the Iowa FACE program, who interviewed the victim's wife and son, who were both familiar with the skid loader and its operation. Photographs of the machine were taken in a shed where it was stored, however we were not able to have the machine started to test its movements and controls. Other sources of information include the county sheriff, fire department, paramedics, and an implement dealer who was familiar with this type of skid-steer loader.

This family farm was 120 acres and currently produced cattle and grain. The victim had lived and worked there for the past 32 years. This was a dairy farm until two years ago when the farmer made arrangements to retire. He was helped by his wife and several children, one of which still lives near the farm and works there regularly. The machine was 25 years old, and had been used by several family members at this farm for the past 11 years. Both the farmer and his son were very familiar with the loader's operation, having used it for general chores around the farm.

INVESTIGATION

The victim's wife and son were interviewed and the machine was examined during our site visit. The machine's movement and steering were controlled by hand levers to the right and left side of the seat, and foot pedals controlled lifting and tilting of the bucket. The left pedal controlled the bucket tilt and the right pedal controlled raising and lowering of the lift arms. The machine had reportedly been producing jerky movements lately, but this was not considered a serious problem and repair was not attempted. The hydraulic oil level had been checked and was normal.

The victim was using his skid-steer loader to clear rocks and shrubs out of a fenceline on his farm. The skid loader had a clevis welded to the top edge of the bucket on each side, to lift and move heavy objects around the farm. A chain was attached to one clevis with the other end secured around a small shrub (1½ inches diameter). The shrub was partially pulled out of the ground when the man was found pinned under the bucket. It was a dry, sunny day, and the area where the fence was located was level.

The farmer was working alone, therefore it is impossible to know the exact events preceding the fatal injury. It is possible he was leaning or kneeling forward out of the loader cage, while the lift arms were raised, to adjust or remove the chain from the bucket. It appears the man inadvertently stepped or fell on the right foot pedal as he leaned forward, causing the bucket to immediately come down on him. The lift arm crossbrace hit him in the back and pinned his chest to the frame of the machine. The engine was still running when he was found.

Another possible scenario may be that the victim was thrown out of the seat due to sudden movements of the machine. This kind of movement would be likely if the victim was pulling a shrub with a raised bucket. Backing up in this situation could easily raise the rear wheels and a sudden correction in travel or bucket position by the operator could cause dangerous and/or

jerky movements of the machine. We were not able to determine the exact events leading to this injury, but both described events are possible.

The manufacturer of this skid-steer loader had recalled all their machines 10-15 years ago to install seat-actuated safety interlock switches. This switch controlled an electro-hydraulic lift arm lock and prevented any movement of the lift arms when the operator left his seat. We observed wires coming from under the seat from this operator-present sensor. Another pair of wires came from the control panel of the loader, identical to the other wires, and with a matching connector. The wires coming from the control panel were taped together indicating that the seat-actuated safety feature had been disabled. The dealer we interviewed stated that safety switches are still functional on many older machines, and that they are relatively inexpensive and easy to replace.

This machine was equipped with a lift arm linkage lock to the left side of the operator's seat. This mechanical lever locks the lift arms in a raised position to protect the operator if he needed to leave the machine with the bucket in the up position. The exact position of the bucket prior to the accident is not known, nor is it known if the victim was accustomed to using this safety feature. The machine had a seatbelt which was not used when this injury occurred, and appeared as if it was never used.

The farmer's son mentioned that the machine was having jerky movements for a few weeks prior to the injury. He had checked the hydraulic levels, and found them to be normal. Since the machine continued to perform well enough, he did not pursue repair at that time. It is not known if these jerky movements contributed to this fatal injury.

CAUSE OF DEATH

The official cause of death is listed as asphyxiation due to crush injury from being trapped under a loader bucket.

RECOMMENDATIONS / DISCUSSION

Recommendation #1 *Owners/operators of skid-steer loaders should not disable or alter factory-installed or retrofitted safety features.*

Discussion: The seat-actuated hydraulic interlock had been disconnected, apparently to allow the operator to use the hydraulics without being in the seat. This may have made some tasks more convenient, however at the cost of safety. An effective safety interlock would have prevented unintentional lowering of the bucket by movement of the pedals. All safety devices should be maintained and kept in working order, regardless of the possible inconvenience they may cause.

#2 *Operators of skid-steer loaders should be educated regarding safe use of their machines.*

Discussion: Using a skid-steer loader and auxiliary chains to pull up and remove bushes may be hazardous. Attaching the chain to the bucket and pulling with the raised bucket easily tips the loader to the front. Regardless of whether this was a factor in this case, this

practice should be avoided. Safer work practices could include 1.) having a co-worker help with chain attachments and other tasks which make it necessary for the operator to leave the machine, 2.) using a backhoe or other machine which is better designed to pull or dig shrubs out of the ground. Under no circumstances should the operator put himself in jeopardy by walking, stepping, or leaning under the raised bucket, unless the machine is turned off and mechanical lift arm stops or braces are used.

Recommendation # 3 *Manufacturers should provide reliable mechanisms to prevent the loader bucket from falling unintentionally.*

Discussion: The hydraulic interlock connected to the operator's seat was the only safety mechanism to prevent unintentional lowering of the bucket. The mechanical lift arm lever could not be used unless the lift arms were fully raised. Several safety mechanisms should be provided in all skid-steer loaders to protect the operators from the danger of being crushed under the bucket. These mechanisms could include a safety belt-operated interlock, an ignition-operated interlock which locks the hydraulics when the machine is not running, an operator-presence sensor in the seat shutting off the engine or attached to a hydraulic interlock (as in this case), a front door interlocking the hydraulics, a safety bar requiring the operator to be present in the seat when using hydraulics, and a mechanical lift arm stop, such as on this machine. These mechanical lift arm stops should be operable in all loader positions, where adequate clearance exists for the operator to safely step in and out of the machine.

Recommendation #4 *Machine operators / owners must keep their equipment in proper working order to ensure its safety.*

Discussion: This machine was quite old and in need of maintenance and repair. The jerky movements of the hydraulics may have caused the lift arms to fall very quickly, which may have been prevented if the hydraulic problem had been repaired. Repairs may be costly and, considering the age of this machine, may not be practical. The only alternative would be to retire the machine and replace it with a newer and safer one.

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Fatality Assessment & Control Evaluation Program (FACE)

The University of Iowa, in conjunction with the Iowa Department of Public Health is investigating the causes of work-related fatalities in the State of Iowa. FACE is a surveillance program funded by the National Institute for Occupational Safety and Health (NIOSH), that identifies all occupational fatalities, conducts in-depth, on-site investigations on specific types of fatalities, and makes recommendations for employers, employees, farmers, and others to help prevent similar fatal accidents in the future.

NIOSH funded state-based FACE Programs include: Alaska, California, Iowa, Kentucky, Maryland, Massachusetts, Minnesota, Missouri, Nebraska, New Jersey, Ohio, Oklahoma, Texas, Wisconsin, Washington, and Wyoming.



Additional information regarding this report or the Iowa Face Program is available from:

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