TO: Director, National Institute for Occupational Safety and Health

FROM: Iowa FACE Program

SUBJECT: Farmer is killed by skid-steer loader when it rolls into creekbed -- Iowa.

SUMMARY
In April 1996, an Iowa farmer was killed while using a skid-steer loader to move earth along the edge of a field. He was using the front bucket to fill in a small waterway, working along the edge of the freshly plowed field. The right front wheel hit a depression while the left wheel hit a bump, and the machine rolled to the right side in a complete circle, landing upright in a small creekbed, with the victim slouched in the operator's seat. When the machine rolled, it crushed the man's head between the rollover protective structure (ROPS) side frame and the ground.

The loader's original ROPS had been replaced with shorter side frames on both sides which provided no protection from the front, top and back of the machine. A local welder had modified the ROPS at the victim's request to accommodate the height of hog buildings where the machine was used (see photo). The farmer was not wearing his seatbelt, so when the machine rolled he was thrown partially up and out of the machine, sufficiently that his head was caught between the side frame and the ground. The victim's wife was an eyewitness to the event, and rushed to help him; however, the man was killed instantly from head injuries.

RECOMMENDATIONS following our investigation are:

1. *Owner-operators of skid-steer loaders should not modify factory-installed ROPS, nor alter other built-in safety devices.*
2. *Skid-steer loader operators should use the seatbelt or other alternate built-in restraint system at all times when operating the loader.*
3. *Owners and operators of skid-steer loaders should be made aware of the dangers related to the use of the machine, including overturn hazard .*

INTRODUCTION
In April 1996, a 50-year-old Iowa farmer was killed while operating his skid-steer loader. The Iowa FACE program became aware of the incident the next day from a newspaper article and began an investigation. Information was gathered from the County Sheriff's Office, which provided photographs of the scene, and the State Medical Examiner. The Iowa FACE investigator and an agricultural safety specialist conducted a site visit in August 1996. Photographs were taken which showed the modified ROPS on the loader, which was still being used daily on the farm.

The farm was a farrow-to-finish hog operation with production of 1,600 head per year. It was a family farm for the past 30 years, and had employed the victim, his wife, and one of their sons. They had 220 acres in corn and soybeans. The skid-steer loader was 2_ years old. The farmer used the loader on a regular basis for many types of farm work and was very familiar with its operation.

INVESTIGATION

During the investigation the Iowa FACE team examined the skid-steer loader, which was stored in a shed at the time. FACE investigators did not have access to the field where the rollover occurred, but studied several photographs taken by the County Sheriff which clearly indicated what happened.

The farmer was working on the edge of a freshly plowed field filling in a small waterway with dirt, using the front bucket of his skid-steer loader. He was driving the machine adjacent to a small creek along the edge of the field, with the left tires on the dirt, and the right tires on the grass. The slope of the field at this point was not steep, but the field was quite rough. The ground dropped off steeply to the right side of the loader since it was adjacent to the creek. Tire prints reveal that the right front wheel went into a small depression at the same time as the left front tire went over a bump in the dirt, which caused the loader to roll to the right. The machine rolled over completely to the right, landing upright in the creekbed with the victim slouched in the operator's seat with obvious fatal head injuries. Detailed photographs of the ground surface showed linear impressions made by the top of the ROPS side frames (see photo), and also a depression in the ground where the man's head was crushed by the left side frame.

When seated upright in the loader, the victim's head was approximately 2 inches above the maximum height of the side frames, providing no overhead protection. The man was not wearing a seatbelt at the time of the rollover. This allowed his body to be thrown partially out of the machine when it rolled, crushing his head against the ground as the loader rolled. The man also acquired a dislocated right knee, presumably from the central T-bar control when the machine inverted.

The victim's wife was working in the field where the overturn occurred. She rushed to aid her husband, noticed the severe head injury, and called 911. When emergency personnel arrived, they observed the significant head injury and confirmed that the man was dead at the scene. The cause of the rollover was discovered by studying marks on the ground, and photographs were taken by officers at the scene.

The skid-steer loader had a modified ROPS. The entire ROPS cage had been removed and replaced with heavy steel frames on the right and left sides (see photo). This lowered the vertical clearance of the machine and allowed it to enter older hog buildings used by the victim. The side frames were welded of 2-inch square steel, solidly built and bolted to the loader body, however, there were no crossmembers to the front or rear of the operator's position, nor any protection above him. These modifications were done by a private welder at the victim's request shortly after purchase of the machine. This alteration also removed other safety devices on the machine: the lift arm locks and the ignition safety switches, which were part of the top assembly. The victim was able to operate the loader while not wearing his seatbelt which indicates that the safety belt interlock was also disabled. This safety interlock connects to the seatbelt and normally prevents the flow of hydraulic fluid when the operator is not wearing the seatbelt.

At the time of our visit, the skid-steer loader with its modified ROPS was still in daily use by family members at the farm. By report the original ROPS was still intact in storage on the farm, although we did not have access to it.

CAUSE OF DEATH

The cause of death from the Medical Examiner's report was, *"massive head injury with basal skull fracture due to skid-steer loader roll-over accident."* Blood samples revealed nothing significant.

RECOMMENDATIONS / DISCUSSION

Recommendation #1 *Owner-operators of skid-steer loaders should not modify factory installed ROPS, nor alter other built-in safety devices.*

Discussion: The ROPS is an essential safety feature of a skid-steer loader. Due to close proximity to the loader bucket and lift arms, the operator is in great danger if the ROPS is removed or modified. After modification this ROPS was too low and provided no protection from the front, top and back. Other safety features were also built in to the original ROPS, such as lift arm safety stops and the ignition safety interlocks. The modified ROPS had neither of these features. These modifications made the skid-steer loader unsafe to operate under any circumstances. The original ROPS and use of a seatbelt would likely have saved the operator's life in this overturn.

Recommendation #2 *Skid-steer loader operators should use the seatbelt or other alternate built-in restraint system at all times when operating the loader.*

Discussion: The skid-steer loader in this case has a seatbelt, and an interlock connected to the seatbelt, which prevents the use of loader hydraulics when the operator is not present and wearing the seatbelt. The seatbelt has two safety functions: first restraining the operator in the protective zone of the ROPS, and secondly, providing protection from unexpected movement of the loader bucket or liftarms. Circumstances indicate that the hydraulic seatbelt interlock was disabled and the seatbelt may have been inoperable at the time of the incident. It is important that the seatbelt or other restraint system is worn to provide these protective functions. In this case, wearing the seatbelt may have kept the operator in the protective zone, although the zone was significantly reduced due to ROPS modification.

Recommendation #3 *Owners and operators of skid-steer loaders should be made aware of the dangers of using these machines, including the overturn hazard .*

Discussion: This fatality, as well as other skid-steer loader fatalities investigated by Iowa FACE and other FACE investigators during the past year, indicate that increased attention is needed to address the hazards in operating skid-steer loaders. Overturn hazard, seatbelt use, modifications of the safety devices, and the potential to be crushed between the bucket and the frame are among the issues which should be addressed in operator education.

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Fatality Assessment
&
Control Evaluation Program
(FACE)

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

Iowa is a major farming state, and therefore the Iowa FACE Program deals with many occupational deaths on the farm. It is a very hazardous profession that claims hundreds of lives nationally every year. We publish detailed reports that are disseminated to key agricultural leaders in Iowa who share our concern for the safety of farmers. To reach and effectively communicate with this independent and vulnerable group is a worthy challenge here in Iowa.

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

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

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