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Iowa City, Iowa 52242

TO: Director, National Institute for Occupational Safety and Health

FROM: Iowa FACE Program Case No. 01IA03801 Report Date: January, 2002

SUBJECT: Operator of Skid-Steer Loader Killed When Thrown Out of Seat.

SUMMARY

A 60-year-old operator of a skid-steer loader was killed while moving dirt at his rural acreage. The man was moving and smoothing soil, preparing to make a foundation for a new barn. The area was level and the soil was dry. To increase the hauling capacity of the front-end bucket, the man had attached four 45-kilogram (100 lb.) tractor counter weights to the rear of the skid loader with a chain. It appears that while backing up with a raised bucket full of dirt, the chain and counter weights



Photo 1 -- Side view of skid-steer loader after the incident.

suddenly fell off, and the machine bucked forward while going over the weights on the ground. The man and the seat of the skid-steer loader were thrown forward out of the loader, and the raised bucket came down and crushed the man against the front frame of the machine. The man was found dead about four hours later. The seat, which was found under the victim, was not securely attached, but only held in place by vertical metal pins. The seat belt had been removed from the machine.

RECOMMENDATIONS based on our investigation are as follows:

- *Owners/operators of skid-steer loaders should not use temporary counter weights.*
- *Owners/operators of skid-steer loaders should not overload the machine by using over-sized buckets.*
- *Owners/operators of skid-steer loaders should maintain the seat and seatbelt in good condition, and use operator restraint systems while operating the machine.*

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INTRODUCTION

An Iowa man was killed while working with a skid-steer loader on his acreage in August 2001. The Iowa FACE program started an investigation after notification from a FACE colleague from a neighboring state. Information and photographs were gathered from the County Sheriff, relatives, medical examiner, and an implement dealer. Two FACE investigators conducted a site investigation.

The victim operated a 4.5-hectare (11-acre) hobby farm, which contained several out buildings. He had grown up on a farm and farmed earlier in his life, but had recently retired from a career in electronics. The man was quite experienced with farm machinery, and had used skid-steer loaders in the past. He lived and worked alone, preparing the acreage as a hobby farm for relatives to sell strawberries, wildflower seeds, and sapling trees.

The man had borrowed the skid-steer loader from a friend in another county. The tractor weights were borrowed from a neighbor. He had two weeks of working experience with this loader before this incident.

INVESTIGATION

The victim was using a borrowed skid-steer loader, which was about 25 years old. He was working on level ground, preparing the area for a new foundation for a small barn. In attempts to increase the capacity of the loader, the man had borrowed tractor weights from a neighbor and attached them to the rear of the skid-steer loader with a heavy log chain.

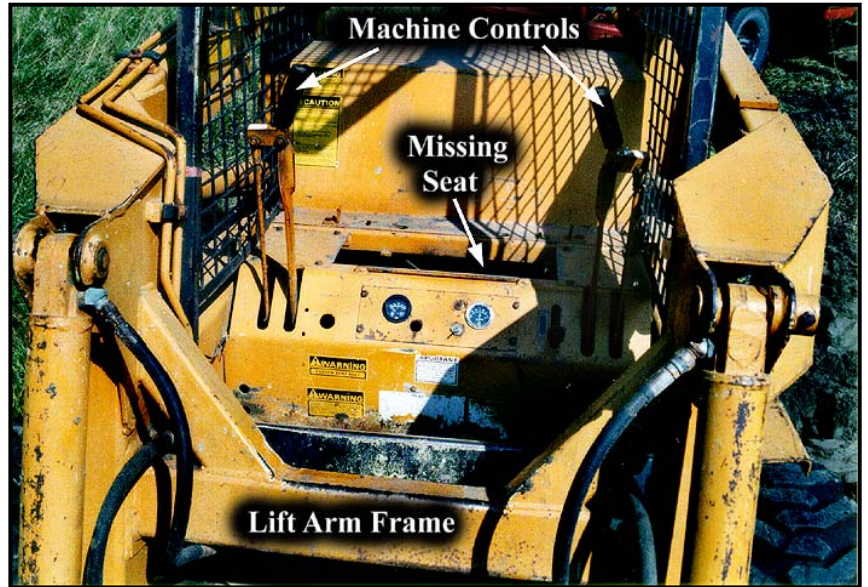


Photo 2 -- View of loader showing missing seat and seatbelt.

The victim was dead at the scene, found crushed between the bucket and the front frame of the machine. The tractor weights, log chain, and seat were found under the machine and under the victim. The large front bucket was completely full of dry dirt. Rescue personnel were able to start the machine to gain access to the victim. They stated that the bucket would not stay up unless constant pressure was applied to the control levers.

No one witnessed this incident. From the available information and photographs, it appears that the machine was backing up while the weights abruptly fell off the rear of the loader. The bucket was full of dirt and raised sufficiently to trap the operator, but it is unknown how high the bucket was at the time of the accident. When the weights fell off, and the wheels drove over them, the machine bucked forward violently, throwing the man and his seat out in front of the loader.

The weights were found underneath the victim and the bucket (see Photo 3). It is not fully clear how the bucket came down and crushed the victim between the bucket and the loader frame. It appears that there was a leak in the hydraulic control system, for rescuers stated that the lever had to be pushed constantly to keep the bucket raised. This problem may have been present before the incident, or it may have been caused by the incident. The overload of dirt in the bucket, and the violent movement of the machine could cause significant loading and failure to the hydraulic system. No further testing was done to identify mechanical failure in this hydraulic system.



Photo 3 -- Tractor weights seen under the bucket.

It is possible that the man may have pushed the control levers as he was thrown forward out of the loader, which would have caused the bucket to fall rapidly or move the machine forward (see Photo 2). The left handle controls the loader lift arms, while the right handle controls the bucket tilt movement. Moving the levers forwards and backwards controls machine forward, reverse, and turning of the loader. The machine was not running when rescuers arrived, so it had stalled during the incident. It was not determined whether this was due to an operator presence control, or otherwise stalling of the machine. The victim was crushed between the front bucket and frame of the loader, not under the bucket. It is not known how high the bucket was prior to the weights falling off, but even at mid-range, there would be enough space for the victim to get thrown out and crushed.

The front bucket on this loader was a utility-size bucket, designed to carry grain, silage, snow, etc. An optional smaller dirt / gravel bucket was available from the manufacturer. This smaller bucket does not require counterweights, and is recommended for construction use. The manufacturer does provide an optional counterweight -- a large metal plate, which is bolted to the bottom of the machine. Photo 4 shows the utility bucket full of dirt at the site of the incident. Using this utility bucket for moving dirt was likely the reason for needing the extra weights at the back of the machine. A mechanic we consulted had concerns about the weight when handling dirt with this bucket.



Photo 4 – Front view of loader bucket full of dirt.

The missing seat (see Photo 2) was found to the victim's right, underneath him. The seat is partially hinged on its front edge and pops into place with pins into holes on the seat base. The seat is normally removed to provide access to the hydraulic pump, electrical gauges, and machine wiring. The seat belt, normally attached to right angle pieces (see Photo 2), had been completely removed from this machine. This belt would normally secure the seat and the operator during operation.

CAUSE OF DEATH

The official cause of death from the Medical Examiner's report was, "*suffocation associated with spinal cord injury and massive internal injury.*" No autopsy was performed.

RECOMMENDATIONS / DISCUSSION

Recommendation #1 *Owners/operators of skid-steer loaders should not use temporary counter weights.*

Discussion: Tractor counter weights were used temporarily in this machine to improve stability and traction. The weights were attached to the back with a chain, and while loading and moving dirt, the weights fell off causing the incident. As the weights fell off, the heavy load in the raised bucket made the machine more prone to tip forward. The machine was apparently backing up and it ran over the weights on the ground at the same time, which caused it to buck violently and throw the operator out of the machine. The sequence of events is not fully clear, but it is likely the incident occurred instantly after the counter weights fell off. Skid-steer loaders are often used in conditions where bouncing or bumping into objects could cause counter weights to fall off, unless they are designed properly for the machine. This machine has available factory-supplied counter weights, which are bolted to the bottom of the machine. Only such factory-supplied counter weights should be used in skid-steer loaders.

Recommendation #2 *Owners/operators of skid-steer loaders should not overload the machine by using over-sized buckets.*

Discussion: A fairly large utility bucket was used for loading dirt in this case. This bucket is designed for general use and lighter materials such as snow, grain, etc. Handling full loads of dirt will exceed its designed capacity. It is evident that the temporary counter weights were needed to compensate for the large size of the bucket. With appropriate counter weights, the machine operation would have been safer, although it would cause excessive wear and tear on the machine. A smaller bucket was available for this machine, designed for handling heavy soil, dirt, and gravel.

Recommendation #3 *Owners/operators of skid-steer loaders should maintain the seat and seatbelt in good condition and use operator restraint systems when operating the machine.*

Discussion: The removable seat on this machine was designed to provide access to the hydraulic pump, wiring, and other machine parts under the seat. The design of the seat attachment may not be adequate to ensure that the seat stays in place in all conditions. The seatbelt had been completely removed, leaving no protection for the operator being thrown forward. There were no other operator restraint systems besides the seatbelt in this older machine. Skid-steer loaders are inherently bouncy, and it is important in all conditions to wear the seatbelt or use other appropriate restraint systems.

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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, Maryland, Massachusetts, Minnesota, Missouri, Nebraska, New Jersey, Ohio, Oklahoma, Texas, Wisconsin, Washington, and Wyoming.

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.

The Iowa FACE team consists of the following: Craig Zwerling, MD, PhD, MPH, Principal Investigator; Wayne Johnson, MD, Chief Investigator; John Lundell, MA, Coordinator; Risto Rautiainen, MS, Co-Investigator.



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

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