

TO: Director, National Institute for Occupational Safety and Health

FROM: Iowa FACE Program

Case No. 2005IA027

Report Date: 31 August 2006

SUBJECT: Farmer Killed When Raised Front-end Loader Bucket Attachment Falls

SUMMARY

During the spring of 2005, a 45-year-old farmer was killed while feeding cattle on his farm. The man was driving a tractor equipped with a front-end loader that had a bucket attached to its lift arms. He was towing a single-axle feed cart behind the tractor and had finished filling several feeders in the cattle yard. On his way out of the cattle yard, he steered his tractor uphill on the incline back toward the gate. It was slippery due to recent rains. The tractor was losing traction. The victim moved from the operator station to stand on the hitch and raised the loader, presumably for added traction. Moving from the tractor seat to the drawbar of the moving tractor was something others had seen the man do before.



Photo 1 – Tractor and feed wagon where they were found (not where incident occurred) with loader still raised and tractor wheels dug deeply into the ground.

Investigation by law enforcement personnel at the scene found that the bucket attachment was not pinned to the loader's frame at the front of the lift arms (Photo 1). While moving uphill with the loader raised high, the bucket came free from its unsecured attachment. It fell to the rear, toward the operator's station, striking the operator on the head and chest. The tractor continued forward, struck a manure spreader, went through one fence and came to a stop against another fence. Its wheels continued to spin for several hours before the incident was discovered by the victim's wife.

RECOMMENDATIONS

- *Tractors with a loader should be operated with the loader close to the ground as much as possible and have sufficient counterweight on the rear wheels, axle, or hitch for stability and traction.*
- *Tractor operators should ensure that attachment locking devices are present, not worn excessively or damaged, function properly, and securely hold attachments in place during use.*
- *The loader should be lowered to the ground before exiting the operator station of the tractor and neither the loader nor the tractor should be operated from anywhere other than the operator station.*
- *Farm operators should construct feeding areas and select equipment so livestock feeding can be done safely in all conditions.*

INTRODUCTION

Mid spring 2005 a 45-year-old farmer was killed while feeding cattle on his farm. He had raised the loader and exited the operator station, moving to stand on the tractor's drawbar, ostensibly to improve traction in the slippery conditions as he tried to keep the tractor moving forward. The bucket attached to the raised front-end loader of his tractor came loose from its mountings. It fell into the operator area and struck the operator as he stood on the drawbar. The Iowa FACE program became aware of this incident through a newspaper clipping and began an immediate investigation. Information was gathered from the Medical Examiner's office and the County Sheriff.

INVESTIGATION

The victim planned for a normal day when he left the house early in the morning to tend to his hogs. His wife noticed nothing unusual when she left for work. The farmer was later seen at 9:45 AM by a friend who helped him load hogs. There was no indication that the victim had stopped for lunch, so this incident likely occurred late morning as the farmer went about his chores, including the routine feeding for his cattle.

The farmer's wife arrived home from work after 5:00 PM and began to prepare supper. Hearing the tractor noise and seeing cattle loose on the farm, she assumed some animals had wandered off and that her husband was rounding them up.



Photo 2 – Close-up of the tractor showing the rear wheels dug in, and also the smashed radio and damaged seat.

After several minutes she went to help and found him face down in the cattle yard with the tractor some distance away, against the fence, still running (Photo 2). She assumed he had been trampled by the cattle and ran to call 9-1-1. She also called a nearby neighbor.

The neighbor found the tractor against the fence along the south part of the cattle yard. The engine was still running. The wheels had dug in until the underside of the tractor rested on the ground and supported the tractor. The left wheel continued to spin in the dirt. When deputies arrived, they found the scene as described. They also found the bucket attachment for the loader at a separate location in the cattle yard, near the victim's cap which was buried in the muck by the manure spreader. After careful analysis of tractor tire tracks and other evidence, investigators were able to piece together an understanding of the sequence of events in this incident. Several findings confirm the sequence of events described above. Rubber tire marks were found on the bucket and corresponding fresh gouge marks were found on the tops of the fenders of the tractor. The radio on the right rear fender was smashed, and the tractor seat was also broken and bent backwards. These confirm that a very heavy metal object fell onto the rear of the tractor.

The cattle farmer was operating his tractor equipped with a front-end loader to pull the wagon full of cattle feed, filling several feeders made from rubber tires located in his sloping cattle yard. He may have had the loader partially raised as is often done to avoid striking the cattle with it. He turned the tractor around and headed up an incline in the cattle yard toward the gate. Due to recent rains, the yard was very muddy. The tractor began to lose traction so he moved from the tractor seat, stood on the hitch of the tractor, and raised the front-end loader to shift more weight to the rear wheels for added traction while trying to guide the tractor forward up the incline. The move from the seat to stand on the hitch of a moving tractor was something others had seen the victim do before.

The bucket had a “quick attach” feature. Part of the connection requires inserting two locking pins to secure the bucket to the loader frame (Photo 3). These pins were not put in place, and with the combination of the raised loader and slope contributed to the bucket slipping off its mounting frame. The bucket fell on the victim as he stood on the hitch of the tractor then tumbled to one side. It struck his chest and head but he did not let go. The tractor moved forward up the incline. It collided with a manure spreader, which changed its course and knocked the victim off. The tractor then continued to the edge of the cattle yard where it crashed into the fence, made a U-turn, and then got stuck in the gate across the cattle yard with its wheels still turning.

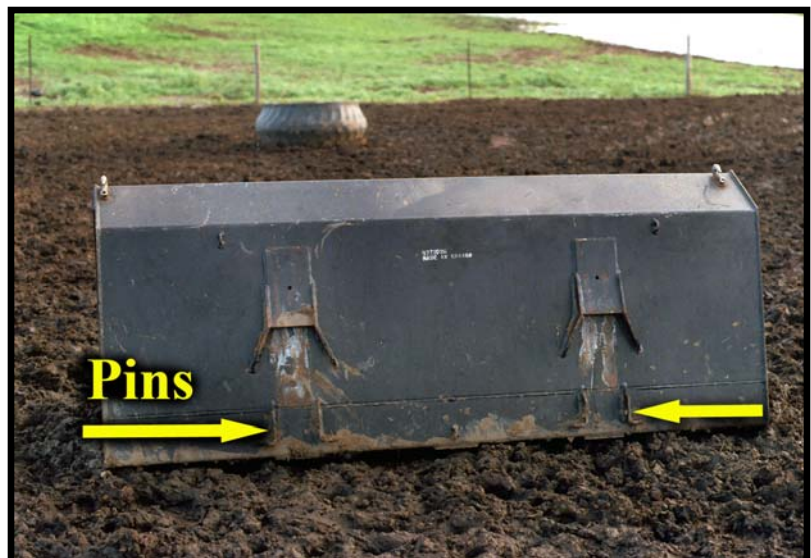


Photo 3 – Loader bucket attachment shown with sleeves to capture the quick attach mounting members of the loader and showing the location of horizontal pins required to be put in place to secure the bucket to the loader during use.

At full height the bucket would be over 13 ft (4 m) above the ground. The ability of the bucket to “rollback”, to hinge around a horizontal axis, enables it to “cradle” material and keep it from spilling. Also at full height, full bucket “rollback” of typically 110 degrees (measured from where the bottom of the bucket is horizontal) means that the attaching mechanism would be oriented such that gravity

would no longer help hold the unsecured bucket on the mountings. It is not known why the bucket was not pinned in place. The pins for it were in the storage location on the loader lift arms.

CAUSE OF DEATH

The cause of death from the autopsy was a ruptured thoracic aorta due to blunt force trauma.

RECOMMENDATIONS / DISCUSSION

Recommendation #1 – *A tractor with loader should be operated with the loader close to the ground as much as possible and have sufficient counterweights on the rear wheels, axle, or hitch for stability and traction.*

Discussion: Attaching a loader to a tractor moves the combined center of gravity forward. When the loader is lowered to where the center of gravity for it and the bucket is below that of the tractor alone, the combined center of gravity for the tractor-loader-bucket combination is lowered below that of the tractor alone. A lower center of gravity improves sideways stability. A center of gravity more forward reduces weight on the rear axle thereby reducing traction. In addition to improving stability, adding ballast weight to the rear wheels, axle, or hitch improves traction.

In this incident the weight of the loaded feed wagon's hitch on the drawbar of the tractor acted like ballast weight. After the feed was unloaded, the tractor had reduced traction which was evident when the farmer turned uphill to exit from the cattle yard. Having adequate counterweight installed could have provided sufficient traction to enable the tractor and grain cart to drive up the slope and out the gate.

Recommendation #2 – *Tractor operators should ensure that attachment locking devices are present, not worn excessively or damaged, function properly, and securely hold attachments in place during use.*

Discussion: The locking pins for this loader bucket quick attachment system were in their stowed location and not put in place to secure the bucket when it was installed. Some uses of the bucket will not demand the installation of the pins. Some operators may not take the time to dismount from the tractor to install them, especially for short term use situations. Nonetheless, it is essential that attachment locking devices be engaged when the attachment is installed.

Recommendation #3 – *The loader should be lowered to the ground before exiting the operator station of the tractor and neither the loader nor the tractor should be operated from anywhere other than the operator station.*

Discussion: Away from the operator position, this farmer had diminished ability to control either the loader or the tractor. Controllable movements of either the loader or tractor could have contributed to the incident because they were not or could not be controlled because of where the operator was moving or because of where he moved.

Recommendation #4 – *Farm operators should construct feeding areas and select equipment so livestock feeding can be done safely in all conditions.*

Discussion: Livestock feeding must be done regularly, often a couple of times each day throughout the year. It is important to ensure these frequent tasks can be done safely in all anticipated

environmental conditions. The feeding and transportation areas should be constructed so that slippery conditions are avoided. This includes installation of proper drainage, use of surface aggregate, avoiding steeply sloped entry ways, and routine maintenance for all such drives. Equipment selection is also important. A rear wheel drive tractor like the one in this incident, especially with a front-end loader installed, does not have the traction of a tractor with front wheel assist, 4-wheel drive, or tracks.

References

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NASD. Skid Steer Loader Safety. Atlanta, GA: Centers for Disease Control and Prevention. National Agricultural Safety Database. Available at www.cdc.gov/nasd_. Accessed 30 August 2006.

Murray Madsen, MBA
Chief Trauma Investigator, IA FACE
Program Consultant, GPCAH
University of Iowa – Iowa City

Risto Rautiainen, Ph.D.
Deputy Director, Great Plains Center (GPCAH)
Co-Investigator, IA FACE
University of Iowa – Iowa City

Fatality Assessment and Control Evaluation

FACE

Fatality Assessment and Control Evaluation, FACE, is a program of the *National Institute for Occupational Safety and Health* (NIOSH), which is part of the *Centers for Disease Control and Prevention* of the *U.S. Department of Health and Human Services*. Nationally, the FACE program identifies traumatic deaths at work, conducts in-depth studies of select work deaths, makes recommendations for prevention, and publishes reports and alerts. The goal is to prevent occupational fatalities across the nation.

The NIOSH head office in Morgantown, West Virginia, carries out an intramural FACE case surveillance and evaluation program and also funds state-based programs in several cooperating states. In Iowa, *The University of Iowa* through its *Injury Prevention Research Center* works in conjunction with the *Iowa Department of Public Health* and its *Office of the State Medical Examiner* to conduct the Iowa FACE program.

Nationally, NIOSH combines its internal information with that from cooperating states to provide information in a variety of forms which is disseminated widely among the industries involved. NIOSH publications are available on the web at <http://www.cdc.gov/NIOSH/FACE/> and from the NIOSH Distribution Center (1-800-35NIOSH).

Iowa FACE also publishes its case studies, issues precautionary messages, and prepares articles for trade and professional publication. In addition to postings on the national NIOSH website, this information is posted on the Iowa FACE site, <http://www.public-health.uiowa.edu/FACE/>. Copies of FACE case studies and other publications are available by contacting Iowa FACE, too.

The Iowa FACE team consists of the following specialists from the University of Iowa: Craig Zwerling, MD, PhD, MPH, Principal Investigator; John Lundell, MA, Co-Investigator; Murray Madsen, MBA, Chief Trauma Investigator; and Co-Investigator/specialists Risto Rautiainen, PhD, and Wayne Sanderson, PhD, CIH. Additional expertise from the Iowa Department of Public Health includes Rita Gergely, Principal Investigator, and John Kraemer, PA, from the Office of the State Medical Examiner.

For additional information regarding this report or the Iowa FACE Program contact:



<p style="text-align: center;">Iowa FACE The University of Iowa 100 Oakdale Campus, #203 IREH Iowa City, IA 52242-5000 Phone: (319) 335-4481 Fax: (319) 335-4290 Internet: http://www.public-health.uiowa.edu/FACE E-mail: murray-madsen@uiowa.edu</p>
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