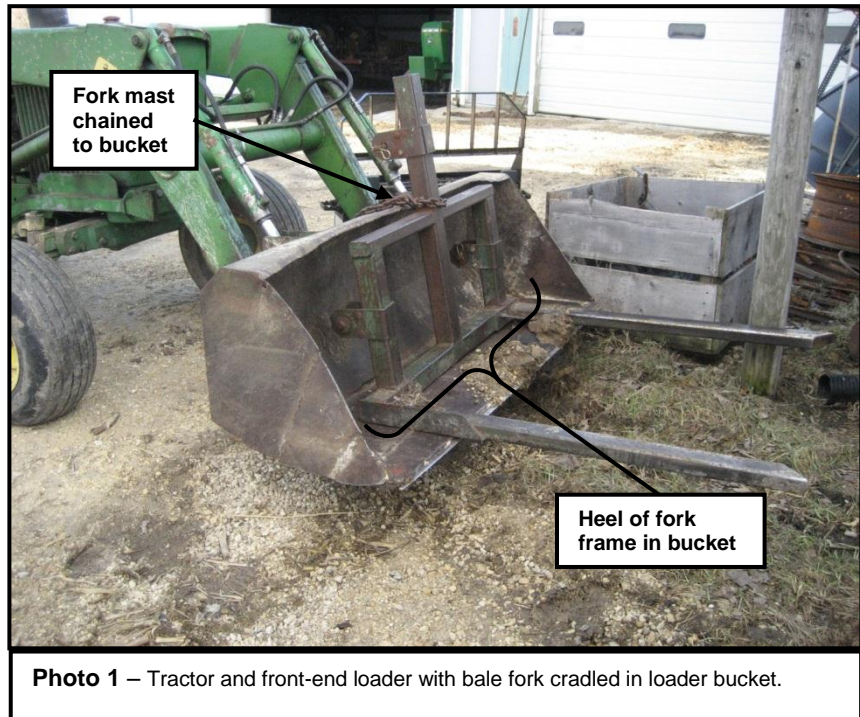

TO: Director, National Institute for Occupational Safety and Health

FROM: Iowa FACE **Case:** 2007IA081 **Report date:** 9 July 2009

SUBJECT: Farmer killed when large round bale tumbled from forks in loader bucket

SUMMARY

Late in 2007, a 60-year-old farmer died while operating his tractor when a large round bale of cornstalks spilled from the forks in the tractor's front-end loader bucket onto him. The loader had been modified by the temporary installation of a 3-point hitch bale fork placed in the tractor's loader bucket. The heel of the bale fork's frame was loosely cradled against the inside curvature of the bucket. The vertical mast of the bale fork's frame was chained at the top center of the loader bucket (Photo 1).



The farmer was trying to back up a slight, but slippery, incline with the cylindrical bale cradled endwise between the forks. He experienced loss of traction as the rear drive wheels of the tractor began to spin on the snow-covered ground. He raised the loader to transfer more weight to the rear wheels of the tractor to improve traction. Still unsuccessful, he began to shuttle the tractor forward and backward, shifting the transmission from forward to reverse gear again and again. Each time the tractor's rear wheels lost traction he moved the tractor forward a short distance then tried backing once more. As he stopped going rearward and shifted to go forward, the bale spilled toward the operator's station and onto the farmer.

The farmer was working alone at the time of the incident. His wife found him unresponsive, slumped forward and to the left of the tractor operator's seat, with the bale resting on him. Local first responders, police, and ambulance personnel answered the call quickly. The farmer was pronounced dead at the scene.

RECOMMENDATIONS

1. *Use front-end loader attachments specifically designed and properly installed for the task to be performed.*
2. *Use tractor-loader combinations capable of performing the task, with wheel base settings and ballast weight as recommended, and carry loads low when moving them.*
3. *Select storage locations for large round bales so they can be easily and safely accessed and moved when needed.*

INTRODUCTION

A 60-year-old farmer was attempting to move a large round bale of cornstalks. He was using a 3-point hitch fork attachment chained into his tractor's front-end loader bucket. Unable to back away from the rows of bales on the snow-covered incline after picking up a bale on the fork tines, he shuttled the tractor forward and backward. As the tractor cycled forward, the bale tumbled back off the fork tines in the loader bucket onto the farmer. The victim's wife inside the farmhouse became aware she could no longer hear the tractor so she went outside to investigate. She found her husband bent forward in the tractor seat underneath the bale of cornstalks.

Iowa FACE investigators learned of this incident through a newspaper press clipping within three days of its occurrence. On-site interviews with the victim's wife and son were conducted during the spring of 2008. Photographs were also taken of the site and the equipment that was in use during the incident. The equipment and its features were described as unchanged from that used at the time of the incident. Additional information was obtained from the local police department as well as medical examiner and autopsy reports.

INVESTIGATION

The 60-year-old farmer in this incident had been involved in farming for most of his life. Fifteen years prior to this incident he started to rent out his 100 acres (40.5 hectares) of farmland and began working off the farm for a local agricultural cooperative and as a mechanic. Both he and his wife worked off the farm yet they continued to raise a small cow and calf herd and fed a few hogs from feeder pig to market weight in buildings on the farmstead. It was a cold, snowy morning when the farmer started the tractor with front-end loader on it. Before he could get to one of the 5 ft diameter 1500 lb (1.5 m, 680 kg) large round bales of cornstalks used as bedding material for the hogs he had to clear a significant amount of new snow from the farmyard and between where the bales were stored and the hog barn.

This farmer had moved large round bales for over 20 years and had considerable experience with the tractor and loader he was using at the time of the incident. It was a mid-sized, mid-1970's utility tractor weighing 5800 lbs (2630 kg) not counting the additional weight of the fluid in the rear tires, one extra weight on each rear wheel axle, and the front-end loader (Photo 2). Its wheels were set so their outside edges were at about the same width as the outer edges of loader bucket.

Rows of large round cornstalk bales had been placed along the edge of the farmyard for wintertime use. The ground was snow-covered and slippery in the area where the cornstalk bales were stored. Chained to the inside of the loader bucket was the framework for a forklift attachment designed for use on the 3-point hitch of a tractor. The victim steered the tractor forward, sliding the forks of his makeshift bale handling attachment lengthwise under a bale. He

raised the loader and began backing away up a slight grade. The weight of the bale on the forks extending ahead of the loader bucket counterbalanced weight on the rear axle of the tractor. Investigators estimated the distance from the center of a bale on the raised forks to the center of the rear axle to be approximately 15 ft (4.6 m) (Photo 2). The farmer raised the bale higher to gain better traction on the slippery surface and perhaps to keep the bale above the other bales as he moved the tractor back and forth. Raising the load added additional weight to the rear axle for improved traction by shortening the horizontal distance between the center of the bale and the front axle of the tractor. Each time the tractor rear wheels lost traction the farmer moved the tractor forward a short distance then backward once again. It is possible he also actuated the raise-lower and/or tilt controls for the loader bucket as he shuttled backward and forward. Finally, as he stopped going backward and shifted to go forward one last time, the bale tumbled onto him in the operator's station.

The victim's wife expected the victim to come into the house to ask her for help to spread the cornstalk bale after he moved it inside the hog barn. When he did not and she could not hear the tractor operating in the yard she became concerned and went outside to investigate. She

found him slumped forward from the tractor seat to the left between the steering wheel and left wheel fender with the bale on top of him. The loader was reportedly raised as shown in Photo 2. The 3-point hitch bale fork in the bucket rotated rearward, pivoting around where it was chained at the top edge of the bucket so that the forks now pointed downward along the sides of the tractor. The exhaust stack of the tractor was not damaged in this incident indicating that the loader had been high in the air and that the bale had missed striking the exhaust stack as it tumbled rearward toward the operator.

The victim's wife immediately called 911 and her son, who responded very quickly. Local first responders arriving on the scene found the victim had no pulse and was not breathing. The bale was removed by the victim's son. The local sheriff also responded and summoned the medical examiner to the scene. The victim was pronounced dead at the scene.

CAUSE OF DEATH

The cause of death was suffocation resulting from mechanical asphyxia.



Photo 2 – Re-enactment showing the equipment involved and the orientation and approximate height of the raised bale before the incident. Note the arrangement of remaining bales illustrating how they were stored.

RECOMMENDATIONS AND DISCUSSION

Recommendation #1 – *Use front-end loader attachments specifically designed and properly installed for the task to be performed.*

Discussion: The bale handling equipment used in this incident was a general purpose front-end loader bucket with a fork attachment chained into it. While the 3-point fork attachment may have been designed for use in handling large round bales on the tractor's 3-point hitch, it was not for installation in a loader bucket. Loader manufacturers and others provide attachments such as bale clamps, grapples, and spears specifically designed for lifting and moving large round bales. When installed properly these attachments hold the bale securely as it is raised, lowered, and moved in transport. Operator manuals for tractors, loaders, and bale handling equipment carry installation and safety practice information to be read and followed.

Recommendation #2 – *Use tractor-loader combinations capable of performing the task, with wheel base settings and ballast weight as recommended, and carry loads low when moving them.*

Discussion: Snow and the slight slope were contributing factors to insufficient traction. The loss of traction was a critical indicator of insufficient tractor and/or ballast weight, and loading (downward force on the rear axle) which was too light even with fluid in the tires and axle weights installed. The center of the round bale load on the forks was well ahead of the front of the loader bucket resulting in leverage that amplified the light rear axle weight problem.

The safe operating practice of carrying front-end loader loads low has multiple advantages. It reduces the risk of overturning the tractor, which is also helped by wheels set as widely spaced as possible for the task to be performed. It also aids in preventing the inadvertent spilling of an unsecured, raised load into the operator's station due to shifting motions, control actuation, rough terrain, or otherwise.

Recommendation #3 – *Select storage locations for large round bales so they can be easily and safely accessed and moved when needed.*

Discussion: The storage location and his approach to retrieve stored bales, which was also influenced by the equipment selected for the task, led the farmer to back the tractor up a slight incline. That incline became very slippery due to normal winter weather conditions. Placing round bales intended for use during the winter where they can be easily and safely accessed and moved under a wide range of environmental conditions should be part of planning as the bales are being stacked in a storage location.

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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 (1-800-CDC-INFO (1-800-232-4636), TTY: 1-888-232-6348, or email cdcinfo@cdc.gov).

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

The Iowa FACE team includes 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 is provided from the Iowa Department of Public Health, including Rita Gergely, Principal Investigator, and John Kraemer, PA, from the Office of the State Medical Examiner.

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