

TO: Director, National Institute for Occupational Safety and Health

FROM: Iowa FACE

Case No. 2005IA002

Report Date: 29 August 2006

SUBJECT: Farmer Pitched from Cart that Tipped while Being Unloaded by Grain Vacuum

## SUMMARY

During the winter of 2005, an 81-year-old farmer died while pneumatically conveying corn from a parked auger wagon into an area of his machinery storage shed. He was standing in the corn near the front of the single-axle grain cart, which had been unhitched from the tractor. The PTO-driven grain vacuum was positioned in the doorway with the tractor connected to it, to provide power take-off (PTO) power, at an angle to it outside the doorway (Photo 1). When a sufficient amount of corn had been vacuumed from the front of the wagon, the weight of corn remaining in the rear of the wagon caused the cart to tip rearward. The farmer was catapulted into the air and landed on the concrete machine shed floor beside the tractor. He suffered a fractured skull and was rushed by ambulance to a regional medical center where he died the next day.



Photo 1 – Grain cart tipped onto its rear beside tractor used to power the portable grain vacuum that conveyed corn into the machine shed.

## RECOMMENDATIONS

1. *Auger wagons that can tip rearward when unloaded unevenly should remain connected to the tractor while they are being unloaded.*
2. *Auger wagons, parked unhitched from the tractor, should be unloaded through a bottom opening (when available) into a hopper from which the grain can further be conveyed.*
3. *Auger wagons without a bottom opening, parked unhitched from the tractor, should be securely blocked or anchored to keep them from tipping rearward or have the rear half of the wagon's contents unloaded first.*

## INTRODUCTION

Early in the winter of 2005 an elderly Iowa farmer was killed while transferring grain from a grain cart into a machine shed on his farm. The Iowa FACE program was alerted to this incident several months after it happened during a routine review of shared data from collaborating sources. An investigation was initiated at that time. Information was gathered from the State Medical Examiner's Office, the County Sheriff, and from local newspapers.

## INVESTIGATION

The farmer was moving corn into a corn storage area in his machine shed using a grain vacuum, with 5 inch (127 mm) diameter ducting, that was powered by the tractor's PTO. The grain cart had a capacity over 356 bushels (12.5 m<sup>3</sup>), or nearly 20,000 pounds (9,072 kg) of corn dry enough for storage at 56 pounds per bushel (780 kg/m<sup>3</sup>) and 15.5% moisture content. The grain vacuum used was capable of conveying 3500 bu/hr (125 m<sup>3</sup>/hr) when operating at capacity or about one bushel per second (2 m<sup>3</sup>/minute). Operating at rated capacity such a pneumatic conveyor could empty a full cart of the size in this incident in about six minutes.

The grain cart was moved into position and unhitched from the tractor. There was significant weight on the tongue of the cart when it was disconnected so that its tongue jack needed to be lowered to enable unhitching, which also kept the grain cart hitch from dropping to the ground. The access ladder to this grain cart is over the hitch frame at the front of the grain box (Photo 2). The farmer climbed the ladder and stepped into the grain cart carrying the intake nozzle and dragging the hose of the grain vacuum with him. While he was suctioning grain from the front of the cart, at some point in time the weight of grain ahead of the rear axle was reduced such that the remaining grain behind the rear axle of the cart was enough to cause the cart to tip rear-ward.



**Photo 2** – Overview showing the tractor, grain vacuum, and the grain cart tipped rearward. Note the ladder on the front of the cart and the down position (for parking) of the jack attached to the hitch frame.

The farmer was pitched from the front of the cart when it rotated around the cart's axle and stopped suddenly as the rear of the cart hit the ground. A wooden brace at the front of the cart was broken, indicating the magnitude of force that propelled the farmer from his original position ahead of the brace.

The farmer flew through the air and landed on the concrete pad near the tractor that was powering the grain vacuum. He suffered multiple head injuries including a fractured skull and was rushed by ambulance to a regional medical center where he died the next day.

### CAUSE OF DEATH

The cause of death taken from the Medical Examiner's report was described as a "closed head injury". No autopsy was performed.

### RECOMMENDATIONS AND DISCUSSION

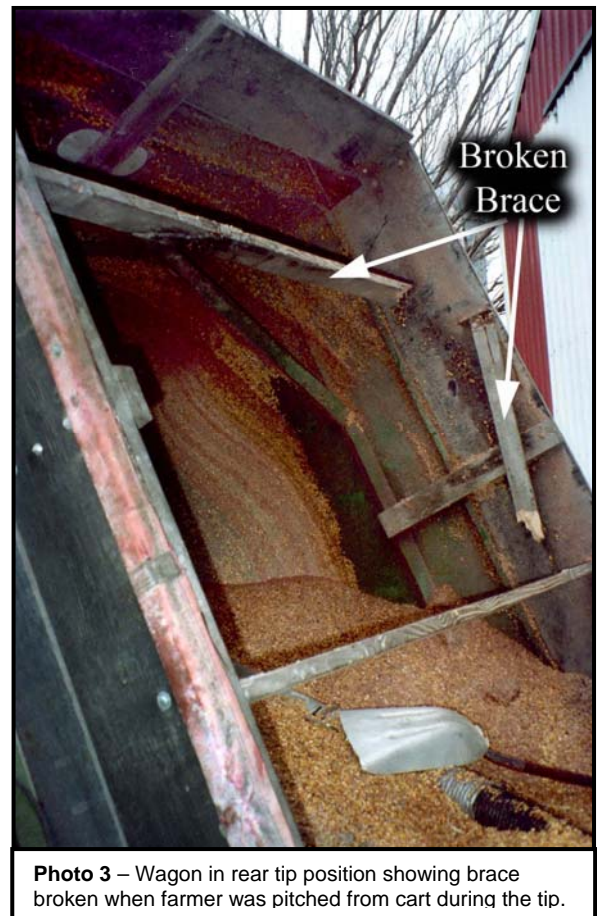
**Recommendation #1** – *Auger wagons that can tip rearward when unloaded unevenly should remain connected to the tractor while they are being unloaded.*

**Discussion:** A grain cart hitch that remains connected to the tractor's drawbar cannot move and therefore keeps the cart hitch from rotating upward and around the wagon axle when an imbalanced load in the cart occurs that would otherwise cause an unhitched wagon to tip rearward. The tractor's drawbar is captured inside the U-shaped end of the cart's hitch and pinned to it. Or, with other hitching arrangements, the end of the cart's hitch can be captured inside the U-shaped end of the tractor's drawbar and is pinned to it.

**Recommendation #2** – *Auger wagons, parked unhitched from the tractor, should be unloaded through a bottom opening (when available) into a hopper from which the grain can further be conveyed.*

**Discussion:** Lowering the cart's hitch to the ground results in a favorable change in geometry, effectively moving the loaded cart's center of gravity further forward of the axle and making it more difficult for the cart to tip rearward. Auger wagons often have an opening near the center of the machine at the base of the auger through which grain can flow by gravity. When the contents of a parked cart can be emptied by gravity out such an opening it minimizes the potential for the cart to be unloaded unevenly and tip over. It also eliminates the need for the farmer to climb the ladder, dragging the cumbersome grain vacuum nozzle and hose, and thereby eliminates the risk of falling from the ladder by allowing the task to be performed at ground level.

**Recommendation #3** – *Auger wagons without a bottom opening, parked unhitched from the tractor, should be securely blocked or anchored to keep them from tipping rearward or have the rear half of the wagon's contents unloaded first.*



**Photo 3** – Wagon in rear tip position showing brace broken when farmer was pitched from cart during the tip.



**Discussion:** If the parked and unhitched cart has no gravity flow opening at the base of the auger in the middle of the cart, then unloading a single-axle cart from the top such as with a grain vacuum should be done with special caution. The hitch should be securely anchored to the ground or the rear of the cart blocked to prevent tipping to the rear. The grain vacuum's intake nozzle should be placed out of the grain near the center of the cart. After climbing the ladder and moving into position above the grain in the middle of the cart, the intake nozzle should be worked rearward from the center of the cart to remove the grain in the rear of the cart first. This keeps a downward load on the hitch point of the cart.

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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 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:



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