

TO: Director, National Institute for Occupational Safety and Health
FROM: IA FACE **CASE ID:** 2005IA034 **REPORT DATE:** 15 June 2006
SUBJECT: Farmer Crushed Against Tractor Tire by Gravity Flow Wagon Box while Unhitching

SUMMARY

A 23-year-old, part-time farmer from northeast Iowa was fatally injured while working alone on his farmstead late in the spring of 2005. He had towed a gravity-flow wagon filled with 150 bushels (5.3 m³) of shelled corn behind his 70 Hp (52 kw) row-crop tractor to the top of a slight knoll in the gravel driveway between the house and machine storage shed. A cement block (silo stave) was placed in front of the right rear wheel of the wagon to block it from rolling forward when the wagon was unhooked from the tractor. Returning to the hitch area, the farmer pulled the hitch pin to disconnect the wagon from the tractor. The wagon moved forward crushing him against the tractor's left rear wheel. The farmer was found by his brother, who had come to meet him at the farm. The brother immediately telephoned for emergency assistance. First responders found the tractor with its engine still running, its transmission in neutral, and its brake set. The left front corner of the fully loaded gravity-flow box pressed against the farmer's chest, pinning him with his back against the tread of the left rear tire of the tractor (Photo 1). The wagon was pulled back about 8-feet from the tractor to free the victim. Resuscitation efforts at the scene were unsuccessful.



Photo 1 – Incident scene after wagon had been pulled backward to free the victim from front left corner of gravity flow wagon box and tractor's left rear wheel.

The brother immediately telephoned for emergency assistance. First responders found the tractor with its engine still running, its transmission in neutral, and its brake set. The left front corner of the fully loaded gravity-flow box pressed against the farmer's chest, pinning him with his back against the tread of the left rear tire of the tractor (Photo 1). The wagon was pulled back about 8-feet from the tractor to free the victim. Resuscitation efforts at the scene were unsuccessful.

RECOMMENDATIONS

- *Providers of gravity flow wagons and users of them should consider equipping wagons with mechanical means such as wheel brakes or chocks to prevent unintended movement when they are unhitched on uneven or sloping terrain.*
- *Tractor operators should securely block (chock) the rear axle wheels of wagons with appropriate chocks before unhitching a wheeled implement such as a wagon that could move on uneven or sloping terrain.*
- *Farmers should evaluate the worksite and equipment to be used, preferring firm level terrain on which to work and uncomplicated equipment logistics.*

INTRODUCTION

The victim worked three days each week at an off-the-farm job less than an hour from where he and wife lived. Their home place, nearly a mile off the main road, was nestled among the irregularly-shaped fields lined by woodlands on this northeast Iowa farm. It's the family dairy farm where the victim grew up working beside his father. Now this young farming couple owned the 50 acre (20 ha) homestead and rented 230 acres (93 ha) more. About 100-acres in small, contoured patches with the rest timberland. Crops of corn and hay helped feed their small herd of beef cattle, a couple dozen hogs, and a few prized horses.

The farmer discussed his work plans for the day with his wife before she left for her off-the-farm job and spoke with her again mid-morning when she called to see how he was doing. He planned to grind shelled corn for the livestock and to move some of the animals to different areas of the farm place. Later in the day his younger brother was coming and the two of them were going to visit a relative in a nearby town. When his brother arrived, he discovered the young farmer pinned between the front of the gravity flow wagon box and wheel of the tractor.

The brother immediately telephoned for emergency medical assistance. Local law enforcement, fire/rescue, and first responder units arrived. Responders to the scene removed the victim from between the wagon and tractor and started resuscitation efforts within 20 minutes of the initial call. The victim had no pulse and was pronounced dead at the scene.

The Iowa FACE Program became aware of this incident through newspaper accounts two days after the incident. A FACE case investigation was initiated and information began to be gathered from the County Sheriff, responders, and the Medical Examiner's Office. An Iowa FACE investigator conducted an onsite visit in late summer and interviewed the victim's spouse.

INVESTIGATION

A 23-year-old farmer was killed late in the spring of 2005 when his chest was crushed between the front left corner of a gravity flow wagon and the back of the left rear tire of a tractor. The wagon was an old, gravity-flow box with sideboards. It was mounted backwards onto an old running gear riding on pneumatic tires (Photo 2). The tractor involved was a 1964 model 706 International Harvester (IH) with a wide front axle configuration, no rollover protective structure, and an IH model 2250 front-end loader attached to its frame (Photo 3).



Photo 2 – Wagon box mounted on running gear to accommodate right side delivery at grinding worksite.



Photo 3 – View of tractor involved in incident parked inside machinery storage building.

This farmer and his wife both worked on and off their farm. He worked three days each week for a local seed retailer. She worked for the same retailer four days each week. They always arranged to have weekends and one extra day together. Time not working off their farm was time spent working on their farm, caring for their livestock, and working the land. They raised about 15 acres (6 ha) of corn and harvested hay from 80 acres (32 ha) to feed their own livestock as well as provide some for sale. They enjoyed their small but varied mix of livestock: a few purebred beef cattle, a couple dozen hogs, and ten horses.

Shelled corn for their livestock had been purchased from a local feed supply. This shelled corn nearly filled the small (150 bushel, 5.3 m³) gravity flow box in which it was stored. The wagon was then parked inside the machinery storage shed for protection against inclement weather. When feed for the livestock was needed, the farmer processed the corn from the wagon through a portable, tractor PTO (power take-off) powered grinder he shared with his neighbor.



Photo 4 – The tractor with gravity flow wagon behind it were positioned with their left wheels on the slope (to the right in this photo) so the wagon's gravity discharge could feed more easily into the intake of the grinder.

On the day of the incident, the tractor was connected to the wagon full of corn in the usual way, by a pin through the aligned holes of the wagon's tongue and the tractor's drawbar. The farmer proceeded to drive the tractor forward, pulling the wagon out of the shed toward the location that worked best for the grinding operation (Photo 4). This location was a slightly elevated area on the gravel pathway about 10 yards (9 m) south of the east end of the machine shed, one-third the distance from the machine shed to the farm house. The tractor and wagon were positioned heading south toward the house with the left side

wheels of the wagon on the slightly higher east shoulder of the pathway. The slightly raised left side made it easier for the shelled corn to flow by gravity down the sloping sides forming the bottom of the wagon and out the adjustable opening located midway along the lower right side of the wagon box. The lower elevation of this opening accommodated positioning the grinder on the lower elevation west of the knoll so the shelled corn flowed easily from the wagon into the grinder's intake hopper auger.

As was typically done after towing the wagon into position, the tractor was unhooked from the wagon then connected to the grinder. The grinder would then be moved into position with the tractor, remaining connected to it to provide the PTO-power needed for the grinder. This day, the grinder remained in the machine shed and the sequence of machinery movements never got past unhooking the wagon in its position on the elevated area of the path.

The farmer spoke with his younger brother by telephone shortly after noon. His brother planned to come to the farm before 3 PM. When he arrived, he heard the tractor running, went inside the farm house for a moment then back outside to see what his brother was doing. He found his brother pinned between the front left corner of the gravity flow box (where the bottom slopes backward away from the junction with vertical front and side sheets) and the left rear tire of the tractor. The farmer was facing toward the wagon with the corner of the wagon box pressing into his chest.

The brother telephoned for emergency assistance. The tractor engine was still running when first responders arrived. The wagon was disconnected from the tractor drawbar and the pin was on the ground below the drawbar. First responders noted that the tractor was in neutral with the parking brake set. The younger brother stated he moved a concrete block (silo stave) from its position about 4-inches in front of the right rear wheel of the wagon to a position ahead of the right front wheel of the wagon so the wagon would not move if emergency responders decided to move the tractor to free his brother.

Marks made by the right rear tractor tire in the gravel of the path indicate the tractor moved ahead after coming to a sudden stop. One plausible explanation is that the farmer applied the brake for that wheel when he stopped, and then the force of the loaded wagon against the tractor nudged the tractor forward. Another plausible explanation is that the impact of the wagon against the tractor, with its parking brake set, caused the tractor to skid forward.

A block ahead of the wagon's right rear wheel is consistent with statements by the farmer's wife that he always "choked" the wagon during this feed grinding operation. She described it as a routine practice he learned in vocational agriculture studies during high school. The position of the block suggests the farmer was aware the wagon, when unhooked from the tractor, could roll forward and that he placed it there before pulling the pin to unhook the wagon tongue from the tractor's drawbar. The block on the gravel surface may not have been sufficient to keep it from sliding and the wagon from moving forward. Perhaps as this strong, young man pushed against the wagon to relieve forward loading so he could remove the hitch pin, or as he turned to hold back the wagon or get out of its way after pulling the pin, he was crushed by the front left corner of the wagon box pressing him against the tractor's left rear wheel.

CAUSE OF DEATH

The cause of death according to the autopsy report was compressional asphyxiation due to the crushing injuries to the chest.

RECOMMENDATIONS / DISCUSSION

Recommendation #1 – *Providers of gravity flow wagons and users of them should consider equipping wagons with mechanical means such as wheel brakes or chocks to prevent unintended movement when they are unhitched on uneven or sloping terrain.*

Discussion: Gravity flow wagons are often unhitched from their towing unit on sloping or uneven terrain where they could begin to move forward or rearward after the hitchpin is pulled, or at some time later. Mechanical means such as a parking brake or chocks can secure a wagon against such unintended movement. While more costly than chocks, a reliable wagon brake that can be activated at the time of disconnecting may be appealing to many farmers. Providing chocks properly designed to function and an easily accessible storage location on the wagon for them could also enhance safety.

Recommendation #2 – *Tractor operators should securely block (chock) the rear axle wheels of wagons with appropriate chocks before unhitching a wheeled implement such as a wagon that could move on uneven or sloping terrain.*

Discussion: Farmers often anticipate the need to chock or otherwise prevent a wheeled implement from moving after it is unhitched from the tractor. It is important that chocks be properly designed and chosen to fit the wheel. Chocks are typically positioned on rear axle wheels, sometimes behind and other times in front of the wheel, or both ahead of and behind the rear axle wheels. When on a side slope or when there is significantly more weight on the downhill side wheels, chocks may be more effectively positioned on the downhill side wheels. When properly designed, selected, and positioned chocks also keep towed equipment from moving when the tractor or other towing unit is moved slightly to relieve binding loads on the hitch pin so that it can be removed more easily.

Recommendation #3 – *Farmers should evaluate the worksite and equipment to be used, preferring firm level terrain on which to work and convenient equipment arrangements.*

Discussion:

Wet ground influencing worksite location, the configuration and placement of equipment, and the absence of another suitable tractor to power the grinder all contributed to overall operational safety at this worksite. Firm and level terrain should be chosen to reduce the potential for equipment to move immediately, during use, or at some later time. Suitable chocks would likely secure the wagon's rear axle wheels from movement better as they gouge into the surface better than a cement block or silo stave whose wider, flat surface and relatively short height would tend to allow it to slide more easily on loose gravel ahead of a rear wheel.

Perhaps the size and placement of machinery needed for this feed-grinding task would not allow a tractor to be connected to the wagon at the same time as another tractor was connected to the grinder. Or, for efficiency and to avoid getting another tractor, the tractor was unhitched from the wagon to move and power the grinder rather than to simply leave it hooked to the wagon. This necessitated unhitching.

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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.

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