
TO: Director, National Institute for Occupational Safety and Health

FROM: Iowa FACE Case No. 2003IA022 Report Date: 06 July 2009

SUBJECT: Tractor with Cable Hitched High to Tow Brush Overturned Rearward on Farmer

SUMMARY

A 56-year-old farmer from east central Iowa died early in the spring of 2003. He was clearing brush, limbs, and fallen trees from along a creek gully at the edge of a pasture on his farm. A strip of level ground separated the creek from a berm that ran parallel to it and hid the work area from view of the farmstead. He was dragging the load



Photo 1 – Tractor shown overturned to rear toward load it was towing with a cable.

toward a burn pile using a braided-wire cable. The cable's other end was hitched high above the drawbar at the rear of his old utility tractor. The front of the skidding load dug into the face of the berm as the tractor pulled forward away from the gully toward the burn pile. The tractor overturned to the rear pinning the victim under its right rear wheel fender (**Photo 1**). The farmer was working alone and the overturn was not witnessed. His wife was first on the scene late the same afternoon, hours after the incident. Several fire rescue, ambulance, and law enforcement service providers responded to her call for emergency assistance, extricated the victim, and placed the tractor upright on its wheels. The tractor was subsequently sold, dismantled, and its parts resold.

RECOMMENDATIONS

1. *Follow tractor operator's manual recommendations for proper ballast weight, hitching, and towing techniques when towing heavy loads.*
2. *A Rollover Protective Structure (ROPS) should be installed on all tractors for which ROPS are commercially available and the associated seatbelt used whenever the tractor is being operated.*

INTRODUCTION

A 56-year-old man died early in the spring of 2003 when the tractor he was operating abruptly overturned rearward pinning him underneath the tractor's right rear fender. Iowa FACE investigators became aware of the incident through a newspaper press clipping account the next day. Documents from responding and investigating authorities, as well as from the medical examiner's office, contributed to this report. In addition, a telephone interview was conducted with the victim's spouse who was first on the scene, although she arrived hours after the overturn occurred. The farmer was working alone and the incident was not witnessed. He was declared dead at the scene.

Together they had owned and lived on this 30 acre farm for five years. Cattle grazed on some of it and a quarter of the acreage was set aside in the conservation reserve program. The property was bounded by a tree-lined creek to the north. The incident occurred in a level area of the pasture between the creek gully and a berm that hid the site from view of the farmstead.

INVESTIGATION

The victim's wife had spoken with him on the telephone about mid morning, and so had his daughter-in-law, but his sister-in-law got no answer when she tried to call him just before noon. He was described as a very scheduled man. It was how he worked during his 30 year career off the farm and every day to get things done on their 30 acre (12.1 ha) farm before heading off to his other job as a machinist and set-up man on second shift at a local manufacturing facility. The victim had been preparing to sell both their farm, which they had purchased five years earlier, and the compact utility tractor. It seemed unusual to his wife when she returned home around 5 p.m. to see his pick-up truck still home and new bottles for lambs that had not yet been fed. She looked around then got on their 4-wheel ATV (all-terrain vehicle) to follow their dog's bark.

It was about 250 yards (228 m) northwest from the house to the back of the field where she found him. A berm of ground blocked her view to the site from the farmstead. The tractor was upside down on top of him in the flat area between the berm and the creek bank from which he had been clearing multiflora rose. (Multiflora rose is a thorny shrub with arching stems once promoted for erosion control and "living fence" but now designated a noxious weed that each county can order to be destroyed at the land owner's expense.) The right, rear-wheel, fender of the tractor pressed diagonally across her husband's neck and upper left chest. She immediately called her son who lived a few miles away then called for emergency assistance. While she was still on the telephone her neighbor (a nurse) came to the scene and was soon followed by several fire rescue, ambulance, and law enforcement personnel.

The belly or mid-mounted rotary mower had been removed from the tractor by the farmer and so had the hydraulically-lifted platform he often used on its rear 3-point hitch when feeding their ducks, geese, and chickens. The tractor was a 1951 model weighing over 2400 pounds (1090 kg), with slightly more than 27 maximum engine horsepower (20 kw), a wheel base of 70 inches (1.8 m), overall length of 115 inches (2.9 m), and overall width with typical tread setting of about

65 inches (1.6 m). The tractor was not equipped with a cab or roll-over protective structure (ROPS) and no seat belt was present or in use at the time of this incident.

A 30 foot (9 m) length of braided-wire cable with a hook at each end connected the tractor to the load of brush and fallen portions of trees it was towing. The cable and hook at one end looped around the head of the load like a choker with the hook secured over the cable. The hook on the other end of the cable was hooked through the uppermost hole on the right side of the bracket which serves as the anchor point for the top center link of the 3-point hitch. This “high hitched” location was 38 inches (96 cm) above ground level and above the tractor’s rear axle (**Photo 2**).

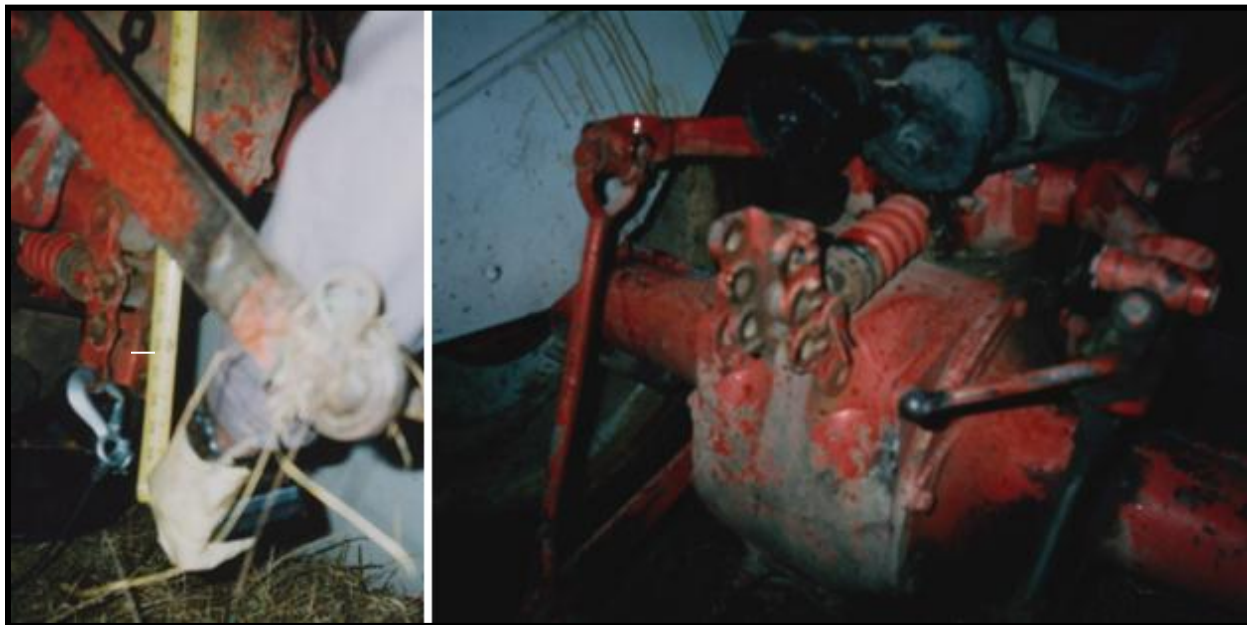


Photo 2 – Picture above left shows upside down tractor with cable hook in top hole of 3-point hitch center link anchor bracket. Picture above right shows anchor bracket position relative to the rear axle on the upright tractor.

The farmer drove forward in second gear to get the maximum pull from his tractor as he dragged the load toward the burn pile. Coming away from the gully with his load in tow, he drove up and onto the berm with his tractor. The front of the load dug into the face of the berm which in combination with the acute angle of pull formed by the cable from the load to its “high hitch” point above the rear axle of the tractor caused the tractor to abruptly overturn to the rear. Proper hitching and installation of a rollover protective structure (ROPS) along with use of its seat belt would likely have prevented this death.

CAUSE OF DEATH

The cause of death according to the autopsy report was asphyxia due to compression of the upper chest.

RECOMMENDATIONS AND DISCUSSION

Recommendation #1 *Follow tractor operator's manual recommendations for proper ballast weight, hitching, and towing techniques when towing heavy loads.*

Discussion: A drawn implement or towed load dragged across the ground creates a resultant line of pull from the load to the drawbar or other attaching point on the tractor. Tractors are designed so the extension of this line of pull passes below the rear axle, effectively working to rotate the front of the tractor downward and thereby placing greater downward force on the front axle. This helps keep the front wheels of the tractor on the ground. The same effect is achieved by adding ballast weight to the front of a tractor. If ballast is added ahead of the front axle it not only adds downward force at the front axle but also reduces weight on the rear axle. Reduced weight on the rear axle reduces the downward force, traction, and the tractor's ability to pull a load. The optimal weight distribution typically recommended for compact utility tractors is sufficient weight to tow the load without excess (over 5%) rear wheel slippage while maintaining 75% of the tractor plus ballast weight on the rear axle and 25% on the front axle. If this ballasted condition cannot be achieved, or the load needs to be hitched higher to raise it off the ground so it can be towed, a larger tractor or preferably commercial log skidder should be used.

When towed loads are hitched to places other than those recommended by the tractor manufacturer the ability of a tractor to safely tow a load is compromised. Tractor operators sometimes connect towed loads to locations above the tractor drawbar, to the rear axle, or even higher, such as to the 3-point hitch center link anchor bracket. Such high hitching reduces the downward force on the front axle when the line of pull passes below the rear axle of the tractor and adds to the upward forces tending to lift the front end off the ground when line of pull passes above the rear axle. Heavy loads and those which could snag and retard or stop forward motion of the tractor should only be attached to the drawbar, or elsewhere as recommended by the tractor manufacturer.

Properly hitched loads can be part of a rearward overturn when they snag and retard or stop the forward motion of the tractor. When this happens, the rear wheels lose traction and spin. If they don't, the front of the tractor will come off the ground. Sometimes both occur simultaneously and suddenly, and even faster when the load is being towed at high speed. In such situations, the momentum of the rising front of the tractor along with asymmetric and intermittent rear wheel traction can result in a rearward overturn situation that cannot be interrupted in the three-quarters of a second it takes to reach the point of no return. Heavy loads should always be towed slowly, with special attention to the terrain for snags and slopes that can contribute to a rear overturn, and clutches or traction power to the rear wheels of tractors starting stubborn loads should be engaged cautiously.

Recommendation #2 *A Rollover Protective Structure (ROPS) should be installed on all tractors for which ROPS are commercially available and the associated seatbelt used whenever the tractor is being operated.*

Discussion: Many overturns happen suddenly, especially rearward overturns which can occur in a fraction of a second and faster than an operator can react. ROPS with seat belt use will not prevent the overturn of a tractor. However, ROPS can often limit an overturn to 90-degrees. They prevent or reduce the injuries which can occur during an overturn by providing a protected zone around an operator, and they are especially effective when the operator is secured within the protective zone by using the seatbelt.

Tractors from domestic manufacturers for the North American market have had ROPS including seatbelt provided as integral equipment for tractors since 1985. ROPS with seatbelts were designed into and are available from original equipment manufacturers for tractors built since

1970. In addition, original equipment manufacturers and aftermarket providers have designed and can provide ROPS and seatbelts for many tractor models manufactured years before they became commercially available in the mid-1960s. There is a ROPS with seatbelt available for the 1951 model compact utility tractor in this incident. Details regarding ROPS for tractors that do not have them can be obtained from local original equipment dealers, state cooperative extension personnel, aftermarket suppliers, and the internet.

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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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