

# MIFACE INVESTIGATION #05MI089

## SUBJECT: Retired Teacher/Farmer Dies When Pinned Under Overturned Tractor.

### Summary

On August 16, 2005, a 58-year-old male retired teacher/farmer was killed when the 48-year-old restored tractor he was driving overturned to the side and pinned him under the tractor seat and steering wheel. The decedent was mowing an unevenly sloped area between the property's driveway and a bean field with a rotary field mower, commonly known as a brush hog, attached behind the tractor. It appears that while mowing the slope, either the tractor wheel and/or the brush hog struck a stump (Figure 1), causing the tractor and brush hog to turn over to the side. The tractor was not equipped with a rollover protection structure (ROPS)/seat belt. The decedent's wife left the home that morning at 7:30 a.m. and returned home at about 9:00 p.m. Her husband was not home, and she assumed that he went to the county fair. She awoke at 3:00 a.m. and noticed he had left his wallet. She immediately began searching the property and finally found him under the tractor. She called 911. Emergency response arrived and he was declared dead at the scene.



Figure 1. Police Photo of stump that was struck by tractor and/or brush hog

### RECOMMENDATIONS

- Retrofit older tractors with properly designed, manufactured and installed rollover protective structure (ROPS) and seat belt when available.
- Even if an older tractor has been retrofitted with a ROPS, owners of older (including classic restored) tractors should evaluate the tractor's capability to perform the tasks and evaluate the risks of using such tractors.
- When trees are cut down in areas where farm equipment and tractors will travel, the stumps should be cut as close to the ground as possible, removed, or ground down.
- Ensure accessory equipment is properly sized to the tractor.
- Practice safe work procedures when operating tractors and/or tractors and accessory equipment on slopes or where there may be unseen obstacles.

Key Words: Agriculture, Tractor, Tractor Overturn, ROPS/Seatbelt, Slope

## INTRODUCTION

On August 16, 2005, a 58-year-old male retired teacher/farmer was killed when the 48-year-old restored tractor he was driving turned over to the side and pinned him under the tractor seat and steering wheel. MIFACE was informed about this incident by a newspaper clipping. The decedent's wife agreed to an August 21, 2006 site visit by the MIFACE investigators. During the course of writing this report, the police department report and pictures, medical examiner's report, and death certificate were reviewed. Pictures used in Figures 1, 2, 3, and 6 in this report are courtesy of the responding police department. The pictures used in Figures 4 and 5 were taken by the MIFACE researcher. Pictures have been modified to remove identifiers.

The family owned property consisted of 20 acres, which included 8 acres of marsh. The family owned horses and planted hay in the front field and hill behind the home. The decedent had a right knee operation in the early 1990s. He required eyeglasses and was wearing them at the time of the incident. The farm had several barns and a workshop; the decedent was establishing a metalworking/woodworking business. One of his hobbies was restoring old John Deere tractors. The decedent had previously restored the tractor involved in the incident primarily for his wife's use. The decedent did not have an operator's manual for the tractor or brush hog.



Figure 2. Tractor after being turned upright by tow company

## INVESTIGATION

The tractor involved in the incident was a restored 1957 John Deere 420 U model (Figure 2). It was a 2-cylinder tractor and was in good running order. The hand clutch was on the left and the brakes were located on the right. The power take-off (PTO) lever was on the right side. The tractor was equipped with an umbrella. The owner had fashioned rectangular fenders that he placed over the existing tractor fenders. Due to his knee problem, he had secured handholds on the fenders to assist in ascending/descending from the



Figure 3. Brush hog after tractor turned upright by tow company

tractor. The rectangular fenders limited the entry space to the operator seat. The tractor was not equipped with a ROPS/seatbelt. Lights were present and in working order on the existing tractor fenders.

The brush hog had a 5-6 foot cutting width and was wider than the tractor frame/wheels (Figure 3).

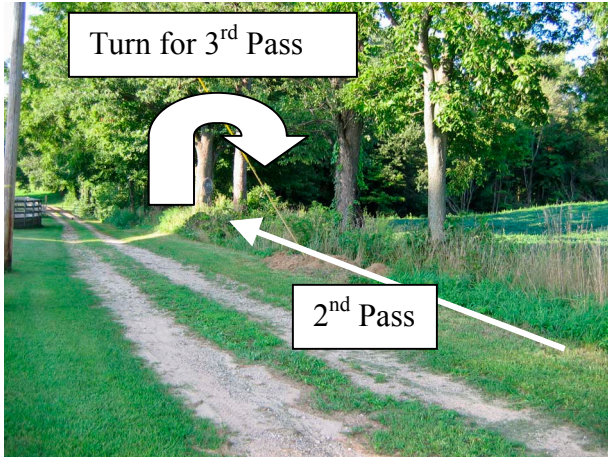


Figure 4. View of bean field on right of slope and driveway

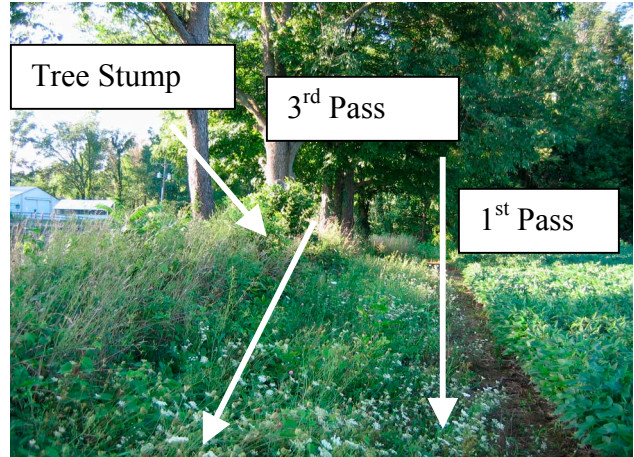


Figure 5. View of bean field and area being cut by decedent

Approximately one year earlier, the decedent had cut down a tree in the area between the driveway and the bean field (Figures 1, 4, and 5). Due to the growth around the stump at the time of the MIFACE site visit, the stump height and diameter could not be measured. The MIFACE investigators estimated that the stump was from a mature tree and measured 10 inches in diameter by 12 inches in height. At some point during the day, after 7:30 a.m. when his wife left for the day, the decedent began to cut the area between the bean field and the driveway. The slope varied in the area between the driveway and the bean field. He had completed two cuts. The first cut was on the edge of the grass on a fairly flat area next to the bean field. His second cut was the grass area between the driveway and the slope. After turning, his third cut was higher on the slope. The tree stump that had been cut the year before may not have been visible to him because of the new tree growth or the brush growth on the slope. It appears either the tractor wheel or the brush hog, or both struck the stump, causing the tractor and brush hog to both turn over to the side and land upside



Figure 6. Overturned tractor

down. The police report did not contain any information about forward speed of the tractor, the gear selected or the engine throttle rpm. Based upon information the decedent's wife shared, MIFACE investigators believe that the tractor was operating at a slow travel speed and lower gear selection and mid to high PTO engine speed (this would be needed to get a good cut with the brush hog).

Based on information given during the site visit, several event scenarios can be developed.

- As the deceased was cutting across the slope, the tractor's front wheel hit the stump, pulling the steering wheel free of the decedent's grasp. When the front wheel hit the stump, it was pulled to the right or up the slope. The mower prevented an overturn at this point, but due to the hand clutch, the operator may not have been able to stop the tractor until the rear wheel hit the stump. As the rear wheel hit, the mower lifted, shifted to the left (downslope) causing the tractor to overturn.
- The decedent may have turned the tractor to the left (down slope) just missing the stump with the tractor. By turning the tractor downslope, the brush hog swung upslope, ran into and possibly up onto the stump. This would quickly cause the entire brush hog to raise up or lean severely. The brush hog was oversized (overweight) for the tractor according to a friend of the decedent and his spouse. This could possibly precipitate a change in the center of gravity and cause both the tractor and brush hog to over turn.
- The decedent may have steered the tractor uphill and the tractor front tire hit the stump. The momentum of the tractor and brush hog could have propelled the tractor and attachment forward up on the stump and tilted the unit, which caused the center of gravity of the tractor to be shifted outside the tractor's wheel setting. This position could have resulted in the turnover.

The decedent's wife returned home between 9:00 p.m. to 9:30 p.m. via the driveway seen in Figure 4. The driveway turned to the left to allow her to park near the door of the home. The overturned tractor was not visible as she drove in. Her husband was not at home. She assumed he may have gone with a friend to the county fair. When she awoke at around 3:00 a.m. she noticed he had left his wallet. Finding his wallet prompted her to start looking for him on the property. She first checked the shop and found that the shop door was open. She checked the barn and found that the tractor and brush hog were not in the barn. She got into her truck and checked the back property. Still not seeing him, she continued her search until she found him under the overturned tractor. She immediately called 911. Emergency response arrived and he was declared dead at the scene

Because the decedent's wife sold both the tractor and the brush hog, MIFACE investigators were not able to see the machinery. She stated that when she used the tractor with this brush hog to mow hay she needed to travel slowly or the front of the tractor would bounce. The extra weight on the rear of the tractor was not compensated for by weights on the front of the tractor (if allowed for by the manufacturer) and therefore was likely a misapplication of equipment attached to this size and weight of tractor.

## CAUSE OF DEATH:

As stated by the Medical Examiner on the death certificate, the cause of death was blunt force trauma due to a farm tractor accident. Toxicological results were negative for alcohol and other drugs.

## RECOMMENDATIONS/DISCUSSION

- Retrofit older tractors with properly designed, manufactured and installed rollover protective structure (ROPS) and seat belt when available.

Older tractors can be equipped with rollover protection structures and seatbelts. Rollover protection structures (ROPS) have been required by federal and state law for all tractors used by employees (with limited exception) in agricultural operations that were built after October 25, 1976. There are two basic types of ROPS for farm tractors: protective frames (two- or four- post structures attached to the tractor chassis) and protective enclosures (cabs or enclosures built around a protective frame). ROPS are designed to help limit a tractor overturn to 90 degrees and to provide the operator a “zone of protection” (Figure 7). The operator must stay within this zone. The operator will not be protected by the ROPS during an overturn if the operator is not wearing a seatbelt. Without a seatbelt, the operator may be totally or partially thrown off the tractor. The seatbelt keeps the operator within the "zone of protection" provided by the ROPS. Even inside a cab, seat belts are important to keep the operator from being thrown against the frame, through a window, or out a door. Therefore, when an older tractor is retrofitted with a ROPS, approved seatbelts must also be installed. Seat belts may or may not be included with an available ROPS package.



Figure 7. Operator Zone of Protection

Some tractors cannot be retrofitted with a ROPS/seatbelt according to the manufacturer or the cost of the retrofit is excessive in relation to the value of the tractor. In these cases, MIFACE recommends that the farm owner not use such tractors and consider renting or leasing a tractor equipped with a ROPS/seatbelt, appropriate equipment for performing the work and discontinuing the use of the non-ROPS/seatbelt-equipped tractor. *Seat belts should not be used on tractors that do not have ROPS.*

The National Farm Medicine Center in Marshfield, Wisconsin maintains “A Guide to Agricultural Tractor Rollover Protective Structures” webpage listing of manufacturers, models, and approximate costs of obtaining retrofit ROPS for tractors. Another option for owners of older tractors to obtain information about ROPS retrofits is to contact their local extension office or tractor dealership. ROPS should be certified to meet at a minimum the standards and regulations of various agencies that ensure that the frame or enclosure is designed to provide overturn protection. ROPS should not be manufactured in the farm machine shop. OSHA requires that ROPS are labeled/marked, therefore, tractor owners should look for a label on the frame or enclosure stating it meets rollover protection standards. Per the Marshfield Clinic website, the cost of a retrofit ROPS/seatbelt for the

John Deere 420 tractor would be approximately \$1,700. The Marshfield Clinic ROPS webpage can be accessed at the Internet address:

[http://research.marshfieldclinic.org/nfmc/resources/rops/default.asp?doc=ROPS\\_tractorRollovers.xml](http://research.marshfieldclinic.org/nfmc/resources/rops/default.asp?doc=ROPS_tractorRollovers.xml)

- Even if an older tractor has been retrofitted with a ROPS, owners of older (including classic restored) tractors should evaluate the tractor's capability to perform the tasks and evaluate the risks of using such tractors.

Many safety features now common on more recent models are not included on older tractors. The horsepower, weight of tractor, and tractor design (e.g. tractor with tricycle configured front tires) may not be compatible with modern equipment. Owners of classic restored tractors should evaluate the use of these tractors in job applications and evaluate any risks posed by the use of the restored tractor to perform these tasks.

- When trees are cut down in areas where farm equipment and tractors will travel, the stumps should be cut as close to the ground as possible, removed, or ground down.

A contributory factor to this tragic incident was the presence of the one-foot high stump. The stump showed fresh damage caused by either the tractor or brush hog running onto/over it. Cutting the stump as close to the ground provides a travel area that will not have the elevation changes (either above ground, or in the case of grinding out a stump, a depression) which would minimize the possibility of the equipment overturning.

- Ensure accessory equipment is properly sized to the tractor.

Too large of an implement can create not only equipment damage, but also safety issues for the equipment operator. Proper matching of accessory equipment with a tractor is generally obvious but it deserves attention. Operators are occasionally tempted to operate an implement with tractors that are too small or too large to operate or control them. A tractor that is too small for the equipment may become unstable because of the extra weight on the three-point hitch. The mower appeared to be a seven-foot mower because it extended just beyond the tractor rear wheels. Generally, the ability of the three-point hitch to lift this mower is an indication of capacity. While this model tractor was known to have a better lift, it did not have overlift capacity. Due to the length of the mower, the manual for the mower or tractor may have recommended counter weights on the front and possibly rear wheels to counteract any shift in the oversized mower the center of gravity. The decedent did not have an operator's manual to determine the maximum accessory size for this restored old tractor.

- Practice safe work procedures when operating tractors and/or tractors and accessory equipment on slopes or where there may be unseen obstacles.

To prevent an overturn to the rear or side, the tractor operator must keep the tractor's center of gravity within the tractor's stability baseline. A tractor's center of gravity is the point where all parts balance one another. Stability baselines are imaginary lines drawn between points where tractor tires contact the ground (Figure 8). If the tractor's center of gravity moves outside the stability baselines, the tractor will overturn. When a tractor (or any piece of equipment) is on a hill, the distance between the equipment's center of gravity and the stability baseline is reduced.

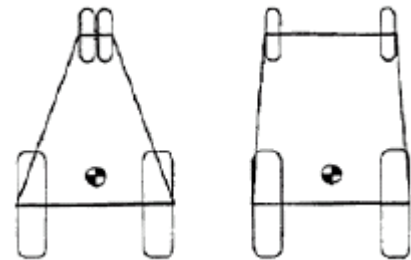


Figure 8. Stability baselines for tricycle and wide front-end tractor

While on the slope, the decedent may have struck the stump or steered the tractor toward the base of the slope. The stump and/or the slope were sufficient to “move” the center of gravity to the outside of the stability baseline between the front and rear tire. When the center of gravity moved outside the stability baseline, the tractor overturned to the side (Figure 9). It is unknown how fast he was driving; his speed may also have played a role in the overturn.

It is very difficult to visually calculate whether a slope is too steep to safely operate a tractor. There are many work practices that can be adopted to minimize the risk of a side overturn. Equipment operators should set the wheel tread at the widest setting suitable for the job to be performed and restrict speed according to operating conditions (if towed equipment fishtails, speeds should be reduced). It is unknown if the mower had stabilizer bars to prevent side-to-side movement. Operators should not let the tractor bounce and slow down before turning. When possible, avoid crossing steep slopes. Keep the heavy end of a tractor pointed uphill on the slope. Back up steep slopes and keep side-mounted equipment uphill. If you must cross a slope, inspect the terrain prior to crossing. Depressions on the downhill side and obstructions on the uphill side can contribute to a tractor overturn to the side.

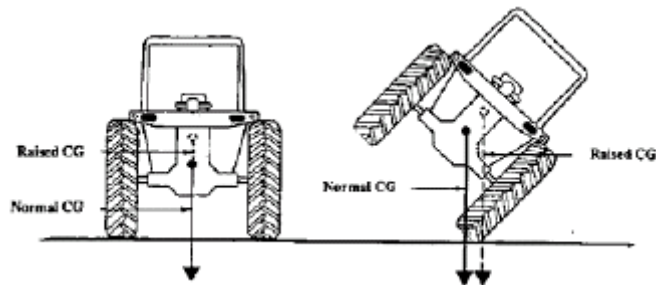


Figure 9. Higher center of gravity allows a side overturn to occur more quickly

## RESOURCES

Farm and Ranch Safety Management 1994 Deere and Company, Moline Illinois, Fourth Edition

A Guide to Agricultural Tractor Rollover Protective Structures, National Farm Medicine Center, 1000 North Oak Avenue, Marshfield, Wisconsin 54449. Internet Address: [http://research.marshfieldclinic.org/nfmc/resources/rops/default.asp?doc=ROPS\\_tractorRollovers.xml](http://research.marshfieldclinic.org/nfmc/resources/rops/default.asp?doc=ROPS_tractorRollovers.xml)

Murphy, DJ. Tractor Overturn Hazards, Pennsylvania State University Fact Sheet Safety –34, Pennsylvania Cooperative Extension Service, Pennsylvania State University College of Agricultural Sciences, Agricultural Engineering Department, 246 Agricultural Engineering Building, University Park, PA 16902. Publication date: 1991.

Internet address: <http://www.abe.psu.edu/extension/factsheets/e/Agsafetyindex.html>

MIFACE (Michigan Fatality Assessment and Control Evaluation), Michigan State University (MSU) Occupational & Environmental Medicine, 117 West Fee Hall, East Lansing, Michigan 48824-1315; <http://www.oem.msu.edu>. This information is for educational purposes only. This MIFACE report becomes public property upon publication and may be printed verbatim with credit to MSU. Reprinting cannot be used to endorse or advertise a commercial product or company. All rights reserved. MSU is an affirmative-action, equal opportunity employer. 1/23/07



# MIFACE

## Investigation Report # 05 MI 089

### Evaluation

To improve the quality of the MIFACE program and our investigation reports, we would like to ask you a few questions regarding this report.

Please rate the report using a scale of:

<b>Excellent</b>	<b>Good</b>	<b>Fair</b>	<b>Poor</b>
1	2	3	4

**What was your general impression of this MIFACE investigation report?**

<b>Excellent</b>	<b>Good</b>	<b>Fair</b>	<b>Poor</b>
1	2	3	4

<b>Was the report...</b>	<b>Excellent</b>	<b>Good</b>	<b>Fair</b>	<b>Poor</b>
Objective?	1	2	3	4
Clearly written?	1	2	3	4
Useful?	1	2	3	4

<b>Were the recommendations ...</b>	<b>Excellent</b>	<b>Good</b>	<b>Fair</b>	<b>Poor</b>
Clearly written?	1	2	3	4
Practical?	1	2	3	4
Useful?	1	2	3	4

**How will you use this report? (Check all that apply)**

- Distribute to employees/family members
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