DATE: September 28, 1995

FROM: Minnesota Fatality Assessment and Control Evaluation (MN FACE) Program
Minnesota Department of Health

SUBJECT: MN FACE Investigation 95MN02801
Farmer Dies After Tractor He was Driving Rolled Over on Him

SUMMARY

A 30-year-old male farmer (victim) died of injuries sustained when the tractor he was driving rolled over on him. He was driving a farm tractor pulling a wagon loaded with approximately 200 bushels of shelled corn. The tractor was not equipped with a rollover protective structure or a general purpose cab. The shelled corn was being hauled into a pasture to be placed in a cattle feedbunk[1]. The victim's father drove a pick-up to the pasture and opened a pasture gate shortly before his son arrived with the tractor and wagon. The gate was located near the top of a steep hill that sloped down into the pasture. The victim slowly drove the tractor up to the open pasture gate. He slowed the tractor at the gate to nearly a complete stop and shifted the transmission into neutral. With the transmission in neutral, the force of the wagon and corn pushed the tractor down the hill. The victim used the brakes to control the speed of the tractor and wagon down the hill. Near the bottom of the hill, he turned the tractor to the right to begin a turn around the feedbunk. As the tractor turned, it slid to the side and overturned 180 degrees to the left and came to rest upside down. The victim was thrown from the tractor and pinned beneath the right fender and the right rear wheel. Emergency medical personnel were called and arrived at the scene approximately 10 minutes after the incident occurred. CPR was immediately administered by the victim's father and was continued by medical personnel while the victim was transported to a local hospital where he was pronounced dead. MN FACE investigators concluded that to reduce the likelihood of similar occurrences, the following guidelines should be followed:

- all tractors should be equipped with a rollover protective structure and a seat belt;
- tractor operators should be trained to recognize and understand the hazards associated with towing items that exceed the weight of the tractor; and
- operators should lock both brake pedals together when driving in slippery

[1] Feedbunk: A long narrow trough for holding feed for dairy or beef cattle.

conditions.

INTRODUCTION

On June 22, 1995, MN FACE investigators were notified of a farm work-related fatality that occurred on June 12, 1995. The county sheriff's department was contacted and releasable information obtained. Information obtained included a copy of their report and copies of their photos of the incident site. A site investigation was conducted by a MN FACE investigator and a Minnesota Farming Health Project public health nurse on July 17, 1995. During the site investigation, information concerning the incident was provided by the victim's parents.

INVESTIGATION

The victim was driving a two-wheel drive farm tractor pulling a gravity flow grain wagon. The tractor was 25 years old and was not equipped with a rollover protective structure or a general purpose enclosed cab. It had a wide front wheel configuration and did not have dual wheels on either rear axle. The front and rear wheel spacing (measured from the center of one tire face to the center of the other tire face) was 72 inches. The tractor did not have any counterweights mounted on it nor were any of the tires filled with fluid. The approximately weight of the tractor according to the manufacturer's specifications was 9500 pounds.

The gravity flow wagon weighed approximately 1500 pounds and had a capacity of approximately 300 bushels. The wagon was loaded with approximately 200 bushels of shelled corn. The corn was hauled into a pasture to be placed in a cattle feedbunk located near the bottom of a steep hill. The estimated weight of the corn, based on a standard weight for corn of 56 pounds per bushel was approximately 11,200 pounds. The estimated total weight of the wagon and corn was approximately 12,700 pounds.

The victim drove the tractor to a pasture located on a farm approximately two miles from where the grain was stored. The victim's father drove a pick-up to the pasture and opened a pasture gate shortly before his son arrived with the tractor and wagon. The gate was located near the top of a steep hill that sloped down into the pasture. Grass in the pasture was approximately 15 to 18 inches tall. At the bottom of the pasture approximately 150 feet beyond the location of the rollover was a narrow stream. The edges of the stream were difficult to see because of the tall grass. The slope of the hill varied from approximately 9.5 degrees or 17 percent near the top to approximately 4 degrees or 7.5 percent at a point 100 feet from the gate which was where the tractor overturned.

The victim slowly drove the tractor up to the open pasture gate. He slowed the tractor at the gate to nearly a complete stop and shifted the transmission into neutral. Apparently, after the transmission was shifted into neutral, the force exerted by the wagon and corn prevented the victim from stopping the tractor and shifting it into a lower gear. With the transmission in neutral, the force of the wagon and corn pushed the tractor down the

hill. The victim used the brakes to control the speed of decent down the hill. As he neared the bottom of the hill, he turned the tractor to the right to begin a 180 degree turn around the feedbunk. The estimated speed of the tractor was approximately 4 to 5 miles per hour as the victim turned it to the right. As the tractor turned, the momentum of the corn and wagon exerted enough force against the tractor drawbar to cause the tractor to slide. The tractor and wagon "jack knifed" and as the tractor slid to the side, it overturned 180 degrees to the left and came to rest upside down. The victim was thrown from the tractor and was pinned beneath the right fender and the right rear wheel.

The victim's father used a two-way radio in the pick-up to notify another family member of the incident. Emergency medical personnel were called and arrived at the scene approximately 10 minutes after the incident occurred. Cardiopulmonary resuscitation (CPR) was administered by the victim's father until emergency medical personnel arrived. They removed the victim from under the tractor and continued to administer CPR while the victim was transported to a local hospital where he was pronounced dead.

CAUSE OF DEATH

The cause of death listed on the death certificate was closed head injury, chest and penetrating intra-abdominal injury due to tractor accident.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: All tractors should be equipped with a rollover protective structure and a seat belt.

Discussion: Preventing death and serious injury to tractor operators during tractor rollovers requires the use of a rollover protective structure and a seat belt. These structures, either a roll-bar frame or an enclosed roll-protective cab, are designed to withstand the dynamic forces acting on them during a rollover. In addition, seat belt use is necessary to ensure that the operator remains within the "zone of protection" provided by the rollover protective structure. Government regulations require that all tractors built after October 25, 1976, and used by employees of a farm owner must be equipped with a rollover protective structure and a seat belt. Many older tractors are in use on family farms and do not have, nor are they required by government regulation to have, such structures to protect their operators in case of a rollover. All older tractors should be fitted with a properly designed, manufactured, and installed rollover protective structure and seat belt. If the tractor involved in this incident had been fitted with a rollover protective structure and a seat belt, and the seat belt had been in use, this fatality might have been prevented.

Recommendation #2: Tractor operators should be trained to recognize and understand the hazards associated with towing items that exceed the weight of the tractor.

Discussion: The momentum of a vehicle in motion is directly proportional to the weight and speed of the vehicle. The total momentum of a tractor and a towed unit or units consists of the momentum of the tractor plus the momentum of the towed unit(s). The combined weight of the wagon and shelled corn was estimated to exceeded the weight of the tractor by approximately 3200 pounds. If the total weight of a towed unit or units exceeds the weight of the tractor pulling them, dangerous situations may be created, especially as speed increases, while turning, or while driving on surfaces such as grass covered areas where traction may be reduced. The momentum of the wagon and corn was estimated to exceed the momentum of the tractor and resulted in a condition that increased the potential for loss of control by the operator. All of these factors either were or may have been present and contributed to the occurrence of this incident. Recognition and understanding of the hazards associated with towing items is essential to reduce the likelihood of dangerous situations that may result in tractor rollovers.

Recommendation #3: Operators should lock both brake pedals together when driving in slippery conditions or conditions where traction may be reduced.

Discussion: The center of gravity of most two-wheel drive tractors, is behind the midpoint of the tractor's length and above the rear axle height. During turns, the forces acting on the tractor can cause it to roll over to the side. If an operator applies braking to only one rear wheel or uneven braking to the rear wheels while driving on slippery conditions or conditions where traction may be reduced, the tractor may suddenly begin to slide to the side. During a slide to either side, the forces acting on the tractor are similar to the forces that exist during high speed turns and they may cause the tractor to overturn. Whenever tractors are used to pull heavy loads or when they are operated on slippery surfaces, the brake pedals should be locked together to reduce the likelihood of causing the tractor to slide to either side and overturn as the result of uneven braking.

REFERENCES

1. Office of the Federal Register: Code of Federal Regulations, Labor, 29 CFR Part 1928.51 (b), U.S. Department of Labor, Occupational Safety and Health Administration, Washington, D.C., April 25, 1975.

2. Agriculture Safety, Fundamentals of Machine Operation, 1987, Deere & Company, Moline, Illinois, Third Edition.

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