The National Institute for Occupational Safety and Health (NIOSH)

Farmer Dies After Becoming Entangled In A Power-Take-Off Shaft

MN FACE Investigation 01MN004
July 25, 2001

SUMMARY

A 41-year-old male farmer (victim) died after he became entangled in an unguarded power-take-off (PTO) shaft. The victim and another worker (a truck driver) used a power-take-off driven auger to transfer animal feed pellets from a semi-truck to a farm grain wagon. They were standing in a restricted area between the PTO shaft that powered the auger and the left side of the semi-truck box. The victim apparently stepped slightly back toward the PTO shaft to provide additional room for the truck driver when the truck driver closed the truck's unloading door. When the victim stepped back, the end of the jacket sleeve on his right arm became entangled in the rotating PTO shaft. The truck driver initially tried to grab the victim's legs to free him. He then got on the tractor, disengaged the tractor's PTO shaft and placed a call to emergency medical personnel. They arrived shortly after being notified and freed the victim from the PTO shaft. They transported him by air ambulance to a nearby major medical facility where he died later on the day of the incident. MN FACE investigators concluded that, in order to reduce the likelihood of similar occurrences, the following guidelines should be followed:

- **all rotating shafts should be covered by shields to prevent workers from becoming entangled;**
- **all equipment shields and guards should be kept in good condition and in place, and;**
- **operators should not wear loose-fitting clothing near operating machines.**

INTRODUCTION

On April 4, 2001, MN FACE investigators were notified of a farm work-related fatality that occurred on March 28, 2001. The county sheriff's department was contacted and a releasable copy of their report of the incident was obtained. Although a site investigation was not conducted, the sheriffs department report and copies of their photographs taken at the incident site provided specific and comprehensive information concerning this fatality. Also, interviews with first responders who were at the scene shortly after the incident occurred provided additional details of the incident. During MN FACE investigations, incident information is obtained from a variety of sources such as law enforcement agencies, county coroners and medical examiners, employers, coworkers and family members.

INVESTIGATION

On the day of the incident, the victim and another worker (a truck driver) were unloading a semi-truck that was parked in the victim's farm yard. The semi-truck was a belly-dump truck that was designed for hauling grain. The truck box was divided in the middle to create two compartments. The bottom of each compartment was slanted from all four sides which caused grain to flow by gravity to a sliding horizontal unloading door located at the bottom of each compartment. A control mechanism for opening and closing each unloading door was located below the left side of the truck box and could be accessed and operated while standing along the left side of the truck.

The semi-truck was filled with a pelleted animal feed supplement. The two workers used a power-take-off (PTO) driven auger to transfer the feed pellets from the semi-truck to a farm grain wagon. The location of the equipment being used at the time of the incident is shown in Figure 1. The intake end of the auger was pushed under the rear compartment unloading door of the truck and a farm grain wagon was parked under the other end of the auger. A tractor was backed up to the auger and the auger's PTO shaft was connected to the tractor's PTO drive shaft. The tractor was approximately four years old and was rated at 105 horsepower. The tractor's PTO shaft was designed to operate at 540 revolutions per minute. During the investigation, it could not be determined at what speed the PTO shaft was rotating at the time of the incident.

The auger's PTO shaft was originally fitted with a two-piece telescopic tubular safety shield to protect workers from the rotating PTO shaft. Although the tubular shield rotated with the PTO shaft, if a worker contacted the tubular shield, it would immediately stop rotating while the enclosed PTO shaft continued to spin. However, at the time of the incident one-half of the tubular shield that enclosed the PTO shaft was missing. This resulted in the PTO shaft being unguarded from the point where it was connected to the tractor to the mid-point of the shaft.

The tractor was positioned nearly parallel to the left side of the truck box as shown in Figure 1.

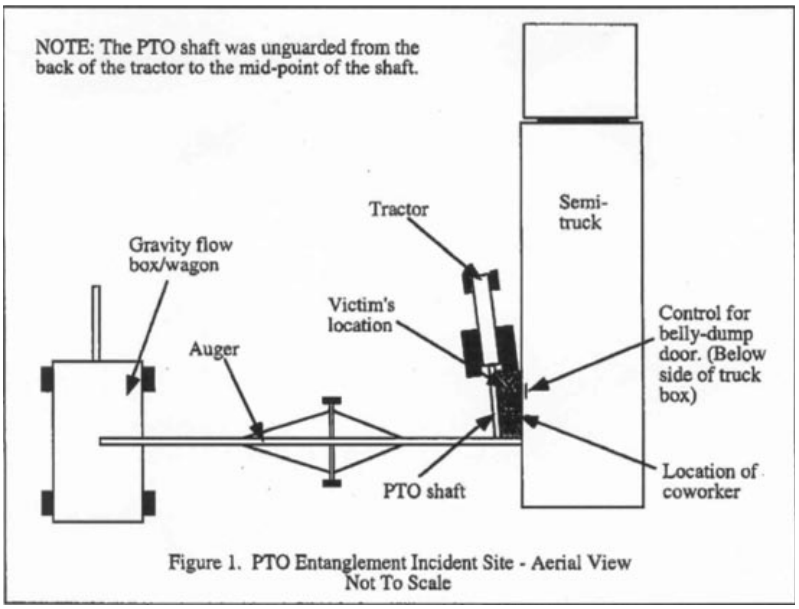

Figure 1. PTO Entanglement Incident Site - Aerial View
Not To Scale

The physical configuration of the equipment at the scene created a small restricted work area (shaded area of Figure 1) that was bound by a portion of the side of the truck box, a portion of the auger, the auger's PTO shaft and one-half of the back of the tractor. The size of the restricted area was approximately 6-7 feet long, 4-5 feet wide at the back of the tractor and 3-4 feet wide at the narrower end of the area. The configuration of the equipment required a worker to be in this restricted area to access the control mechanism to open and close the horizontal unloading door of the truck's rear compartment.

The victim and the truck driver were standing in the restricted area at the approximate locations indicated in Figure 1. When the rear compartment of the truck was empty, the truck driver moved toward the victim to reach the mechanism for closing the rear compartment unloading door. The victim apparently stepped slightly back toward the PTO shaft to provide additional room for the truck driver. When he stepped back, the end of the jacket sleeve on his right arm became entangled in the rotating PTO shaft. He sustained multiple trauma as he was thrown against the ground and against parts of the tractor by the rotating shaft. In addition, his right arm was completely amputated at the shoulder before the tractor's PTO shaft could be stopped. The truck driver initially tried to grab the victim's legs to free him. He then got on the tractor, stopped the PTO shaft and placed a call to emergency medical personnel. They arrived shortly after being notified and freed the victim. They transported him by air ambulance to a nearby major medical facility where he died later on the day of the incident.

CAUSE OF DEATH

The cause of death listed on the death certificate was not available at the time this report was completed.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: All rotating shafts should be covered by shields to prevent workers from becoming entangled.

Discussion: Exposed rotating shafts are hazardous situations that can cause serious injury or death to workers. All rotating shafts that workers are exposed to should be covered by properly designed guards and shields. In this incident, a grain auger was being driven by a power-take-off shaft of a farm tractor. In this case, the PTO shaft was unguarded from the point where it was connected to the tractor to the mid-point of the shaft. As a result, one half of the rotating horizontal shaft between the tractor and the auger was exposed and resulted in the victim becoming entangled in it.

Recommendation #2: All equipment shields and guards should be kept in good condition and in place.

Discussion: Shields and guards protect workers from moving components that can cause serious injury or death. During this investigation, it was learned that the auger's PTO shaft was originally fitted with a two-piece telescopic tubular safety shield to protect workers from the rotating PTO shaft. However, at the time of the incident one-half of the tubular shield that enclosed the PTO shaft had apparently been previously damaged and was missing. All damaged equipment shields and guards should be immediately repaired to provide workers adequate protection from rotating shafts and moving machine components. In addition, whenever any safety shields and guards are removed from equipment to perform necessary maintenance or repairs, they should be properly reinstalled before the equipment is used.

Recommendation #3: Operators should not wear loose-fitting clothing near operating machines.

Discussion: The risk of entanglement in rotating shafts and machine components can be reduced if operators do not wear loose fitting clothing. Work clothing should be well-fitting and zippered or buttoned, not open. Frayed or loose fitting clothes, jackets and sweat shirts with drawstrings, and boots or shoes with long shoe laces should be avoided. Although it did not appear that the victim in this incident was wearing loose fitting clothing, this recommendation is a general safe work practice that should always be followed by operators of machines whenever the risk of entanglement exists.

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