



## The National Institute for Occupational Safety and Health (NIOSH)



# Farmer Dies After Being Pinned Beneath The Header Of A Combine in Minnesota

Minnesota FACE 00MN014

## SUMMARY

A 37-year-old male farmer (victim) died after he was pinned beneath the header of a combine. The header was equipped with hydraulic cylinders to raise and lower it. Attached to one of the hydraulic cylinders was a mechanical safety stop. When the header was raised, the safety stop could be locked in position to prevent the header from being lowered or falling to the ground due to activation of the hydraulic system or due to a failure of a hydraulic system component.

Across the bottom of the header was a row of fixed and movable pads. The movable pads were connected via control arms to a system that provided automatic control of the header height. While the combine was driven through fields, the movable pads contacted the ground first since they extended slightly below the fixed pads. When the combine traveled over uneven ground, an upward force was exerted against one or more of the movable pads. An upward movement of any one of the movable pads caused the hydraulic control system to automatically raise the header. As the combine traveled forward and the terrain became more even, the movable pad or pads returned to their normal position and caused the hydraulic system to lower the header to its previous position.

During the 1999 harvest season, the automatic height control system did not always maintain the header in a position close to the ground. Instead the header would start and continue to rise higher and higher. While the victim harvested soybeans, one or more of the movable pads apparently became stuck and caused the header to rise off the ground. The victim stopped the combine and moved the engine's throttle lever to an idle position before leaving the cab. He did not lock the safety stop in place to prevent the header from lowering before crawling beneath it. While under the header it began to lower and he became pinned beneath it.

The victim's father was at their farm site waiting for a call from his son to tell him that a grain truck parked in the field was full of soybeans. When he did not receive a call as expected he drove to the field and discovered his son beneath the header. He entered the cab and activated the hydraulic system to raise the header. After raising the header he removed his son and used a cell phone to call emergency personnel. They arrived at the scene shortly after being notified and pronounced the victim dead at the scene. MN FACE investigators concluded that to reduce the likelihood of similar occurrences, the following guidelines should be followed:

- workers should always use all safety devices that machines are equipped with to prevent injury and exposure to hazards; and
- machines that are not working properly should be taken out of service and repaired prior to use.

## INTRODUCTION

On March 31, 2000, MN FACE investigators were notified of a farm work-related fatality that occurred on October 11, 1999. The county sheriff's department was contacted and releasable information obtained. Information obtained included a copy of their report of the incident and copies of their photographs of the equipment involved. On May 1, 2000 a site investigation was conducted by a MN FACE investigator. 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 used a modern self-propelled combine to harvest a field of soybeans. The combine was manufactured in 1992 and was purchased in 1995 by the victim and his father. Attached to the front of the combine was a 22.5 feet wide attachment known as a header. The header was equipped with a set of long cylindrical reels and a horizontal cutting bar designed to cut a variety of crops including soybeans. While the combine was used to harvest soybeans, the cutting bar slid along the ground and cut off the soybean stems approximately one inch above the ground. The cut stems and soybean pods were transferred by a large auger to the center of the header and then pulled into the feeder and harvesting portions of the combine.

The entire header and feeder portion of the combine was equipped with hydraulic cylinders to raise and lower it for harvest and transport operations. The hydraulic cylinders were manually controlled by a lever located in the operator's cab of the combine. The combine was also equipped with a system that automatically controlled the height of the header while crops were being harvested. The automatic control system maintained the cutting bar as close as possible to the ground as the tilt of the combine changed due to variations in the slope of the ground.

Attached to one of the hydraulic cylinders used to raise and lower the header was a movable safety stop. During harvesting operations the safety stop was locked in a retracted position and the header could be raised and lowered as needed. Whenever the header was raised to near its maximum height for transport or maintenance, the safety stop could be manually lowered and locked in position. When lowered and locked in position, the header was prevented from lowering or falling to the ground due to either an inadvertant activation of the hydraulic control levers or a failure of a component of the hydraulic system.

Across the bottom of the header and directly beneath the cutting bar were a series of approximately six inch by six inch square steel pads. The pads were mounted adjacent to each other and continued along the entire length of the header. The surface of each pad was not completely flat but had a slight curvature that enabled them to slide along the surface of the ground. Most of the pads were rigidly fastened to the bottom of the header, however every sixth pad beginning from either end of the header could move slightly in an up and down direction. The movable pads extended approximately one quarter inch below the position of the fixed pads. Each movable pad was connected to one end of a control arm that was located beneath the header. The other end of each control arm was fastened to a long round shaft that extended along the entire length of the back of the header. Near the middle of the shaft, one end of a small control arm was welded to the shaft. The other end of the small control arm was connected via a thin insulated cable to an electrical sensor known as a potentiometer.

While the combine was driven through the field with the header height in the automatic control mode, the movable pads contacted the ground first since they extended slightly below the fixed pads. When the combine traveled over uneven ground, the combine would tilt to either side and an increased upward force would be exerted against one or more of the movable pads. A slight upward movement of one or more of the movable pads caused a slight rotation of the round shaft attached to the ends of the control arms. An indication of this rotational movement was transferred to the potentiometer which sent an electrical signal to the hydraulic control system. The hydraulic control system would automatically raise the

header until the upward pressure against the movable pad was eliminated. As the combine traveled forward and the terrain became more even, the movable pad or pads that had moved upward would return to their normal position and cause the hydraulic system to lower the header to its previous position slightly above the ground.

During the MN FACE site investigation, the MN FACE investigator was informed that during the 1999 harvest season, the automatic height control system was operating inconsistently. While harvesting soybeans in fields that were slightly wet due to recent rain, the hydraulic system would not always maintain the header in a position close to the ground. Instead the header would start and continue to rise higher and higher versus remaining within a few inches of the ground. This may have been caused by wet soil or mud that caused one or more of the movable pads to become stuck in an “up or raised” position. A movable pad stuck in an up position would cause the system to sense a non-existent upward force and cause the hydraulic system to raise the header higher and higher off the ground.

While the victim was harvesting soybeans on the day of the incident, one or more of the movable pads may have become stuck and caused the header to rise higher and higher off the ground. The victim stopped the combine, disengaged its operating mechanism and moved the engine’s throttle lever to an idle position before leaving the combine cab. Before crawling beneath the raised header, he did not lower and lock the steel safety stop in position to prevent the header from lowering to the ground. He crawled under the header in an apparent attempt to determine if any of the movable pads were stuck in an “up or raised ” position. While under the header, he apparently pulled down on one or more of the movable pads and caused the automatic control system to respond and lower the header. Before he was able to escape he became pinned to the ground beneath the header.

The victim’s father was working nearby at their farm site and waiting for a call from his son that a grain truck parked in the field was full of soybeans. When he did not receive a call as expected from his son, he drove to the field and discovered his son pinned beneath the header. He entered the cab, accelerated the combine engine and activated the hydraulic system to raise the header. The hydraulic system operated properly which indicated that the header hadn’t lowered because of a failure such as a broken hydraulic hose or a mechanical failure. After raising the header he removed his son and used a cell phone to call emergency personnel. Emergency medical personnel arrived at the scene shortly after being notified and pronounced the victim dead at the scene.

## CAUSE OF DEATH

The cause of death listed on the death certificate was asphyxiation due to to compression.

## RECOMMENDATIONS/DISCUSSION

**Recommendation #1: Workers should always use all safety devices that machines are equipped with to prevent injury and exposure to hazards.**

Discussion: Modern machines, including farm equipment are designed and equipped with a variety of effective safety devices. These devices protect workers while the machines are being used and during maintenance and repair of the machines. Safety devices are designed to prevent workers from being exposed to hazards and hazardous situations or to eliminate hazards in certain cases. In this incident, one of the hydraulic cylinders that controlled the height of the combine header was equipped with a manually safety stop. When moved and locked in its lowered position the safety stop prevented the header from lowering by activation of the hydraulic system from within the combine cab or falling due to a failure of a component of the hydraulic system. Before crawling under the raised header the victim did not lower and lock the safety stop in position to keep the header in its raised position. In this case, if the safety stop had been locked in place this fatality probably would have been prevented.

**Recommendation #2: Machines that are not working properly should be taken out of service and repaired prior to use.**

Discussion: Workers should ensure that machines are regularly inspected and maintained in proper working condition. Upon inspection, if a machine is found in need of repairs or if during use it does not operate properly, it should be taken out of use until it is repaired and operating correctly. In this incident, the automatic height control system for the combine header had been operating inconsistently and would not always maintain the header in a position close to the ground. In wet ground conditions, the header would occasionally start and continue to rise higher and higher versus remaining within a few inches of the ground. This may have been caused by wet soil or mud that caused one or more of the movable pads to become stuck in an "up or raised" position. If the combine had been taken out of service and the automatic height control system for the header had been repaired so it operated properly, this fatality might have been prevented.

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