ADMINISTRATIVE REPORT **DATE: October 14, 1998**
PUBLIC HEALTH SERVICE/CDC/NIOSH/DSR
FACE 98-12

TO: Director, National Institute for Occupational Safety and Health

FROM: Division of Safety Research, NIOSH

SUBJECT: Fence Technician Pinned Inside Cargo Van by Line Laying Machine — North Carolina

SUMMARY:

On May 21, 1998, a 22-year-old male fence technician trainee (the victim) for an invisible fence distributorship was caught between the handlebar of a line-laying machine and the rear door jamb of a cargo van as he attempted to unload the machine. The victim was accompanying the head fence-technician during initial job training and had been dispatched to a residence to complete a fence installation which had been started by another technician. While preparing to begin work, the victim entered the back of the cargo van to unload the machine. When he started the machine's engine, the machine either immediately moved in reverse or moved in reverse when he engaged the reverse drive mechanism. The handlebars of the machine pinned the victim against the inside upper edge of the van's rear door jamb. Co-workers, who were working at the side of the residence, heard a squealing noise from the van, went to investigate and found the victim pinned. They shut down the machine and removed him from the van. One of the co-workers, a certified EMT began first aid while the homeowner notified 911. A local emergency medical squad responded within 7 minutes and transported the victim to a local medical center where he was pronounced dead, shortly after arrival.

NIOSH investigators concluded that to prevent similar incidents in the future, employers should:

- ensure that there is safe clearance between transport vehicles and mobile machines to allow safe loading and unloading of equipment

- ensure that employees follow written safe procedures for loading and unloading mobile machines from transport vehicles.

Additionally, equipment manufacturers should:

- develop safe operating procedures which include all aspects of the machine's use, including loading and unloading from transport vehicles.

- consider the use of engineering controls to eliminate operating positions which expose workers to hazards of tight clearance.

INTRODUCTION

On May 21, 1998, a 22-year-old fence technician trainee (the victim) for an invisible fence distributor was killed while attempting to unload a line-laying machine from a cargo van. On May 22, 1998, officials of the North Carolina Occupational Safety and Health Administration (NCOSHA) notified the Division of Safety Research (DSR) of the occurrence, and requested technical assistance. On June 18, 1998, a DSR safety engineer reviewed the case with the NCOSHA District Supervisor, interviewed the distributor, the division general manager, the head fence technician, and examined and photographed the line-laying machine and cargo van.

The employer in this incident was a distributor of invisible fences used for pet containment. The distributorship had been in business for 11 years and employed 31 people in 6 retail divisions. There were 8 employees in the victim's division. Training was conducted on the job. Fence technicians normally worked alone. However, as part of the hiring and training process, the operation of the line laying machine was shown to prospective employees at the division office and candidates were hired on a temporary basis and assigned to work with the head fence technician for 5 days. If they successfully completed this trial period, they were hired as full time employees and assigned a 2 to 3 week detail with the service manager. The victim had just satisfactorily completed 4 days on the job, and had been advised on the morning of the incident that he would be permanently hired.

The employer had general written safety policy and procedures. The unwritten procedures for operating the line-laying machine, including loading and unloading, were learned on the job and by viewing a video prepared by the manufacturer of the machine. This was the employer's first fatality.

INVESTIGATION

The pet-containment systems sold and installed by the company consisted of a radio transmitter, an antenna wire buried approximately 5 inches below ground level, and a radio receiver

fastened to the pet's collar. When the pet approached the buried antenna, the receiver detected a signal and delivered a mild shock to the pet. The antenna wire was buried by a walk-behind machine known as a line layer. The line layer (see figure) weighed about 800 pounds and was powered by a 16-hp single-cylinder engine which propelled the machine and powered a blade which projected into the ground from the center of the machine. In operation, the blade reciprocated vertically, slicing the ground and laying the wire which passed through a hole in the blade.

On the day of the incident, the victim had begun work at the normal 7:30 a.m. start time. He accompanied the head technician and together they installed a fence at a residence near the district office.

After completing this task, they were routed by the division's general manager to another location where another fence technician had experienced a machine malfunction during an installation. They arrived at the site about 12:00 p.m. They parked their cargo van in the driveway at the right side of the residential property. The head technician and the fence technician walked to the left side of the residence and around the back, discussing details for completing the job. The fence technician was going to return to the division office while the victim and the head technician completed the last 100 feet of fence installation. While so engaged, they heard a noise coming from the driveway which sounded like car tires squealing. They went to the driveway and found the victim inside the van, pinned between the right handlebar of the line-laying machine and the top of the rear door jamb. He was unconscious with his head hanging freely. They shut down the machine and moved the victim from the van, taking him to a shaded area of the residential grounds. While they were moving the victim, the homeowner arrived and called 911. One of the co-workers, a certified EMT, began first aid. A unit from the local fire department and an emergency medical squad responded within 7 minutes. CPR was started and the victim was transported to a local medical center where he was pronounced dead.

Evaluation of the circumstances surrounding the incident indicates that while the head technician and the fence technician had been discussing the fence installation, the victim had attached ramps to the rear sill of the cargo van, and entered the van. There are two different scenarios that could have led to this fatality. The first is that the victim placed the transmission of the line laying machine in reverse, and pulled the starting rope while the machine's drive control was engaged. The machine, still warm from use on the previous installation, may have started readily and moved to the rear. Or, he may have started the machine's engine with the drive control disengaged, placed the transmission shift

lever in reverse and then engaged the drive control to move the machine. The victim, located within the 9-inch clearance between the handlebars and the top of the van's rear door jamb, was pinned by the right handlebar of the reversing machine.

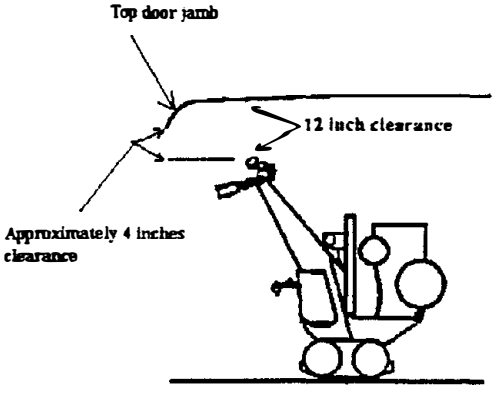
CAUSE OF DEATH

The medical examiner's investigation attributed death to traumatic asphyxia due to crushing injury to the chest.

RECOMMENDATIONS

Recommendation #1: Employers should ensure that there is safe clearance between transport vehicles and mobile machines to allow safe loading and unloading of equipment.

Discussion: The cargo van used in this incident is of sufficient size to allow for transport of the persons, equipment, and materials to the job site. However, the available clearance between the van body and the line-laying machine may be insufficient for routine safe loading and unloading. It is possible to safely unload the machine while remaining outside the confines of the cargo body. The pull rope for the recoil starter



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as well as the operating controls are accessible from outside the van. However, it is also possible to access the machine while positioned inside the van. Measurements taken during the evaluation indicate that there is sufficient room for a person to enter the van and crouch over the machine while operating the

controls. When in the transport position, there is approximately 17 inches of horizontal clearance from the end of the handlebars to the van's door jamb and approximately 30 inches of horizontal clearance from the top of the handlebar support to the door jamb. The vertical clearance from the top of the handlebar support to the ceiling is approximately 12 inches. This transport position was recommended by the van's manufacturer because it is directly over the van's rear axle where it would not negatively affect the road handling of the vehicle. The victim was 70 inches in height and weighed 166 pounds. There is sufficient clearance for a person of his size to fit between the machine and the door jamb. However, if the machine is moving to the rear, the available clearance decreases rapidly, as the machine is capable of reaching the door jamb in approximately 1 second, leaving slightly more than 4 inches of clearance between the top of the handlebar support and the door jamb.

When evaluating the size and configuration of transport vehicles for mobile machinery, safe loading and unloading must be considered. In this instance, a van having a larger cargo body or door opening, or an open-top vehicle, may have offered increased clearance and safety.

Recommendation #2: Employers should ensure that employees follow written safety procedures for loading and unloading mobile machines from transport vehicles.

Discussion: The employer's unwritten procedures for transporting, loading, and unloading the line-laying machine are as follows:

- The machine is transported in an enclosed cargo van. A specially designed box-shaped carrier provided by the line-laying-machine manufacturer is secured to the van floor, directly over the rear axle. To load, a set of ramps is secured to the van's sill and the machine is moved up and into the carrier. Once in the carrier, the machine is shut down with the drive controls engaged and the transmission in gear. The ramps are detached and loaded and the machine is ready for transport. The combination of the carrier and the resistance of the machine's transmission when the drive control is engaged is sufficient to secure the machine against movement during transport.

- To unload, the ramps are attached, the machine's drive control is disengaged, and the engine is started. The transmission shift lever is placed in reverse and the drive control is engaged, allowing the machine to be moved out of the van and down the ramps.

Evaluation of the circumstances surrounding the incident suggests that on the day of the incident, these procedures were followed, with the possible exception that either at the time of loading from the first installation of the morning, or just prior to the engine being started for unloading, the shift lever for the machine's transmission may have been placed in reverse and the drive control engaged before the victim pulled the starter rope. The machine started immediately, moved in reverse, and pinned the victim before he had time to react. It should be noted that during the previous 4 days, the victim had been observed correctly loading and unloading the machine some 8 to 10 times and he may have followed the correct procedure without comprehending his proximity to the door jamb. In addition to verifying that the machine's drive control is disengaged before starting the engine, safe work procedures should require remaining outside the van while guiding the machine up the ramps and into the carrier. Additionally, developing procedures in written form reinforces management's commitment to safety and ensures uniformity of the procedures among the workforce.

Recommendation #3: Equipment manufacturers should develop safe operating procedures which include all aspects of the machine's use, including loading and unloading from transport vehicles.

Discussion: The video supplied by the manufacturer for training shows the machine being unloaded while the operator is inside the van. Additionally, the operating instructions for the machine address starting the engine and positioning the machine in the carrier for transport. Unloading procedures are not addressed. Operating instructions should address all aspects of machine operation. For this machine, procedures should be developed which caution the operator to disengage the main drive control (lever in forward position) and to place the shift lever in neutral before starting the engine. The operator should be further cautioned to avoid tight clearances such as the area between the handlebars and the van's door frame, when unloading from closed vehicles. These cautions should be included in the operator's manual and could be effectively reinforced through the use of warning labels attached to the machine.

Recommendation #4: Equipment manufacturers should consider the use of engineering controls to eliminate operating positions which expose workers to hazards of tight clearance.

Discussion: It should be possible to equip the machine in this incident with starting controls which would facilitate starting the

engine from outside the cargo van. The machine could be equipped with an electric starter (on the date of the investigation, the distributorship had several machines on-site so equipped) which would allow the machine to be key-switch started while remaining outside the van. Alternatively, the handle for the starter's pull rope could be re-positioned to the handlebar support so that it could be accessed from outside the van. This position would be similar to the arrangement of modern walk-behind lawn mowers that allow the operator to pull the starter rope while standing behind the mower. Also, the application of a "dead man" control to the handlebars, similar to that currently incorporated in walk-behind lawn mowers, should be considered. Similar protection might be offered by interlocking the ignition with the drive control to prevent the engine from starting while the drive control was engaged. Any of these devices could offer redundant protection to safe operating procedures.

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Fatality Assessment and Control Evaluation (FACE) Project

The National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR), performs Fatality Assessment and Control Evaluation (FACE) investigations when a participating State reports an occupational fatality and requests technical assistance. The goal of these evaluations is to prevent fatal work injuries in the future by studying the working environment, the worker, the task the worker was performing, the tools the worker was using, the energy exchange resulting in fatal injury, and the role of management in controlling how these factors interact.

States participating in this study: North Carolina, Pennsylvania, South Carolina, Tennessee, and Virginia.

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