

FACE Report Number: 2001-09

March 13, 2002

## *28-year-old Laborer Dies After Being Struck by Excavator Bucket - North Carolina*

### SUMMARY

On March 12, 2001, a 28-year-old laborer (the victim) died after he was struck by the bucket of an hydraulic excavator. The victim, a coworker, and the company president were using an excavator equipped with a quick-disconnect bucket-coupler to load concrete manhole sections onto a truck for transport to another location. The company president was operating the excavator. The victim was positioned on the ground to connect the manhole sections to the excavator while the coworker was located on the truck to disconnect the sections after they had been landed on



*Photo: Excavator and manhole sections shortly after incident*

the truck bed. The operator had positioned the excavator's bucket near a manhole section and was waiting while the victim attached a three-leg bridle to the manhole section for lifting. The victim had connected two bridle legs and was connecting the third when the bucket suddenly disconnected from the excavator stick, fell onto the manhole section, and struck the victim, knocking him to the ground. Emergency responders were notified immediately. The victim was pronounced dead at the scene from blunt trauma to the head.

### 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 notified by participating states (North Carolina, Pennsylvania, South Carolina, Tennessee, and Virginia); by the Wage and Hour Division, Department of Labor; or when a request for technical assistance is received from NIOSH-funded state-level FACE programs in Alaska, California, Iowa, Kentucky, Massachusetts, Minnesota, Missouri, Nebraska, New Jersey, Ohio, Oklahoma, Texas, Washington, West Virginia, and Wisconsin. The goal of these evaluations is to prevent fatal work injuries in the future by studying the work 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. The FACE program does not seek to determine fault or place blame on companies or individual workers. For further information visit the FACE website at [www.cdc.gov/niosh/face/faceweb.html](http://www.cdc.gov/niosh/face/faceweb.html) or call toll free 1-800-35-NIOSH.



NIOSH investigators concluded that to help prevent similar occurrences, employers should

- *ensure that equipment is operating correctly by training operators to conduct visual and operational checks of all machine systems and control functions before working the machine*
- *ensure workers on foot remain outside of hydraulic excavator swing areas and clear of attachments when using the machines for hoisting materials*
- *ensure that equipment fixtures and their operating systems are installed according to the manufacturer's recommendations*

## INTRODUCTION

On March 12, 2001, a 28-year-old laborer (the victim) died after he was struck by the bucket of a hydraulic excavator. On March 14, 2001, the North Carolina Occupational Safety and Health Administration (NCOSHA) notified the Division of Safety Research (DSR) of the incident. On July 11, 2001, a DSR safety engineer met with the NCOSHA safety compliance officer assigned to the case and reviewed the case file, which included photographs of the incident scene and a police report. The employer declined to participate in the investigation pending legal proceedings.

The employer was a utility contractor specializing in pipeline construction that had been in business for 25 years and employed 100 people in several states. The company had been contracted by a municipality to install sewer pipe as part of a utility improvement project. The company employed eight people on the project. The company had a written safety policy and procedures and conducted weekly safety meetings.

## INVESTIGATION

Around 7 a.m. on March 12, 2001, the eight-person crew, including the company president, met at the field office for a safety talk and to discuss the day's work. At about 7:15 a.m. the workers left for the job site. Since the weather forecast for March 12, 2001, had predicted rain, pipe installation was suspended. Workers were engaged in catch-up work that included sowing grass seed over areas where pipe had been installed and moving materials from storage areas to the work sites. The company president and two laborers, one of whom was the victim, were moving sections of precast concrete manholes from a storage area to the work site using an hydraulic excavator and a flatbed truck. They had successfully moved one truckload of manhole sections and had returned to the storage site around noon to load a second. The sections were lifted from the ground to the truckbed using an hydraulic excavator equipped with a lifting eye on the bucket and connected to the manhole sections with a three-leg bridle hitch. The company president was operating the excavator while the victim, located on the ground, connected the bridle hitch legs to wire rope lifting eyes cast in the manhole sections. Once the sections had been landed on the truck, the coworker disconnected the bridle.



The excavator was equipped with a quick disconnect coupler device that allowed the operator to disconnect the bucket from the excavator stick while remaining at the controls rather than dismounting and removing the bucket mounting pins manually. This device operated electro-hydraulically and consisted of an operating switch with warning buzzer and indicator light that was located behind the operator's seat in the cab; a servo-operated hydraulic diverter valve located on the excavator stick; and an hydraulically operated latching mechanism fixed to the end of the excavator stick. To disconnect the bucket, the operator curls the bucket to fully extend the bucket cylinder and lowers the bucket near the ground. The lock/unlock switch is then moved to the unlock position and the bucket curl control is activated. The system is designed so that when the bucket cylinder is fully extended and the control is activated, hydraulic fluid is diverted from the bucket cylinder to retract the quick disconnect coupler slide lock. The bucket cylinder is slowly retracted while keeping the attachment close to the ground. This uncurls the coupler from the attachment. Moving the lock/unlock switch to unlock also activates a buzzer and a red indicator light to warn the operator that the coupler is in the unlocked position.

Shortly before 12:30 p.m., the crew was preparing the second load of the day. They had loaded two manhole sections and were in the process of lifting a third. The operator positioned the excavator bucket over the manhole section and was waiting while the victim connected the legs of the bridge. The victim was standing on the ground near the manhole section and was either directly under or near the raised excavator bucket. He had connected one or two of the bridge legs and was in the process of connecting the third when the excavator operator heard a buzzing noise inside the operator's cab. He glanced at the control panel, thinking that the buzzer was a low-oil-pressure or high-coolant temperature indication. He realized that the buzzer was the quick coupler disconnect warning and immediately called a warning to the victim. However, the bucket disconnected and fell before the victim could move clear from the area. The bucket fell, glancing off the manhole section, struck the victim, and knocked him to the ground. Emergency responders arrived at the scene after notification by the operator; however, the victim was pronounced dead on site.

Examination of the machine by manufacturer's representatives after the incident identified the absence of a check valve in the hydraulic circuit which would allow retraction of the quick disconnect slide lock in any bucket position. Also, the operating switch was mounted outside of the operator's view, and the electric power to the switch was intermittent, preventing the indicator light and buzzer from immediate activation when the switch was moved to unlock position.

### **CAUSE OF DEATH**

The medical examiner concluded that the cause of death was blunt head trauma.

### **RECOMMENDATIONS/DISCUSSION**

***Recommendation #1: Employers should ensure that equipment is operating correctly by training operators to conduct visual and operational checks of all machine systems and control functions before working the machine.***

Discussion: The position of the lock/unlock switch at the time of the incident could not be conclusively established. Since an intermittent malfunction existed within the electrical circuit supplying power to the switch, it may not have activated the coupler's bucket locking mechanism when placed in the lock position. Before use, the quick disconnect manufacturer recommends that the mechanism and hydraulic hoses be visually inspected for defects and that the mechanism be cycled. Conducting an operational check of all excavator functions, including cycling the coupler mechanism and curling the bucket, could identify equipment malfunctions before workers are exposed to injury risks.

***Recommendation #2: Employers should ensure workers on foot remain outside of hydraulic excavator swing areas and clear of attachments when using the machines for hoisting materials.***

Discussion: The victim was connecting the legs of the three-leg bridle to the manhole sections for lifting, and the excavator bucket was located in the air near or directly over the victim. By choosing the proper length wire rope for the bridle legs, it should have been possible to keep the bucket located on the ground while the legs were rigged to the lifting eyes of the manhole section. This would eliminate the risk of injury from being struck by a falling disengaged bucket and would decrease the risk of injury from inadvertent swinging or extension of the excavator stick.

***Recommendation #3: Employers should ensure that equipment fixtures and their operating systems are installed according to the manufacturer's recommendations.***

Discussion: The manufacturer of the quick disconnect coupler recommends that the operating switch box be installed in the cab in a location where it is readily visible to the operator and protected from inadvertent activation. When the system was added to the excavator, the switch box had been installed on a shelf behind the operator's seat where it would be well-protected from inadvertent activation. This position was outside of the operator's normal zone of vision yet placed the switch box near the operator's left ear where the buzzer could be heard. Locating the switch box in a more readily visible location may have allowed the excavator operator to detect an unlatched bucket more quickly and provide a more timely warning for workers on foot. Additionally, a more visible location may have facilitated the detection of the intermittent power problem by the excavator operator, and the malfunction could have been repaired before the machine was operated.

## **INVESTIGATOR INFORMATION**

This investigation was conducted by Paul H. Moore, Safety Engineer, Fatality Assessment and Control Evaluation Team, Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH.