

F.A.C.E.

INVESTIGATION REPORT

Fatality Assessment and Control Evaluation Project

FACE #95-NJ-030-01

Construction Laborer Killed After Being Entangled
on a Rotating Directional Drilling Machine Pipe



New Jersey Department of Health and Senior Services
Occupational Disease and Injury Services
P.O. Box 360
Trenton, New Jersey 08625-0360
(609) 984-1863

TO: Division of Safety Research
National Institute for Occupational Safety and Health
Morgantown, West Virginia 26505

FROM: Fatality Assessment and Control Evaluation (FACE) Project
New Jersey Department of Health (NJDOH)

SUBJECT: Face Investigation #95-NJ-030-01
Construction Laborer Killed After Being Entangled on a
Rotating Directional Drilling Machine Pipe

DATE: August 25, 1995

SUMMARY

On March 7, 1995, a 28-year-old male construction laborer was killed when his clothing became entangled on a rotating drilling pipe. The incident occurred during a directional drilling operation when a 640 foot-long shaft for a utility pipe was being drilled under a major highway. This process used a specially designed drill rig that drills a horizontal shaft that is directed by the drill operator. In this operation, the shaft started at the drill rig at the side of the road, passed down and under the highway, and was directed upwards until the drill bit emerged from the ground on the opposite side of the highway. The drilling had been completed and the crew was enlarging the shaft by pulling the drilling pipe back and forth through the shaft. The victim and his co-worker were attaching lengths of pipe to the rotating drill pipe as it was pulled back toward the rig. The victim was holding a length of pipe that started to turn as the threads connected. A loose end of his clothing wrapped around the pipe, catching hold and pulling the victim around it, killing him. NJDOH FACE investigators concluded that, in order to prevent similar incidents in the future, these safety guidelines should be followed:

- o Workers should not wear loose clothing when working near moving machinery.
- o Employers should ensure that work crews are in communication at all times.

- o Directional drilling machine manufacturers should consider designing an emergency stop device that can be operated from a remote location.

INTRODUCTION

On March 9, 1995, NJDOH FACE personnel received a newspaper article about a work-related fatal incident involving a drilling machine. A FACE investigator contacted the company's safety consultant and legal counsel to arrange for a site visit, which was conducted on March 29, 1995. The visit included interviewing the employer's representative and legal counsel, examining a drill rig similar to the one involved in the incident (which was not available that day), and visiting and photographing the incident site. FACE investigators also discussed the incident with the investigating police detective and viewed a police video taken the day of the incident. Additional information was obtained from the OSHA compliance officer, police report, and medical examiner's report.

The employer was a construction company specializing in gas and utility pipe installation and repair. The construction company was a family business that has been in operation for 43 years and employed 90 workers at the time of the incident. The company conducted in-house training and sent supervisors and workers out for OSHA "competent person" training, and had a detailed written safety program. The victim was a construction laborer who had worked for the company for more than seven years. He had completed an eight-hour training seminar shortly before the incident.

INVESTIGATION

The victim's construction company had been contracted as part of a project to install a sewer pipe underneath a major ten-lane highway. To avoid digging across the highway, the company used a directional drilling method which would drill a narrow shaft under the highway. The shaft was enlarged until it was wide enough for the sewer pipe to be pulled through it, allowing the project to be completed without disrupting traffic. The construction company was only contracted for the directional drilling work; construction of the sewer lines leading to and away from the highway was to be done by other contractors.

The company started work on the project on Friday, March 4, 1995. Working from engineering

drawings provided by the contractor, the company positioned their directional drilling rig on an embankment near the side of the highway. The drill rig was a hydraulically powered, tracked vehicle designed to drive a drill auger horizontally into the ground at a rated thrust of 30,000 pounds. The drill bit was attached to 10 foot lengths of smooth 2.5 inch diameter steel drilling pipe which connected to each other by threaded male and female fittings. The drill rig was towed on a trailer pulled by a utility truck. This trailer held a diesel engine that powered all the drill's hydraulics and functions. The trailer also had a mixing tank for a water and clay slurry that was pumped through the drilling pipe to lubricate the drill bit and prevent the newly drilled shaft from collapsing.

Over the next few days, the crew drilled and enlarged the shaft under the highway. The drill rig operator sat at a small control panel and directed the drilling using joystick controls. A second employee set lengths of drilling pipe onto the rig which drove the drill into the ground at a prescribed angle. It took about three minutes to drive a ten-foot length, at which time another drilling pipe was connected and the drilling restarted. By interpreting the pressure readings from the drill head, the rig operator determined where the drill head was and changed the direction of travel (up, down, or side to side) as per the engineering drawings.

The shaft started at the drill rig, passed under the highway, and traveled up until the drill bit and pipe emerged from the ground on the opposite embankment, about 640 feet from the drill rig. The shaft was then enlarged with a reamer, which was attached to the drilling pipe and pulled back through the shaft to the drill rig. This was done in stages, first using a four-inch diameter reamer, followed by an eight-inch and finally a 13-inch reamer. During reaming, a second crew working on the opposite embankment attached lengths of drilling pipe to the end of the rotating pipe that was pulled back into the ground. Both crews stayed in contact with hand held radios, and it was company policy to stop drilling during any radio communication.

The incident occurred on the last day of enlarging the shaft. The workers arrived on site at 8:00 a.m. and divided into two work crews. A foremen/ machine operator, pipe loader, and mechanic manned the drill rig on the east side of the highway while the victim and a second laborer stayed with the exposed drilling pipe on the west side. The day passed uneventfully, and it was decided that the crews would work past their usual 4:30 p.m. quitting time to complete the job. At 5:00 p.m., the crews last used the radio during a coffee break. The weather was starting to get misty, so the victim wore his personal two-piece rubber rainsuit over his clothing. At about 6:30 p.m.,

the victim's crew had nine lengths of drilling pipe left to connect, about 20 minutes of work. Standing in front of the rotating drilling pipe as it receded into the ground, the victim held a length of drilling pipe against it and let the turning motion screw the threads together (see Figure 1). As he held spinning pipe, the tail of his flannel shirt wrapped around it. The victim yelled for his co-worker, who came to help him. At this point, the clothing had not fully caught around the pipe, which was rotating and moving through the wrapped cloth. The workers waited, hoping that the drilling pipe would work its way out through the clothing as it moved down into the shaft. When the clothing caught and began to wrap tighter, the co-worker unsuccessfully tried to cut the victim's clothing loose with a pocket knife. He also tried to call for help on the radio but apparently could not operate the unit. The co-worker then ran across the adjacent overpass bridge to the drill rig and told them to stop the machine. The workers notified the police and EMS, who found the victim underneath the drilling pipe with his clothing wrapped up to his neck. The victim was pronounced dead at the scene.

CAUSE OF DEATH

The county medical examiner attributed the cause of death to asphyxia due to compression of the chest and neck.

RECOMMENDATIONS AND DISCUSSION

Recommendation #1: Workers should not wear loose clothing when working near moving machinery.

Discussion: To avoid entanglements with moving machine parts, FACE recommends that workers should not wear loose clothing around drilling pipes or other moving machinery. A properly secured one-piece jumpsuit or similar clothing is suggested because it has no loose ends.

Recommendation #2: Employers should ensure that work crews are in communication at all times.

Discussion: It is not known why the co-worker was unable to radio for help, however, the loss of communication was critical in this incident. To prevent future communication problems, all

workers should be trained in the use of radios and other communication equipment. This equipment should be tested throughout the day, and extra batteries should be available for portable units. FACE also recommends developing an emergency plan that includes a backup communications system. This could be the use of an air horn or other device that can alert the opposite crew. The plan could simply state that sounding the alarm would require the drill crew to immediately shut down all machinery and send help to the other crew.

Recommendation #3: Directional drilling machine manufacturers should consider designing an emergency stop device that can be operated from a remote location.

Discussion: The victim's work crew did not have any direct control of the drilling machine in this process. When their communications broke down, the co-worker had no choice but to run more than 600 yards to alert the drill crew to stop the machine. FACE recommends that directional drilling machine manufactures consider designing a device that would stop the machine from a remote location. A suggestion is a radio-controlled emergency "panic button" that would shut down the machine when pushed.

DISTRIBUTION LIST

Immediate Distribution

NIOSH
Employer and Counsel
NJ State Medical Examiner
County Medical Examiner
Local Health Officer
NJDOH Census of Fatal Occupational Injuries (CFOI) Project

General Distribution

USDOL-OSHA Region II Office
USDOL-OSHA New Jersey Area Offices (4)
NJDOL OSHA Consultative Service
NJDOL Public Employees OSHA
NJDOH Public Employees OSHA
NJ State Safety Council
NJ Institute of Technology
NJ Shade Tree Federation
University of Medicine & Dentistry of NJ
Jersey Central Power & Light
Public Service Electric and Gas Company
Atlantic Electric
Liberty Mutual Insurance Company Research Center
Private Consultants and Companies (3)