A laborer for a boring and tunneling company in Texas, died when he was struck by a hydraulic hose.

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SUMMARY

On October 3, 1998, a 32-year-old laborer for a boring and tunneling company died when he was struck by a hydraulic hose. The victim was part of a work crew digging a tunnel and inserting a 54-inch casing. They were using two hydraulic jacks, laid horizontally and connected by hydraulic lines. The jacks were used to push the pipe into the tunnel one section at a time. The victim was standing next to a hydraulic jack when pressure was put to the hydraulic line. The male end of the coupling, attached to the jack, split in half. The female end flew up and struck the victim in the abdomen.

The TX FACE investigator concluded that to reduce the likelihood of similar occurrences, employers should:

**** Install straps (whip checks) to the hydraulic hose and the point where the hose is connected.***

**** Instruct workers not to stand adjacent to hydraulic hose connections when hydraulic pressure is initially applied.***

**** Ensure relief valves are set so they do not exceed the maximum pressure recommended by the manufacturer for couplings, hoses or other equipment connected to the pump.***

INTRODUCTION

On October 3, 1998, a 32-year-old, male laborer died when he was struck in the abdomen by a hydraulic hose. The TX FACE program officer was made aware of the incident by the area OSHA office on October 9, 1998. A visit to the site was made. Pictures of a similar coupling and the area were taken. The justice of the peace and EMS personnel were also contacted.

The employer is a tunneling and boring company. The company employs 100 workers, 30 of whom perform the same duties as the victim. This company has been in business for 50 years. There were six other workers at the site at the time the incident occurred.

The safety program is managed by the company president. A written safety program is in place, but written procedures were not included for this particular task. The company conducts pre-employment physicals and drug screening.

Safety meetings are conducted on a weekly basis. Refresher training is also conducted weekly. Task specific training is conducted on the job (OJT) at the job site.

The victim had been employed with the company for 1½ years. This was the first fatality experienced by the company.

INVESTIGATION

The victim and coworkers were in a trench digging a tunnel and inserting a pipe casing. They were using a machine which provides hydraulic pressure to two cylinders. The cylinders were connected to the machine and to each other by hydraulic lines. When it came time to insert more sections of casing, the cylinders were laid down on their sides with one end against a stop and the other against the casing. Hydraulic pressure was then applied which forced the end against the casing to expand and push the casing into the tunnel.

Hydraulic lines were connected to two points on each cylinder. The method ensured equal pressure was applied by each cylinder. The coupling was a quick-disconnect type coupling. The hose was disconnected by lifting a spring-loaded ring on the female end of the coupling. The male end stayed attached to the cylinder. The coupling was rated to withstand 3500 psi. and this figure was stamped on the female end. However, they were designed to withstand four times that amount of pressure.

The machine used to supply the hydraulic pressure was a custom-made, diesel-powered hydraulic jacking unit. It was capable of supplying 10,000 psi. hydraulic pressure. It was equipped with a relief value that was set for 6,500 psi. at the time of the incident. The only documentation available on the unit consisted of diagrams for the piping systems.

The day before the incident, the couplings were changed on the pump jacks. The new couplings were used on the day of the incident. There were no indications (such as, leaks around the coupling) that would warn workers the coupling was about to fail.

On the day of the incident the victim and coworkers continued to tunnel. Once enough space had been dug away, the workers lowered a piece of casing into position to be pushed into the tunnel. The pump jacks used to push the casing into the tunnel were laid into position. The hydraulic lines were connected to the pump jacks.

The victim was standing next to the pump jack when the operator of the hydraulic pump, located on the top of the trench, started to increase the pressure on the lines. This forced the ends of the pump jacks to extend out until they came into contact with the casing. When the end of the pump jack came in contact with the casing, the pressure jumped to almost 3,000 psi instantly, according to the pump operator. This is normal for the hydraulic system. Within seconds of the hydraulic pump reaching the operating pressure, the male end of the coupling cracked in half, lengthwise. The female end attached to the hose struck the victim in the abdomen.

When the supervisor on top of the trench saw what happened, he called “911." However, due to his state of distress and with English as a second language, he was not able to describe what had happened to the operator. A passerby was stopped who was able to complete the notification to the fire department.

Emergency medical services personnel responded and removed the victim from the trench and transported him to the hospital where he was pronounced dead on arrival.

CAUSE OF DEATH

The medical examiners report stated the victim died from a puncture wound to the abdomen.

RECOMMENDATIONS

***Recommendation #1* - Employers should install straps (whip checks) to the hydraulic hose and the point where the hose is connected.**

Discussion: The hydraulic line was pressurized to almost 3,000 psi. according to the pump operator. The relief valve was set for 6,500 psi according to tests performed on the relief valve after the incident. When the male end of the coupling broke, the hydraulic hose was thrown in the direction of the victim with enormous force. A strap would have limited the distance the coupling was able to travel when the male end failed. One end should be secured around the hose and the other to a secure anchoring point. Should a hose break or coupling fail, the distance a hose or coupling would travel would be the length of the strap.

***Recommendation # 2* - Employers should instruct workers not to stand adjacent to hydraulic hose connections when hydraulic pressure is initially applied.**

Discussion: The victim was standing adjacent to the pump jack when hydraulic pressure was applied to the hose. In this incident it was a coupling that failed. The reason the coupling failed could not be determined. A similar situation may occur from a worker not securely attaching the hydraulic hose.

This particular coupling was a "quick disconnect" type. A spring loaded ring is released in order to connect/disconnect coupling. In the center of the male and female ends are parts that are also spring loaded. They are depressed when the two ends are connected. A certain amount of force must be exerted to connect the two together. There is a possibility the ring or the two ends will not properly seat. If this occurs, when pressure is applied, the hose will be thrown through the air.

***Recommendation #3* - Employers should ensure relief valves are set so they do not exceed the maximum pressure recommended by the manufacturer for couplings, hoses or other equipment connected to the pump.**

Discussion: After the incident, the relief valve was tested to determine what pressure it was set at before it would activate. The test results revealed it was set at 6,500 psi.

In this incident, the coupling was rated for a maximum pressure of 3,500 psi. Couplings are designed to withstand two to three times their rated capacity. It could not be determined if there was a material failure of the coupling because the manufacturer declined to comment.