

**SUBJECT:** A plumber was killed when a skid-steer loader tipped forward and struck him in the head.

## SUMMARY

A 50-year-old plumber working for a construction company subcontractor died on February 5, 2005 from head trauma he received after being struck in the head by a skid-steer loader that tipped forward. The victim had been installing a section of pipe in the ground next to a newly constructed foundation. The victim was standing in an open-end trench that was 2-feet 9-inches deep and 5-feet 8-inches wide. The victim was placing a PVC sleeve around a cut-off valve while a coworker used a skid-steer loader to backfill with sand. As the skid-steer loader approached the access edge of the trench, the skid-steer loader shifted in the damp/wet dirt and the loader tipped forward. The bucket of the loader struck the victim's head and then pinned his arm between the bucket and the trench wall. The victim's arm was pinned under the loader bucket for approximately 10 minutes until the fire department arrived and freed the victim. He was then transported by helicopter to the hospital and pronounced dead shortly after arrival.

Oklahoma Fatality Assessment and Control Evaluation (OKFACE) investigators concluded that to help prevent similar occurrences, employers should:

- Ensure that employees are not positioned underneath elevated loads handled by lifting or digging machinery.
- Develop a written procedure for operating mobile machinery in and around excavations and ensure that operators are adequately trained based upon written procedures and the operator's manual.
- Ensure that all employees follow written policies and procedures for use of personal protective equipment (PPE).
- Develop, implement, and enforce written plans and procedures for working safely in trenches and other excavations.
- Develop written contracts that establish the safety responsibilities and worksite representation of the general contractor and subcontractors.



Figure 1. Skid-steer loader similar to the one involved in the incident



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## INTRODUCTION

A plumber working for a construction company subcontractor died on February 5, 2005 from head trauma received when he was struck in the head by a skid-steer loader that tipped forward. OKFACE investigators were notified of the incident, and an interview with company officials was conducted on May 4, 2005. OKFACE investigators also reviewed the death certificate, investigating officer's video, and reports from the Medical Examiner and the Occupational Safety and Health Administration (OSHA).

**Employer:** The victim was employed by a plumbing subcontractor on a multi-employer worksite. A general contractor acted as the controlling employer of the worksite and hired the subcontractor to install sewer and water piping, excavate and backfill all underground piping, connect to sewer and water utilities, and install all plumbing fixtures. The plumbing subcontractor had been in business for 28 years and employed approximately 60 people at the time of incident. The subcontractor had been working at the site for less than one month. The subcontractor had a safety program, but did not have written procedures in place for the task being performed. The subcontractor was responsible for the safety of their employees and for providing all instructions to them.

On the day of the incident, the general contractor did not have a representative on site. General contractor officials stated that before the incident, it was verbally expressed to all subcontractors that a contractor representative must be on site at all times while work was being performed. A written contract existed between the general contractor and subcontractor that specified the subcontractor comply with OSHA regulations and a requirement that all workers wear hard hats.

**Victim:** The 50-year-old victim had more than 20 years of experience as a plumber in the construction business working for the same plumbing company. He spent the previous 10 <sup>1</sup>/<sub>2</sub> years as a job foreman for his employer. At the time of the incident, he was performing tasks for which he had many years of experience. Neither employee was wearing a hard hat at the time of the incident.

**Training:** At least two subcontractor employees had excavation/trenching training, but they were not at the site on the day of the incident. The subcontractor conducted monthly safety meetings and provided cardiopulmonary resuscitation (CPR) and first aid training. The employee operating the skid-steer loader at the time of incident received on the job training in skid-steer loader operation but did not receive formal training in safe operation of machinery or hazard recognition.

**Incident Scene:** The victim and his coworker were the only two people working at the commercial construction site. Both employees were working during the weekend as instructed by their immediate supervisor, but the general contractor had no knowledge that subcontractor employees were working on the day of the incident. They were preparing the site for installation of a one-inch water pipe. The 5-foot 8-inch wide open-ended trench sloped from ground level downward to a depth of 2-feet 9-inches. The deep end of the trench stopped a few inches from a newly constructed foundation wall. The soil around the sloped trench was damp/wet and the bottom of the trench was muddy.

**Weather:** On the day of the incident, the weather conditions were cool with overcast clouds.

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## INVESTIGATION

On the day of the incident, the victim and one coworker, an apprentice plumber and equipment operator, were on site to prepare for the installation of a one-inch water pipe. The victim had installed a pipe on the outside of a newly constructed foundation wall 24 inches below ground level. A 3-foot long 6-inch diameter PVC sleeve was placed around the water pipe cut-off valve to allow for future access. The non-written procedure was to backfill the excavation with sand. The plumber was standing in the trench supporting the pipe to prevent movement or breakage of the pipe while sand was poured around the pipe.

The victim was in the trench holding the sleeve over the valve with his right hand, while his coworker used a skid-steer loader (Figure 1) to haul a bucket of sand over to the area and the victim used his left-hand to guide him. The skid-steer loader bucket was filled with sand (Figure 2) and the bucket was elevated higher than the victim's head. As the coworker approached the edge of the trench, the left tire shifted in the damp/wet dirt and the skid-steer loader tipped forward (Figure 3). The victim had a shovel in the trench to place sand around the sleeve, but the pair were attempting to dump the sand directly from the loader. As the skid-steer loader tipped forward, the bucket struck the victim in the head and then pinned his left arm against the wall of the excavation.

The coworker immediately dismounted the loader, observed the victim's situation, and used a cell phone to dial 911. The local fire department arrived at the scene in less than five minutes. The winch and a cable from the fire department's brush truck was used to stabilize and tip the loader backwards, freeing the victim's arm. The victim was transported by helicopter to the hospital and pronounced dead shortly after arrival to the emergency room.

## CAUSE OF DEATH

The Medical Examiner's report listed the cause of death as head trauma.



Figure 2. Skid-steer loader bucket of sand (taken after the incident)



Figure 3. Skid-steer loader tipped forward (from video filmed after the incident)



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## RECOMMENDATIONS

### **Recommendation #1: Employers should ensure that employees are not positioned underneath elevated loads handled by lifting or digging machinery.**

Discussion: Employers should ensure that employees are not positioned underneath elevated loads during loading or unloading. Employees positioned under elevated loads can be struck by spillage or falling materials. According to OSHA standards, no employee shall be permitted underneath loads handled by lifting or digging equipment. Backfill material could have been placed into the excavation with the skid-steer loader bucket without the victim standing in the trench. After backfill material had been placed under the water pipe, the victim could have held the PVC sleeve in place while his coworker used the available shovel to finish placing and packing sand around the sleeve and water pipe.

### **Recommendation #2: Employers should develop a written procedure for operating mobile machinery in and around excavations and ensure that operators are adequately trained based upon written procedures and the operator's manual.**

Discussion: All mobile machinery operators should be trained based upon written machine-specific procedures and the operator's manual. The written procedures should address the safe operation of mobile machinery including necessary precautions when operating machinery in and around excavations. Movement of heavy machinery can cause soil failure such as cracks, fissures, and undermining of excavation stability. These situations can lead to excavation wall cave-ins and mobile equipment rollovers. The written procedures and operator's manual should be available to operators at all times for review.

Operator's manuals contain important information regarding safety features, limitations of machinery, warning statements, and guidelines for safe operation of machinery. Some warning statements included in the operator's manual for the skid-steer loader involved recommended the operator to carry bucket or attachments as low as possible, do not travel or turn with lift arms up, and load, unload, and turn on flat level ground.

According to OSHA standards, employees should be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. OSHA standards require that materials or equipment are kept at least 2 feet from the edge of excavations, or retaining devices are provided to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

### **Recommendation #3: Employers should ensure that all employees follow written policies and procedures for use of personal protective equipment (PPE).**

Discussion: Employers should ensure that employees are trained on the use of PPE and written policies are available to employees regarding the use of PPE. The written PPE policies should include a minimum requirement of PPE for employees to wear while on a worksite. At this particular site, workers were required to wear hard hats, although neither the victim nor his coworker was wearing one at the time of the incident. It is unknown if the use of a hard hat would have changed the outcome of this incident, but hard hats have been shown to prevent and reduce the severity of injuries in a variety of instances. Employees should be instructed on the benefits and importance of PPE.



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**Recommendation #4: Employers should develop, implement, and enforce written plans and procedures for working safely in trenches and other excavations.**

Discussion: Written plans or procedures should be developed, implemented, and enforced for work operations located in and around trenches and other excavations. These plans should be reviewed by supervisors and employees on a regular basis and should be made available at the worksite as needed. Corrective action and retraining should be provided to employees if noncompliance of written plans and procedures are observed. If any special conditions exist that might present unfamiliar hazards, additional safety procedures and training should be developed to reduce or eliminate the hazard exposure to employees.

Employees who work in or around excavations should receive as part of their safety training the hazards associated with working in and around trenches and other excavations. Training should include the hazards of water accumulation, vibration, heavy equipment operations, underground utilities, hazardous atmospheres, soil types, and stability of surrounding structures. Other elements of excavation training should include requirements regarding means of access and egress, emergency rescue equipment, inspections, competent persons, professional engineer services, and protection of employees by sloping, benching, and support systems.

**Recommendation #5: Employers should develop written contracts that establish the safety responsibilities and worksite representation of the general contractor and subcontractors.**

Discussion: Contracts should be written with language that addresses the responsibilities of general contractors, subcontractors, and third-party contractors. The site-controlling party should be identified in the contract and a safety officer should be designated for the controlling party. The contract should clearly state the chain of command that employees from all parties should follow and should provide the safety officer with the authority to stop operations and take corrective action to address potentially life-threatening hazards. The contract should be agreed on and signed in advance of any work that is to be performed. The contracts should include safe work practices and procedures. Each party should have a system to ensure compliance by self-monitoring, monitoring by the other party, or by an outside consultant or other unbiased party.

## REFERENCES

- Occupational Safety and Health Administration, CFR 1926.650, 651, & 652, *Excavations*.
- National Institute for Occupational Safety and Health, Publication No. 98-117, *NIOSH ALERT: Preventing Injuries and Deaths from Skid-Steer Loaders*.
- National Institute for Occupational Safety and Health, Publication No. 85-110, *NIOSH ALERT: Preventing Deaths and Injuries from Excavation Cave-Ins*.
- Oklahoma State University, EHS Safety Manuals, *Trenching and Shoring Procedures*, [www.pp.okstate.edu/ehs/manuals/Trench.htm](http://www.pp.okstate.edu/ehs/manuals/Trench.htm)
- Occupational Safety and Health Administration, *OSHA Technical Manual, Section V: Chapter 2, Excavations: Hazard Recognition in Trenching and Shoring*, [www.osha.gov/dts/osta/otm/otm\\_v/otm\\_v\\_2.html](http://www.osha.gov/dts/osta/otm/otm_v/otm_v_2.html)



The Oklahoma Fatality Assessment and Control Evaluation (OKFACE) is an occupational fatality surveillance project to determine the epidemiology of all fatal work-related injuries and identify and recommend prevention strategies. FACE is a research program of the National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research.

These fatality investigations serve to prevent fatal work-related 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 injury, and the role of management in controlling how these factors interact.

For more information on fatal work-related injuries, please contact:

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