SUBJECT: A construction laborer was struck in the head and killed by a falling steel beam.

SUMMARY

A 21-year-old Hispanic laborer died on October 29, 2005 from head trauma after being struck by a steel rectangular tube beam. At the time of the incident, the decedent and his coworker were standing on a 32-inch by 48-inch platform that was elevated approximately six feet above the ground by a forklift. They were preparing to secure a steel beam into place that was being supported by a second forklift and wooden post. The steel beam consisted of two 20-foot long sections welded together. The middle of the beam rested on the forks of the second forklift 11 feet, 6 inches above the ground. As the victim and his coworker were preparing to bolt the beam into place, the forklift operator raised the beam to shift it to the south. As he did that, the steel beam came off the south support post and tipped over. The forklift's hydraulic side shift was malfunctioning, but it is unknown whether that contributed to the injury. The beam struck the decedent in the head and knocked his coworker off the platform. A call was immediately placed for emergency response. The decedent was taken to the nearest hospital by emergency medical services (EMS) and then airlifted to another hospital where he was pronounced dead later that same day.

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

- Ensure that employees do not position themselves under elevated loads.
- Ensure that employees wear hard hats when working in areas where there is a potential for head injury from falling or flying objects and fall protection when working at elevations of six feet or more.
- Ensure that forklift operators elevate personnel only with approved lifting cages that are properly attached to machinery.
- Develop, implement, and enforce a comprehensive written safety program and training in the language(s) and literacy level(s) of all workers, which includes training in hazard recognition and the avoidance of unsafe conditions.
- Ensure that forklifts and other machinery in need of repair are tagged and taken out of service until maintenance personnel perform repairs.

INTRODUCTION

On October 29, 2005, a 21-year-old Hispanic laborer died from head trauma after being struck by a steel beam. OKFACE investigators were notified of the incident and conducted an interview with the employer on January 11, 2006. OKFACE investigators reviewed the death certificate and reports from the Medical Examiner, emergency medical services, local fire department, and the Occupational Safety and Health Administration (OSHA).

Employer: The victim was employed by a roof truss manufacturing company. The company had been in business for 20 years and employed approximately 10 full-time workers. Written task-specific safe work procedures were available for all regularly performed tasks and the employer conducted monthly safety meetings. The company had a written safety and health program. Enforcement procedures for machinery operator training and evaluation were utilized for some, but not all, machinery operators. The company did not have a labor/management safety and health committee or written machine-specific safe operating instructions.

Victim: The victim was born in Mexico and had lived in the United States for an unknown amount of time. He had been employed by the company for six months and his previous work history and experience were unknown. His primary language was Spanish; he could not read English and spoke very little English. English was the primary language of the employer and direct supervisor; one of the victim's coworkers was bilingual and could provide translations as necessary, but he was not on-site during the incident.

Training: Task-specific on-the-job training was provided to employees. Classroom and on-the-job machine-specific training was provided for some, but not all, forklift operators. At least two persons who worked for the company had received forklift training and operator certification from a local vocational school. The decedent received on-the-job training, but he did not receive forklift operator certification training. The employer maintained records of those employees who did receive forklift operator training. The company's standard operating procedures did not address the task being performed at the time of incident, as the task was not part of regular employee duties or company operations.

Incident Scene: The incident occurred on company property at the lumber storage building (Figure 1). The employer and three employees were present at the time of the incident. The work shift began at 8:00 a.m. and the incident occurred at 4:00 p.m. The ground conditions were dry level dirt.

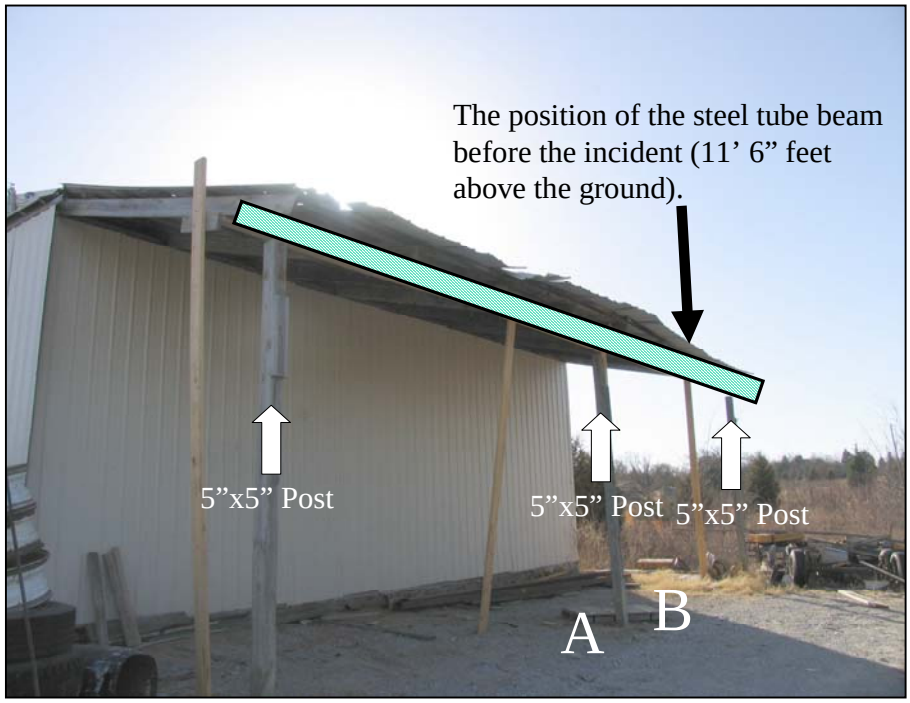

Figure 1. Incident scene: A indicates the position of the forklift holding the steel beam, and B indicates the position of the forklift holding the platform.

Weather: Weather conditions at the time of incident were cool and dry.

INVESTIGATION

The decedent's coworker had been assigned the task of fabricating the beam and the decedent was assigned as his assistant. This assignment was not a usual work task for either employee. After fabricating

the beam, the decedent and a coworker were using two forklifts to replace a wood beam with the new rectangular tube steel beam on a lean-to roof of a storage building (Figures 1 and 2). The steel beam was composed of two 20-foot long rectangular shaped steel tubes measuring four inches by six inches with one-quarter-inch thick walls (Figure 3). The two tubes were welded together with a one-and-one-half-inch by three-inch steel channel welded to the top to form a single steel beam 40 feet long, weighing approximately 1,000 pounds. Three brackets, composed of 3-inch by 3-inch by 12-inch angle iron (L-shaped) (Figure 4), were welded to the six-inch face of the steel beam. Six inches remained to attach the beam to three new 5-inch by 5-inch by 11-foot, 6-inch treated wood posts. The decedent and coworker assembled the steel beam, steel channel, and angle iron brackets at the worksite. They worked together to shore up the roof, remove the old wooden beam, and place the new steel beam on top of the three support posts. Although hard hats were available, neither employee was wearing one.

A wood forklift platform was used during the work to elevate the decedent and his coworker. The forklift platform was built with a 32-inch by 48-inch wood pallet and a ¾-inch by 33-inch by 48-inch piece of plywood banded to the pallet (Figure 5). Forklift A was positioned on the north side of the center wood post facing east and was used to elevate the steel beam to a height of 11 feet, 6 inches. Investigation records indicated that the hydraulic side shift on the carriage of forklift A, which controlled the side-to-side motion of the forks, was in need of repair. It is unknown if this malfunction contributed to the incident. Forklift B was located on the south side of the center wood post facing northeast. Forklift B was used during the incident to elevate the wood platform holding the decedent and coworker. Forklift A was approximately 20 years old and forklift B was 10 years old. The forklift platform was not an approved lifting device and it was not secured to the forklift; the forks of the forklift just went through the open slots on the bottom of the pallet.

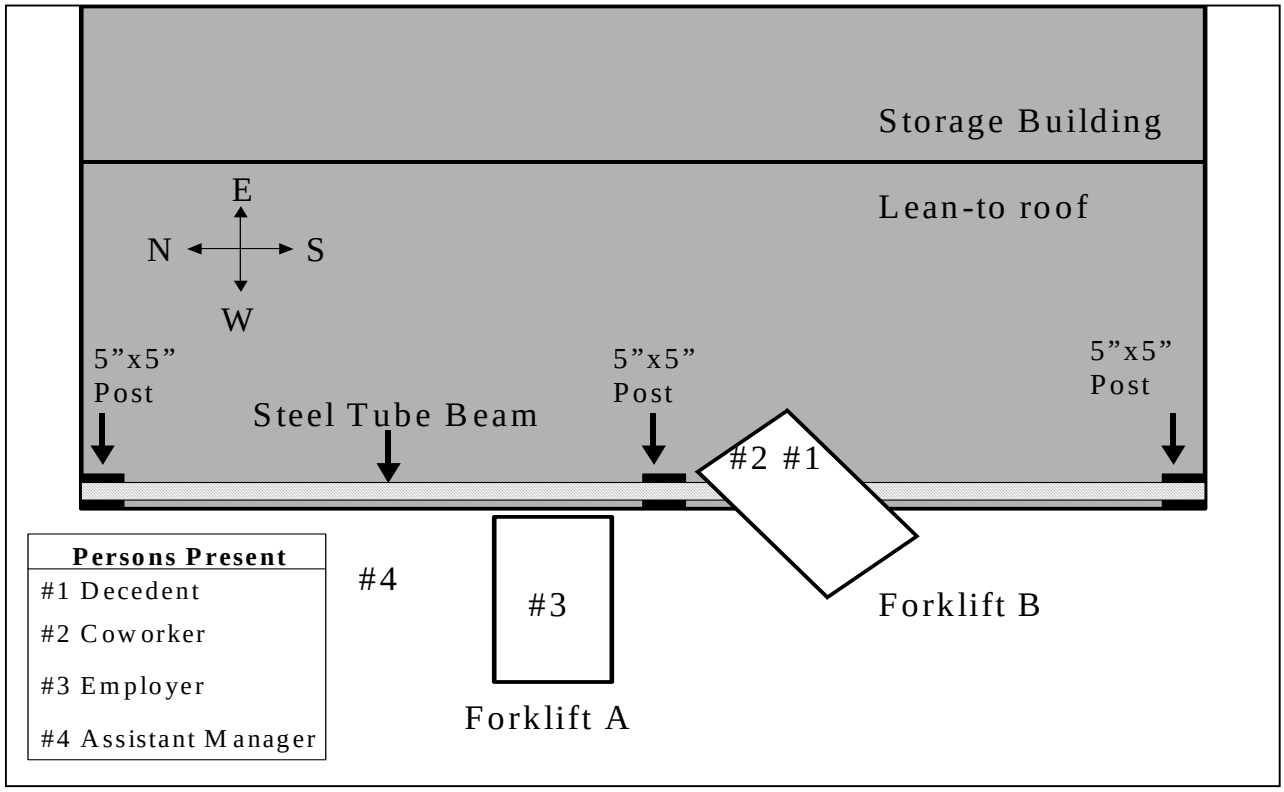

Figure 2. Overhead view diagram of the scene at the time of the incident (not to scale)

The decedent had been operating forklift B to elevate his coworker on the platform during most of the work. However, about the time they were ready to bolt the steel beam to the posts, the employer, who was forklift certified, arrived at the site. The forklift platform was lowered, the employer instructed the decedent to join his coworker on the platform, and the employer raised the forklift platform to an elevation of approximately 6 feet.

Figure 3. Two 20-foot sections of steel rectangular tube beam involved in the incident

The employer moved to the controls of forklift A after he raised the platform with forklift B. The employer stated that the steel beam needed to be shifted towards the south, but the decedent's coworker disagreed with him and said it did not need to be shifted. The decedent and the coworker were standing on the platform with the roof at approximately chest level before they both squatted under it to bolt the beam to the center post. During this time, the new steel beam was resting on the tips of the forks of forklift A and only the south end of the steel beam was in contact with a support post. When the employer used forklift A to raise the beam to shift it to the south, the end of the beam came off the support post and fell. As the steel beam fell, the north end of the steel beam tipped upward and struck the northwest edge of the roof. As the beam fell, it struck the decedent's coworker and knocked him off the platform to the ground. It also struck the

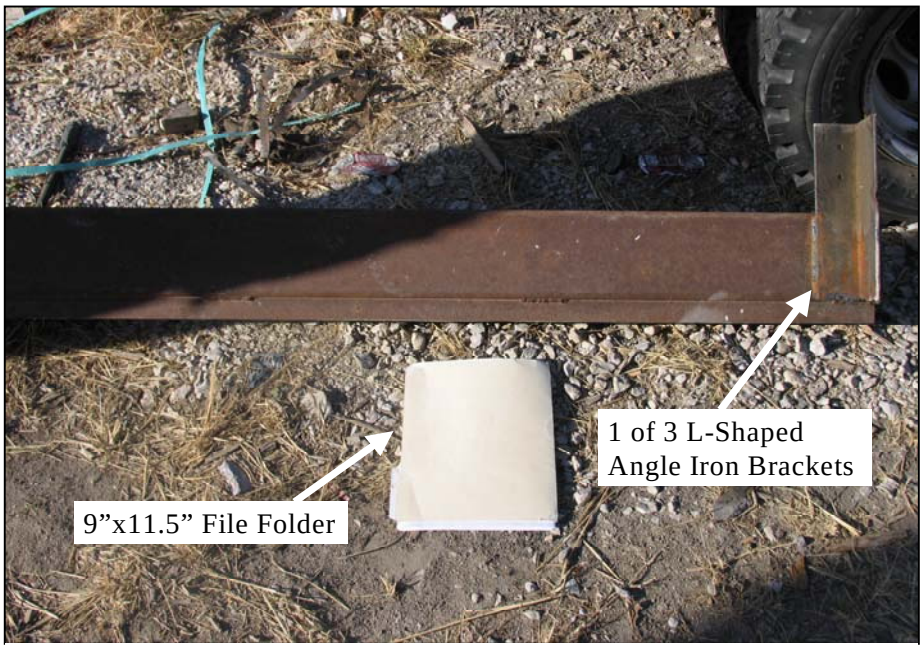

Figure 4. L-shaped angle iron brackets attached to the steel beam

decedent in the head and landed on him. After falling to the ground, the coworker climbed the mast of forklift B to push the steel beam off the decedent. When the decedent's coworker moved the 40-foot beam, it fell to the ground, breaking the weld. The forklift platform was lowered and a call was immediately placed for emergency medical response. The assistant manager of the company had just arrived at the site as the incident occurred and was standing on the north side of forklift A. EMS arrived in less than 10 minutes and transported the decedent to the nearest hospital from which the decedent was airlifted to a trauma facility. He was pronounced dead later that same day.

Figure 5. Wood platform used during the incident

CAUSE OF DEATH

The Medical Examiner listed the cause of death as blunt force head trauma.

RECOMMENDATIONS

Recommendation #1: Employers should ensure that employees do not position themselves under elevated loads.

Discussion: Employers should ensure that employees are trained not to position themselves under elevated loads and that forklift operators are trained to recognize the hazard of allowing employees under loads elevated by forklifts. Areas below and adjacent to suspended loads should be controlled access zones, which employees should not occupy. According to OSHA standards, "no person shall be allowed to stand or pass under the elevated portion of any powered industrial truck, whether loaded or empty." Furthermore, employers should ensure that elevated loads, particularly ones that are heavy and subject to tipping, are supported properly. Loads should be braced or tied off so as to protect from potential movement, and they should be leveled prior to initiating the lift.

Recommendation #2: Employers should ensure that employees wear hard hats when working in areas where there is a potential for head injuries from falling or flying objects and fall protection when working at elevations of six feet or more.

Discussion: Employers should maintain and enforce written policies that require employees to wear appropriate personal protective equipment when exposed to hazards. Although personal protective equipment may not have prevented the fatality in this incident, its use is always a prudent safety practice. In this incident, the employees should have been required to wear hard hats to protect themselves from head injury, regardless of the methods used to

elevate and secure the steel beam. OSHA standards require protective hard hats to be worn when working in areas where there is a potential for injury to the head from falling or flying objects. Personal fall protection should be utilized when working at elevations of six feet or more.

Recommendation #3: Employers should ensure that forklift operators elevate personnel only with approved lifting cages that are properly attached to machinery.

Discussion: Employers should provide an approved lifting cage when employees need to work at elevated heights. An approved lifting platform was not used during this incident. Company-built personnel platforms should comply with OSHA regulations and standards from the American National Standards Institute (ANSI) and the American Society of Mechanical Engineers (ASME). Employers should also consider consulting with their forklift manufacturer to identify appropriate personnel platforms designed for their particular machines. OSHA standards require lifting platforms and other types of scaffolding to be examined by a competent person before each work shift to ensure structural integrity. Approved lifting platforms should be equipped with a means of protecting workers from falling from the platform and also should be attached to the forklift to prevent the platform from falling. When lifting employees in an approved lifting cage, basic safety measures should be utilized. Basic safety measures include the use of restraining means, such as rails, chains, or body harnesses with lanyards or deceleration devices; elevating a worker on a platform only when the vehicle is directly below the work area; securing and leveling the platform to the forklift; and lowering the platform before driving to another location. Sway controls should not be used to make lateral movements while workers are on a raised platform; even small adjustments in the hydraulics can produce exaggerated, jerky movements of the forks and platform.

Recommendation #4: Employers should develop, implement, and enforce a comprehensive written safety program and training in the language(s) and literacy level(s) of all workers, which includes training in hazard recognition and the avoidance of unsafe conditions.

Discussion: Employers should develop comprehensive, written safety programs that include safety and hazard recognition training. The effects of training should be measured through testing and demonstration. In the case of noncompliance with training, corrective action through additional training and retesting should be performed to address safety concerns. Untrained employees should be prohibited from operating machinery or performing tasks for which they have not been instructed. Employees should be trained to recognize hazards posed to themselves and other persons working near them. Periodic testing and evaluation can provide opportunities for the evaluator to identify unsafe operating procedures and provide corrective action through retraining on safe operating procedures. All written and oral training should be appropriate for the language and literacy level of the employees who are being trained. Overcoming language and literacy barriers is crucial to providing a safe work environment. Organizations that employ workers who have a limited understanding of English should design, implement, and enforce a safety program in the language(s) of the employees and should provide a competent interpreter who can clearly convey instructions and explain workers' rights. Employers should consult resources, such as OSHA's website, *Compliance Assistance: Hispanic Employers and Workers*, (http://www.osha.gov/dcsp/compliance_

assistance/index_hispanic.html), for assistance in developing and improving multilingual safety and training programs.

Recommendation #5: Employers should ensure that forklifts and other machinery in need of repair are tagged and taken out of service until maintenance personnel perform repairs.

Discussion: All equipment and machinery, including forklifts, should be maintained with regular, thorough safety checks. Pre-start safety inspections should be conducted by trained and authorized operators at the beginning of each shift. A supervisor should be designated to ensure that inspections are performed daily, necessary repairs are made, and records are kept on file. OSHA standards require that powered industrial trucks be taken out of service when found to be in need of repair, defective, or in any way unsafe. Maintenance issues should be immediately reported to the designated authority and the truck should be taken out of service until it has been restored to a safe operating condition.

REFERENCES

- Occupational Safety and Health Administration, 29 CFR 1910.178, *Powered Industrial Trucks.*
- Occupational Safety and Health Administration, 29 CFR 1926 Subpart E, *Personal Protective and Life Saving Equipment.*
- Occupational Safety and Health Administration, 29 CFR 1926 Subpart M, *Fall Protection.*
- Occupational Safety and Health Administration, 29 CFR 1926.602, *Material Handling Equipment.*
- American National Standards Institute, B56.1-1969, Section 606, *Safety Standard for Powered Industrial Trucks.*
- NIOSH ALERT: *Preventing Injuries and Deaths of Workers Who Operate or Work Near Forklifts.* Department of Health and Human Services, Center for Disease Control and Prevention, National Institute for Occupational Safety and Health, 1998. Publication No. 2001-109
- Occupational Safety and Health Administration, *Standard Interpretations: Fall Protection Requirements for Elevated Platforms of Powered Industrial Trucks; Body Belts Versus Harnesses*, 06/28/2004.
- Operating manual and specifications for the type of vehicle in use.

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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