Massachusetts FACE • Occupational Fatality Report

Massachusetts Department of Public Health
Occupational Health Surveillance Program
Fatality Assessment and Control Evaluation Project

Iron Worker Crushed in Collapse of a Telescopic Boom Lift - Massachusetts

Investigation: # 07-MA-045-01
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SUMMARY

On November 21, 2007, a 52-year-old male iron worker, the victim, was fatally injured when a lift's telescopic boom collapsed, crushing him. The victim was working with a co-worker to replace one of the lift's counterbalance valves. At the time of the incident, the lift's boom was in an extended position. The victim had just removed the valve when the boom collapsed, crushing him against the lift's base. The co-worker was away from the immediate work area when he heard a loud noise and went back to the work area and found the victim. The co-worker placed a call to the local police and for emergency medical services (EMS). The local police and fire departments and EMS arrived within minutes. The victim was freed and EMS transported the victim to a local hospital where he was pronounced dead. The Massachusetts FACE Program concluded that to prevent similar occurrences in the future, employers should:

- **Ensure that when working on hydraulic boom lifts that the booms are either in the stowed position or that the booms are supported;**
- **Ensure that only qualified repair personnel conduct maintenance and repair work on equipment;**
- **Routinely conduct a job safety analysis (JSA) to ensure proper practices and procedures are implemented to complete tasks;**
- **Develop, implement, and enforce a comprehensive hazardous energy control program, including lockout/tagout procedures, and routinely review and update the program; and**
- **Develop, implement, and enforce a comprehensive written safety and health program and provide training.**

Manufacturers of machine components should:

- **Consider including hazard warnings inside the packaging of hydraulic system components.**

INTRODUCTION

On November 21, 2007, the Massachusetts FACE Program was alerted by the local media that on the same day a 52-year-old male iron worker was fatally injured when he was crushed by a lift's boom. An investigation was initiated. On December 11, 2007, the Massachusetts FACE Program Director traveled to the office and incident location of the steel erection and welding company and met with a company representative. The police report, death certificate, and company information were reviewed during the course of the investigation. In addition, photographs of the incident location and lift were taken.

The employer is a steel erection, welding, and steel beam manufacturer that has been in business for 14 years. The victim had worked at the company for approximately one year at the time of the incident. The victim's prior work experience included work as a diesel and aircraft mechanic and as a pipe fitter. The company has two working owners and four employees. It had been reported that there were no designated job titles, therefore, employees, including the owners, perform any tasks needed to complete jobs. In addition, it was reported that the company only hired individuals with multiple years of experience.

The two company owners were the individuals in charge of employee health and safety. The company did not have a written comprehensive health and safety program, a hazardous energy control program, or lockout/tagout procedures. The company does provide employees the OSHA required powered industrial truck training, the OSHA 10-hour training, and steel erection training. All employees have the Massachusetts Department of Public Safety Hoisting License. It was reported that the company occasionally provided toolbox talks to employees and encouraged employees to utilize the lift's manufacturers' operating and maintenance manuals. Employees were not part of a collective bargaining unit.

INVESTIGATION

The company is a steel erection, welding, and steel beam manufacturer. The machine involved in the incident was a 60 foot telescopic boom lift (Figure #1). The lift was manufactured in 1999 and had been purchased by the employer in 2005 from an equipment rental company. The lift is equipped with a three cylinder diesel engine and a hydraulic-based boom. The work platform located at the end of the boom measures three feet by eight feet and has a 500 pound capacity. The lift weighs approximately 20,000 pounds, of which 2,000 pounds is the weight of the lift's boom. It was reported by the employer that the lift had not been altered and that it has not needed any major repairs since the date it was purchased. General maintenance and minor repairs, such as changing tires and grease and oil changes for the company's equipment, including the lift, were performed by the company's in-house mechanic. Repairs to equipment that were considered to be complex were typically contracted out.

Prior to the incident, the lift had not been operating properly. The lift's boom was moving up and down very slowly. The employer knew that they were going to have some downtime

coming up and decided to have employees repair the lift during the expected slow period. A counterbalance valve (Figure #2) that was not operating properly was reported as the reason that the lift's boom was moving slowly. The counterbalance valve has two functions. One function is to control the amount of hydraulic oil present in the boom's pistons, which in turn control the raising and lowering of the boom. The second function is to prevent boom movement in the event of a hydraulic line failure.

The company had not performed this type of repair previously, and it was reported that they typically did not perform maintenance or repairs to their equipments' hydraulic systems. The week before the maintenance task was to take place, the company consulted with an equipment shop about the repair. An equipment shop representative visited the employer's garage and instructed one of the company owners on how to replace the valve, who then relayed this information to the mechanic and the victim. It was reported by the company owner that the equipment shop representative stated that the entire repair could and should be performed from the rear of the lift and that the boom should be in the stowed position during the repair.

On the day of the incident, the victim arrived at the company location sometime between 6:00 a.m. and 6:30 a.m. The victim knew he would be working in the garage that day performing maintenance tasks with a co-worker and would not be out at a worksite with the other company employees. The co-worker who was onsite with the victim was the employee who was considered the company mechanic.

The employer stated that the valve replacement task was estimated to take approximately 30 minutes to complete and that it was the first task to be completed that day. The lift was typically stored outdoors, with its hydraulic boom in an extended state, and had to be brought into the garage area of the building where the repair was to take place. In order for the lift to fit through the building's large overhead garage door, the lift's boom was lowered and placed in the stowed position and then driven inside the garage. Once the lift was positioned inside the garage, the boom was then extended up approximately 15 feet.

At approximately 8:00 a.m., the victim had started to loosen the counterbalance valve accessing it from underneath the rear of the lift. Once the valve was loosened, the co-worker went to take a restroom break. While the co-worker was away, the victim continued with the repair and climbed onto the lift's base to access the counterbalance valve (Figure #3) from the front of the lift. At the location where the victim would have climbed onto the lift's base, there was a manufacturer's decal that stated "Warning Crushing Hazard." While on the lift's base, which positioned the victim directly underneath the raised boom, the victim continued to loosen the valve. When the valve was loosened further this allowed the hydraulic pressure/oil to be released from the hydraulic system. As the hydraulic pressure/oil was released, the raised boom collapsed onto the victim, crushing him between the boom and the top of the lift's base.

The co-worker heard a noise, exited the bathroom and went to the work area to find that the boom was no longer in the raised position and that the victim crushed underneath the boom. The

co-worker then placed a call to 911. The local police and fire department and emergency medical services (EMS) personnel arrived at the incident location within minutes.

After the boom collapsed, the lift's hydraulic system lacked the pressure needed to be able to move the boom via the lift's controls. A skid-steer loader was utilized to lift the boom and wooden blocks were then used to secure the boom in a slightly raised position. The victim was then freed and removed from the top section of the lift's base. Cardiopulmonary resuscitation was administered by EMS personnel, and the victim was transported to a local hospital where he was pronounced dead.

At the time of the site visit the employer stated that they were no longer going to perform any hydraulic-based maintenance tasks on their equipment.

CAUSE OF DEATH

The medical examiner listed the cause of death as asphyxia due to chest compression.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should ensure that prior to starting work on hydraulic boom lifts that either the booms are properly supported or that the booms are in the stowed position.

Discussion: Hydraulic systems need to be pressurized to have controlled movement of the hydraulic powered object, in this case the lift's boom. Prior to working on any component of a hydraulic system, the first steps should be to conduct a job safety analysis (Recommendation #3) and to implement lockout/tagout procedures (Recommendation #4). One of the next crucial steps, which should be part of the hazardous energy control program, is to ensure that any potentially movable parts are blocked and secured. In this case, the boom should have been either in the lowest position, the stowed position, or if the boom was required to be in a raised position during the maintenance task, the boom should be properly secured from moving with blocking.

Recommendation #2: Employers should ensure that only qualified repair personnel conduct maintenance and repair work on equipment.

Discussion: In this case, the victim was assisting the company's mechanic to replace a lift's counterbalance valve. At the time of the incident the victim, who during the previous week had been shown once how to perform the repair, was working alone while the co-worker was on a restroom break. Reportedly the mechanic and the victim had been informed about how to perform the repair, including the need to access the valve from the rear of the lift and to place the boom in the stowed position. It appears, however, that both the co-worker and victim were not

aware of the correct procedures and of all of the serious hazards associated with the task being performed.

Employers should ensure that only qualified personnel perform maintenance and repair tasks. A qualified person could be an employee that has been through specific training to perform the repair task or a hired qualified contractor specifically for the task. In addition, workers who are assisting qualified personnel to perform these tasks should not be allowed to continue a task when left alone even for a short period of time.

Recommendation #3: Employers should routinely conduct a job safety analysis (JSA) to ensure proper practices and procedures are implemented to complete tasks.

Discussion: A job safety analysis (JSA) is a way to evaluate how to perform tasks safely and to identify all potential hazards and hazardous situations that could occur when performing tasks, such as performing maintenance and repairs to hydraulic systems. A JSA should be routinely conducted for all tasks to be performed and equipment utilized during the task in order to identify uncontrolled hazards. When conducting a JSA for a specific task that will involve the use of machinery and equipment, employers should utilize the manufacturer's owners/service manuals. These manuals will have the proper operation, repair and maintenance procedures for the equipment to be involved. Once hazards are identified, the employer should take steps to eliminate or control these hazards.[1]

In this case, if a JSA was conducted for the task of replacing the counterbalance valve, it might have revealed that 1) replacing the counterbalance valve while the boom was in the raised position without blocking and 2) not locking out the hydraulic system, would lead to the hazard of the boom collapsing. Once these hazards were revealed, the proper controls including lockout/tagout and blocking the boom, could have been implemented. In addition, although not a factor in this incident, a JSA for this task should also address the hazards of pressurized hydraulic oil. A high-pressure release of hydraulic oil can injure eyes or other body parts by burning or penetrating the skin.

Recommendation #4: Employers should develop, implement, and enforce a comprehensive hazardous energy control program, including lockout/tagout procedures, and routinely review and update the program.

Discussion: In this case, the employer did not have a hazardous energy control program, which would have included procedures for lockout/tagout. OSHA regulation 29 CFR 1910.147, *The control of hazardous energy (lockout/tagout)* requires that employers establish procedures for isolating machines and equipment during servicing and maintenance from the input of energy by affixing appropriate locks or tags to energy isolating devices and then blocking and securing any movable part.[2,3] This is done to prevent any unexpected energization, start-up or release of stored energy that would injure workers during servicing and maintenance of machines and

equipment. All forms of energy must be considered, including electrical, hydraulic, pneumatic, and mechanical. Therefore, for each machine and piece of equipment, an individual lockout/tagout procedure is needed that specifies the requirements to properly perform lockout/tagout on that machine or piece of equipment, as well as when lockout/tagout should be implemented.

A machine's or piece of equipment's specific lockout/tagout program should be documented in writing and include, but not be limited to:

- Identification and labeling of all hazardous energy sources
- Procedures to de-energize, isolate, block, and/or dissipate all forms of hazardous energy, and verify by tests and/or observations that all energy sources are de-energized before work begins
- Requirements that workers secure the machines' energy control devices with their own individually assigned locks and/or tags
- Inspecting repair work before reactivating the equipment
- Ensuring that all workers are clear of danger points before re-energizing the system
- Inspecting each energy control procedure at least annually, to ensure that the procedures and the requirements of the OSHA standard are being followed

Involving employees in the process of inspecting and updating the hazardous energy control program and training is important. The employer should seek input from employees by having employees evaluate the effectiveness and limitations of the hazardous energy control program. Employers should ask employees about techniques involved in completing tasks that require them to expose any part of their bodies to machine and equipment hazards, especially maintenance activities and common procedures that are not typically thought of as part of the everyday operation. Employees who spend the majority of their time operating and performing maintenance tasks on machines and equipment will be able to contribute valuable information that might have been overlooked, and these employees will likely be able to contribute the most information about the effectiveness and limitations of the hazardous energy control program.

Recommendation #5: Employers should develop, implement, and enforce a comprehensive written safety and health program and provide training.

Discussion: A comprehensive safety and health program should be developed by employers and include, but not be limited to, a hazardous energy control program (Recommendation #4), hazard recognition, how to control these hazards (Recommendation #3), and the avoidance of unsafe conditions and training on each topic. In high hazard industries some maintenance and repair tasks could potentially be overlooked and not included in the comprehensive safety and health program. Therefore, when developing a comprehensive safety and health program it is important that all tasks performed by workers are addressed. In this case the employer mentioned that the company's safety and health focus had been on the multiple hazards of steel erection because he never thought an employee would be injured at the office/garage.

Employers should utilize their employees' expertise throughout the development process of the comprehensive safety and health program and seek employee input. Once the comprehensive safety and health program is written, employees' input should continue to be utilized when the program is routinely updated. The program should be updated when safety concerns arise and when new equipment and new tasks are introduced into the workplace. It is important that the programs' training content and the names and dates of employees completing the training should be documented and retained by the employer. Employers should ensure that the trainer who provides training is qualified through education and/or experience to conduct training. In addition, a comprehensive safety and health program is not going to be effective if the employer does not strictly enforce the procedures outlined in the program. Enforcing a comprehensive safety and health program should include random inspections of employee work habits related to procedures outlined in the program.

As a reference, a summary of the Occupational Safety and Health Administration's (OSHA) draft proposed safety and health program rule, which discusses the safety and health responsibility of employers, has been included at the end of this report. In addition, the Massachusetts Division of Occupational Safety (DOS) offers free consultation services to help employers improve their safety and health programs, identify hazards, and train employees. DOS can be contacted at 617-969-7177. More information about DOS can be found on their Web site at www.mass.gov/dos/consult/.

Recommendation #6: Manufacturers of machine components should consider including hazard warnings inside the packaging of hydraulic system components.

Discussion: One hazard common to hydraulic systems involves the unexpected loss of the hydraulic system's pressure. Manufacturers of hydraulic system components should consider including large bright colored hazard warnings when packaging their products. In this case, the hazard warning with the valve could have stated that a potential hazard existed during the replacement of the valve and that the hydraulic system must be locked out and any movable part of the equipment must be blocked and/or in the stowed position. The warnings could also refer back to the manufactures maintenance manual, which could explain the hazard in greater detail.

REFERENCES

1. DOL. OSHA. *Job Hazard Analysis.* Publication Number: 3071. [www.osha.gov/publications/osha3071.pdf]. Date accessed: March 5, 2008.

2. Code of Federal Regulations. 29 CFR 1910.147. *The control of hazardous energy (lockout/tagout).* Washington DC: U.S. Government Printing Office, Office of the Federal Register.

3. NIOSH [1999]. *NIOSH Alert: Preventing worker deaths from uncontrolled release of electrical, mechanical, and other types of hazardous energy*. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 99-110.

Figure 1 – Boom lift involved in the incident.
This is looking at the front of the lift.

Figure 2 – Counterbalance valve is located between the two vertical hydraulic hoses.

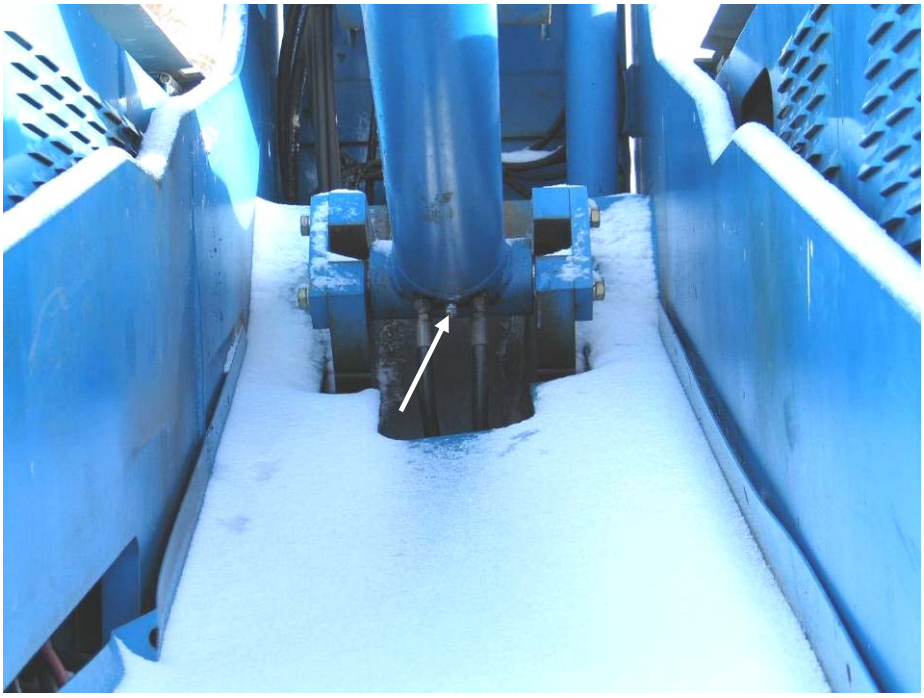

Figure 3 – Location where victim was crushed and a decal warning of a crushing hazard.

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FATALITY ASSESSMENT AND CONTROL EVALUATION PROGRAM

The Massachusetts Department of Public Health, in cooperation with the National Institute for Occupational Safety and Health (NIOSH), conducts investigations on the causes of work-related fatalities. The goal of this program, known as Massachusetts Fatality Assessment and Control Evaluation (Massachusetts FACE) is to prevent future fatal workplace injuries. Massachusetts FACE aims to achieve this goal by identifying and studying the risk factors that contribute to workplace fatalities, by recommending intervention strategies, and by disseminating prevention information to employers and employees.

Massachusetts FACE also collaborates with engineering and work environment faculty at the University of Massachusetts at Lowell to identify technological solutions to the hazards associated with workplace fatalities.

NIOSH funded state-based FACE Programs currently include: California, Iowa, Kentucky, Massachusetts, Michigan, New Jersey, New York, Oregon, and Washington.

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Additional information regarding this report is available from:

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