Massachusetts FACE • Occupational Fatality Report

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

Mechanic Repairing a Multi Terrain Loader Pinned between the Loader's Lift Arm and Frame – Massachusetts

Investigation: # 09-MA-044-01
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SUMMARY

On October 16, 2009 a 65-year-old male heavy equipment mechanic (victim) was fatally injured while repairing a multi terrain loader. At the time of the incident, the multi terrain loader's lift arm had a fork attachment connected to it and the lift arm was in a raised position. The victim had positioned a step ladder underneath the loader's raised lift arm against the loader's cab and it appears that the victim was standing on the ladder at the time of the incident. A co-worker returning to the worksite found the victim crushed between the loader's lift arm, which was now in the lowered position, and the cab. The co-worker placed a call for emergency medical serviced (EMS). Within minutes EMS arrived and the victim was pronounced dead at the incident location. The Massachusetts FACE Program concluded that to prevent similar occurrences in the future, employers should:

- **Ensure that safeguards and interlocks are functioning properly, used and are never bypassed;**
- **Ensure that the lift arm cylinder lock is engaged prior to exiting a multi terrain loader's cab during maintenance tasks requiring the lift arm to be in the raised position;**
- **Ensure employees only start or access the controls of a multi terrain loader when seated in the loader's cab;**
- **Develop, implement and enforce lockout/tagout procedures for maintenance tasks that include the use of the cylinder locks when the lift arm is required to be in the raised position;**
- **Ensure employees are not performing potentially hazardous tasks alone in isolated areas; and**
- **Develop, implement and enforce a safety and health program that addresses hazard recognition and avoidance of unsafe conditions.**

INTRODUCTION

On October 30, 2009, the Massachusetts FACE Program was notified by the Occupational Safety and Health Administration (OSHA) through the 24-hour Occupational Fatality Hotline that on

October 16, 2009, a 65-year-old male mechanic was fatally injured while repairing a machine. An investigation was initiated. On December 9, 2009, the Massachusetts FACE Program Director traveled to the company's main office and met with a company representative. The police report, death certificate, and corporate information were reviewed during the course of the investigation.

The company, incorporated in 1973, is a site development and earth moving contractor with a primary focuses on large projects involving previously undeveloped land. The company's main tasks include site excavating and grading work, and it hires sub-contractors for tasks such as paving, guardrail installation and landscaping. The number of workers employed by the company varies by season. The company typically has 115 employees during the spring and summer months and 30 or fewer employees during the winter months. The company has over 100 pieces of heavy earth moving equipment, including multi terrain loaders, the type of machine the victim was repairing. The typical work day for employees would start at 7:00 a.m. and end at 3:30 p.m., and the work week would be Monday through Friday with no weekend work. On occasion there is overtime, which is limited to the weekdays only, extending the work day from 3:30 p.m. up to 5:30 p.m. The victim had been employed by the company for 25 years as a heavy equipment mechanic. Prior to this job, he was a crane operator.

The company does not have a written health and safety program or a lockout/tagout program. It was reported that management is very active in each project to ensure safety and that there is at least one or more of the following personnel on a project site at all times: foreman, superintendent, project manager, general manager, company owner. In addition to the training provided to employees through their unions, the company provides the OSHA 40 Hour Hazardous Waste Operations and Emergency Response Standard (HAZWOPER) course on an annual basis. The victim did have a current Massachusetts Department of Public Safety hoisting license, which is required in Massachusetts to operate multi terrain loaders. There is a maintenance schedule for the company's equipment that includes preventive maintenance based on hours operated. A majority of the maintenance work on the equipment is performed in the field, not at the company's garage. Most of the non-management employees, including the victim, have union representation.

INVESTIGATION

The machine that was being repaired at the time of the incident was a multi terrain loader (loader). The machine is similar to a skid-steer loader, with one of the main differences being that multi terrain loaders have rubber tracks instead of tires (Figure #1). The loader was manufactured in 2005 and was purchased by the company in 2006 from an equipment rental company. The loader's dimensions are 115 inches long (with no attachments), 82 inches high and 75 inches wide. The loader's lift height is 93 inches. The employer reported that the loader had not had any major problems or needed any major repairs since being purchased.

The loader has an enclosed cab with one seat for the operator. There are two joystick controls inside the enclosed cab. The joystick control to the right of the operator's seat is the travel control and the joystick to the left controls the hydraulics for the attachments and lift arm. The key ignition for the loader is located near the ceiling, in the upper right hand corner of the cab. The operator's seat has a pressure switch interlock that will prevent the joysticks from operating unless there is a person seated: it was reported that this interlock was not working properly when tested after the incident. The seat is also equipped with a lap bar restraint with an interlock, which prevents the loader from movement if the bar is not down. The loader's cab door is also equipped with an interlock that will prevent the lift arm from raising if the door is open.

The loader has a lift arm that wraps around the front of the machine. The lift arm has two hydraulic cylinders located on either side of the loader. The hydraulic cylinder located on the right side of the loader is equipped with a cylinder lock. When engaged, the cylinder lock will prevent the raised lift arm from being able to be lowered, both intentionally and unintentionally. To engage the cylinder lock, first the lift arm must be lowered and the cylinder lock storage pin removed from the cylinder lock brace by either the operator exiting the cab or by someone outside of the cab. The lift arm is then raised until the brace engages by dropping onto the cylinder (Figure #2). A lock pin is inserted through the lift arm brace and a cotter pin installed to keep the lock pin and brace in position on the cylinder. Again, this task can only be performed by a person who is outside of the loader's cab. To lower a lift arm that is locked in the raised position, the above procedure is performed in reverse.

At the time of the incident, the loader was located in an open, but isolated area, adjacent to a large residential construction project for which the company was hired to perform the site excavation work. The project site was 33 acres and the project had been ongoing for multiple years. At the time of the incident 22 apartment buildings had been constructed and there was one year remaining until the project would be completed. The type of loader that was involved in the incident is smaller in size compared to other earth moving equipment and can easily fit into tighter spaces and be less disruptive to the area than larger earth moving equipment. This type of loader is typically used at the end of a project, such as in this incident.

The loader had not been used for a few weeks prior to the incident and was in need of maintenance. The two problems to be addressed with the loader were that the heater was not working properly and that when the loader was parked and not used the battery would draw down. The victim's task for the day of the incident was to repair the loader so it could be used to complete some up coming tasks at the apartment complex. On the day of the incident, a Friday, the victim started his day at 7:00 a.m., first arriving at the company office location and then traveling to the open area where the loader was located. A co-worker, who was a parts runner for the victim, was intermittently at the incident location throughout the day of the incident, but most of the day the victim was working alone. The first task the victim performed was replacing the loader's battery, and then the victim started to try and diagnose the heater problem.

The loader has an access panel located on the machine's left side that provides access to the heating unit. At the time of the incident, the access panel and the heating unit were removed from the loader and the heating unit was disassembled. The loader's lift arm, with a fork attachment connected to it, was in the raised position and the cylinder lock was not engaged. The loader's cab was also partially raised for better access to the heater and other components. The victim had placed a four foot stepladder against the loader's cab, underneath the raised lift arm (Figure #3). It appears that the victim was standing on the stepladder when the incident occurred.

At the time of the incident, the co-worker was out getting a part for the loader. Prior to the incident, the victim had called the co-worker and told him that they were not going to be able to complete the repair to the loader that day and that they would need put the loader back together for the weekend and continue with the repair on Monday. After the call, the co-worker started his return to the incident location.

When the co-worker arrived back at the incident location at approximately 1:00 p.m., he found the victim crushed between the loader's arm, which was now lowered, and frame/cab. The loader was running when the victim was found, which reportedly was not the case when the co-worker left the incident location to pick up a part for the loader. The co-worker placed a call for emergency medical services (EMS). Within minutes EMS and personnel from the local police department arrived at the incident location. The victim was pronounced dead at the incident location.

CAUSE OF DEATH

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

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should inspect equipment daily to ensure that safeguards and interlocks are functioning properly, used and are never bypassed.

Discussion: The multi terrain loader involved in the incident was manufactured with multiple safeguard and interlocks to prevent unintentional movement and control activation when the operator is not properly seated in the protective cab. Equipment should be inspected daily, prior to beginning work, and any equipment found to be defective, including safety features not functioning properly, should be removed from service until the repairs have been completed. When safeguards and interlocks are not functioning properly or they are intentionally bypassed, it places the equipment operator and other workers, including maintenance workers, at increased risk of injury from moving parts and crushing forces.[1]

In this case, at the time of the incident, the loader's lift arm was in the raised position and the cylinder lock was not engaged. The loader was running and the lap bar restraint was in the down position even though no worker was seated in the operator's seat. Also, it was discovered after the incident when the loader was inspected that the operator's seat interlock was not functioning. All of these factors combined with the victim working underneath the raised lift arm contributed to the event that lead to the fatal injury sustained by the victim.

Recommendation #2: Employers should ensure that the lift arm cylinder lock is engaged prior to raising the multi terrain loader's lift arm for maintenance tasks.

Discussion: During normal operation of a multi terrain loader, operators should never exit or place any part of their body outside of the cab without lowering the lift arm to the ground first.[1] In this case, the incident occurred not during normal operation of the loader, but during a maintenance task where the victim needed the loader's lift arm in the raised position. Prior to the entering the loader's cab to raise the lift arm maintenance tasks, the lift arm cylinder lock should have been engaged. Engaging the lift arm cylinder lock first and then raising the lift arm will prevent any movement of the lift arm during the maintenance task and will allow safe access to the cab with the lift arm in the raised postion.[1] In addition, the process of engaging the lift arm cylinder lock should be incorporated into the loader's lockout/tagout procedures (Recommendation #4).

Recommendation #3: Employers should ensure employees only start or access the controls of a multi terrain loader when seated in the loader's cab.

Discussion: In this case, although un-witnessed, evidence suggests that the victim might have positioned the step ladder against the front of the loader to reach up into the cab area to start the loader's engine. Once the engine was started, it appears that the victim might have unintentionally engaged the lever that controls the raising and lowering of the loader's lift arm, causing the lift arm to lower and crush the victim against the ladder and the loader frame/cab. Ensuring that employees only start and engage a loader's controls while seated in the operator's seat, can prevent the unintentional engaging of the loader's controls leading to crushing injuries by the loader's lift arm.

Recommendation #4: Employers should develop, implement and enforce lockout/tagout procedures for maintenance tasks that include the use of the cylinder locks when the lift arm is required to be in the raised position.

Discussion: In this case, the employer did not have a hazardous energy control program, which would have included procedures for lockout/tagout. At the time of the incident, the victim was repairing the multi terrain loader and the lift arm was in the raised position without the cylinder lock engaged, an event that would have required implementing lockout/tagout procedures.

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 and train employees on these procedures.[2,3] Lockout/tagout is performed to prevent any unexpected energization, start-up or release of stored energy, such as an unexpected hydraulic system failure, 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.[4]

A lockout/tagout procedure should be developed for the multi terrain loader that specifies the requirements to properly perform lockout/tagout on that machine, as well as when lockout/tagout should be implemented. The lockout/tagout procedure for the loader should include the use of the manufacturer provided cylinder lock (Recommendation #2). 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 ensure employees are not performing potentially hazardous tasks alone in isolated areas.

Discussion: The location where the victim was performing the maintenance task on the loader was isolated from the other workers and the general public. In this case, the victim did have a co-worker who was helping him with the maintenance task, but the co-worker was not at the worksite and was performing errands for lengthy periods of time throughout the day. Because the cause of death was asphyxia due to compression of torso, if a co-worker was present at the time of the incident, they might have been able to climb into the cab and raise the loader's lift arm, freeing the victim and potentially stopping the asphyxia. The co-worker could have then placed a call to emergency medical services, resulting in quick medical attention.

Recommendation #6: Employers should develop, implement and enforce a safety and health program that addresses hazard recognition and avoidance of unsafe conditions.

Discussion: At a minimum, a comprehensive safety and health program should include an explanation of the worker's rights to protection in the workplace, safe work practices workers

are expected to adhere to, specific safety protection for all tasks performed, ways to identify and avoid hazards, and who they should contact when safety and health issues or questions arise.

In this case, topics including safe operation of multi terrain loaders, lockout/tagout procedures for maintenance tasks, how to control identified hazards, and the avoidance of unsafe conditions, such as working underneath an unblocked, raised hydraulic lift arm, should be addressed. Employers should use their employees' expertise throughout the development process of the comprehensive safety and health program by seeking employee input. Even after the safety and health program is developed, employers should continue to seek employees' input during the routine updating of the program. The program should be updated when safety concerns arise and when new equipment and new tasks are introduced into the workplace.

Employers should ensure that they have fully and effectively implemented their comprehensive safety and health programs by routinely performing assessments of the work area and work practices and immediately addressing any observed unsafe conditions. As part of the program's implementation, training should be provided to all employees on program topics, including hazard recognition and the avoidance of unsafe conditions.[5] All training provided to employees should be documented. Documentation should include: who provided the training and their qualifications, the content of the training, workers who were trained, and any assessments of workers' comprehension of the training.

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 Department of Labor Standards (DLS) offers free consultation services to help small employers improve their safety and health programs, identify hazards, and train employees. DLS can be contacted at 617-969-7177. More information about DLS can be found on their Web site at www.mass.gov/dos/consult.

REFERENCES

1. NIOSH [2010]. NIOSH Alert: *Preventing Injuries and Deaths from Skid-Steer Loaders*. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 11-128. www.cdc.gov/niosh/docs/2011-128/pdfs/2011-128.pdf

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.

4. NIOSH [2011]. NIOSH Workplace Solutions: *Using Lockout and Tagout Procedures to Prevent Injury and Death during Machine Maintenance*. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 11-156. www.cdc.gov/niosh/docs/wp-solutions/2011-156/pdfs/2011-156.pdf

5. Regulations, 29 CFR 1926.21 Safety training and education. Washington D.C.: U.S. Printing Office, Office of the Federal Register.

Figure 1 – Loader involved in the incident

Figure 2 – Loader with lift arm raised and cylinder lock engaged

Red cylinder
lock is engaged

Figure 3 – Loader with step ladder visible

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.

Additional information regarding this report is available from:

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The completed form may be returned by fax to (617) 624-5676, by mail to FACE, 250 Washington Street, 6th Floor, Boston, MA 02108, or by email to ma.face@state.ma.us.