TO: Director, National Institute for Occupational Safety and Health

FROM: Iowa FACE Program

SUBJECT: Boom truck arm breaks causing tree trimmer to fall to his death -- Iowa

SUMMARY: In July, 1995 a self-employed tree trimmer (the victim) died from head and neck injuries caused by falling 50 feet from a boom truck bucket. The victim was using an older "cherry picker" boom truck to trim trees with a small chainsaw at a friend's acreage. The lower section of the hydraulic boom and the hinge area was constructed of metal. The upper section and the bucket were made of fiberglass. The upper section was round and approximately 8 inches in diameter.

At the time of the accident the boom was in maximum vertical extension above the truck. The victim was holding a 70 lb. branch that he had just cut. He momentarily hyperextended the fiberglass boom to clear the truck cab. At this extreme point in its travel, the upper section of the boom snapped completely in two at its base where it inserted into the metal hinge portion of the boom. The fiberglass arm swung down like a pendulum to a resting position, the broken ends being held adjacent to each other by cables inside the extension arms. These cables automatically keep the bucket level with the ground in normal operation.

When the boom arm broke, the bucket remained in a fixed position with the fiberglass arm, inverting when it swung down, propelling the victim headlong into the ground, killing him instantly. When emergency personnel arrived, they observed the fatal head and neck injuries and confirmed that the man was dead at the scene. The victim was not wearing a hard hat, nor any type of safety belt or harness.

RECOMMENDATIONS following our investigation were as follows:

- 1. *Boom truck operators should wear fall protective equipment as outlined in 29 CFR 1926.566 (b)(2v), "A body belt shall be worn and a lanyard attached to the boom or bucket when working from an aerial lift."*
- 2. *All equipment which mechanically supports or lifts human life should be maintained in excellent working condition, with routine inspections and maintenance of all parts by qualified technicians.*
- 3. *Tree trimmers and boom truck owners should not use a boom arm as a crane to move logs, tree limbs, or objects which exceed its rated capacity. (CFR 1926.556 (b)(2vi).*

INTRODUCTION

In July 1995 a 48 year old male tree trimmer with 20 years experience was killed when the fiberglass arm of his boom truck broke in two throwing him to the ground below. On July 25

the Iowa FACE program became aware of the incident from a regional newspaper and began an investigation. On August 15, a site visit was conducted by one Iowa FACE investigator, however the boom truck itself was not available for inspection. Sources of information about this event include the county Sheriff (who had photographs), newspaper articles, and interviews with an eyewitness and family members of the victim.

The victim was the owner of a small tree trimming business employing up to 5 others seasonally for various types of tree services. He had been in business approximately 20 years and was the only full-time employee of the business. He was working alone at the time of the fall, however there was an eyewitness watching from below.

This was a small family owned business with very informal training of its workers and no written safety program in place. All training was task specific and conducted on-the-job. The boom truck was over 40 years old and had been mounted on several different truck bodies. It received heavy use and was occasionally used to move logs and branches. The machine had a rated capacity of 300 lbs., therefore unsuitable for this type of heavy work.

This boom had failed the victim two times in the past. Once it came down suddenly, but at a low height causing only minor injuries. The second time worn cables failed but the owner climbed out onto a tree for safety. The boom truck was old and in poor condition. Daily use had made the owner complacent and unmotivated to pay for repairs or replacement.

INVESTIGATION

The victim was called to the acreage owned by the eyewitness to top off several trees in a corner of his property. The area was flat and dry and the weather was good for this work. The victim drove an older hydraulic boom truck which had a round fiberglass upper extension arm with a fiberglass bucket at its end. This hydraulic boom lift had been used on several trucks in the past. Total reach of the boom lift was 52 feet. The bucket was attached by pulleys and cables through the boom joints to keep it automatically level with the ground throughout its movement.

The outriggers of the boom truck were extended and the tree trimmer was quickly performing his job high in the bucket. He was using a small chainsaw to remove smaller limbs in the treetops. At the time of the accident the boom arms were fully extended straight up above the truck. The victim had just cut off a limb approximately 3 inches in diameter and ~14 ft. in length which weighed ~70 lbs. He was holding this branch in one hand and maneuvering the bucket with the other hand, putting the boom in slight hyperextension to gain clearance from the truck. At this point of maximum hyperextension, the eye witness heard a sharp crack when the upper fiberglass arm snapped in two at its base, and it began to swing to the side. The victim managed to throw off the limb he was holding and also the chainsaw before the broken arm swung down.

The victim was not wearing any safety belt or lifeline. Therefore when the fiberglass arm swung down the bucket became inverted and propelled the victim headfirst into the ground, killing him instantly. The bucket swung partially to the other side of the truck before coming to rest in the midline, with the bucket firmly attached in an inverted position.

The eyewitness immediately called an ambulance which arrived within a few minutes. Emergency personnel noticed the severe head and neck injuries of the victim and after confirming asystole, did not proceed with resuscitory efforts. He was later pronounced dead at the scene by the county

medical examiner.

The eyewitness was also a friend of the victim and had known him for several years. He reported that the victim had been working rather quickly and efficiently, causing significant motion in the bucket and extension arm. The bucket was rated for 300 lbs. and the victim weighed ~220 lbs, so adding the limb and the saw would easily increase the load to 300 lbs.

According to the sheriff's photographs and the report of the eyewitness the fiberglass arm broke off one inch below its insertion point in the metal hinge socket of the boom lift, where the two sections of the boom are connected (see photograph #1). The appearance of the cracked fiberglass revealed an old crack in the fiberglass, confirmed by the debris accumulated in it over time. In normal operation this area of the fiberglass receives great stress as the boom jerks about, however this portion of the fiberglass arm was hidden within the metal collar in normal use, and no one was aware of this crack. It was known that the fiberglass arm was loose in its socket, however the owner had not fixed this condition.

When the boom was momentarily put into hyperextension the normal stresses on the fiberglass boom were suddenly reversed. The cracked area of the boom normally received compressive forces when the boom was is a typical position. When the forces reversed and this area was pulled apart it snapped in two. The maximum bucket load coupled with the jerky movement of the arm added further to the level of stress generated at this weak point in the fiberglass boom causing it to fail.

The victim was thrown head first onto the ground by the falling bucket. He was killed instantly from severe head and neck injuries. When the bucket came to a resting position the top of the inverted bucket was approximately 9 ft. off the ground. It is possible that if the victim had been wearing a safety belt and short lifeline, that he may have survived the accident.

CAUSE OF DEATH

The official cause of death from the county medical examiner *was "closed cranio-cerebral trauma due to a fall from an extension truck."* No autopsy was performed.

RECOMMENDATIONS / DISCUSSION

- **Recommendation #1** *Boom truck operators should wear fall protective equipment as outlined in 29 CFR 1926.566 (b)(2v), "A body belt shall be worn and a lanyard attached to the boom or bucket when working from an aerial lift."*

  Discussion: The victim did not fall straight down out of the bucket, but rather fell in an arc as the bucket swung down like a pendulum. Had he been wearing a safety belt with a short lifeline it is likely he would have survived the fall, although possibly with significant injury.

- **Recommendation #2** *All equipment which mechanically supports or lifts human life should be maintained in excellent working condition, with routine inspections and maintenance of all parts by a qualified mechanic.*

  Discussion: The victim in this case had a history of delaying or ignoring needed maintenance and repair on his equipment. Mechanics who had worked on this boom truck stated they knew the fiberglass arm was loose in its metal socket, and that it needed attention.
  The boom had failed the victim two times in the past. Once the victim managed to climb onto an

adjacent tree before the boom came down, and the other time it failed when suspended close to the ground producing only minor injuries. The entire boom truck was in poor operating condition yet the victim was unwilling to have it repaired or replaced. The fiberglass bucket was entirely worn out on its edges and bottom making it dangerous to stand directly in the middle of the bucket. Mechanics recall warning the victim *"that machine is going to kill you someday"* unless the victim got it repaired.

- **Recommendation #3** *Tree trimmers and boom truck owners should not use the boom arm as a crane to move logs, tree limbs, or other objects which exceed its rated capacity.*

(CFR 1926.556 (b)(2vi).

Discussion: Using a boom truck as a crane is a great hazard to all workers involved. Use of the boom lift in this fashion frequently exceeds its rated capacity and puts excessive stress on all machine components. While hydraulic systems may be capable of loads much higher than the rated capacity, boom arms are mechanically not capable to bear the extra load, and the potential for failure is high. Rapid and jerky movements of the boom arm further increase the stress at critical joints and cause material fatigue. The victim was reported to have used the boom as a crane to move logs and limbs. The rated capacity of 300 lbs. was easily exceeded in this work.

Photograph #1

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Fatality Assessment
&
Control Evaluation Program
(FACE)

The University of Iowa, in conjunction with the National Institute for Occupational Safety and Health (NIOSH), is investigating the causes of work-related fatalities in the State of Iowa. FACE is a surveillance program that identifies all occupational fatalities, conducts in-depth, on-site investigations on specific types of fatalities, and makes recommendations for employers and farmers to help prevent similar fatal accidents in the future.

Iowa is a major farming state, and therefore the Iowa FACE Program deals with many occupational deaths on the farm. It is a very hazardous profession that claims hundreds of lives nationally every year. We publish detailed reports that are disseminated to key agricultural leaders in Iowa who share our concern for the safety of farmers. To reach and effectively communicate with this independent and vulnerable group is a worthy challenge here in Iowa.

NIOSH funded state-based FACE Programs include: Alaska, California, Colorado, Georgia, Indiana, Iowa, Kentucky, Maryland, Massachusetts, Minnesota, Missouri, Nebraska, New Jersey, Wisconsin, and Wyoming.

Additional information regarding this report or the Iowa Face Program is available from:

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