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Fatal Injuries Caused by Logs Rolling Off Trucks: Kentucky 1994–1998

Timothy William Struttmann, MSPH[1,2,3]* and Amy Lynn Scheerer, MSPH[1]

Background *Logging is one of the most hazardous occupations and fatality rates are consistently among the highest of all industries. A review of fatalities caused by logs rolling off trucks is presented.*
Methods *The Kentucky Fatality Assessment and Control Evaluation Project is a statewide surveillance system for occupational fatalities. Investigations are conducted on selected injuries with an emphasis on prevention strategy development. Logging was an area of high priority for case investigation.*
Results *During 1994–1998, we identified seven incidents in which a worker was killed by a log rolling off a truck at a sawmill, accounting for 15% of the 45 deaths related to logging activities. These cases were reviewed to identify similar characteristics and risk factors.*
Conclusions *Investigations led to recommendations for behavioral, administrative, and engineering controls. Potential interventions include limiting load height on trucks, installing unloading cages at sawmills and prohibiting overloaded trucks on public roadways.* Am. J. Ind. Med. 39:203–208, 2001. *© 2001 Wiley-Liss, Inc.*

KEY WORDS: logging; fatality; case report; sawmill; intervention

INTRODUCTION

Logging has been described as one of the most hazardous and perilous occupations in the nation [Myers and Fosbroke, 1994; NIOSH, 1995; Ruser, 1995; Sygnatur, 1999]. In 1997, the Bureau of Labor's Census of Fatal Occupational Injuries identified logging as the most dangerous occupation with a rate of 128.7 deaths per 100,000 workers, a risk 27 times higher than the overall work-related fatality rate of 4.7 [Sygnatur, 1999]. Although the national occupational fatality rate has continued to steadily decrease over the last 10 years, the rate for logging has remained relatively high [Sygnatur, 1999].

A nationwide study of 1,278 death certificates for logging-related fatalities found that of the 636 deaths due to falling objects, 16% were related to falling logs, half of which occurred during loading or unloading trucks [Myers and Fosbroke, 1994]. Overloaded logging trucks were found to be a contributing factor in logging-related fatalities that were investigated in West Virginia [Helmkamp and Lundstrom, 2000]. A study of logging-related death certificates by Paulozzi [1987] identified three cases due to logs rolling off trucks during the loading procedure; however, the analysis was of deaths which occurred from the time of tree felling to loading, thus excluding those which may have occurred during unloading. Similarly, a study of 36 non-fatally injured loggers treated in a West Virginia hospital also excluded unloading-related injuries, but identified one injury due to a log rolling from a truck during loading [Williams et al., 1996]. An analysis of data obtained through the North Carolina medical examiner system for 1977–1991 showed 8% of fatalities in the logging industry that were due to logs falling from trucks; however, the study did not include how many occurred during loading or unloading nor

[1]Kentucky Injury Prevention and Research Center, Occupational Injury Prevention Program, Lexington, Kentucky 40504-2915
[2]Southeast Center for Agricultural Health and Injury Prevention, Lexington, Kentucky 40504-9842
[3]Kentucky School of Public Health, Lexington, Kentucky 40536-0003
Contract grant sponsor: National Institute for Occupational Safety and Health, CDC; Contract grant number: U60/CCU409879-05, U07/CCU408035-08.
*Correspondence to: Tim Struttmann. E-mail: tstruttm@pop.uky.edu

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the circumstances of the events [Rodriguez-Acosta and Loomis, 1997].

The National Institute for Occupational Safety and Health (NIOSH) and its public and private sector partners identified loggers to be at high risk of injury, thus this worker group is a priority area in the National Occupational Research Agenda (NORA) [NIOSH, 1996; Rosenstock et al., 1998]. Loggers have been recognized to be at high risk of injuries due to falling objects [NIOSH, 1996], such as trees, limbs, and logs, and dedicated efforts must be undertaken to adequately address this public health crisis.

Although articles cited here included data about fatalities due to logs falling from trucks, a review of the literature did not reveal any in-depth analysis of these events. This paper summarizes seven on-site case investigations conducted by the authors where the cause of death was logs rolling off transport trucks at sawmills. It concludes with recommendations for prevention of these types of incidents.

METHODS

A database of all occupational fatalities in Kentucky is maintained as part of the Fatality Assessment and Control Evaluation (FACE) Project funded through NIOSH since 1994. Kentucky is one of 15 such states which maintains a statewide surveillance system for occupational fatalities and conducts on-site investigations of selected types of events with an emphasis on prevention strategy development. Investigations by trained industrial hygienists involved an analysis of the circumstances pre-, during, and post-event to identify risk factors [Haddon, 1968]. Detailed case reports were developed for each investigation. Further discussion of FACE methods is provided elsewhere [Struttmann et al., 1996]. Completeness of the FACE surveillance system was confirmed through comparisons with Kentucky Census of Fatal Occupational Injuries data [Kentucky Labor Cabinet, 1999].

Fatalities related to logging activities were selected as a priority area to conduct investigations. Logging-related fatalities included those that occurred at any point of the logging process from clearing land and felling trees to transporting logs to the mill, and may have included occupations other than "logger," such as machine operator or log truck driver. Within a 3 week period in the fall of 1998, three fatalities occurred in Kentucky as a result of logs which rolled off trucks at sawmills. These events prompted a review of the FACE data and investigation reports.

We chose to focus on this type of incident because the work environment, although dangerous, lacks conditions ordinarily found at the logging site such as steep terrain, leaning trees and unpredictable fall direction, uneven and unfamiliar ground, and unique situations to confront each work day. A sawmill, with routine operating procedures and relatively predictable flow of traffic and responsibilities may be more conducive to implementation of interventions.

RESULTS

During the 5-year period 1994–1998, we identified seven similar events in which a worker was killed by logs rolling off trucks at sawmills, accounting for 15% of the 45 deaths related to logging activities. No cases were identified where logs rolled off trucks at sites other than at sawmills, such as the loading site. Using the Standard Industrial Classification Manual [Office of Management and Budget, 1987], all the cases occurred in the category of logging (2411) and sawmills and planing mills (2421) and were given an external cause of death code (E-code) of 916, struck by falling object [Practice Management Information Corporation, 1997]. All of the workers were male and ranged in age from 31 to 64 years with a mean of 48. Five were employees of small logging businesses, one was employed by a sawmill as a truck driver, and one was a self-employed truck driver. Their experience levels varied from more than 25 years to less than one. No personal protective equipment (PPE) was used.

The following case reports briefly describe the seven fatal incidents which we investigated as part of the FACE Project. Figure 1 shows an example of a logging truck in Kentucky in which the logs are loaded well above the standards or vertical stakes on the truck bed.

Case Reports

Case 1

In December 1998, a 42-year-old logger accompanied the truck driver to the sawmill with a load of logs on a 20-feet flatbed truck. The stack of logs was rounded above the height of the 53-inch standards (vertical stakes) and secured by only one chain on the middle of the load. When they arrived, the logger got out of the truck and assisted the driver in backing the vehicle into place for unloading. When the driver got out to begin unloading, he saw the logger lying on the ground on the passenger side of the truck with a 13-feet log nearby. Apparently the logger loosened the chain and a knotted log that had moved into an unstable position during transport rolled off and struck him.

Case 2

In December 1998, a 31-year-old sawmill employee arrived with a load of poplar logs that were stacked well above the standards on the truck. Three straps had been placed around the load to keep the logs in place. While waiting in line for his truck to be unloaded, he began releasing the straps which allowed a log to roll off and strike him.

Figure 1. An example of an overloaded logging truck.

Case 3

In November 1998, a 32-year-old tractor-trailer driver, along with his father, arrived at the sawmill with a load of logs secured by straps and stacked above the standards on the trailer. The driver and his father exited the truck and while the father waited at the front of the truck, his son released the straps. As he walked to the other side of the truck to pull the straps from the load, a log rolled off and struck him.

Case 4

In April 1996, a 64-year-old male who had been working part-time driving a semi-trailer truck owned by a logger, drove alone to the mill with a load of logs. The logs were stacked approximately 4 feet higher than the standards and were bound by two chains in poor condition. He began the unloading procedure before any employees of the mill came to assist. He unhooked the chain nearest the front of the truck. As he began releasing the second chain, the logs shifted and the chain broke. Three logs rolled off the truck and struck him.

Case 5

In October 1995, a 52-year-old self-employed logger who had at least 25 years of experience was using the family-owned truck to haul a load of logs to the mill. The standards on the flatbed truck were approximately 3 feet high with the logs stacked 3–4 feet above them. When he arrived at the mill he began the unloading procedure alone. After unhooking the chains on one side he walked to the other side of the vehicle to unfasten the chain attached on that side. As he did so, a log rolled off, struck him on the back of the head and pinned him on the ground.

Case 6

In September 1995, a 63-year-old logger was with his two nephews as they drove two truck loads of logs to the mill. The logs were stacked at least twice as high as the standards on the sides of the flatbed trailers. As one nephew began to unchain the logs from his truck, the logger walked up to the truck, out of view of his nephew. When the chains were released, a log rolled off and struck the logger, pinning him underneath.

Case 7

In May 1994, a 51-year-old self-employed logger hauled a load of logs to the sawmill. The logs were overloaded above the standards and secured by two chains on the flatbed single-axle truck. As he began to loosen the second chain, a log from the top rolled off and struck him.

Although the circumstances of each incident varied, some important similarities were found among the cases: the vertical standards on the truck were about 4 feet high and the logs exceeded the height of the standards, usually by 3–4 feet; the trucks were parked on fairly level ground; the logs were not held in place by a loader or other equipment when the chains/binders/straps were released; and, the logs fell from a stationary truck at a sawmill after the logger or driver released the binders. In all but one case, only one log fell from the truck.

DISCUSSION

As with many injury prevention efforts, an effective approach is likely to be multi-faceted, including interventions conducted through education, regulation, and engineering controls. Furthermore, interventions must be sensitive to the issues that are important to the workers in that environment. A variety of professionals should be consulted in these prevention efforts: communicating the hazards in a manner that will elicit behavior change should involve an expert in message design; making administrative law changes would require the input of police, lawmakers, and industry representatives; and, evaluations of the interventions would require the careful eye of the public health professional in medical surveillance.

Behavioral/Educational Interventions

First and foremost, the height of the stack of logs should not exceed the height of the standards on the truck. Because loading occurs at the landing in the forest, this decision must occur before the chains/binders/straps are applied. Therefore, worker training should focus on the hazards associated with loading logs above the standards. Successful training needs to include both worker and employer commitment, a complete work site hazard analysis, and a comprehensive safety program. Training objectives should not stop at information delivery but rather should be designed to develop safe work behaviors.

Logger training and education programs such as the Kentucky Master Logger (KML) course, cosponsored by a partnership between the University of Kentucky, Department of Forestry Cooperative Extension Service, the Kentucky Division of Forestry, and the Kentucky Forest Industries Association, are available in 32 states [Forest Resources Association Inc, 2000].

Although state requirements vary, these programs frequently include courses on Best Management Practices, Occupational Safety and Health regulations, business management, safety training, and first aid. To enhance the safety training provided through the KML program, FACE Project staff developed a six-minute educational video on proper log truck loading and unloading. In addition, the video was distributed to others interested in logging safety and is available at www.kiprc.uky.edu.

Administrative/Regulatory Interventions

Binders on logs should not be released prior to securing the logs with an unloading line or device as stated in Occupational Safety and Health (OSH) Regulation 29 CFR 1910.265(d)(1)(i)(b) [Occupational Safety and Health Standards for General Industry, 1997]. These regulations address activities at sawmills which usually have grapples (log loaders) that can be placed around or against the load to limit movement of the logs.

Regulation 29 CFR 1910.265 (h)(6)(vii) addresses activities at log loading sites and states that vertical stakes on the truck would be enough to secure the logs in place during unloading ''provided that the logs are not loaded higher than the stakes'' [Occupational Safety and Health Standards for General Industry, 1997]. Unfortunately the large number of logging sites and the remote locations of the operations make enforcement of regulations only a dim possibility.

Written policies should be in place regarding unloading procedures at the mill and owners should enforce the policies. Sawmill operators should consider prohibiting overloaded trucks on mill property and establishing guidelines that are enforced through economic sanctions against the owner of the overloaded truck. Further, sawmill owners should take an active role in educating loggers by describing and showing what an unsafe load is and why it cannot be accepted.

Most importantly, lawmakers should consider initiating or refining regulations to limit weight and height of the stack of logs on vehicles using public roadways. Frequently loads that are above the standards are also overweight. In most cases the height is restricted to $13'6''$ without a permit [Kentucky Revised Statutes]. Regulations could include more specific limits on the height of the logs in relation to the standards; for example, restricting loads to not more than one log diameter above the standards. Such regulations could be enforced by existing law enforcement agencies. If fines for overloading by weight and height are severe enough to compromise profits for loggers, a reduction in this type of fatal incident may follow.

Engineering Interventions

An unbinding cage should be used at the mill to protect the workers during unloading procedures (Fig. 2). This is a steel frame cage 39 feet long, 8 feet high, and 4 feet deep. The truck is parked along the cage, and the binders are released from underneath the cage where the worker is protected from a falling log. The cost to construct the cage is about $5,500 [American Pulpwood Association Inc., 1995].

Figure 2. Unbinding Cage.

Alternatively, physical restraint of the logs while the binders are released (e.g., a grapple placed around the load) should be part of the routine unloading procedure.

In many cases, the rubber tire loaders used at log loading sites are used to place logs on the truck. These loaders have two claw-shaped grappling jaws to lift several logs at a time and move them about the loading yard and on to a truck. Rubber tire loaders cannot lift the loader bucket over tall standards; thus, standards are short to accommodate the loader. To allow loaders access during the loading operation and prevent logs from rolling off during the unbinding procedure, standards could be designed to raise or extend upward after loading the logs. These could extend to near the maximum non-permit height of 13 feet by 6 inches. Alternatively, using knuckleboom loaders instead of rubber tire loaders would allow trucks to have standards tall enough to contain a complete load yet still be below weight and height restrictions. Knuckleboom loaders are stationary units in a loading zone that lift one or few logs at a time using a claw and allowing the logs to be lifted well over the height of the truck and standards.

CONCLUSION

Hazardous conditions inherent at the logging site include uneven terrain, temporary logging roads, snags and dead treetops, leaning trees, and steep slopes. Most of these environmental conditions are not present at the sawmill where the unloading area is generally flat, established roadways guide traffic, and permanent structures foster more predictability than found at the logging site. Furthermore, loggers' perception of the risks is likely different at sawmills because of the lack of these physical hazards and interventions should be developed accordingly. Hazard recognition is a critical step in prevention [Myers and Fosbroke, 1994].

Regulations for both a forest setting and a sawmill setting have attempted to reduce the risk of logs rolling off trucks causing fatal injury. However, cases continue to occur because workers fail to recognize the inherent hazards associated with the unloading operation or they recognize and choose to discount the hazard because they feel the risk is manageable.

Effective interventions should address practices at the logging site as well as the sawmill and include educational, administrative, and engineering components. Education and training efforts should be grounded in behavior theory taking into account not only the work environment, but also factors such as economics and stress experienced by the self-employed operating a small business [Kidd et al., 1996]. For example, interventions should acknowledge economic motivations of overloading trucks and the associated risks.

Like the farmer, the individual logger is likely to be self-employed or work with only a few other persons. However, agriculture as an industry is largely removed from routine occupational safety and health enforcement. This is not the case for logging. Regulations passed in 1995 by the U.S. Department of Labor are a clear effort to control hazards at logging sites and sawmills. Unfortunately, limited resources prevent on-site inspections of many logging sites where the loading takes place.

Several approaches to hazard reduction and injury prevention are recommended: avoid overloading trucks, use adjustable height standards, utilize unloading cages at sawmills or grapples to stabilize loads, and regulate log height limits on trucks through enforcement on public roadways. Adoption of these strategies, particularly in combination, should reduce the type of fatal incidents described here. Further, rigorous evaluation of interventions including training and regulatory changes are necessary.

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