

II. INTRODUCTION

This report presents the recommended standard prepared to meet the need for preventing occupational injuries and deaths in logging operations. The criteria document fulfills the responsibility of the Secretary of Health, Education, and Welfare, under Section 22 (c)(1) of the Occupational Safety and Health Act of 1970 to "...develop and establish recommended occupational safety and health standards."

The National Institute for Occupational Safety and Health, after a review of data and consultations with others, formalized a system for the development of criteria upon which standards can be established to protect workers from hazards in the workplace. It should be noted that any criteria and recommended standard should enable management and labor to develop safer equipment, better work practices, and more appropriate training programs that will result in safer work environments. Simply complying with the recommended standard should not be the final goal.

These criteria for a standard for logging (part of a continuing series of criteria developed by NIOSH) apply only to occupations in logging from felling to first haul, as applicable under the Occupational Safety and Health Act of 1970. The proposed standard includes the operations of felling, bucking, limbing, yarding and loading. Not included here are road, trail, bridge, and camp construction; equipment safety specifications and design; rigging specifications; chipping operations; transportation (hauling); or subsequent provisions after initial loading operations are accomplished.

This recommended standard places emphasis on work practices. It is intended to protect workers against accidents and injuries and to be attainable with existing technology. It is not intended to inhibit flexibility in the way a task is performed nor restrict the development of safer techniques.

The methodology of this study consisted of developing, evaluating, and recording information from literature searches; consultations with an advisory group; and visits to logging sites for on-the-spot input into recommendations for the proposed standard. The advisory group consisted of knowledgeable individuals from industry, labor, government, and academia. They assisted NIOSH by providing sources of information, arranging site visits, and reviewing the feasibility of recommended work practices. A preliminary draft of proposed work practices was reviewed in April 1975 by eight groups of logging professionals at Berlin, New Hampshire; Bangor, Maine; Wausau, Wisconsin; Laramie, Wyoming; Cour D' Alene, Idaho; Springfield, Oregon; Redding, California; and Baton Rouge, Louisiana. Among the 82 individuals present at these meetings, were those from 52 logging companies, the US Forest Service, and other organizations such as workmen's compensation boards, state regulating agencies, and educational institutions.

Standards covering issues of occupational safety and health that are of general application without regard to any specific industry are intended to be applicable to this recommended standard even though no specific reference is made to them. Examples of these general areas are: exposure to toxic chemicals, noise, temperature extremes, and general duty requirements.

III. LOGGING HAZARDS

Industry Characteristics

Accident statistics issued by the Bureau of Labor Statistics and other federal agencies [1-3,13-15], state agencies [4-6,8-10,16-25], trade associations [27-32], logging companies (personal communication), and individuals (written communication) have been collected and are presented in Tables VIII-1 through VIII-22. These data show clearly that logging is an extremely dangerous occupation.

Inadequate training, poor working techniques and safety measures, coupled with the inherent dangers in felling, bucking, yarding and loading logs, are the major reasons why logging is one of the most hazardous occupations in the United States.

When the OSHA Target Industry Program was initiated in 1971, lumber and wood products became one of the target industries, based on the 1969 injury frequency rate of 34.6 injuries/million man-hours; logging camps and logging contractors contributed an injury frequency rate of 38.4 injuries/million man-hours worked. [14] This rate was considerably higher than the general industry rate.

In an attempt to reduce the number of accidents and injuries in this target industry, both private and public organizations have published literature promoting safe work practices. Examples are the Loggers' Safety Manual, [33] Fallers' and Buckers' Handbook, [11] and Professional Timber Falling: A Procedural Approach. [12]

In addition, industry associations such as the American Pulpwood Association promote logger safety by relaying safety standards information

[34] to the logging industry work force.

As a result of this impetus as well as individual initiative, some industry members have instituted their own safety programs. Although the report is unsubstantiated, a major company with an active safety program had a 1973 injury frequency rate of 2.73 injuries/million man-hours (0.55 injuries/100 full-time workers) [30] compared to Department of Labor's logging industry figure of 31.2 injuries/100 full-time workers.

Historical Reports

From 1923 until 1966, the national standard applicable to logging was the American Logging and Sawmill Safety Code, Handbook Series of the Bureau of Standards, Number 5, published 1924. [1]

A 1955 report on injuries and accidents in logging operations cited an injury frequency rate of 80.1 disabling injuries/million employee-hours worked. [13]

The proposed American National Standards Institute (ANSI) standard 03.1-1971 revised 1974 stated that in 1967 the American Pulpwood Association petitioned ANSI for sponsorship of a new standard and the first committee meeting was held in February 1968. This committee was composed of representatives of industry, labor, equipment manufacturers, insurance carriers, government, and other interested experts. Their effort resulted in publication of ANSI pulpwood logging standard 03.1-1971 in March 1971. [2] This standard was the basis for the present federal Pulpwood Logging Standard, 29 CFR 1910.266. The ANSI standard (03.1) as of January 1976 was undergoing revision to include all logging instead of being restricted only to pulpwood logging. [2]

A 1972 NIOSH study of the logging industry resulted in a two-volume report [3] that included logging industry characteristics, worker fatality analyses, disabling work injuries analyses, and costs of disabling work injuries. The study concluded that an adequate national safety standard for the logging industry was needed.

Extent of Hazard

In 1971, the Department of Labor marked the lumber and wood products industry, of which logging is a major segment, as one of the five most dangerous occupations in the United States. This designation was based on the high fatality and severity rates recorded annually. The data presented in this document support the suitability of that selection and attest to the need for corrective measures.

Based on information supplied by employers, the Bureau of Labor Statistics [15] estimated that in 1973 there were 79,500 people working in logging operations in the US. The same study reported a 1973 injury incidence rate (total recorded cases/100 full-time workers) of 31.2, or approximately 1 injury for every 3 workers. This is from approximately 24,800 injuries among 79,500 logging workers. Of the 24,800 logging injuries about half (12,800) involved lost days giving a 1973 lost workday incidence rate of 16.1/100 full-time workers. [15]

The total injury incidence rate for the total logging industry, not just felling to first haul, (31.2%) is approximately 2.9 times the all private manufacturing rate (10.6%). [15] The logging industry's lost workday incidence rate (16.1%) is approximately 4.9 times the private manufacturing rate (3.3%). [15] It also has been stated that loggers have

a fatality likelihood 25 times greater than the private manufacturing average. [23]

Although the above data were derived from information supplied by employers, some skepticism exists about the accuracy of the number of people employed in the logging industry. By using the quantity of wood produced during 1961 and applying the ratio of total annual production and productivity/man day, NIOSH estimates that as many as 300,000 workers may be involved in logging operations. [3] Among the major difficulties in estimating the number of workers in the logging industry are the seasonal nature of the work force and the preponderance of small, independent operators.

Hazard Categories

Within the total logging operation, felling to first haul, numerous dangerous situations arise which may result in worker accidents and/or deaths.

Analysis of available logging fatality data reveals that of all logging occupations, fellers and buckers consistently have had the greatest rate of fatalities. Of all California logging fatalities from 1966 through 1972 and Oregon fatalities from 1966 through 1973, 47 and 37%, respectively, were fellers and buckers. [16,24] In combined data for Washington (1968, 1970-72) and California (1968, 1971) fellers and buckers were victims of 44% of all logging fatalities. [3]

Skidding/yarding and loading occupations had lower and, except for choker setters, more variable fatality rates than those for fellers/buckers according to the available logging fatality data. Choker setters, log

loaders and truck drivers, for example, had 20, 8 and 6%, respectively, of the logging fatalities listed in the combined Washington and California data. [3] The 1966-72 California data shows choker setters, skidder operations and truck drivers comprised 27, 14 and 11%, respectively, of total logging fatalities. [16] (It is not known how many of those truck driving fatalities occurred after first haul). Oregon data reveal that during 1966-72, 14% of logger fatalities were choker setters. [24]

Analysis of available logging injury data shows that as with fatality risk, fellers and buckers are the logging workers of greatest injury risk. During 1970, [16] fellers and buckers suffered 36% of all logging-related work injuries in California. According to the NIOSH "Worker Safety In Logging Operations-1973" document, [3] approximately 50% of all worker injuries in Southern US logging operations (no dates given) involved fellers and buckers. For Montana (1968-72) and the state of Washington (1965-71, as reported in the NIOSH document, [3] these workers were the victims of approximately 50 and 35% of logging injuries, respectively. Fellers and buckers were 90% of the injured workers identified in an analysis of Northeastern US logging injury reports (written communication, the Maine Industrial Accident Commission, 1975).

From analysis of available logging fatality and injury data (Tables VIII-1-12), NIOSH finds that for convenience of subsequent analysis and discussion and for development and organization of work practices designed to eliminate or alleviate logging hazards, five major classes of hazards are categorized in this document. These categories are (1) falling and flying objects, (2) rolling and moving logs, (3) chain saw operations, (4) slips, trips, and falls, and (5) moving equipment.

(a) Falling and Flying Objects

Falling and flying objects are major sources of danger to workers in all logging operations from felling to first haul. Vibration from chain saws, moving equipment and falling trees can cause loose parts and even whole trees to fall. Improper cutting techniques can cause a tree to fall in an unexpected direction and/or to barberchair (split vertically), which also results in loss of control of the felling direction and propels large splinters from the stump. Felling a tree into standing trees can cause breakage and propel tree parts into occupied work areas, dislodge loose parts in other trees, kickback the falling tree, and shatter snags. A worker struck by one of these falling or flying objects can be seriously injured or killed.

A summary of recorded logging injuries for falling and flying objects is presented in Table III-1. Falling and flying objects were identified as the agents in 12 to 43% of the logging worker injuries. Especially noteworthy is that this hazard category, as previously discussed, accounted for 37, 47 and 44%, respectively, of the reported logging fatalities in Oregon during 1966-73 (Table VIII-2), [24] California from 1966-72 (Table VIII-9), [16] and combined California (1968, 1971) and Washington (1968, 1970-72) data (Table VIII-10), [3] respectively.

A national insurance carrier reported that workers' compensation payments for injuries sustained from this hazard category amounted to 42% of their total payments in logging as shown in Table III-2.

TABLE III-1

LOGGING INJURIES FROM FALLING AND FLYING OBJECTS IN THE US

No. of Injuries	Total No. of Injuries	Percentage of All Logging Injuries	Appendix Table	Reference
110	881	12.5	(VIII-1)	[3]
114*	305	37.4	(VIII-2)	[24]
87	493	17.6	(VIII-3)	[17]
57	132	43.2	(VIII-4)	[MIAC**]
1,604	4,990	32.1	(VIII-5)	[Pearson]
19	123	15.4	(VIII-6)	[Sarna]
58	274	21.2	(VIII-7)	[16]
157	2,210	7.1	(VIII-8)	[18]

* Indicates fatalities

** Maine Industrial Accident Commission

TABLE III-2

COMPENSATION FOR INJURIES RESULTING FROM FALLING AND FLYING OBJECTS

Accident Type and Major Cause	Total No. of Injuries	Percentage of All Logging Injuries	Percentage of Total Cost	Percentage of Total Cost For Logging
Struck by falling objects	1,604	19.6	\$5,591,018	41.9
Trees, branches	1,153		4,681,980	
Logs	185		588,984	
Objects	36		76,374	
Lumber or timber	19		34,428	
Other	211		209,252	

Adapted from (M Pearson, Written Communication, November 1974)

(b) Rolling and Moving Logs

Rolling and moving logs are hazardous to loggers during all phases of logging operations. They possess enormous kinetic energy; being hit by a

moving 3-foot diameter, 18-foot-long southern pine weighing around 5,000 pounds can be compared to being hit by a large automobile.

In steep terrain, logs can roll during limbing and bucking operations or can be jarred into motion by vibration from falling trees. During yarding, logs can twist or turn unpredictably when being moved over uneven terrain, boulders or stumps. In landing and loading operations, logs are raised to higher elevations for stacking into decks or onto trucks. When improperly secured or improperly handled, they can roll off and maim or kill.

A summary of incidence of injuries and deaths in this hazard category is shown in Table III-3. Contact with rolling and moving logs accounted for 4 to 24% of all logging injuries and 11 to 31% of all logging deaths.

TABLE III-3
INJURIES FROM ROLLING AND MOVING LOGS

No. of Injuries	Total No. of Logging Injuries	Percentage of Injuries	Appendix Table	Reference
31	881	3.5	(VIII-1)	[16]
95*	305	31.1	(VIII-2)	[24]
6	132	4.5	(VIII-4)	[MIAC**]
1,183	4,990	23.7	(VIII-5)	[Pearson]
7	155	4.5	(VIII-7)	[16]
11*	101	10.9	(VIII-9)	[16]

* Indicate fatalities

** Maine Industrial Accident Commission

This hazard category also accounted for 13% of workmen's compensation payments made to loggers as shown in Table III-4.

TABLE III-4

COMPENSATION FOR INJURIES RESULTING
FROM ROLLING AND MOVING LOGS

Accident Type and Major Cause	Total No. of Injuries	Percentage of Total Injuries	Cost	Percentage of Total Cost
Struck by moving objects (total)	1,183	14.5	\$1,859,983	13.9
Logs	342		771,580	
Trees, branches	422		591,664	
Vehicles, misc.	8		103,931	
Other	411		392,808	

Adapted from (M Pearson, Written Communication, November 1974)

(c) Chain Saw Operations

The chain saw is used during felling, limbing, bucking, and knot bumping in both the felling and landing areas. Although chain saw accidents cause few fatalities compared to falling and flying objects or rolling and moving logs, they are a very significant cause of logging accidents. [32]

When the saw is in operation, careless positioning of the chain can cause the saw to kick back toward the operator. The cutting teeth on the upper edge of the saw bar move in a direction away from the operator; at the tip of the bar, the teeth then travel downward and around rapidly. If the lower region of the saw bar tip engages an unyielding object such as a knot, spike or limb, the bar may recoil upward and backward toward the operator's face. If the upper bar tip is involved, the saw recoils downward toward the operator's legs. If during either of these kickback responses the chain contacts the operator, injuries will result that may include lacerations and amputation. The chain saw can rip out a 1/2-inch

wide trough of flesh and sometimes bone which is difficult to treat and slow to heal. [32] Chain saw accidents can also occur if the operator stumbles and the running saw contacts the body. Flying chips discharged by the saw can endanger the worker's eyes. Contact with a sharp chain can inflict a serious cut, with the muffler a serious burn, with the sawdogs a serious puncture.

Table III-5, a summary of available data, shows that the frequency of chain saw injuries ranges from 13-33% of total injuries.

TABLE III-5
FREQUENCY OF CHAIN SAW INJURIES

No. of Injuries	Total No. of Logging Injuries	Percentage of Injuries	Appendix Table	Reference
113	881	12.8	(VIII-1)	[16]
42	132	31.8	(VIII-4)	[MIAC*]
893	4,990	17.9	(VIII-5)	[Pearson]
41	123	33.3	(VIII-6)	[Sarna]
66	274	24.1	(VIII-7)	[16]
584	2,210	26.4	(VIII-8)	[3]
1,096	4,231	25.9	(VIII-11)	[Pearson]
158	881	17.9	(VIII-12)	[16]
90	274	32.8	(VIII-13)	[16]

* Maine Industrial Accident Commission

(d) Slips, Trips, and Falls

Slips, trips, and falls are potential hazards in all logging operations. Most are due to the unevenness of the forest floor, steepness of the terrain, and to the natural or work-resulting litter about the work areas. Since worker movement is essential for both production and safety and the walking-working surface is difficult to control, there is a high

potential for injuries. For example, tripping while escaping from the stump during the felling operation, slipping under a log while setting a choker, or falling with a running saw while bumping knots each can result in serious injuries.

The summarized data contained in Table III-6 shows that slips, trips, and falls directly accounted for 8-27% of all reported injuries. They also can cause accidents such as chain saw cuts which may be attributed to other hazard categories.

TABLE III-6
INJURIES FROM SLIPS, TRIPS AND FALLS

No. of Injuries	Total No. of Injuries	Percentage of Injuries	Appendix Table*	Reference
212	881	24.1	(VIII-1)	[16]
10	132	7.6	(VIII-4)	[MIAC**]
15	123	12.2	(VIII-6)	[Sarna]
74	274	27.0	(VIII-7)	[16]
311	2,210	14.1	(VIII-8)	[3]
72	737	9.8	(VIII-14)	[18]

* NOTE: Table VIII-15 has not been included because of the manner in which slips, trips and falls were classified.

Table VIII-16 has not been included because the same information is in Table VIII-1.

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(e) Moving Equipment

Logging operations employ a variety of devices for handling logs and other materials. This mechanical equipment includes rubber-tired skidders, tractors, shears, cranes, loaders, logging trucks and cable-rigging installations. During their operations, these devices are in motion and

move their load up, down, backward, forward and sometimes sideways in a rotating or swinging manner. Their potential for inflicting injury results mainly from the speed at which they operate and their proximity to workers.

Hazards from these devices are enhanced because of the environment in which they are operated. Rain soaked, icy or snow packed ground, poor visibility, steep or uneven terrain and strong winds are some of the environmental conditions which can increase equipment associated hazards. Accidents associated with moving logging equipment frequently result in serious injury and/or death. Table III-7 shows the incidence of injuries and deaths resulting from moving equipment, which averages about 25% of the total fatalities attributed to logging.

TABLE III-7
INJURIES AND DEATHS RESULTING FROM MOVING EQUIPMENT

No. of Injuries	Total No. of Logging Injuries	Percentage of Injuries	Appendix Table	Reference
18	881	2.0	(VIII- 1)	[16]
75*	305	24.6	(VIII- 2)	[24]
2	132	1.5	(VIII- 4)	[MIAC**]
6	123	4.9	(VIII- 6)	[Sarna]
27*	101	26.7	(VIII- 9)	[16]
5	274	1.8	(VIII-13)	[16]
32*	101	31.7	(VIII-17)	[16]

* Indicate fatalities

** Maine Industrial Accident Commission