

criteria for a recommended standard . . .

LOGGING FROM FELLING TO FIRST HAUL



U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Public Health ServiceCenter for Disease ControlNational Institute for Occupational Safety and Health

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PREFACE

The Occupational Safety and Health Act of 1970 emphasizes the need for standards to protect the health and safety of workers exposed to an ever-increasing number of potential hazards at their workplaces. To provide relevant data from which valid criteria and effective standards can be deduced, the National Institute for Occupational Safety and Health (NIOSH) has projected a formal system of research with priorities determined on the basis of specified indices. Recommended standards for the control of occupational hazards, which are the result of this work, are based on the best available information. The Secretary of Labor will weigh these recommendations along with other considerations, such as feasibility and means of implementation, in developing regulatory standards.

NIOSH intends to present successive reports as research and additional epidemiologic and safety studies are completed. Criteria and standards will be reviewed periodically to ensure continuing protection of the worker.

I am pleased to acknowledge the contributions to this report on logging by members of my staff; by the Review Consultants on Logging; by the Advisory Group on Logging composed of representatives of industry, labor, state and federal governments, and educators; by D. Douglas Dent, NIOSH consultant in logging; and by Robert B. O'Connor, M.D., NIOSH consultant in occupational medicine. The NIOSH recommendations for standards are not necessarily a consensus of all the consultants and professional societies that reviewed this criteria document on logging. Lists of the NIOSH Review Committee members and of the Review Consultants appear on the following pages.

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The Division of Criteria Documentation and Standards had responsibility Development primary for development of the criteria and recommended standard for logging from felling to first haul. The Bendix Corporation developed the basic information for consideration by NIOSH staff and consultants under contract No. CDC-99-74-70. Troy Marceleno, P.E., Division of Surveillance, Hazard Evaluation, and Field Studies had NIOSH program responsibility for development of the document. Maurice Georgevich served as criteria manager. Final preparation of the document was accomplished by Jerry M. Johnson, Ph.D. and John M. Fajen.

v

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Table of Contents

		Page
PREFACE		iii
REVIEW C	OMMITTEES	vi
I.	RECOMMENDATIONS FOR AN OCCUPATIONAL STANDARD FOR LOGGING FROM FELLING TO FIRST HAUL	
	Section 1 - Definitions Section 2 - Work Practices Section 3 - Training(Informing Employees of Hazards) Section 4 - Medical Section 5 - Posting Section 6 - Personal Protective Equipment	1 5 26 27 28 29
II.	INTRODUCTION	31
III.	LOGGING HAZARDS	
	Industry Characteristics Historical Reports Extent of Hazard Hazard Categories	33 34 35 36
IV.	DEVELOPMENT OF STANDARD	45
v.	TRAINING GUIDELINES	48
VI.	RESEARCH NEEDS	57
VII.	REFERENCES	59
VIII.	APPENDIX - Tables	62

I. RECOMMENDATIONS FOR AN OCCUPATIONAL STANDARD FOR LOGGING FROM FELLING TO FIRST HAUL

The National Institute for Occupational Safety and Health (NIOSH) recommends that safety for logging be promoted by adherence to the following sections. Sufficient technology exists to permit compliance with the recommended standard. The criteria and standard will be subject to review and revision as necessary.

Section 1 - Definitions

The following definitions were taken or adapted from 29 CFR 1910.266, and from various logging codes, texts, and training courses. [1-12]

Arch Rear section of a tractor yarder, generally Ushaped. Serves as a boom or hoist and raises leading end of logs off the ground for hauling through the woods. Backcut (felling cut) Final cut in felling a tree. Made on the side opposite the undercut and direction of fall (Figure I-4). Fabric of high tensile properties designed to Ballistic Nylon provide protection from lacerations. Cable logging system which uses a lighter-than-Balloon Logging air craft to provide vertical lift to a turn of logs as it is towed by the yarder to the landing. Vertical split of a tree due to improper felling Barberchair technique. Area within the curve when a line or rope is Bight curved.

Binder	Chain or wire rope used to bind a load of logs.
Block	Pulley used in cable logging to change direction of motion or increase pulling power.
Brow Log	Log placed parallel to any roadway at a landing or dump to protect carriers while loading or unloading.
Buck	To saw felled trees into shorter lengths.
Bucker	One who saws felled trees into shorter lengths.
Buddy System	Procedure in which two workers are always within sight and/or sound of each other.
Bunk	Cross supports on which the logs rest on a logging car or truck.
Cant Hook	Stout wooden lever used for rolling logs in which the tip is fitted with a curved metal hook.
Calked Boots	Boots containing steel calks or spikes in the heel and soles.
Chain Brake	Safety device which stops the saw chain.
Chain Saw	Saw powered by an engine or motor in which the cutting elements are on a circular chain.
Choker	Short length of wire rope that forms a noose around the end of a log to be skidded and is attached to the skidding vehicle or to the skidding line.
Choker Setter	One who attaches chokers to logs.
Coupling Pole (reach)	Rod or beam which connects a trailer to a motorized logging truck.
Cutter (feller, bucker)	One who fells, bucks or limbs, trees.
Cutting	The process of felling, bucking or limbing trees.
Cutting Area	Area on which the trees have been, are being, or are to be, cut.
Deck	Pile of logs.

Directional Felling	Application of a felling technique to control the direction of fall of a tree.
Dog	Short metal stake, one end of which is sharp for driving into a log and the other with an eye for attaching to another log.
Dogs, Saw	Metal plate containing three to five points or fingers located in front of the chain saw housing, protruding parallel with the bar. They act as a pivot point for the saw during cutting.
Fell (cut)	Process of severing a tree from the stump so that it drops to the ground.
Fellers	Workers who cut down trees.
First Haul	Transportation from the yard (landing) after the initial loading operations have been completed.
Gra pple	 Device at the working end of a line or boom used to pick up and hold the load. Two small iron dogs joined by a short chain and used to couple logs end to end when skidding.
Guard	Protective device around a machine or danger zone.
Hazard	Condition in which risk is involved.
High Lead Block	The main line pulley for moving logs.
Holding Wood (hingewood)	Section of wood located between the undercut and the backcut which prevents the tree from prematurely slipping or twisting from the stump, and controls the direction of fall (Figures I-3 and I-4).
Jackstrawed	Logs stacked randomly or irregularly.
Kickback	Strong thrust of the saw back toward the cutter, generally resulting from improper use of the saw. Kickback also refers to a tree jumping back over the stump toward the cutter.
Knot	Branch cross-section that is embedded in a tree trunk or board.
Knot Bumping	Removing limbs with a chain saw or axe just prior to loading.

Landing (yard)	Area where logs are brought for subsequent loading and hauling.
Limb (branch)	To remove the limbs from a felled tree.
Lines	The wire ropes or cables used in logging.
Loader	Machine or person used to load logs onto a transport vehicle.
Lodged Tree	Tree that has not fallen to the ground after being partially or wholly separated from the stump or otherwise dislodged from its natural position.
Log	Tree segment suitable for subsequent processing into lumber, pulpwood, or other wood products.
Logger (lumberjack)	One engaged in the production of logs.
Matchcutting	Felling trees without making an undercut.
Peavy	A stout wooden lever used for rolling logs; the tip is fitted with a strong, sharp spike.
Picaroon	Device with a head similar to an axe, with a point rather than a blade, which is used to assist in the lifting and placement of bolts of wood.
Pulpwood	Wood cut or prepared primarily for use by a pulp mill. Also refers to pulp species such as hemlock, white fir, spruce.
Reynaud's Syndrome	Circulatory disorder of the extremities which can be caused by extended exposure to vibration.
Rigging	The lines, blocks, sheaves, etc used in cable systems of logging.
Root Protrusions	Lateral and vertical extensions of roots above ground.
Root Wad	Mass of roots and dirt which projects above the ground level after a tree has been pushed over.
Scaler	One who determines the volume of a log or load.
Skid (yard)	To pull or drag logs or trees from the stump to a landing.

Skidder (yarder) Machine (either track laying or wheeled) or an animal, used to move logs or trees to a landing. The overhead supporting steel cable used for Skyline various types of logging. Standing dead tree or portion thereof. Snag Spar Tree Tree at the landing that is rigged and used for yarding logs. Also used for loading and swinging. Tree or branch that has been placed under Springpole tension. Strawline Small cable. Strip Defined area of timber allocated to a cutting crew. Tail-hold Anchor used for making fast a line. Hooking device used to lift or skid logs. Trip Tongs Group of logs yarded or skidded at one time. Turn Undercut (face) Wedge-shaped cutout or notch that controls the direction of fall of a tree (Figure I-2). "V" Lead In yarding, when the angle of the main line between the yarder, the bull block, and the turn of logs is less than 90 degrees. Widowmaker An overhanging loose limb or section of a tree which might become dislodged and fall on a logger working beneath it. Loops of line around a cylinder or tree. Wraps Yard (landing) Place where logs are accumulated. Yarding (skidding) The act of moving logs to the yard or landing.

Section 2 - Work Practices

The classes of logging hazards are abbreviated here as follows: falling and flying objects, FFO; rolling and moving logs, RML; chain saw operations, CSO; slips, trips, and falls, STF; and moving equipment, MVE. They identify the hazard that the work practice prevents or helps to alleviate.

(a) General

(1) The employer shall instruct and supervise employees to ensure that the following work practices are complied with.

(2) The employer shall account for each employee at the end of each shift. During the workday, the buddy system or some other effective system shall be used to ensure accountability of each employee.

(b) Felling and Bucking (CSO, FFO, RML, STF)

(1) Chain Saws and Hand Tools

(A) Tools shall be used only for the purposes for which they were designed.

(B) Each tool shall be inspected and any deficiency corrected prior to use.

(C) The cutting edges of tools shall be kept sharp and properly shaped.

(D) Heads of hammers, wedges, and sharp tools shall be dressed or ground to a suitable radius when they become mushroomed or cracked.

(E) Hand-held files shall be equipped with a handle.

(F) Stored tools shall be shielded or otherwise protected to prevent injuries.

(G) Chain saws shall be inspected daily to ensure that handles and guards are in place, and controls and other moving parts are functional.

(H) The saw shall be adjusted to prevent the chain from moving when the engine is at idle.

(I) Unless the carburetor is being adjusted, the saw shall be turned off before any adjustments or repairs are made to the saw or to the chain.

(J) The saw handlebars shall be kept free of oil accumulations which could result in the loss of control of the saw.

(K) The chain saw engine shall be stopped before fuel or oil is added.

(L) The chain saw shall be fueled outdoors not less than 20 feet from persons smoking or from other potential sources of ignition.

(M) Chain saw reserve fuel shall be stored in an approved US Department of Labor, Occupational Safety and Health Standards, (1910.106) container. Metal containers and portable tanks meeting the requirements of and containing products authorized by Chapter I, Title 49 of the Code of Federal Regulations (regulations issued by the Hazardous Materials Regulations Board, Department of Transportation) also shall be acceptable.

(N) The power saw shall be moved at least 10 feet upwind from the fueling point and wiped free of spilled gasoline before it is started.

(0) Firm footing shall be ensured before the saw is started and operated.

(P) Chain saws shall be started on the ground or on a solid surface, ie, a log or stump. They shall be held firmly with the

bar tip clear of any obstruction.

(Q) A saw shall not be operated unless it is equipped with a muffler and spark arrester.

(R) The saw shall be controlled with both hands during operation.

(S) Saws shall be turned off when being carried over uneven ground, underbrush, or slippery surfaces.

(T) The saw shall not be carried on the shoulder unless the engine is stopped. Furthermore, the chain and dogs shall be adequately shielded unless the shoulder and neck are otherwise protected.

(2) Manual Felling Operations (CSO, FFO, STF)

(A) No work shall be started or continued when heavy fog precludes visibility of tree tops or during high winds, electrical storms, or other hazardous weather conditions.

(B) Employees shall be spaced and their duties organized so that the actions of one will not create hazards for others.

(C) Work areas shall be assigned so that a tree cannot fall into an adjacent occupied work area. The distance between work areas shall be at least twice the height of the trees being felled. A greater distance may be required on downhill slopes depending on the degree of the slope and on the type of tree and other considerations.

(D) Strips shall be worked in such a manner that hangups caused by felling into standing timber are avoided.

(E) Hazards shall be checked before cutting is started. This includes checking the tree to be felled for dead limbs, rot, and lean to determine felling direction. Adjacent trees shall be checked

for dead limbs and their potential for becoming springpoles. Precautions shall be exercised for each situation before any cut is started.

(F) An escape path to a safe location shall be determined and prepared before cutting each tree. This path shall extend from the base of the tree to the safe location at an angle away from the felling line (Figure I-1).



From Dent DD: Professional Timber Falling--A Procedural Approach. Portland, Oreg, Ryder Printing Co, 1974, 182 pp

FIGURE I-1 ESCAPE PATH

(G) If the tree to be cut could possibly contact a powerline, the power company shall be notified immediately and all

personnel shall remain clear of the area until the power company representative advises it is safe to continue the operation.

(H) A cutter shall not be approached any closer than twice the height of trees being felled until a signal of approach has been acknowledged. An all-clear signal shall be given before cutting is resumed.

(I) Snags or trees which are unsafe to cut shall be removed by some other method.

(J) Snags that have loose bark in the area of the proposed cut shall have that bark removed before being felled.

(K) When a snag has elevated loose bark which cannot be removed, the buddy system shall be used to watch for and give warning of falling bark.

(L) To avoid use of wedges which might dislodge loose material, snags shall be felled in the direction of lean unless other means (mechanical) are used.

(M) Deteriorated or hazardous snags or trees shall be felled if they could endanger the cutting area, access area, landings, vehicular traffic, rigging, or rigging operations.

(N) Where felled trees are likely to roll and endanger workers, cutting shall proceed from the bottom toward the top of the slope, and performed uphill from previously felled timber.

(0) A warning shall be given to persons in the vicinity of a tree about to be felled and a determination made that such persons are out of reach of the tree and clear of logs, fallen trees, snags, or other trees which may be struck by the falling tree.

(P) As soon as the tree is committed to fall, the predetermined escape path shall be immediately followed to the safe area.

(Q) Undercuts shall be of a sufficient size to guide the tree in the intended direction of fall and to minimize the possibility of splitting (Figure I-2). Once the undercut is made, the felling process shall be continued to completion, unless the cutting area is kept free of unauthorized workers until the tree is felled.

(R) Undercuts shall be cleaned out to their full depth and width.



From Dent DD: Professional Timber Falling--A Procedural Approach. Portland, Oreg, Ryder Printing Co, 1974, 182 pp

Figure I-2 THE UNDERCUT

(S) The back cut shall be stopped at the point that allows holding wood to guide the tree or snag to prevent it from prematurely slipping or twisting from the stump (Figures I-3, I-4).

(T) The fall of a tree shall be controlled, if necessary, by inserting wedges, applying leverage in the back cut, or by using mechanical equipment.

(U) When a wedge is being used, the cutter shall watch for limbs or other material which might be jarred loose.

(V) Wedges shall be of soft metal, hardwood, or plastic.

(W) Cutting holding wood in lieu of using a wedge shall be prohibited.



From Dent DD: Professional Timber Falling--A Procedural Approach. Portland, Oreg, Ryder Printing Co, 1974, 182 pp

Figure I-3 HOLDING WOOD



From Dent DD: Professional Timber Falling--A Procedural Approach. Portland, Oreg, Ryder Printing Co, 1974, 182 pp

Figure I-4 BACKCUT, HOLDING WOOD AND UNDERCUT

(X) Lodged trees shall be clearly marked with red and white striped tape and all workers in the area shall be instructed not to pass or work within two tree lengths of such trees except to ground them.

(Y) Matchcutting should not be permitted and shall not be permitted for trees larger than 9 inches in diameter.

(3) When explosives are used, blasting operations shall be carried out in accordance with regulations in Title 29, Chapter XVII, Occupational Safety and Health Administration, Department of Labor, Occupational Safety and Health Regulations for Construction, Subpart H, Sections 1910.109(e). (FFO, STF)

(4) Bucking Operations (CSO, FFO, RML, STF)

(A) Bucking shall not be conducted within two tree lengths or directly downhill of felling operations.

(B) Anyone within range of any log that might roll shall be warned before cutting starts.

(C) The tree (and root protrusion, if applicable) shall be carefully examined to determine which way the logs (and root protrusion) will roll, drop, or swing when the cut is completed. No worker shall be allowed in this so determined danger zone during cutting.

(D) The bucking location shall be cleared of hazardous obstructions before bucking begins.

(E) Bucking shall be performed uphill from previously bucked logs unless the log to be bucked is securely anchored or blocked to prevent rolling or swinging.

(F) Propping of logs or trees as a means of protecting workers downslope from the logs or trees shall be prohibited.

(G) Saw pinching and subsequent chain saw kickback shall be prevented by using wedges, levers, guidelines, and saw placement, or by undercutting.

(H) Logs shall not be jackstrawed when being bucked in piles or decks at a landing.

(I) Logs incompletely bucked shall be conspicuously marked with red and white striped tape and all workers in the area shall be notified of the location of the logs.

(c) Yarding (FFO, MVE, RML, STF)

(1) Skidder Maintenance and Repair (MVE, STF)

(A) Cracked or broken glass or other glazing material that obscures vision or constitutes a hazard shall be removed or replaced.

(B) Gasoline engines shall be stopped before being refueled.

(C) Smoking within 20 feet of the refueling operation shall be prohibited.

(D) When charging batteries, the vent caps shall be kept in place to avoid electrolyte spray. Care shall be taken to ensure that vent caps are functioning. The battery (or compartment) cover(s) shall be open to dissipate heat.

(E) Smoking shall be prohibited in the charging area.

(F) Precautions shall be taken to prevent open flames, sparks, or electric arcs in battery charging areas.

(G) Tools and other metallic objects shall be kept away from the tops of uncovered batteries.

(H) Before any work is performed on blades, arches, or other equipment, the equipment shall be blocked, lowered, or otherwise secured to prevent slipping or falling.

(I) Engines shall be stopped before being repaired.

(J) All braking systems shall be kept in good operational repair.

(K) Radiator coolant level shall be checked when the engine is cold. When the radiator cap must be removed from a hot radiator, the pressure shall first be released before the cap is removed.

(2) Skidder Operational Requirements (MVE)

(A) A skidder shall be operated only by an authorized operator.

(B) A skidder shall be operated only when the operator is in the position or location intended for such purpose.

(C) Seatbelts shall be worn when the skidder is equipped with rollover protective canopy.

(D) Riding on skidders is permitted only in seats designed for that purpose.

(E) The operator shall not start the skidder until all other persons are clear of both the machine and of all elements to be set in motion by the machine.

(F) When skidding equipment is operated near an electric powerline, a minimum clearance of 10 feet shall be maintained between the powerline and all elements of the equipment including items being transported.

(G) When the skidder operator dismounts with the engine running, the transmission shall be disengaged, the brakes set, and the blade lowered.

(H) Before the engine is shut down, the brake locks shall be applied and all elements such as blades, buckets, grapples and shears shall be lowered to the ground.

(3) Skidding Procedures (FFO, MVE, RML, STF)

(A) Before a skidder is started or moved, the operator shall be certain that nothing is in the way which could be set in motion by the movement of the machine thereby endangering personnel.

(B) A log or turn shall not be moved until all personnel are in the clear (and on the uphill side on sloping ground).

(C) Skidders shall not be operated within a radius of two tree heights of trees being felled unless called upon by the cutter to ground lodged trees. All cutters shall be notified of the skidder's entrance into the area and all felling within two tree lengths of the skidder shall be stopped.

(D) During use of a winch, the equipment shall be positioned so that the winch line is as closely aligned as possible with the long axis of the machine.

(E) Operators of mobile skidding equipment shall not use such equipment on unsafe slopes and under other conditions that exceed the safe operating limits of the equipment.

(F) Guiding lines onto drums with hands or feet shall be prohibited.

(4) Choker Setting (FFO, MVE, RML, STF)

(A) Care shall be taken to keep workers clear of rolling logs when chokers are being set or unhooked.

(B) Choker holes shall be dug from the uphill side of the log when there is danger of a log rolling.

(C) Chokers shall be placed near the end of the log or tree length, and at the log end nearer the yarder.

17

(5) Signals (FFO, MVE, RML)

(A) Signals shall be established and used; seeFigure I-5 for examples.

(B) Signalling devices or communications systems shall be provided and maintained in working condition.

(C) Operators of engine-driven trucks and railroad cars shall be guided by signals from an observer with an unobstructed view of the operation. Vehicles shall not be moved until all workers are in the clear.

(D) Logs, loads, or rigging shall not be moved unless the signal received is clear and distinct. If there is any doubt about signal meaning, the signal shall be repeated as understood and a confirming signal awaited.

(E) Employers shall ensure that workers are familiar with all signals.

(F) Signals shall be given only by designated persons except in emergencies.

(G) Signalling by means of throwing objects in the air shall be prohibited.

(H) A signal such as a siren or extended blowing of a vehicle horn shall be used only to alert workers of exceptional hazards.

(I) When a grapple, balloon, or helicopter logging system is being used, radio shall be used to transmit instructions.



From Hand Signals for Logging Operations. State of Oregon, Workmen's Compensation Board, Accident Prevention Division, Labor and Industrial Building (not dated)

FIGURE I-5

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EXAMPLES OF SKIDDER LOGGING VISUAL SIGNALS THAT MAY BE USED

(6) General (FFO, MVE, RML, STF)

(A) Equipment shall be inspected for malfunctions and defects. Those which affect its safe operation shall be reported to the supervisor and corrected before operations are started.

(B) Workers shall not be permitted to get on or off moving equipment.

(C) Lines shall not be hooked, adjusted, or crossed while the line is in motion.

(D) Wire rope (cable) shall not be knotted except on strawline hook attachments and temporary repair for archline hooks.

(E) Logs shall not be landed at the loading area if there is danger of incoming logs or rigging striking or fouling the loading rigging.

(F) Log piles and decks shall be located and constructed to provide working areas around them that will accomodate the safe movement of men and machinery.

(G) Logs shall not be landed until workers and equipment are in the clear.

(H) Workers removing logs from or placing them in decks shall be within sight or sound of the operator or of a signalman.

(I) When yarding is conducted during the hours of darkness, the area shall be illuminated to a 20 foot-candles minimum. The source of illumination shall be located and directed so as to create a minimum of shadows and glare. If a portable-type tail-hold is used, lights shall be directed on the equipment to allow the workman to ascertain visually that the tail-hold equipment remains stabilized.

. (J) Landings shall be sized to provide safe working space for both workers and machines, and shall be kept clear of hazardous obstructions, rubbish, and other slipping and stumbling hazards.

(7) Cable Operations--except Skidder Operations (FFO, RML, STF)

(A) Workers shall be directed to get clear of logs, root wads, or rigging before the go-ahead signal is given and to stay clear until movement has stopped.

(B) The bight of any moving line under stress shall not be entered except when natural barriers provide protection.

(C) The anchor stump area and the bight of lines shall be evacuated as the guyline or wraps are being tightened.

(D) Chokers shall not be hooked or unhooked until rigging is stopped completely.

(E) Swinging and yarding with a "V" lead is prohibited on tree-rigged systems. The angle between the machine, the high lead block, and the yarding or swing road on tree-rigged systems shall not be less than 90 degrees (commonly referred to as a square lead).

(F) Skyline hooks, slings, lines, cables, skids, logs, or rigging shall not be ridden by personnel except in a carrier designed specifically for that purpose.

(G) Personnel may be transported on skyline logging machinery in safely designed carriers only after the carrier has made a complete traverse of the skyline.

(H) When transporting personnel, lines shall not be moved faster than 300 feet per minute.

(I) Chokers shall not be used on the grapple system when the yarder operator cannot clearly see the workers setting the choker.

(d) Loading (MVE, RML, STF)

(1) Area Maintenance--When a shovel or swing-type loading machine is engaged in handling logs and there are workers immediately nearby, a minimum of 36 inches clearance shall be maintained between the counterweight of the loading machine and such things as trees, logs, banks, backslopes, and trucks. If this clearance cannot be maintained, the hazardous area shall be isolated, using barriers or similar means.

(2) Signals (MVE, RML)

(A) Signals shall be established and used; see Figure I-6 for examples.

(B) To control the movement of a log truck being loaded, when the truck is to be moved, a positive means of communication shall be established between the truck driver/loader and/or the loading operator.

(3) Truck Loading Requirements (MVE, RML)

(A) The loader operator shall not be distracted while he is operating the controls.

(B) The transport vehicle shall be positioned so that a safe working clearance is provided between it and the pile or stack of forest products (logs, etc).

(C) When logs are being loaded, the load shall be built up in a manner to be stable without the use of binders. Binders shall be considered only as precautionary measures to ensure stability of the load.



From Hand Signals for Logging Operations. State of Oregon, Workmen's Compensation Board. Accident Prevention Division. Labor and Industrial Building (not dated)

FIGURE I-6 EXAMPLES OF LOADING SIGNALS

(D) In pyramidal loading, the centers of the upper logs shall be inside the centers of the outside log on the tier below.

(E) To prevent tilting, logs shall be loaded so that no more than one-third of the log's weight extends beyond the supporting logs below.

(F) Sufficient brow log blocking, or the equivalent shall be utilized to prevent logs from rolling out of control.

(G) Not more than the upper half of any log shall extend above the stakes unless the log is properly and securely saddled.

(H) Logs shall be loaded in an uncrowded manner to prevent excessive strain on the bunk stakes, binders, or bunk chains.

(I) Binders shall be placed and tightened around the completed load before it is balance-shifted. Binders shall be placed and secured before a truck is moved from the landing or loading area.

(J) Binders shall remain on the load until safeguards have been provided to prevent logs from rolling off the side of the truck when the binders are released. When binders are being adjusted, only one binder shall be loosened at a time.

(K) Binders shall be so placed that they must be released from the unloading machine side. Exception may be made at dumps where the unloader is equipped with tongs, grapples, or other mechanical devices that are capable of restraining the entire load.

(L) Trailers loaded on trucks shall be secured.

(M) When unloading trailers from motor trucks, the trailer shall be hoisted clear, the truck driven a safe distance, and the trailer lowered to within 1 foot of the roadway before workers approach the

trailer or reach (coupling pole) for positioning.

(4) Worker Location (MVE, RML, STF)

(A) Only the driver shall be permitted in the truck cab while logs are being loaded.

(B) All workers shall be in the clear while logs are being hoisted or while logs or loads are being shifted on trucks.

(C) Only the machine operator and necessary personnel shall be permitted in the work area.

(D) No one shall be permitted alongside or underneath trucks being loaded until communication has been established with the loading machine operator and assurance has been received that it is safe.

(E) The loading operator shall be notified and his acknowledgement ensured of anyone's intention to release bunk locks, place or remove compensating pins, scale logs, read scales, or make connections.

(F) Loads being raised or lowered shall not pass over any person or an occupied truck cab. No one shall be permitted to pass or stand under a suspended load.

(5) Procedures and Operations (CSO, FFO, MVE, RML, STF)

(A) Tongs shall be carried with the points so directed that, in case of a fall, they will not injure the worker.

(B) If an unobstructed view of all personnel and of vehicles being loaded cannot be maintained, communications shall be established to maintain awareness of worker location.

(C) When grapples, trip tongs, or similar devices are used, the log holding device shall be lowered to the ground whenever

the machine is unattended, ie, when the operator is out of sight or more than 25 feet from the machine.

(D) Hoisting or transport equipment shall not be left unattended with the power on or with the load suspended.

(E) Cross-haul hooks shall be maintained in a condition that will ensure secure holds.

(F) Loading hooks and tongs shall be securely attached on the loading line with screw shackles or equivalent devices.

(G) The use of a plain spiked loading hook without a bell is prohibited. Loading hooks shall be kept in good repair. Hand rope shall be attached to loading hooks.

(H) Where there is danger of tongs or hooks pulling out of the log, straps shall be used. Tongs may be used on extra-large logs, provided the logs are barked and notched to provide a secure hold.

(I) Peavies, cant hooks, picaroons, or slings shall be used to roll logs.

(J) Knot bumping shall be done before a log is loaded or after it is safely positioned on a load.

Section 3 - Training (Informing Employees of Hazards)

The employer shall ensure that employees have sufficient proficiency to safely perform their intended tasks before allowing them to participate in logging operations without immediate supervision. The employer or his representative shall train employees in the work practices contained in Section 1, and explain the associated hazards of the job. A training program shall be developed and implemented. (Chapter V contains suggested training gwidelines.)

Section 4 - Medical

(a) All employers shall ensure that their employees are physically fit to carry out their assigned jobs safely. This shall be accomplished either by a medical examination made available to each new employee before placement or through a current medical report provided by the employee. Biennual examinations shall be provided for employees under 40 years of age, and annual exams for employees 40 years of age and older. This shall be a general medical examination to identify aggravated, previously existing conditions and any new condition that would endanger the worker's safety. It shall include examination of the cardiovascular, musculoskeletal and central nervous systems, and emphasize the integrity of the extremities and digits, of hearing and visual acuity, and for chain saw operators, an examination of peripheral vasculature (Reynaud's syndrome). All employees shall be given a copy of their medical report upon termination of employment to take to his or her next employer.

(b) The ability of employees to safely perform their assigned tasks shall be medically determined upon return to work after an absence for illness or injury of 5 or more days.

(c) A complete series of tetanus toxoid inoculations shall be made available to each new employee. Booster doses shall be made available at least every 10 years to maintain active immunity, unless an injury requiring a booster intervenes.

(d) First Aid Provisions

(1) A minimum of two people trained in first aid shall be available at each worksite to render emergency aid. First aid supplies approved by a consulting physician, eg, the US Forest Service first aid kit, shall be available at each worksite.
(2) Snake bite kits shall be available at each worksite wherever there is a possibility of a bite by a venomous species.

(3) A vehicle capable of being used for the evacuation of injured employees shall be located in the vicinity of the worksite during logging activities.

(4) Employers shall ensure that employees are aware of the location of all first aid equipment, the evacuation vehicle, and how to obtain emergency assistance and medical attention.

Section 5 - Posting

(a) Warning signs shall be prominently displayed on access roadsto a logging area. Signs shall be removed when logging is completed.

(b) Warning signs and any instructions shall be printed in English. They shall also be printed in the language of non-Englishspeaking workers, if any, unless these workers are otherwise informed. All illiterate workers shall be given special instruction.

(c) Snags and logs that are partially bucked shall be conspicuously marked with red and white striped tape.

(d) Telephone numbers for ambulance service, first aid, hospital emergency service, and fire and rescue squads shall be posted near the logging operation, for example in the vehicle specified in Section 4(d)(3), and at the communication center.

Section 6 - Personal Protective Equipment

(a) General Requirements

(1) The employer shall be responsible for ensuring adequacy, maintenance, and sanitation of all personal protective equipment.

(2) The employer or his representative shall instruct employees on the use of personal protective equipment.

(3) Equipment guards such as chain brakes, chain guards, or throttle controls shall not be tampered with or removed.

(b) Selection and Use

(1) Employees shall wear eye and face protection in accordance with 29 CFR 1910.133.

(2) Employee exposure to air contaminants shall be limited in accordance with 29 CFR 1910.93, and respiratory protection shall be in accordance with 29 CFR 1910.134.

(3) The employer will comply with requirements of 29 CFR1910.95 for noise exposure.

(4) When operating a chain saw, employees shall wear leg protection (chaps, pads, inserts) made from ballistic nylon or its equivalent.

(5) Depending on the requirements of the terrain and the timber, employees shall wear safety boots, safety shoes, or calked boots (excluding low-cut shoes). Safety-toe footwear shall be constructed in accordance with 29 CFR 1910.136.

(6) In areas where there are potential drowning hazards, employees shall wear flotation devices in accordance with 29 CFR 1918.106 and shall work within sight or sound of another person.

29

(7) When operating chain saws, filing sharp tools, or handling any kind of rope or cable, employees shall wear appropriate hand protection such as leather gloves.

(8) Employees shall wear head protection in accordance with29 CFR 1910.135.

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, Louisana. 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 <u>American Logging and Sawmill Safety Code</u>, <u>Handbook Series of the Bureau</u> of <u>Standards</u>, <u>Number 5</u>, 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

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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 catagory amounted to 42% of their total payments in logging as shown in Table III-2.

TABLE III-1

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]

LOGGING INJURIES FROM FALLING AND FLYING OBJECTS IN THE US

* 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	Cost	Percentage of Total Cost For Logging
Struck by falling	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 timbe:	r 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

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]

INJURIES FROM ROLLING AND MOVING LOGS

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

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	

COMPENSATION FOR INJURIES RESULTING FROM ROLLING AND MOVING LOGS

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

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*]
89 3	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]

FREQUENCY OF CHAIN SAW INJURIES

* 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 uneveness 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

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]

INJURIES FROM SLIPS, TRIPS AND FALLS

* 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. Maine Industrial Accident Commission

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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, shears, cranes, loaders, logging trucks and cable-rigging tractors, installations. During their operations, these devices are in motion and

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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

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	1 32	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]

INJURIES AND DEATHS RESULTING FROM MOVING EQUIPMENT

Indicate fatalities

** Maine Industrial Accident Commission

IV. DEVELOPMENT OF STANDARD

Basis for the Recommended Standard

Logging has been shown to be an extremely hazardous occupation. The Bureau of Labor statistics for 1973 reported an injury incidence rate of 31.2%, or approximately one injury for every three loggers. This is 2.9 times the all-manufacturing sector rate of 10.6%. [15] The same report identified a lost workday incident rate of 16.1% which is almost five times the all-manufacturing rate of 3.3%. The incidence of lost workdays/100 full-time workers was 307.8 which is the highest rates of all industries in the private sector. The percent of disabling injuries resulting in death was more than five times greater than that of all manufacturing. [14]

The work practices portion of the recommended standard was developed after extensive review of published information, [3,12,11] the present federal code, applicable portions of state codes, [4-6,8-10,19-23] and the International Labour Office forestry recommendations, [27] consultations with logging professionals, and visits to sites of logging operations.

After consultation with a number of safety professionals, many with experience in logging operations, it is the judgment of NIOSH that compliance with these recommended work practices will reduce logging injuries. In a hazardous industry such as logging, the proper training of workers is a necessity. The training process permits the employer to determine whether employees demonstrate the knowledge, understanding and skills to safely perform their assigned tasks.

Because physical health of an employee affects his or her ability to perform the job safely, it is necessary that preplacement examinations be

required. They shall include an examination of the cardiovascular, musculoskeletal and central nervous systems, and emphasize the integrity of the extremities and digits, of hearing and visual acuity, and for chain saw operators, an examination of peripheral vasculature (Reynaud's syndrome). Due to the nature and environment of logging operations, determination of the need for tetanus immunization shall be necessary. Such examinations are necessary to ensure that workers are physically able to perform their tasks in a safe manner. Periodic examinations during employment are important to recognize developing conditions which might jeopardize worker safety.

Because of the hazards encountered in the logging industry and because of the frequent remoteness of work areas from medical facilities, it is recommended that trained first aid personnel, along with first aid equipment and means of transportation to medical care, be available at the worksite.

It is apparent that more research is needed in the field of logging safety. Ergonomic, behavioral, and motivational factors contributing to worker safety must be identified and methods developed to improve worker behavior to effect safer work conditions. Also, equipment must be designed to eliminate or minimize operational hazards and mechanization developed to separate the worker from uncontrollable hazards.

Comparison with OSHA Pulpwood Logging Standard (29 CFR 1910.266)

The NIOSH recommended standard differs from the present federal pulpwood logging standard 29 CFR 1910.266, in the following ways:

(a) The recommended logging standard from felling to first haul includes all logging operations such as those relating to sawlogs, veneer bolts, poles and pilings rather than being limited only to pulpwood operations.

(b) Preplacement and periodic medical examinations are prescribed. In addition, employers are required to provide their employees a copy of his or her medical report to take to the next job.

(c) Training of employees is required.

(d) The recommended standard does not include provisions dealing with equipment protective devices, personnel transport, off-highway truck transport, chipping operations, or the construction and maintenance of roads, trails, and bridges.

V. TRAINING GUIDELINES

In an industry as inherently hazardous as logging, the training of workers is vital. The training process permits the employer to train new employees in proper work practices and techniques from the beginning of their careers. An employee can learn the proper techniques to accomplish assigned tasks safely from a competent, experienced individual. Training also helps set the stage for molding employee attitudes by demonstrating employer concern and commitments to safe work practices.

Training Methods, Frequency, and Evaluation

(a) Methods

Training may be carried out through formal programs in classrooms, with field trips and practical testing, and/or on-the-job instruction. Utilizing the latter method, employees are shown a segment of the task and allowed to work at it. As they develop proficiency, more work segments are added. This method requires close supervision as each new step is introduced until each employee is judged competent to carry out the tasks. Reference material such as "Professional Timber Falling" by D. Douglas Dent [12] which emphasizes the procedural approach, plus other material such as the British Columbia "Fallers' and Buckers' Handbook," [10] are recommended.

(b) Frequency and Need

The frequency and need for training will vary depending on the individual and the complexity of the operation and/or as dictated by injury

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reports. The results of monitoring should also be used as an aid in determining frequency. First-line supervisors may be the best judges of when, and in what areas, workers need training, as they see them frequently and are familiar with their work performance. Usually, they are the most cognizant of how employee accidents can be minimized, since they may have first-hand knowledge of accident circumstances.

(c) Evaluation

The evaluation of employee performance should be conducted by firstline supervisions. Supervisors can discern, through observation, whether employees are adhering to recommended work practices and can satisfactorily demonostrate skills required of the particular task.

Written tests or checksheets may also be used in conjunction with the above.

Program Content

(a) Work Practices

A work practice can be defined as the methodology for the safe performance of a task. The work practices presented in Chapter I, Section 2, are intended to eliminate or minimize accidents and injuries occuring in felling to first haul operations where the majority of logging injuries occur.

The employer shall ensure that each employee knows, understands and regularly observes practices which are applicable to assigned duties, together with work practices generally applicable to all loggers. The employer must also ensure that each employee understands the relationship between the recommended work practices and the hazards they are intended to minimize.

(b) Hazards and Precautionary Measures

(1) Falling and Flying Objects

The category of falling and flying objects includes limbs, bark, dead trees, lodged trees, logs, and tools dropped by workers. It also includes objects which are propelled through the air such as trees kicking back at the stump, saplings springing back after being bent over by trees falling on them, or can result from chain reactions. For example, skidders or other yarding equipment may strike an item, causing it to be propelled, or to strike other objects which in turn are propelled into a worker.

The effect on workers from falling and flying objects can range in seriousness from eye irritation caused by sawdust propelled by a chainsaw to fractures, concussions, spinal injuries, or crushing injuries sometimes resulting in death caused by falling trees.

These hazards may be minimized by taking the precautions pertaining to falling and flying objects as recommended in Work Practices, Chapter 1, Section 2. Additional things to consider include tree species characteristics which may make them inherently more dangerous to fell than others as is the case with elder trees which splinter profusely.

(2) Rolling and Moving Logs

Rolling and moving log hazards can originate during felling, bucking, skidding, limbing, scaling, or loading at the landing. Logs that roll unexpectedly are cause for special concern. Logs left or placed in certain positions, because of their round configuration and large potential energy, can be veritable traps waiting to be sprung on the unwary logger.

The severity of the injuries in this category depends on the size and velocity of the log and the manner in which it strikes the worker.

Precautions which can be taken to minimize these hazards are review and compliance with the recommended work practices pertaining to rolling and moving logs.

(3) Chain Saw Operations

Chain saw operations, as denoted here, are those which utilize chain saws to fell trees, cut limbs from the felled trees, buck those trees into prescribed lengths, and trim knots and limbs from logs at the landing during loading.

Injuries in this category range from minor burns received from touching a hot chain saw muffler, to severe lacerations caused by contact with the running chain.

Precautionary measures which can be taken to minimize these hazards are review and compliance with the recommended work practices pertaining to chain saws. Protective clothing and equipment, especially face shields, hearing protection, and leg protection afforded by chaps, pads and inserts made from ballistic nylon, can play an important role in preventing injuries resulting from chain saw use.

(4) Slips, Trips, and Falls

By the very nature of his activities, the logger must climb over, on, under or proceed around numerous obstacles to perform his duties. Common sources of concern include vines, brushes, rocks, saplings, limbs and other parts of trees, as well as other natural debris. This situation is further complicated when the logger carries a chain saw during felling, bucking, and knot bumping activities, which increases the possibility of

injury. In other logging operations, such as skidding, yarding, or loading required duties include the handling of wire cables, hooks and grapples. In addition, moving equipment is constantly present and therefore the logger must continually watch his footing while keeping an eye on nearby operating equipment. In this environment, slips, trips, and falls are common. The logger does not consider many of these occurrences as accidents, but merely part of his occupation and environment. He accepts that frequent slips and falls are part of his normal work situation.

The result of slips, trips, and falls can range from an embarrassed worker to death. A slip and fall in the felling area can result in death if the cutter falls while moving away from a falling tree or other object. Slipping off a large tree in the bucking area could result in broken bones, strains and sprains, or lacerations from falling upon a running saw chain. Injuries at the loading site are usually related to tripping over debris, slipping from logs, and falling from log piles and trucks. Injuries in this area range from simple bruises to concussions.

Precautions which can be taken to minimize these hazards are review and compliance with the recommended work practices pertaining to slipping, tripping and falling. Another area of special concern is equipment operators who wear calked boots and must mount and dismount equipment frequently. The slipping-falling hazard can be minimized by skidproofing the stepping surfaces, by providing handrails, and by wearing appropriate footwear.

(5) Moving Equipment

The moving equipment associated with logging includes cables, skidders, rigging attachments, loaders and logging trucks. They present

hazards when they are in motion near the worker. Some loggers are actively involved with several of these at one time. For example, the choker setter is expected to hook a log, signal to someone, move to the next log, and be alert to hazards which other workers may create by their unsafe acts (such as moving a skidder before the signal is given, backing without looking, driving skidders at an unsafe speed through the woods without regard for fellow employees, and entering the landing without due care).

The severity of injuries from moving equipment often can be very serious depending on the size and velocity of the equipment, and the manner in which it strikes the worker.

Precautions which can be taken to minimize these hazards are review and compliance with the recommended work practices pertaining to moving equipment.

(c) Medical and First Aid

Treatment of the injured logger by well-trained first aid personnel can mean the difference between life and death. More often, however, it will reduce the lasting effects of an injury and will comfort and protect the injured. All employees should know the location of the trained first aid people, first aid supplies, and how to secure ambulance services.

One source of first aid training that should be considered is the American Red Cross training course, available from the local Red Cross chapter.

The book <u>Standard First Aid and Personal Safety</u>, [31] should be read by all loggers. Special reference should be made to the chapters concerning first aid treatment of head wounds, shock, and electric shock. Because many logging injuries occur in remote areas and involve the spinal

column, loggers should be familiar with proper immobilization procedures and appropriate short distance transport techniques.

Because chain saw injuries are common, loggers should be thoroughly familiar with techniques to stop bleeding and be aware of first aid for strains, sprains and fractures. The employer should ensure that medical personnel are readily available for consultation on matters of health, particularly as they may also relate to logging-type injuries. All employees should be appraised of where to go, or whom to call should a need arise for professional medical care.

- (d) Suggested Topics for a 1-Day Safety Orientation Program
 - (1) Introduction

(A) Discuss the objectives of the training program and the general environment to be encountered in the workplace.

(B) Present and discuss "What the Occupational Safety and Health Law Means to Loggers." [34]

(2) Work Practices

(A) Present work practices concerning hand tools.

(B) Present work practices pertinent to workers

present, and to each type of worker, and show the relationship required to prevent injuries during a mix of tasks, ie, skidding and felling, skidding and bucking, etc.

(C) Discuss the five hazard categories and how they can be minimized by adherence to the recommended work practices.

(3) Protective Equipment

(A) Eye and Face Protection

(i) Show films (for list of films, contact the Society for the Prevention of Blindness).

(ii) Demonstrate proper and safe use of equipment.

(B) Ear Protection

(i) Discuss possiblility of hearing loss from

saws and equipment engines.

- (ii) Demonstrate ear protectors.
- (C) Hard Hats
 - (i) Display hard hats.
 - (ii) Demonstrate proper method of wearing.
 - (iii) Explain limitations of hats.

(D) Leg Protection

- (i) Show different types of leg protection.
- (ii) Explain under what circumstances leg

protection is to be worn and how it protects the workers against kickback injuries.

- (E) Loggers' Safety Footwear
 - (i) Show different types of boots.
 - (ii) Explain the type of operation for which

each type of boot is used.

(iii) Select a boot to be used in the locale.

(4) An Example of a Dangerous Operation - Skidding

(A) Show film "Round Trip to Danger." This and other films are available from forestry associations.

(B) Discuss film highlights.

(C) Ensure that equipment operators and personnel working with them are aware of signals being used to control movements at the workplace.

(5) First Aid

(A) Detail location of first aid supplies.

(B) Detail procedure for obtaining first aid, medical help, and ambulance.

(6) Summary

Summarize by asking questions pertaining to each segment of training.

VI. Research Needs

The most basic research need is to develop and implement an adequate nationwide system for injury data collection. This is necessary to identify the problems in sufficient detail to permit an assessment of priorities for further research. The data collection vehicle must identify not only the effect on the worker (ie, the injury) but the causative and contributing factors that led to the injury. Data should also be collected on accidents in which a reportable injury does not result (the near miss). By identifying all factors involved in the accident sequence, we can determine where the appropriate injury control techniques can be most effectively applied to eliminate the potential adverse consequences.

Once problems are identified and priorities set, further research can be undertaken to develop the corrective measures necessary to eliminate the hazardous situations. One general area of effort probably should be to evaluate present techniques and develop new techniques of work practices applicable to the various operations under existing technologies. This type of corrective measure probably can be accomplished most expeditiously and with a minimum time delay.

Research to apply existing engineering technologies to meet the needs of present operations in this industry is necessary. The development of new equipment to increase worker safety as well as efficiency can serve to reduce the number of accidents and resulting injuries to the worker population. This area of research may permit the worker to accomplish his assigned task without exposing himself to the potentially hazardous

situations which cannot be eliminated.

High priority must be given to the development of protective clothing and equipment to safeguard the worker from hazardous situations until the condition can be eliminated by other methods. These should be considered as temporary controls of injury and not as ultimate solutions to the problem.

Research in the area of behavioral and motivational factors affecting the worker's safe accomplishment of his assigned task must be undertaken to determine the interaction of these factors as compensating or contributing mechanisms to the accident sequence. The role of supervision in this area must be studied. In addition, effective training programs must be developed if appropriate. The previously mentioned factors must be researched and the knowledge obtained to train a safe, efficient worker who can adequately master his work environment.

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VIII. APPENDIX - TABLES

TABLE VIII-1

DISABLING WORK INJURIES IN LOGGING BY DETAILED ACCIDENT TYPE AND AGENT, CALIFORNIA, 1970

Accident Type and Agent	No. of Injuries
Struck by or striking against: Hand tools in use	<u>386</u>
Chain saw Power saw Axe Jack Other	113 17 6 2 2
Other objects while handling	
Truck trailer Log Tree Other	5 4 2 7
Moving equipment other than motor vehicles	
Yarding equipment Other	11 7
Falling or flying objects	
Branch Tree Log Choker Rock Other	43 39 17 2 2 7
Moving or rolling objects	
Lo g Rock	31 3
Hand tool, n.e.c.*	14

TABLE VIII-1 (CONTINUED)

DISABLING WORK INJURIES IN LOGGING BY DETAILED ACCIDENT TYPE AND AGENT, CALIFORNIA, 1970

Accident Type and Agent	No. of Injuries
Stationary objects	
Log	8
Tree	3
Branch	2
Yarding equipment	2
Other	11
Contact with sharp object	7
Other	19
Fall or slip	212
On same level	·
Using chain saw	20
Walking on uneven ground	19
Setting, pulling chokers	18
Walking on littered ground	16
Running, walking from falling tree	10
Walking on wet, slippery ground	6
Walking through brush	4
Loading truck	2
Other	15
From elevated level	
Log	37
Truck	8
Bank	6
Tractor	4
Branch	3
Stump	3
Other	3
While stepping on, off, or over	
Log	17
Tractor	12
Truck	9
TABLE VIII-1 (CONTINUED)

DISABLING WORK INJURIES IN LOGGING BY DETAILED ACCIDENT TYPE AND AGENT, CALIFORNIA, 1970

Accident Type and Agent	No. of Injuries
Accident involving moving motor vehicle	102
Struck by objects set in motion by Overturning, running off road	41 14
Strain or overexertion in operating Fall from Run over or struck by	9 7 7
Contact with vehicle or object within vehicle	6
Caught between vehicle and other object Collision with fixed object Collision with other moving vehicle	5 5 5
Shifting load or object falling within vehicle	3
Strain or overexertion Lifting or lowering	<u>85</u>
Chain saw Log	4 4
Power saw Tire Other	2 2
Using hand tool	12
Chain saw Axe Other	10 2 5
Pushing or pulling object	
Cable Choker Other Setting choker Holding or carrying object Sudden or awkward motion Other	4 4 12 6 5 9

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TABLE VIII-1 (CONTINUED)

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DISABLING WORK INJURIES IN LOGGING BY DETAILED ACCIDENT TYPE AND AGENT, CALIFORNIA, 1970

Accident Type and Agent		No. of Injuries
Caught in or between		<u>36</u>
Choker		10
Log		6
Tractor		3
Tree		2
Tractor		2
Truck		2
Other		11
Foreign substance in eye		23
Branch		13
Wood chip		4
Dust		2
Other		4
Bite, sting		<u>11</u>
Contact with welding flash, toxic, or noxious substance		<u>7</u>
Hot environment or substance		<u>4</u>
Cardiovascular strain or disease		2
Other, and type not stated		<u>13</u>
	Total	881

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TABLE VIII-1 (CONTINUED)

DISABLING WORK INJURIES IN LOGGING BY DETAILED ACCIDENT TYPE AND AGENT, CALIFORNIA, 1970

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SUMMARY				
Accident Type	No. of Injuries	Percentage		
Struck by or striking against	386	43.8		
Fall or slip	212	24.1		
Accident involving moving motor vehicle	102	11.6		
Strain or overexertion	85	9.6		
Caught in or between	36	4.1		
Foreign substance in eye	23	2.6		
Bite, sting	11	1.2		
Contact with welding flash, toxic, or noxious substances	7	0.8		
Hot environment or substance	4	0.5		
Cardiovascular strain or disease	2	0.2		
Other and type not stated	13	1.5		
Total	881	100.0		

* not elsewhere classified Derived from reference 16

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Year of Occurrence										
Source	1966	1967	1 96 8	1969	1970	1971	1972	1973	Total	Percent age
Falling/flying objects	19	15	15	11	11	15	9	19	114	37.4
Rolling/moving logs	13	8	19	13	9	12	9	12	95	31.1
Chain saws	0	0	0	0	0	0	0	0	0	0,0
Slips, trips, and falls	2	0	3	1	1	0	1	0	8	2,6
Moving vehicles	11	9	1	3	10	14	13	14	7 5	24.6
Ergonomic violation	0	0	0	0	1	1	0	0	2	0.7
Miscellaneous	0	0	2	0	5	0	1	3	11	3.6
Total	45	32	40	28	37	42	33	48	305	100.0

OREGON LOGGING INDUSTRY FATALITIES

Derived from reference 24

FLORIDA INJURY DATA LOGGING CAMPS AND LOGGING CONTRACTORS AS OF SEPTEMBER 1974

Injury Type	No. of Injuries	Percentage	
Struck against	126	25.5	
Struck by	201*	40.8	
Caught in/under/between	25	5.0	
Fall on same level	23	4.7	
Fall to different level	23	4.7	
Overexertion or bodily reaction	59	12.0	
Contact with temp/press extreme	6	1.2	
Contact with toxic substances, etc	8	1.6	
Motor vehicle and aircraft accident	19	3.9	
Other	3	0.6	
TOTAL	493	100.0	

* 87 from falling/flying objects Derived from reference 17

NORTHEASTERN US DISABLING WORK INJURIES (LOGGING) 1973, 1974

Agent		No. of 1 Injuries	Percentage
Falling/flying objects		57	43.2
Rolling/moving logs		6	4.5
Chain saws		42	31.8
Slips, trips, falls		10	7.6
Moving vehicle		2	1.5
Ergonomic (motion)		7	5.3
Insect bite		5	3.8
Tool		2	1.5
Other		1	0.8
	Total	132	100.0

Derived from (Maine Industrial Accident Commission Data, written communication, 1975)

Accident Type and Major Cause	No. of Injuries	Percent of Injuries	Cost	Percent of Cost
Struck by	1,604	<u>19.6</u>	\$5,591,018	41.9
falling objects				
Trees, branches	1,153		4,681,980	
Logs	185		588,984	
Ubjects	36		/6,3/4	
Lumber or timber	19		34,428	
Other	211		209,252	
Struck by moving objects	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	
Handling	587	7.2	\$ 657,168	4.9
Logs	148		281,851	
Board, plank,				
plywood	75		98,073	
Trees, branches	56		43,481	
Chain saw	29		34,067	
Other	279		199,696	
Cut by	1,455	17.8	\$ 636,106	4.8
Chain saw	864	<u></u>	387,233	
Saw-misc (wood)	369		159,971	
Axes (hatchets)	93		44,219	
Other	129		44,683	
Collision or Upset Trucks and	<u>161</u>		\$ 483,181	3.6
trailers (semi) Contractors'	58		197,445	
vehicles	4		51 861	
Trucks, straight	12		46.379	
Automobile	10		22 721	
Skidder	10		30 /17	
Other	67		123 359	
Offici			123,330	
Total	4,990		\$9,227,456	

INSURANCE COMPANY INJURY CAUSE AND COST ANALYSIS FOR WORKMEN'S COMPENSATION CLASSIFICATION 2702 (LOGGING) ANALYSIS BY ACCIDENT TYPE

Derived From (M Fearson, written communication, November 1974)

AMERICAN PULPWOOD ASSOCIATION NORTHEASTERN TECHNICAL DIVISION CUMULATIVE YEAR TO DATE LOST TIME LOGGING INJURIES

	Number o	of Cutting Injuries
Source	December 1972	December 1973
Falling limbs or stubs	4	15
Trees, logs, or bolts	10	20
Chain saws	19	22
Slips, trips and falls	2	13
Hand tools	1	0
Machinery	2	4
Other	2	9
Tot	al 40	83

From (RP Sarna, written communication, February 1976)

DISABLING WORK INJURIES TO FELLERS BY DETAILED ACCIDENT TYPE AND AGENT, CALIFORNIA, 1970

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Accident Type and Agent	Number of Injuries	Percentage
Struck by or striking against	155	56.7
Chain and tool, in using	66	
Power saw	8	
Axe	1	
Falling/flying object		
Branch	30	
Tree	20	
Log	4	
Other	4	
Moving/rolling object		
Log	6	
Rock	1	
Bumping into stationary object		
Log	2	
Tree	1	
Other	3	
Contact with sharp object	6	
Other	3	
Fall or slip	74	27.0
Fall or slip on the same level		
Running, walking from falling tree	10	
Setting, pulling, unhooking choker	7	
Using chain saw	7	
Walking on littered ground	6	
Walking on uneven ground	6	
Walking on steep ground	3	
Loading truck	2	
Walking on wet, slippery ground	2	
Walking through brush	2	
Other	8	

TABLE VIII-7 (CONTINUED)

DISABLING WORK INJURIES TO FALLERS BY DETAILED ACCIDENT TYPE AND AGENCY, CALIFORNIA, 1970

Accident Type and Agent		Number of Injuries	Percentage
Fall from elevation		11	
Other		4	
Fall or slip while stepping off, or over log	on,	6	
Foreign substance in eye		<u>17</u>	6.2
Branch		8	
wood chip Dust		4	
Other		3	
Strain or overexertion Using hand tool		$\frac{16}{8}$	5.8
Chain saw Other		6 2	
Lifting or lowering object		6	
Chain saw		4	
Other		2	
Pulling on choker		2	
Caught in or between Cable		$\frac{4}{1}$	1.5
Log		1	
Rigging Tree		1 1	
Contact with poison oak		2	0.7
Insect bite		2	0.7
Other		<u>2</u>	0.7
Accident type not stated		<u>2</u>	0.7
	Total	274	100.0

Derived from reference 16

Agent	Cutting	Hauling	Other	Injuries Total	%
Falling limbs and studs	144	11	2	157	7.1
Trees, logs, bolts	386	82	28	496	22.4
Chainsaws	560	14	10	584	26.4
Slips and falls	166	72	73	311	14.1
Hand tools	126	49	31	206	9.3
Machinery	47	54	23	124	5.6
Horses and equipment	44	19	9	72	3.3
Infections, minor wounds	27	9	12	48	2.2
Other	106	30	76	212	9.6
Total	1,606	340	264	2,210	100.0

LOGGING INJURIES, AMERICAN PULPWOOD ASSOCIATION NORTHEASTERN DIVISION, 1958-72

Derived from reference 3

WORK FATALITIES IN LOGGING BY DETAILED ACCIDENT TYPE CALIFORNIA, 1966-72

Accident Type	No. of Fatalities
Struck by or striking against	57
Falling tree, snag, branch	36
Log rolling downhill	6
Log falling from truck	4
Log being skidded, varded	3
Flying limb	2
Log rolling off deck	-
Bulldozer blade fell on	ĩ
Flying wood	ĩ
Loading boom fell on	ĩ
Log swinging	-
Struck by falling block	1
Accident involving moving motor vehicle	27
Overturning, running off road	13
Caught between moving vehicle and other object	4
Collision with other moving vehicle	3
Tractor ran over	3
Log crashed into truck cab	1
Log rolled on tractor	1
Log swung against tractor	1
Tree fell on tractor	1
Caught in or between	13
Two trees	
Log and tractor	2
Two logs	2
Loader and trailer	$\overline{1}$
Loader and chain saw	1
Log and power saw	1
Log and truck	1
Snag and log	1
Heart attack	<u>3</u>
Heat stroke	1
Total	101

Derived from reference 16

SUMMARY OF LOGGING FATALITIES FOR WASHINGTON (1968, 1970-72) AND CALIFORNIA (1968,1971)*

OCCUPATION OF VICTIM																		
A = Feller E	= Log	Load	er			J	-	Lab	ore	r			N	-	Equ	ipa	ent	
B = Bucker F	= Skide	der				K	-	Pow	der	man	L				Ope	rat	or	
C = Rigger (Misc) G	= Chas	er				L	-	Tag	&	Tal	1 ym	an	0	-	Hau	li n	g E	ngr
D = Choker Setter H	= Truc	k Dr	ive	r		М	=	Gra	der				P Q	=	Obs Oth	erv	er	
Fatality Cause	Total	A	В	С	D	E	F	G	H	I	J	ĸ	L	M	N	0	P	Q
Felling/bucking operations																		
Struck by felled tree (self)	2	2																
Struck by felled tree (other) 10	3	3		1				1	1						1		
Struck by tree knocked	6	6																
Struck by snag	9	7			1	1												
Struck by flying timber (widowmaker)	14	11	1		1													
Struck by uprooted tree	3	1	1		1													
Struck by lodged tree	5	4	1															
Struck by kickback																		
Struck by tree left standing	4	4																
partially cut																		
Struck by slab	2	2																
Trees falling uphill/bckwrd	12	11	1															
Skidding/yarding operations																		
Struck by rolling log/tree	17	3	6	3	3									1				1
Hit/log hit by other thing	3	1			1			1										
Hit/lot dropped during loadi	lng 14	1		1		3		2	7									
Struck by log being yarded	10			2	7			1										
Struck by tractor-skidded lo	og 1						1											
Struck by rigging incl choke	er 4				3			1										
Struck by log movement durin	ig 4			2	2													
choker setting																		
Struck by springback of tree	s 1				1													
released from tension																		
Struck by chunk or timber	2				2													
dropped from rigging																		
Struck by tree felled by	1				1													
winching cable																		
Struck by swinging log	1						1											

TABLE VIII-10 (CONTINUED)

SUMMARY OF LOGGING FATALITIES FOR WASHINGTON (1968, 1970-72) AND CALIFORNIA (1968,1971)*

		OCCI	JPAT	ION	1 01	7 VI	CTI	M										
A = Feller E B = Bucker F C = Rigger (Misc) G D = Choker Setter H	E = Log Loader F = Skidder G = Chaser H = Truck Driver			J = Laborer K = Powderman L = Tag & Tallyman M = Grader					N = Equipment Operator O = Hauling Engr P = Observer Q = Other									
Fatality Cause	Total	. A	В	с	D	E	F	G	н	I	J	K	L	M	N	0	P	Q
fransport operations	15								13								2	
gents																		
Slips, trips and falls	3	1			2													
Heart attack	3	1			1													
Drowning	1		1															
Falls from logs	1		1															
Struck by log hit by vehicle	1	1																
Chain saw	5	3	1															
Hit by tree felled by vehicl	e 1				1													
Struck by vehicle	26				10	6	1	2	7									
Electrocution	1					1												
Loss of vehicle control	20					3	4		9					2	1			1
Powder blast	1											1						
Snag (direct or indirect)	13	11			1	1												
ocation																		
Felling/bucking area	72	55	13		1					1						1	1	
Yarding skidding area	50			8	35			5								1		
Landing area	40	3	1	1		13	1	8	11		1		1					2
otal	184	60	13	8	37	15	6	8	25	1	1	1	1	2	1	1	1	2

NOTE: Table VIII-10 summarizes 184 fatality reports and many of the fatalities have been used more than once in showing relationships. Only the total fatalities, as a function of occupation, for each cause are correct; the totaling of vertical columns is not intended. Derived from reference 3

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INSURANCE COMPANY INJURY CAUSE AND COST ANALYSIS FOR WORKMEN'S COMPENSATION CLASSIFICATION 2702 (LOGGING) ANALYSIS BY CAUSE

Major Cause and Accident Type	No. of Injuries	Percent of All Injuries	Cost	Percent of Cost
Trees, branches Struck by	<u>1,955</u>	23.9	\$5,751,207	<u>43.1</u>
falling objects Struck by	1,153		4,681,980	
moving objects	422		591,664	
Contact with Struck by	101		125,051	
flying objects	47		88,431	
Caught between	33		61,638	
Fall from elev.	1.2		55,613	
Handling	56		43,481	
Other	131		103,349	
Logs	1,038	12.7	\$2,052,076	15.4
Struck by moving objects Struck by	342		771,580	
falling objects	185		588.984	
Handling	148		281,851	
Fall from elev.	22		98,557	
Caught between	115		82,852	
Other	226		228,252	
Chain saw	1,096	13.4	\$ 542,110	4.1
Cut by	864		387,233	
Kick back	103		56,783	
Other	129		98,094	
Person injured	142		\$ 409,052	<u>3.1</u>
Heart attack	8		236,432	
Overexertion	108		138,449	
Other	26		34,171	
Other	3,849			
Total	8,180			

Derived from (M Pearson, written communication, November 1974)

DISABLING WORK INJURIES IN LOGGING BY DETAILED AGENCY, CALIFORNIA, 1970

Agent	No. of Injuries	Percentage
Hand tools	219	24.9
Chain saw	158	
Power saw, n.e.c.*	27	
Axe	10	
Saw, hand	4	
Jackhammer, tamper	3	
Hammer, hand	2	
Peeling bar	2	
Wedge	2	
Wrench	2	
Other	9	
Logs, trees, lumber	201	22.8
Log	112	
Branch	47	
Tree	41	
Lumber	1	
Vehicles .	151	17.1
Tractor	79	
Truck	37	
Road grader	12	
Log loader	11	
Truck trailer	9	
Automobile	2	
Dolly	1	
Working surfaces	137	15,6
Groundoutdoors	107	-
Truck bed	12	
Truck running board	7	
Log deck, ramp	4	
Tree, branch	4	
Elevated working surface, n.e.c.*	2	
Staging	1	

TABLE VIII-12 (CONTINUED)

DISABLING WORK INJURIES IN LOGGING BY DETAILED AGENCY, CALIFORNIA, 1970

Agent	N In	o. of juries	Percentage
Hoisting, rigging, and loading equipment Choker Yarding equipment, n.e.c.* Shovel loader	:	90 59 25 6	10.2
Chemicals, hot or injurious substances Dust Poison oak Welding flash Dynamite		9 3 3 2 1	1.0
Machines Welding machine Other		8 2 6	0.9
Containers		<u>5</u>	0.6
Other agencies Insect Rock Binder, wrapper Brush Metal stock Tire Person injured (heart attack) Pipe Stock part Other		46 11 5 4 3 3 3 2 2 2 2 11	5.2
Agency not stated		<u>15</u>	1.7
]	lot a l	881	100.0

* not elsewhere classified Derived from reference 16

DISABLING WORK INJURIES TO FELLERS BY DETAILED AGENCY, CALIFORNIA, 1970

Agency	No. of Injuries	Percentage
Hand tools Chain saw Power saw, n.e.c.* Axe Other	<u>112</u> 90 15 2 5	40.9
Logs, trees, lumber Branch Log Tree Lumber	79 26 26 25 2	28.8
Working surfaces Groundoutdoors, n.e.c.* Tree, branch Log Staging	53 47 4 1 1	19.3
Chokers	12	4.4
Vehicles Tractor Log loader	5 4 1	1.8
Other	<u>9</u>	3.3
Agency not stated	<u>4</u>	1.5
Total	274	100.0

* not elsewhere classified Derived from reference 16

STATE OF MAINE 1972 INJURIES BY ACCIDENT TYPE LOGGING CAMPS AND LOGGING CONTRACTORS

Accident Type	No. of Injuries	Percentage	
Struck against/by	455	61.7	
Fall from/on	72	9.8	
Caught in/under/between	49	6.6	
Overexertion	43	5.8	
Contact with extreme temperatures	4	0.5	
Contact with substances by inhalation/ingestion/absorption	3	0.4	
Contact with electric current	0	0.0	
Motor vehicle accident	9	1.2	
Other	79	10.7	
Unknown/unclassifiable	23	3.1	
Total	737	99.8*	

* Not 100% due to rounding off Derived from reference 24

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PENNSYLVANIA WORK INJURIES LUMBER AND WOOD PRODUCTS, APRIL 1973

Туре	No. of Injuries
Striking against objects	25
Struck by objects	66
Caught in, on, or between objects	11
Falls on same level	4
Falls to different level	3
Slips (not falls) or overexertion	26
Other	1
Total (includes one fatality)	136

Derived from reference 26

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DISABLING WORK INJURIES IN LOGGING BY ACCIDENT TYPE AND AGENCY, CALIFORNIA, 1970

Accident Ťype	Total	Machines	Hoisting, Rigging, and Loading Equipment	Vehicles	Hand Tools	Chemicals, Hot, Injurious Substances	Working Surfaces	Logs, Trees, Lumber	Other or Agency not Stated
Struck by or striking against	386	1	46	15	171	_	18	117	18
Fall or slip	212	-	12	17	4	-	117	59	3
Accident involving moving vehicle	102	-	-	102	-	-	-	-	-
Strain or overexertion	85	2	18	8	23	-	1	12	21
Caught in or between	36	2	14	7	3	-	1	8	1
Foreign substance in eye	23	2	-	1	14	-	-	4	2
Other or accident type not stated	37	1	-	1	4	9	-	1	21
Total	881	8	90	151	219	9	137	201	66

Derived from reference 16

WORK FATALITIES* IN LOGGING BY DETAILED AGENT, CALIFORNIA, 1966-72

Agent		No. of Fatalities	
Trees, log, branches Tree Log Branch		60 36 18 6	
Vehicles Tractor Truck Log loader Road grader		32 18 8 3 3	
Hoisting apparatus Choker Haulback line Loading boom Yarding equipment, n.e.c.**		5 1 1 1 2	
Heart attack		<u>3</u>	
Heat stroke		<u>1</u>	
	Total	101	

A work fatality is: (1) a death for which a finding and award decision is issued by the Workmen's Compensation Appeals Board; (2) a death for which liability is accepted by the insurance carrier or self-insurer without an Appeals Board determination; (3) a death for which a compromise and release agreement is approved by the Appeals Board in which dependency is the sole issue; (4) a death for which the amount of the compromise settlement either equals or exceeds the commuted value of a findings and award.
** not elsewhere classified Derived from reference 16

TYPES OF ACCIDENTS INVOLVING CHAIN SAWS, LOGGING, 1970 (CALIFORNIA)

Accident Type	No. of Injuries
Saw kicked back	67
Struck by falling, flying branch, twig, splinter	31
Saw slipped while using	14
Strain in using, handling	13
Saw struck by branch	5
Saw slipped from grasp, n.e.c.*	5
Worker slipped, fell with saw, n.e.c.*	5
Hand slipped into saw	3
Chain jumped off saw	2
Other or type not stated	13
Total	158

Derived from reference 16

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Activity	No. of Injuries	Percentage
Falling tree	63	39.9
Limbing, trimming tree	42	26.6
Bucking log	34	21.5
Lifting, lowering, carrying saw	5	3.1
Thinning	5	3.1
Brushing out	3	1.9
Other or activity not stated	6	3.8
Total	158	99,9*

CHAIN SAW ACCIDENTS BY ACTIVITY OF INJURED WORKER, LOGGING, 1970 (CALIFORNIA)

* Not 100% due to rounding Derived from reference 16

MAINE LOGGING INJURIES, 1972 ANALYSIS OF MAJOR INJURY SOURCES

	No. of Powered Hand Tool Injuries*	Percent of Total	No. of Plant, Tree and Vegetation Injuries**	Percent of Total
Туре				
Struck by	170	87.3	157	78.5
Struck against	9	4.6	6	3.0
Bubbed/abraided	7	3 6	6	2 0
Overevertion	3	1.5	13	6 5
Fall	2	1 0	14	7 0
Caught in under hetween	1	5	- -	2 5
All others	3	15	1	2.5
AII Others	5	1.5	-	• •
Total	195	100.0	200	100.0
Nature				
Cut, laceration, puncture	184	94.5	27	13.5
Contusion, crushing, bruis	e 5	2.5	65	32.5
Fracture	3	1.5	36	18.0
Sprains, strains	3	1.5	33	16.5
Amputation	-	-	1	.5
Concussion	-	-	4	2.0
Hernia, rupture	-	-	2	1.0
All others	-	-	32	16.0
Total	195	100.0	200	100.0
Body part				
Upper extremitites	117	60.4	11	5.5
Lower extremities	61	31.0	49	24.5
Trunk	10	5.0	62	31.0
Head	6	3.1	58	29.0
Multiple parts	1	• 5	10	5.0
Neck	-	-	9	4.5
All others	-	-	1	0.5
Total	195*	100.0	200**	100.0

Accounted for 26% of all logging injuries Accounted for 27% of all logging injuries *

**

Derived from reference 25

QUEBEC LOGGING SAFETY ASSOCIATION INC.

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	1971		1972		197 3	
Accidents due to	251	(34%)	209	(30%)	320	(31%)
MECHANICAL DAW	231	(34%)	209	(30%)	520	()1%)
Mechanical saw injuries						
due to kickback	221	(88%)	185	(89%)	295	(92%)
Parts of body injured						
from mechanical saws						
Arms	25		26		46	
Elbows	1		1		1	
Wrists	5		1		4	
Hands	53		51		65	
Fingers	63		42		67	
Thighs, legs, & knees	63		54		90	
Feet	15		14		12	
Toes	2		3		5	
Ankles	-		1		-	
Skull	2		-		3	
Face	6		6		5	
Torso	1		4		8	
Multiple	15		6		14	
	251		209		320	
Type of work						
Felling	31		34		61	
Branching	113		92		124	
Bucking	60		45		87	
Clearing	11		9		20	
Piling	1		-		1	
Filing	2		-		1	
Skidding	2		1		-	
Repairing	-		2		-	
Other operations	1		2		1	
	221		185		295	
Injuries due to burns	2		2		4	
Total number of						
accidents reported	731		689		1,043	

From (DV Myles, written communication, January 1975)

FLORIDA LOGGING INJURIES BY AGENT, 1974 JANUARY-SEPTEMBER

Agent	No. of Injuries
Wheeled tractor	9
Shovel of backhoe	2
Hand tool, portable power tool,	-
or machine	5
Saw chain	129
Elevation, n.e.c.*	1
Drilling, boring turning machine,	
n.e.c.*	1
Machine, n.e.c.*, linotype	6
Cable, chain, rope	12
Trees or Limbs	62
Truck	18
Furniture	8
Lumber and timbers	76
Pole or post	2 '
Saw	1
Saw, circular	2
Hoisting apparatus, n.e.c.*	3
Belt conveyers	1
Conveyers, n.e.c.*. overhead trolley	1
Saw, table or jump	1
Metal object, fabricated, n.e.c.*	2
Nail, spike or track	$\frac{1}{2}$
Splinter wood	2
Flying particlewind blown	-
Splinter metal	1
Pick or mick ave	1
Wire not electrically charged	2
Drill	2
Hook no o *	2
Rolog herog containers-full	2
bales, boxes, containers-iuli	2
Or empty Brick hudlidge block and	3
Drick Dullding, Dlock, etc	D 2
Metal Stock	2
raper 100se, paper in cases,	,
rolls, etc	4

TABLE VIII-22 (CONTINUED)

FLORIDA LOGGING INJURIES BY AGENCY, 1974 JANUARY-SEPTEMBER

Agent	No. of Injuries
Glass, n.e.c.*	1
Tire of wheel	5
Pliers	1
Wrench	2
Drag line, crawler, crane	1
Pipe	1
Axe	4
Hammer	1
Sledge	1
Tracked vehicle or dozer	1
Chain hoist or chain blocks	1
Floors	3
Ground	15
Ramps, runways	1
Sidewalk	1
Working surface, n.e.c.*	10
Hand truck or dolly	1
Hose and pipes	1
Stairs or steps	1
Skid, pallet, flat	1
Bodily motion, n.e.c.*	10
Temperature/pressure abnormal	3
Gasoline	1
Fire, flame	2
Acids, n.e.c.*	1
Chemicals and poisons, n.e.c.*	1
Poisons, wood or vegetation	3
Poison, infectious agents, n.e.c.*	1
Infrared, ultraviolet	1
Locomotive	1
Grader or scraper	1
Miscellaneous	38
Total	485

* not elsewhere classified Derived from reference 17

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