Yarding Logging Safety

Oregon Fatality Assessment and Control Evaluation

Yarding Safety

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INTRODUCTION

Logging Hazards

Danger in logging is ancient. In the Middle Ages, according to a history of housing, when a Chinese emperor demanded wood for building from a forested province, the peasants "wept with despair until they choked." For every thousand people who went into the mountains in search of wood, the people said, five hundred came back.

Today, the fatality rate for loggers is far less than 50 percent. Heavy machinery and rigging systems help control the massive forces involved in moving logs from the woods; yet trees and logs, machines and rigging, still impose a heavy cost. Combining the frequency and rate of lives lost, direct logging occupations are the most hazardous work in Oregon.

This safety booklet tells the stories of 18 fatal incidents in yarding operations in Oregon over 6 years, 2003-2008, with accompanying safety recommendations. Fatal incidents in yarding indicate five hazard areas: rigging activities, the landing area, skidding machinery, helicopters, and transportation. Narratives of the incidents may help to remind loggers of the many activities where extra caution is necessary.

This booklet also presents an overview of seven elements in "Effective Logging Safety," bringing safety factors found in other fields into a logging context. Many detailed tasks, handling things and materials, must be learned in logging to avoid catastrophe. The seven elements address dispositions instead of things.

1. Management commitment
2. Planning
3. Supervision
4. Communication
5. Human Factors
6. Environment
7. Risk Management

The booklet also presents a summary of Oregon safety rules related to yarding, and information resources; and an example of a fatality investigation report by the Oregon Fatality Assessment and Control Evaluation (OR-FACE) program.

Information provided here is designed to promote safety in logging. Practical experience is necessary to make it work. Be sure to get hands-on training in the field with experienced loggers.

PERSPECTIVE

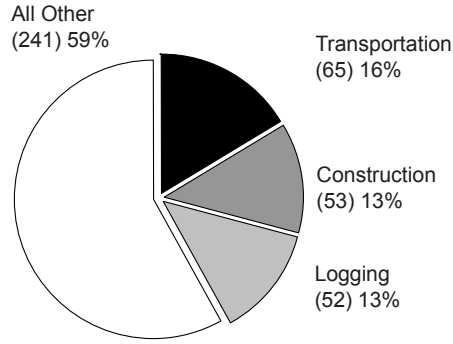
Yarding Operations

The large number of fatal traumatic injuries in logging make it one of the top three most hazardous industries in Oregon. Transportation incidents are most frequent; but the rate of fatalities in logging is much higher. During 2003-2008, 13% of all worker fatalities occurred in logging, among less than 8,000 workers, or 0.5% of the working population.

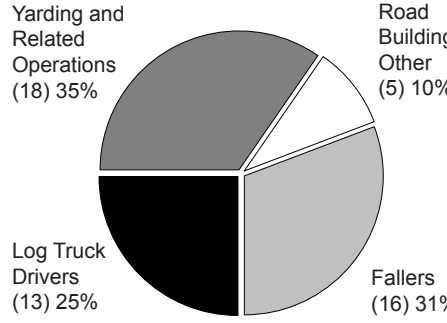
Among loggers over the 6-year period, about one-third of all fatal incidents occurred in yarding and related operations. Above one-fourth of all incidents involved fallers; another one-fourth involved log truck drivers. About 10 percent involved machine operators in road building or shop mechanics.

More loggers are involved in yarding than in other operations, and a larger number of injuries occur in yarding. An OR-FACE estimate of fatality rates in logging showed fallers and log truck drivers at highest risk – but particular jobs in yarding operations may be just as hazardous.

Worker Fatalities in Top Three Hazardous Industries, Oregon 2003-08



Distribution of Logging Industry Fatalities by Setting, Oregon 2003-08



Jobs in yarding include machine operators, workers hauling or towing machinery, rigging crews, chasers and other ground personnel at the landing, helicopter pilots, skidding machine operators, and mechanics. The distribution of 18 incidents in this booklet is inclusive: except for yarder and loader operators, all types of workers in yarding operations are represented by a fatality on the job.

Information Resources

OR-FACE investigation reports are available online for many of the incidents presented in this booklet. An abridged version of one report is reproduced at the end of this booklet (p.45). Find the complete report and other OR-FACE fatality investigation reports at www.ohsu.edu/croet/face

Oregon OSHA's ***Division 7 Forest Activities*** rules provide a valuable summary of safe work procedures in local logging. The rules codify the best knowledge available for safe practices, and industry experts continue to update the standards.

Additional information on best practices for yarding operations in the Pacific Northwest is available in the following sources.

The Oregon Forest Activities code covers many topics directly related to yarding operations.

- Safety and Health Program
- Planning, First Aid, and Work Conditions
- Personal Protective Equipment
- Tool Safety
- Roads, Flagging, Vehicles, and Flammables
- Rigging and Rigging Practices
- Machines
- Falling
- Yarding Operations
- Loading and Transport
- Unloading
- Helicopters
- Wildland Fire Safety
- Signaling Systems
- Tree Climbing

Division 7 text is available online at:
www.orosha.org/standards/div_7.html

Yarding and Loading Handbook
Oregon OSHA, 2010. Available online: www.orosha.org/pdf/pubs/1935.pdf

Cable Yarding Systems Handbook
WorkSafe BC., 2006 [Canada]

Best Practice Guidelines for Cable Logging
FITEC, 2000 [New Zealand]

Field Guide for Danger Tree Identification and Response
USDI Bureau of Land Management & USDA Forest Service, 2008.

Practical Methodology for Operational Layout of Commercial Skyline Thinning Systems
Oregon State University Forest Research Laboratory, 2004

OREGON 2003-2008

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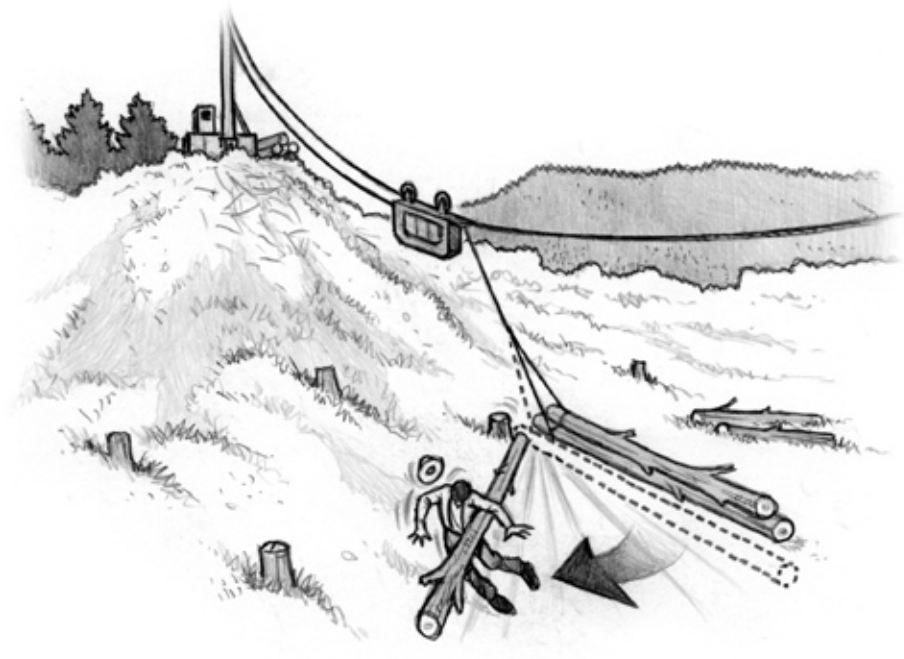


Yarding turn

Douglas County – Nov 2004

A 47-year-old logger, working as a chokersetter, was hit by a treetop in a cable logging operation, and died 7 days later. Working with a partner, the chokersetter may have been "crowding the rigging" – standing too close to the cable path as the yarder began to pull the turn of logs uphill. A small tree within the turn was being held down by another tree, and immediately as the turn moved, the treetop broke loose and hit the chokersetter in the stomach. He was admitted to the hospital with serious internal injuries and died 7 days later.

Swinging log in turn

Lincoln County – Mar 2008

A 30-year-old logger working as a chokersetter was killed while working under a skyline. He had just set a choker on a log and was not in the clear when the turn was lifted. The end of the log dug into a bank and the other end swung around and struck the logger.

Precautions

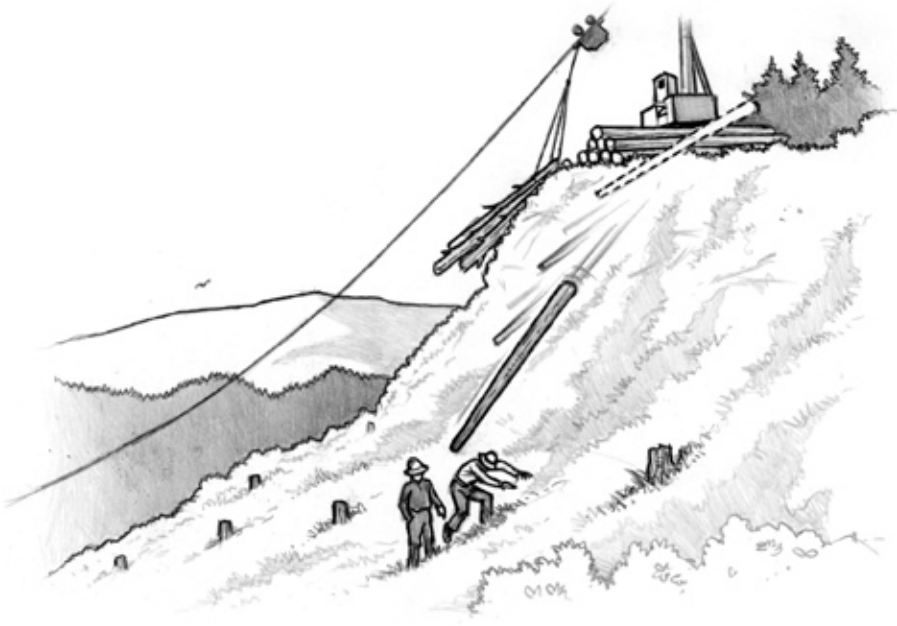
ALWAYS GET IN THE CLEAR BEFORE A LINE MOVES.

Get in the clear before any line begins to move. Account for the bight of the line and the length of the logs in the turn. Stand behind or to the side of the turn, and preferably uphill.

A COMPETENT PERSON MUST SUPERVISE AND COMMUNICATE WITH THE LOGGING CREW TO ASSURE SAFE WORK PRACTICES.

All operations at a logging site must be planned in advance. A competent person must evaluate and correct potential hazards to minimize danger to workers. Hold a pre-work safety meeting to discuss hazards in the specific situation. Determine in advance where workers should safely position themselves when a turn moves.

Rigging 3



Sliding pole

Lane County – Mar 2006

A 21-year-old inexperienced logger, working as a chokersetter in a yarding operation, was killed by a pole sliding down a hillside. The rigging crew had just hooked a turn of logs to the skyline and moved to a location in the clear of the turn being yarded, standing uphill and to the side of the turn. As the turn moved uphill, a narrow 41-foot-long pole with a sharp end came sliding downhill toward the crew. The pole narrowly missed the rigging slinger, who saw a flash of movement in the corner of his eye and leaned forward. The chokersetter, standing next to him, was struck and impaled by the pole.

Precautions

ON HILLSIDES, STAY ALERT FOR LOOSE OBJECTS.

On a steep hillside, gravity is the primary source of hazardous energy, endangering workers with rolling or sliding objects, and from slips and falls. In this incident, the crew had inspected the terrain far up the hillside to identify and stay clear of loose objects. The incident emphasizes the importance of staying constantly alert for moving objects.

MAKE SURE THE LANDING AREA IS LARGE ENOUGH TO KEEP LOGS FROM ROLLING OR SLIDING BACK DOWN THE HILL.

It could not be determined with certainty if the log in this incident came from the landing, but the incident emphasizes the importance of making sure the landing area is well planned and large enough to keep landed logs from rolling or sliding back down the hill. Workers at the landing area must ensure that the decking area and landing chute are stable and well maintained.

MAKE SURE WORKERS AT THE LANDING CAN COMMUNICATE WITH THE CREW ON THE GROUND.

Work out a signal in advance between the chaser and the yarder engineer on the landing, so if the chaser sees a log or other material go over the edge, he can alert the yarder engineer to blast the whistle. A long blast of the yarder's whistle can alert the rigging crew that logs or debris may be coming their way.

Rigging 4

Skyline cable

Lincoln County – Apr 2003

A 37-year-old logger, working as a hooktender, was struck and killed by a skyline cable. The hooktender and a coworker had pulled slack in the cable to reach a new tailhold. The two loggers were standing in front and within 15 feet of the new tailhold stump when the hooktender signaled to have the skyline pulled taut by the yarder. The cable was caught in a slash pile, but slowly continued moving until it broke free, whipped outward, and struck the hooktender in the chest. The hooktender had recently worked a record number of days in a row, and methamphetamine use was reported by the medical examiner.

Precautions

STRING LINES TO AVOID HANG-UPS.

The safest way to run a line is directly in lead from the yarder to avoid excess slack in the line and the risk of hang-ups when tightening the line. When changing roads, this means pulling the skyline back to the yarder and then out again to the new position. Jumping lines in a road change is usually quicker and easier, and is a common practice. This incident emphasizes the importance of using extra caution when jumping a line.

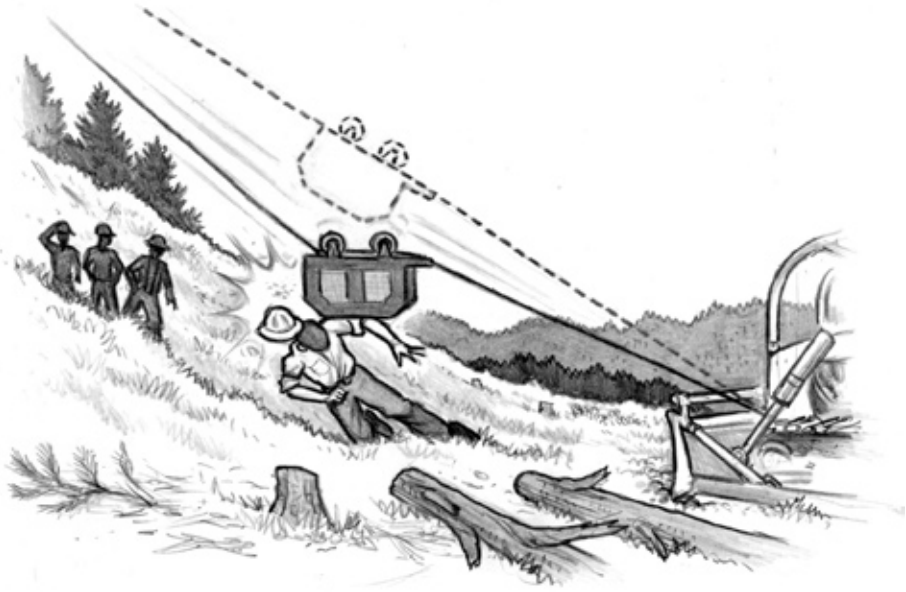
ALWAYS GET IN THE CLEAR BEFORE A LINE MOVES.

Stay beyond reach of the slack in a moving line, even when standing opposite the direction of movement. A line that breaks free of an obstruction can whip back nearly as far as it whips out. Stay behind the tailhold.

AVOID EXTENDED WORK SCHEDULES AND DRUG OR ALCOHOL USE DURING WORK HOURS.

Fatigue is a risk factor in occupational injuries, particularly for shifts longer than 8 hours and working more than 40 hours per week. Alcohol use or a binge the night before work can also reduce attentiveness. Methamphetamine use may actually improve performance for many hours during use, but once the stimulant effect wears off, the user is exposed to extraordinary fatigue, both mentally and physically. Habitual or excessive use of methamphetamine can produce disorientation and agitation, and in heavy long-term use, paranoid psychosis. In a hazardous work environment, the disruption of clear mental processes may be more dangerous than fatigue.

Rigging 5



Carriage return

Yamhill County – Jul 2006

A 45-year-old logger, working as a chokersetter, was killed in a skyline yarding operation when he was crushed by the skyline carriage. The logger was new to logging, 1 week on the job, and was working under supervision. The carriage returned down the skyline from the landing and as soon as the stop whistle sounded, the chokersetter rushed in to grab the chokers lying in the brush under the carriage. The carriage was 8-10 feet overhead and was still rolling a bit. The yarder engineer was just in the process of setting the mainline brake when the skyline suddenly slackened. The carriage dropped and crushed the chokersetter, killing him instantly. The medical examiner reported the victim's blood alcohol content at .02.

Precautions

SUPERVISE NEW WORKERS CLOSELY.

The majority of training in logging is performed on the job. New workers are assigned to work with individuals with experience. It is highly important that these trainers closely supervise new worker behavior and routines. For competency-based training, first discuss the ideas and reasons for a task to be done a particular way, then show the task, have the trainee do the task under supervision, and continue supervision until the task is done appropriately. Recheck all workers regularly, and new workers more often.

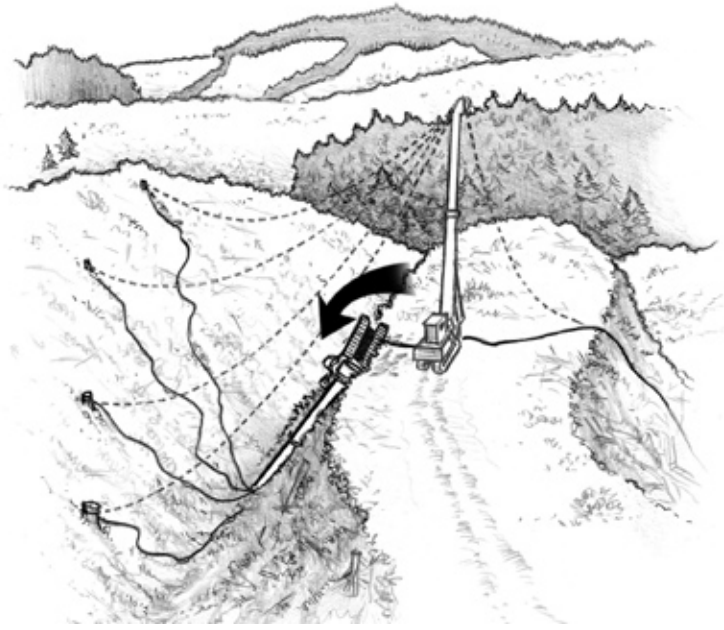
ALWAYS STAY CLEAR OF RIGGING.

The rigging crew must not approach the rigging until lowered and stopped so the chokers stop swinging. Even then, never trust suspended rigging and never stand directly under it. In this instance the chokersetter was too quick to the rigging, but other causes produced the sudden drop of the carriage: not a faulty brake, but possibly one or both of the following two conditions.

HUNG-UP LINE – The skyline in the setup was draped across several small logs on the back end of the unit. A log could slip and allow the skyline to drop, or the skyline could dig into the log, so slack builds up behind it and falls suddenly after the rigging is already stopped. Report hang-ups at once to the rigging slinger to keep lines clear.

EQUIPMENT TAIL ANCHOR – The skyline tailhold in the setup was a parked bulldozer, which must be set up carefully to work as an anchor. The skyline was disconnected from the bulldozer and respooled that morning, because of problems spooling on the yarder drum. The bulldozer could have been moved and was less secure, or turned out of lead with the skyline road, or the line once reconnected was not tightlined to clear small hang-ups, like a fouled strap or shackle or branch in the way.

Landing 1



Yarder collapse

Washington County – May 2006

A 23-year-old inexperienced logger, working as a chaser, was killed when a yarder tipped over and crushed him. The crew was setting up the yarder on a new landing and was in the process of tightening the guylines. The chaser and the siderod (site foreman) worked together to spool the guylines onto guyline drums at the rear of the yarder. The chaser worked on the deck of the yarder on the top two drums, while the siderod worked from the ground on the bottom two drums. As the fourth and final guyline was being spooled, the siderod heard a coworker yelling, and saw the man motioning with his arm over his head, indicating the yarder was going over. He took off running and just made it past the tracks when the yarder toppled backward over the steep hillside. Still on the deck of the yarder, the chaser ran toward the cab in an attempt to get inside, but did not reach it before the yarder went over. The yarder operator inside the cab emerged with minor injuries.

Precautions

USE EXTRA CAUTION WHENEVER LOADS APPROACH THE TOWER'S MAXIMUM CAPACITY.

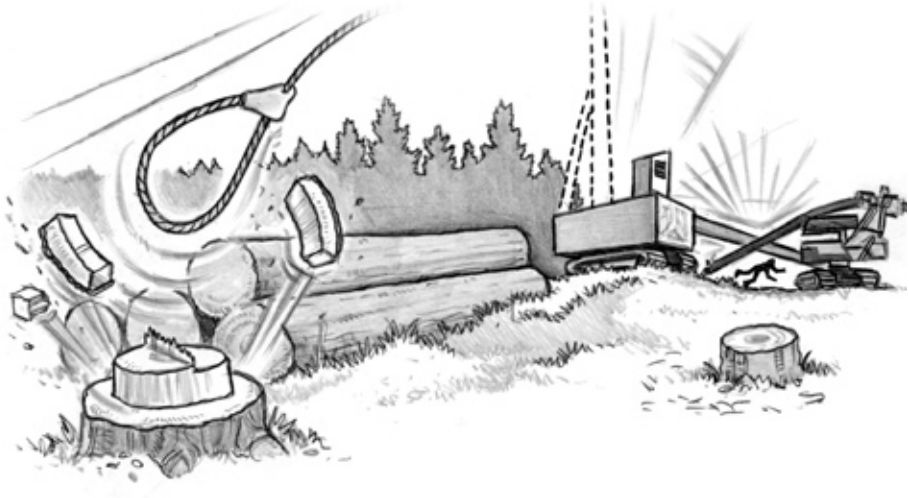
Most important in tower stability, make sure the yarder is on a solid, level foundation, and that guyline angles are no greater than 50 degrees measured horizontally (or as recommended by the machine manufacturer). The flatter the angle, the greater the stability. In addition, this incident draws attention to the distance of the guyline anchors from the yarder as a risk factor in tower stability. A longer guyline produces more cable weight on that side of the tower; and a fully extended cable empties the guyline drum and greatly increases torque on the line when the guyline is being drawn taut. Snap guylines on the front of the yarder can offset the extra weight. Follow model setups provided by the yarder manufacturer.

CONSIDER LEAVING THE GUYLINE LOCKING DOGS OUT DURING INITIAL SPOOLING.

The dogs need to be locked during the yarding phase of the operation to prevent the guylines from unspooling when a load is placed on the skyline, but it is generally not necessary to lock the dogs during the initial tightening of the guylines. In this instance, if the dogs had not been in the locked position, the operator might have been able to dump the guylines and prevent the tower from going over.

TRAIN NEW LOGGERS TO STAY ALERT FOR HAZARDS AND BE PREPARED FOR INSTANT RESPONSE.

Landing 2



Anchor failure

Polk County – Apr 2003

A logger working as a chaser was killed while standing on a landing site in front of a delimber. A nearby yarder was in the process of completing a turn on a cable-logging operation, when two of the four stumps used to secure the tower's guylines failed. The yarder tower lost stability and fell on the boom of the delimber, sheering off a sheave (cable pulley guide) from the front of the boom. The sheave fell and struck the chaser on the head.

Precautions

PLAN THE LANDING SITE FOR YARDING REQUIREMENTS BEFORE FALLING OCCURS.

Sufficient stump height for guyline anchors must be available around a landing site. In this incident, one guyline was evidently attached to the bowl of the stump, with not much room above the notch, which may have contributed to the guyline pinching off the top of the stump and coming loose.

SET GUYLINES AT NO MORE THAN A 50-DEGREE ANGLE, IN PROPER GUYLINE ZONES, AND EQUALLY SHARING THE LOAD.

An angle steeper than 50 degrees puts more downward pressure on the tower, which can cause the tower to buckle on a heavy load. If guylines must be rigged steeper than 50 degrees, back off on turn size. Use tie-back anchors or other additional support for anchors if necessary.

CHECK THE INTEGRITY OF THE GUYLINE ANCHORS DAILY, BEFORE AND DURING OPERATION.

Do not attempt to continue logging operations if an anchor stump/tree shows signs of failure.

MAINTAIN PROPER DEFLECTION IN THE SKYLINE TO REDUCE STRESS ON THE YARDER TOWER.

Landing 3

Runaway Pickup

Clatsop County – Sep 2004

A 28-year-old hooktender was killed on an active logging site by a pickup truck. The incident was not witnessed. The pickup was discovered on a slight incline, with the hooktender pinned underneath it. The transmission was in neutral. Apparently the engine stalled, and the hooktender may have been underneath working on the starter, or had attempted to push the vehicle. An hour before the incident, the starter failed and the pickup had to be push started. The victim was reportedly aware that the parking brake on the pickup was not functioning properly.

Precautions

DO NOT STAND IN THE FRONT OR REAR PATH OF A VEHICLE THAT IS RUNNING, AND AVOID THOSE POSITIONS EVEN WHEN A VEHICLE IS PARKED.

SHUT DOWN THE ENGINE BEFORE EXITING A VEHICLE, AND ENGAGE THE PARKING BRAKE ON AN INCLINE.

Unexpected movement of a parked vehicle is a common source of injury. Always shut down the engine before exiting, and stabilize the wheels. Fix a faulty parking brake immediately.

BLOCK TIRES BEFORE WORKING BENEATH A VEHICLE.

YOU ARE NOT A SUPERHERO. DO NOT TRY TO STOP A ROLLING VEHICLE WITH YOUR BODY.

Landing 4

Warming fire

Coos County – Jan 2006

A 37-year-old field mechanic for a logging company was killed when he tried to stoke a warming fire by pouring gasoline on it. The mechanic and a coworker arrived at a logging site at 7 a.m. to perform maintenance on a log loading machine. The weather was cold and rainy, and the coworker started a warming fire, using a combination of diesel fuel and chainsaw gasoline. The coworker left to call for parts on a cell phone, and when he returned about 15 minutes later, he found the mechanic lying 35 feet from the warming fire, engulfed in flames. Another fire, about 20 feet away, was a burning plastic gasoline container.

Precautions

NEVER USE GASOLINE OR SAW GAS NEAR AN OPEN FLAME.

Gasoline quickly vaporizes and becomes explosive. Diesel fuel alone can be safely used to start a fire, but may fail in wet conditions. A mixture of diesel and gasoline (3:1 or 4:1) is acceptable to start a fire, but should not be used to stoke a fire without an authorized drip torch. Always store fuel in approved containers.

USE APPROPRIATE MATERIALS TO SAFELY START AND STOKE A FIRE.

Plan ahead to avoid the use of any liquid fuels. Stay equipped with waterproof fire sticks or solid fuel gel to start and stoke warming fires.

EMPLOYERS SHOULD TRAIN EMPLOYEES ON SAFE PROCEDURES FOR STARTING AND STOKING FIRES.

Emphasize the extreme hazard of using gasoline on a fire.

Skidding Machinery 1

Bulldozer choker

Coos County – Sep 2004

A 52-year-old ranch hand was killed during a logging operation while operating a D4E Caterpillar to skid logs to a landing. The ranch hand was an experienced logger. With the engine left running, gear in reverse/neutral, parking brake set, and front blade raised about 1 foot off the ground, the ranch hand was setting chokers to logs behind the bulldozer. The bulldozer was on a slight incline and the tracks were on branches. As the ranch hand leaned down, the bulldozer dislodged and slid backward. The victim was killed instantly.

Precautions

BEFORE EXITING A BULLDOZER, THE MACHINE OPERATOR MUST APPLY THE BRAKE AND LOWER THE FRONT BLADE TO THE GROUND.

NEVER RELY SOLELY ON THE BRAKES OF A BULLDOZER TO PREVENT MOVEMENT.

STAY ALERT TO CONDITIONS WHERE BULLDOZER TRACKS MAY BE UNSTABLE.

PLAN AHEAD.

Develop a site-specific safety plan that includes an assessment of hazards and actions to minimize risks.

Skidding Machinery 2

Towing hook

Clackamas County – Mar 1979

In 2005, a former heavy equipment operator for a logging company died from a seizure resulting from a head injury that occurred 26 years earlier, in 1979, when he was age 21. The operator was struck in the face by a towing hook when cable rigging failed while pulling heavy equipment from the mud at a logging site. The injury left him legally blind and subject to grand mal seizures. The seizures were well controlled by twice-daily medication. He apparently missed taking his medication for 2 days.

Precautions

SELECT AND USE APPROPRIATE HOOKS AND OTHER RIGGING FIXTURES TO PREVENT LOADING BEYOND THEIR STRUCTURAL CAPACITY.

IN A TOWING OR LIFTING OPERATION, WORKERS SHOULD BE REMOVED FROM THE HAZARD AREA OR GUARDED FROM THE REACH OF THE RIGGING IN THE EVENT OF FAILURE.

THE WORKSITE MUST BE INSPECTED DAILY BY A COMPETENT PERSON TO DETECT AND CORRECT HAZARDS, PARTICULARLY THOSE RELATED TO EXPECTED LOADS ON EQUIPMENT.

Skidding Machinery 3

Skidder passenger

Klamath County – Oct 2005

An 18-year-old logger working as a skidder operator was killed when he fell off a moving skidder while riding as a passenger on the step outside the cab. At the end of a 10-hour workday, the operator parked his own skidder and rode outside a coworker's skidder up a dirt skid road to retrieve a fuel truck to the landing site to fuel the machinery there. On the way, he fell off the skidder and was run over. The victim died at the scene shortly after the arrival of first responders from the local fire department.

Precautions

NEVER RIDE AS A PASSENGER ON A MACHINE UNLESS AN APPROPRIATE SEAT AND OPERATOR RESTRAINT SYSTEM IS AVAILABLE.

EMPLOYERS MUST DEVELOP A FORMAL TRAINING PROCESS FOR OPERATORS OF MOBILE MACHINERY, INCLUDING WRITTEN DOCUMENTATION AND REGULAR EVALUATION.

Over time, poor training and bad habits can creep into work practices. A formal training process with written documentation helps keep both workers and employers accountable to maintain safe practices.

Skidding Machinery 4

Skidder off road

Curry County – Sep 2008

A 54-year-old logger, working as a skidder operator, was killed when the skidder went over a steep embankment. The operator was working alone on an unimproved road at a logging site. The skidder toppled about 60 feet down the embankment. The victim was ejected, and was found dead at the scene a few feet above the skidder.

Precautions

WORKERS MUST BE TRAINED ON EACH SPECIFIC MACHINE BEFORE OPERATING.

All makes of a machine operate a little differently. In this incident, the operator was in an older machine than he was used to running. Possibly, he stalled the machine and lost his brakes. On the newer machine, the transmission would have gone into park if it stalled. Also, the steering on the older machine was not as responsive when going in reverse (he was backing when the incident occurred). The steep grade of the road challenged the operator's ability to control this particular machine. Train first in safe conditions.

WEAR THE SEATBELT WHEN OPERATING EQUIPMENT, PARTICULARLY WHEN WORKING ON STEEP GRADES.

Retrofit kits are generally available for older machinery.

Helicopters 1-2

Helicopter steep terrain

Douglas County – May 2004

A 41-year-old helicopter pilot was killed during a logging operation in a steeply sloped, tree-covered terrain. The helicopter was in a hover, attempting to snag a log using a 200-foot line, when it drifted sideways and the right main rotor struck tree branches. The helicopter then rolled out of control and descended to the ground. The pilot, a resident of Australia, had extensive experience as a helicopter pilot. The steep terrain evidently reduced the safety margin for the length of the line over the treetops.

Helicopter gear shaft

Grant County – Mar 2006

A 39-year-old helicopter pilot in a logging operation was killed when the helicopter developed engine trouble and crashed. The pilot was experienced in helicopter yarding operations in logging. Just after dropping off a load of logs from a 200-foot line, the pilot communicated that he needed to return to the service area. Witnesses heard a loud whining noise before the crash, about halfway to the service area. No entanglement was evident from the dangling line from the helicopter. Investigation revealed an improperly assembled roller bearing in the engine gear shaft, resulting in damage to the shaft and gear teeth.

Precautions

STAY ALERT TO THE SITUATION.

Goal fixation is a common problem when working in a hazardous environment. Always stay alert to the overall situation. When working on a slope, consider positioning the helicopter with the nose toward the treeline to afford a better view of the obstacles. Working above steep ground gives a false sense of altitude, and makes it more difficult to maintain a safe minimum distance.

DRILL IN ADVANCE TO PREPARE FOR POSSIBLE ENGINE FAILURE.

Reaction time is the key issue when the engine fails. Autorotation of the rotor blades to control the descent is possible only within the first few seconds after power is removed. Training in advance helps to make an automatic response. Muscle memory can override a troubled thinking process.

ALWAYS KNOW YOUR ESCAPE ROUTE.

Difficult terrain or populated areas complicate the decision for an emergency landing, and can delay reaction time in an emergency. Orient to each new setting and where to go in the event of power loss.

Transportation 1

Backing log truck

Marion County – Apr 2007

A 72-year-old logger directing traffic at a logging site was killed when a log truck backed over him. The logger was controlling road access through an active falling zone. After the logger waved through two empty log trucks, the rear truck stopped as a noisy skidder passed along the road from the opposite direction. The driver of the stopped truck decided to back up to talk to a person behind him and ran over the logger directing traffic, who was standing behind the vehicle.

Precautions

MACHINERY OPERATORS AND TRUCK DRIVERS ON A LANDING MUST SEE WORKERS ON THE GROUND ARE SAFE BEFORE MOVING.

Workers on the ground in a busy work environment may not always stay alert to vehicles moving around them. Operators must look to confirm workers are safe before moving, and signal their intentions. This incident emphasizes the importance of enforcing this rule for log truck drivers on the landing as well. Always communicate to other workers before making an unusual movement that breaks from routine.

STAY CLEAR OF OPERATING TRUCKS AND MACHINES.

Always signal an operator and get acknowledgement before approaching an operating machine or truck. Landing workers must keep to set positions where operators know where to look for them. Never work in the blind spot of a truck.

FLAGGERS SHOULD WORK WITH A STANDARD PADDLE TO DIRECT TRAFFIC.

Transportation 2-3

Loaded yarder

Lane County – Sep 2004

A 42-year-old truck driver was killed when the surface of a logging road gave way under his heavily loaded truck and lowboy trailer. The driver was hauling a yarder to a new location and took an alternate route to avoid a weight-restricted bridge. A second truck was attached by a cable strap to help the rig climb a steep incline. The narrow road gave way under the right rear tire of the trailer, and the rig was pulled over the edge. The cab was raised high in the air and the cable strap disengaged. The truck rolled once before coming to rest 30-50 feet down the embankment in an upright position. The victim was ejected and pinned beneath the wheels.

Unsecured boom

Klamath County – Dec 2003

A 36-year-old log truck driver was killed while passing an oncoming truck transporting a log loader. The boom of the log loader had not been adequately secured, and it swung outward into the oncoming lane just at the moment of passing. The cab of the log truck driven by the victim was completely shorn off.

Precautions

PRE-DRIVE THE ROUTE INTO A LOGGING UNIT TO PREPARE FOR HAZARDS.

The heavy weight of yarding equipment makes off-road driving extremely hazardous. The truck operator must know the road conditions firsthand, and should drive the route in advance to prepare for problems with steep grades, load-limited bridges, tight corners, weak subgrades, or overhead hazards. An assist vehicle is critical on slopes to control movement. Use extra caution in tight road areas, go very slow, and stay in the center of the road. Only an experienced driver should transport logging equipment. Check equipment beforehand to ensure everything is in good condition.

USE ADEQUATE TIEDOWNS TO SECURE LOADS.

Know and follow required procedures to secure loads on log trucks and equipment transport. Internal brakes on a machine should never be relied upon to control movement.

SEVEN ELEMENTS IN

Effective Logging Safety

The stories of loggers described in the preceding pages involve yarding operations and equipment, with specific precautions in circumstances only a logger is likely to experience: looking to avoid a sliding log or swinging cable, close encounters with trucks or mobile machinery, or hauling heavy equipment on a poor mountain road at a slow walking pace.

In Oregon, many specific safety rules for logging are well rendered in Oregon OSHA's, *Division 7, Forest Activities*. Reviewing the preceding incidents, however, it occurred to us that logging safety shares essential principles with work safety in general. Sometimes these essential principles are mentioned in one or another section of occupational safety rules, but not always. Best practices may cover additional areas of concern that rules do not require.

Following are seven essential elements in worker safety, brought together as a plan, roughly in order of importance, and adapted to a logger's perspective, including management commitment, planning, supervision, communication, human factors, environment, and risk management.

1. Management Commitment

Safety starts at the top. This is the most important step in workplace safety.

Owners and managers have a central role, and responsibility, to provide a safe work environment. Following are a few action points where management commitment makes a critical difference for safety.

Safety and health plan. A company must develop a written, comprehensive safety and health plan; and most important, the written plan must then be implemented by the owner and authorized supervisors at the worksite in the forest.

Does the site actually have available the necessary supplies for first-aid, fire suppression, equipment maintenance, and communications? Are competent persons supervising the operation?

Know and apply Oregon OSHA and company safety rules, so they become second nature.

Share knowledge. Communication is the key to success. Share what you know, and encourage coworkers to share knowledge and perspectives, too. Establish monthly safety meetings, as well as regular tailgate meetings prior to work. Encourage open dialogue for all members of the crew, regardless of rank.

Make safety work. Help workers adopt safe practices and consider safety part of the work day: yarder operators check the equipment and anchors daily; chokersetters stay in the clear on a carriage return and avoid "crowding the rigging" to make a faster turn; a chaser stops to signal the loader operator before passing through the work area. Owners and supervisors influence the pace of production. Set a standard by including hazard assessment and other safety requirements in the original planning of the logging unit.

Attention to safety takes time, and therefore adds costs to production every day. There may be a good economic argument to include safety in production for maximum efficiency – considering skilled worker time lost, insurance rates, or fines – but however the sum works out, safety counts on its own. No one wants a serious injury or death as part of their workday, for self or others. Include safety in all planning, and adjust the pace of production to include safe work practices.

2. Planning

Effective planning minimizes risks. One estimate suggests that 70 percent of accidents occur due to poor planning . A planning checklist should include the following key points.

Planning the unit

Hazard assessment. Pay attention to unique features of the unit and identify specific hazards, such as standing snags, rock outcroppings, stream buffers, or power lines. Determine ways to avoid or eliminate identified hazards in the work areas.

Weather. Consider how weather may impact the operation, and particularly the roads. Snow, wind, and rain can produce a treacherous environment.

Landing Locations. Identify optimum landing locations and potential secondary

Effective Yarding Safety (continued)

landing locations in the unit. Account for available equipment, yarding distances, payload, and anchor points. Plan for maximum deflection.

Landing size. Calculate the required minimum area for equipment, landing chute, decking, and loading areas.

Haul roads. Anticipate the interaction between haul roads and logging processes. Consider the entire haul route. Control access when necessary.

Timber falling. Determine the method of falling. Have the faller crew clearly identify any danger trees left standing with bright hazard ribbons.

Anchor requirements. For each potential landing, evaluate the available anchors and determine if additional equipment or anchors will be needed.

External communication. Confirm external communication links and make emergency plans for each proposed landing in the unit. Make sure all workers are informed of emergency procedures. Print directions with the identified route and location in an emergency kit placed near the external communication link.

Internal communications. Determine necessary equipment for the particular unit, including radios, horns, and whistles. Register the radio with Oregon OSHA to ensure frequency and tone do not overlap with other operators working in the area.

Pre-work safety meeting. The importance of communication is too often underestimated. Workers with expertise in different aspects of logging operations may be able to provide useful options

PRESERVE ANCHOR STUMPS

Alert fallers to preserve support trees that may be needed in the skyline corridors. Also, inform mechanical feller operators to preserve anchor stumps around potential landings. Mechanical fellers typically cut timber close to the ground, which eliminates the possibility of using those stumps for anchors.

and practical advice; and everyone together needs to become familiar with the particular hazards identified in the unit and how they will be eliminated or controlled. The pre-work meeting gets everyone thinking about safety before work begins, and allows the landing and rigging crews to collaborate as a team. Discuss emergency communications and response at the meeting.

Landing Setup

Loggers arriving onsite conduct the actual layout of the landing, involving the following planning points.

Layout. Evaluate the size and volume of timber to move through the landing. Tree-length logging requires much more room than cut-to-length. High volume and sorting requires additional log decks and a surge area.

Payload. Observe how slopes and deflection will affect logging. Analyze the payload and the worst scenario to determine how much wood can be safely loaded onto the skyline.

Anchors. Locate available guyline stumps or suitable alternatives for the expected yarder locations.

Road order. Plan road changes in advance. Usually, skyline roads work away from the landing entry road to give the loader and log trucks more room as logs accumulate. The rigging crew should always log from the top of a hill to the bottom, so logging never occurs beneath an unlogged area.

Equipment zones. Ensure that every piece of equipment has an independent zone of operation. Avoid or control areas where equipment crosses or may impact other equipment or workers.

Safe work area. Include all workers in the planning process to maximize input and ensure that everyone understands the operational organization. Communication at this stage is essential to safety. Before moving in, assess the stability of elevated areas around the landing; clear hazards and loose materials.

Equipment Inspection

Before setting up the yarder, a competent person must inspect all machinery, spar, rigging, cables, blocks, shackles, and tools, and make repairs or replace defective equipment. Checklists are available for yarders and other machinery. In all cases, read and follow the manufacturer's specifications.

Effective Yarding Safety (continued)

3. Supervision

A competent person or persons must supervise all aspects of the logging operation, from planning to active logging. Once logging begins, supervisors must make sure all daily and periodic checking and correction are made to equipment, anchors, and work behavior.

Logging is complex and training ongoing. Supervisors and experienced loggers should share knowledge and reinforce best safety practices.

Training the Trainer

On-the-job training is a typical way to learn new skills. Loss of an expert knowledge base in logging currently makes training more difficult. A supervisor must remain aware that trainers can pass on bad habits as well as good, or trainees can misinterpret instructions. Recheck learned skills in practice to directly observe competence before clearing a worker for a particular job.

New Workers

The forest environment and the large forces in logging can produce unpredictable dangers. New workers are likely to get absorbed in the challenge of doing a job well; but to stay alive, a logger must also be constantly alert and immediately responsive to communication signals from coworkers. Supervise new workers closely in the first month, and again after 6 months, when recorded injuries tend to rise again (early confidence apparently breeds carelessness). Note that Hispanic workers, in particular, may be culturally attuned to risk everything for the job.

Curb goal fixation to improve situational awareness. Pay close attention to safe practices, and emphasize safety as part of the work.

4. Communication

Competent authority is essential at a logging site to make critical decisions and lead the crews; but the hazardous environment also requires free input from all to question authority or question what is misunderstood, and share knowledge and individual perspectives. Communication for safety is important in many work situations, especially in relation to mobile machinery and workers on the ground nearby. In any nonroutine situation, a worker should inform nearby coworkers of intended actions. Communication is

particularly important if a coworker is not visible or has attention elsewhere.

Teamwork

Communication exercises relationships and helps build a crew into a team. Periodic tailgate meetings provide an opportunity to share knowledge about planned procedures, hazards, and other issues.

Encourage a culture where each worker has a voice and looks out for others. Every worker should have line-stop authority.

Crew Resource Management

Communication among team members is often obstructed by concerns for hierarchy or personal attitudes. Currently in Oregon, old-school loggers often work alongside a new generation of loggers, and disharmony is known to arise that brings the two sides to talk as little as possible to one another. But communication is critical.

A communication model from aviation – crew resource management – may be useful. The model was developed to manage errors in flight, encouraging the crew to supplement the training and skills of the pilot. Any crew member is encouraged to speak up, with the assurance that conflicting views can be discussed and resolved. Working out the dynamics of authority and teamwork can be difficult to achieve in an active and dangerous environment, but the element of teamwork will improve crew performance.

Foreign-born workers with poor English skills must be trained in their own language, and a person to do this should be available before hiring. The principal problem in this area is not the foreign language itself, but shyness due the language barrier, which may also affect other workers, for other reasons. Encourage all workers to speak up and participate as a team.

One method to encourage participation is to rotate who leads the discussion at daily tailgate meetings before work begins. Taking a lead helps a worker think about and adopt safe practices.

5. Human Factors

Selecting loggers for a crew is critical for a safe and productive operation. Skills count, but also aptitude, judgment, and personal characteristics. Poor judgment or inability to work as a team could disqualify a new logger right away; but even with a good crew, ongoing attention is important to detect loss of aptitude or attentiveness due to personal factors – mainly related to the following issues.

Vitality. A logger can be distracted by lack of food or water, or being cold and wet.

Effective Yarding Safety (continued)

To keep up with demanding work, keep workers comfortable as well as possible.

Fatigue. Fatigue is often suspected in occupational fatalities. Extended work hours are a primary cause, associated with increased injury rates and deteriorating performance. Factors outside work can also contribute to fatigue. Long commutes, for example, are common.

Drugs. Use of alcohol or marijuana during work hours is forbidden, of course; but alcohol can also produce debilitating fatigue from a binge the night before. Workers should avoid a binge prior to an early-hour work morning.

Workers in demanding occupations may be more drawn toward methamphetamine, which can improve performance for many hours during use. Habitual or excessive use of methamphetamines, however, can produce disorientation and agitation, and in heavy long-term use can result in paranoid psychosis. Once the stimulant effect wears off, a user is exposed to extraordinary fatigue, both mentally and physically. Beware of any drug use that may increase worker risk while logging.

Family issues. Family issues, debts, and other sources of stress can distract a worker. Check the mood of crew members to be sure no one is distracted from the tasks at hand. Workers may not willingly accept help – may insist on working for the extra pay or the time away from home. A supervisor will need to make a timely decision when intervention is necessary to ensure the safety of that one person as well as others in the crew.

Generational differences. Age is a commonly observed factor in work behavior in logging. Old-school loggers, typically raised in a rough-and-tumble world of hard knocks and years of experience working in the woods, are different from the new generation of loggers, who probably never had it so hard and may expect to advance just by showing up. When selecting a crew, make sure younger workers will fit well with older workers. Divisions in a crew due to personality clashes for any reason can hurt performance and safety for everyone.

Learning styles. Individuals learn at different rates. Some will catch right on; others will struggle and need several attempts at a task. Supervise new workers closely to confirm proficiency.

6. Environment

Weather and ground conditions can ruin a good setup. Consider the following precautions.

Rain. Rain can slow down a rigging crew, due to bulky clothes or rain gear that restrict movement. Try to stay warm and dry to avoid stress, which reduces alertness. Warming fires are common to keep hands from freezing.

Slips, trips, and falls are the most common source of injury. In rain-slick conditions, take extra care walking on slopes, logs, and machinery.

Inspect the yarder cribbing, anchors, and slopes for slides. Chokersetters should be alert for hazards with sliding logs or other materials that appeared stable when dry. Look for signs of loose trees or stumps. Report suspicious signs at once.

Fog. Low visibility impairs the ability of the rigging crew to stay clear of the bight of the line and other hazards. Additional communication systems can be organized to work in fog, but on steep ground work must stop if the crew cannot see loose logs, rocks, or stumps. Wait for visibility to improve.

Snow. Skyline yarding in heavy snow is typically impractical, nonproductive, and hazardous. Workers must be extremely cautious. Caulks pack with snow, and walking on logs can be impossible. Workers quickly tire sloshing around in heavy clothing. In case of emergency, rescue services may be unable to reach the site. Light snow also produces hazards for the rigging crew. In moderate conditions, it may be possible to load trucks off the landing, but hazards for workers remain a concern.

Electrical storms. The tower and rigging lines make for a great lightning rod. Stop work and get away from standing timber, equipment, and corner blocks.

Hot and dry conditions. Fire is a big concern. Apply all recognized fire-prevention procedures. Make sure lines are not rubbing, blocks are well greased and turning, and brush is cleared out from around blocks. Do not set a power saw in brush that could easily ignite. Be prepared to activate a firefighting plan in case a fire does occur.

Worker fatigue is also an issue. Drink plenty of water and increase salt intake to avoid cramping up. Know the signs of dehydration, heat exhaustion, and heat stroke. Wear adequate clothing to avoid sunburn or sunstroke.

Effective Yarding Safety (continued)

7. Risk Management

Risk management involves paperwork. Document activities as you go to be able to learn about trends and improve safety through feedback and discussion with the crew. Consider the following main points.

Maintenance records. Keeping records for machine maintenance is not required in logging, but is a good idea to track performed work and to schedule when worn parts need to be replaced. Timely preventive maintenance avoids failure, down time, and possible injury.

Employee records. Documenting worker training is required, particularly for those operating machinery. Records confirm that training is conducted and tracks individual work performance. Evaluate workers regularly.

Accident investigation. A company safety and health program must include resources to investigate and follow up on worker injuries. Discuss incidents and near misses with the crew and solicit input. Worker stories of near misses, which are not recorded, may provide useful perspective to identify and control hazards.

Workers' Compensation claims. Keep records for Workers' Compensation claims to observe trends and spot problems. Review injury claims to identify areas that may need attention. Insurance rates can eat into profit. Properly managing workers and worker safety can make a huge financial impact for a company.

Logger killed by falling sheave when yarder tower collapses

OR-FACE 2003-06 Investigation Report First published October 2005

INVESTIGATION

When guyline support failed, the yarder tower fell onto a nearby delimber (right).

On April 18, 2003, a 42-year-old logger, working as a chaser, was killed when a yarder tower collapsed during a cable yarding operation. The chaser had been on the job 6 weeks. The chaser's regular duties included unhooking the turns of logs that were yarded onto the landing, and also bucking and limbing logs that the delimber could not handle. At the time of the incident, the chaser was standing to the front left of the delimber, near the cab. The position was considered a safe spot on the landing.

The crew was sending in a turn of four tree-length logs when the logs hung up on a stump. With the sudden stress on the yarder tower, the back-right guyline came off of its stump, which increased pressure on the next stump, and that guyline came off as well. With two guylines down, the other two guylines could not hold the tower upright.

The tower fell forward in the direction of the turn, striking the boom of the delimber operating in front of the yarder. A sheave located midway along the boom, attached by a solid steel pin, sheared off. The sheave fell and struck the chaser on the head, and punched through his hard hat.

Tower stability in a skyline yarding operation involves several primary factors: skyline deflection, skyline braking, and the size of turns and anchorages. It is unclear if the tower failure in this incident was the immediate result of the tower setup, or in the guyline setup. An engineering failure analysis would be necessary to isolate the initial cause of the incident.

The employer believed the skyline deflection on the setup was appropriate for the size of trees in the turns and for the loads exerted on the skyline, while OR-OSHA called the deflection "minimal."

The two anchor stumps that failed were both 20-22 inch dbh Douglas fir. The

third and fourth anchors were guyed off to notched stumps and double-tied back to green trees. The employer reported checking the anchors daily for signs of failure. One logging expert consulted in this investigation believed the notch cut into the first stump was in the root swell and not in the holding wood, and this may have contributed to the anchor failure.

SAFETY RECOMMENDATIONS

1. Plan the landing site beforehand.
Make sure nearby anchor stumps are left at an appropriate height to secure guylines, and the guylines will not interfere with decking the logs at the landing. In this incident, one guyline was evidently attached to the bowl of the stump, with not much room above the notch, which may have contributed to the guyline pinching off the top of the stump and coming loose.

When planning units, it is also important to give sufficient space around the landing to deck the logs. Make sure decking areas do not interfere with the guylines in any way. A guyline can possibly shake loose when bumped.

2. Set up yarder guylines at no more than a 50-degree angle, sharing the load, and secured by additional support
Follow manufacturer's instructions, when setting up the tower. Make sure guylines are not steeper than 50 degrees, measured horizontally. An angle steeper than 50 degrees puts more downward pressure on the tower, which can cause the tower to buckle if a turn is too heavy. If guylines must be rigged steeper than 50 degrees, back off on turn size.

It is also important that the guylines are placed into the proper guying zones. Zones are defined in the manual that came with the yarder, or can be found in OR-OSHA regulations. If guylines cannot be placed into these zones, because of obstructions or lack of good anchors, the operator needs to place additional guylines to share the load.

Guylines attached to anchors at different distances from the tower need to be tensioned, so all guylines share the load. Guyline anchors that are closer need to be set slightly looser than those that are farther away, so the guylines will all have the same tension on them when the tower is under load.

Use only healthy trees or stumps as anchors. Cut notches for guyline cable placement 1½ times the circumference of the cable, and no more, to ensure the cable stays in the groove, without reducing the integrity of the anchor. A deeper notch effectively decreases the diameter and holding power of the stump, and increases the risk of parts slabbing off.

If notching will be too deep (or too high or too low) on anchor stumps, consider alternative guyline anchorage systems. Trees harvested today are smaller than their predecessors, and the use of tie-back anchors and other alternatives as additional support for guylines is not uncommon. Alternatives for securing guylines and stabilizing the tower include use of heavy logging equipment, logs placed in open trenches ("deadman"), tie-back stumps, or specialized equipment such as tipping plates.

3. Check security of the guyline anchors daily, before and during operation.
Stumps used as anchors should be observed daily for signs of failure: pulling out of the ground, slabbing off, becoming loosely attached, wire rope eating too deeply into the notch, and so on. Check anchors (stumps) while the operation is in progress. Do not attempt to continue logging operations if an anchor stump or tree shows signs of failure.

4. Maintain proper deflection in the skyline to reduce stress on the yarder tower. Consider using slightly less pressure on the skyline brake.
Insufficient deflection (sag) in the skyline may have been a contributing factor in this tower failure. Deflection helps to absorb and dissipate forces exerted upon the skyline during the yarding cycle. With insufficient deflection, the forces on the tower will be transferred directly onto the yarder guylines and anchors. If the operator is unable to achieve proper line deflection, payloads on the skyline should be backed off.

Also in this incident, a hang-up may have increased pressure on the yarder tower. By using slightly less pressure on the skyline brake, the skyline will reel out in the event of an overload situation. A brake will hold tension in the skyline, but under extreme tension will slip and reel out more skyline to increase deflection and load capacity. The operator needs to be careful when using this method when minimal lift is involved, as the carriage can hit the ground if the skyline reels out too fast, or too much.

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The material in this booklet is public information.

FREE TO COPY

This logging safety booklet is intended to supplement safety training for workers and employers in active yarding operations. The information provided here may reinforce knowledge, but written materials cannot replace hands-on training in the field with experienced trainers. Be sure to learn safe practices before working in the woods.

Safety training is generally available directly from employers in the logging industry. Additional training and safety materials are available locally from Oregon OSHA, Associated Oregon Loggers, and the Student Logging Training Program in the Forest Engineering Department at Oregon State University.

For more information:

Oregon Fatality Assessment and Control Evaluation
Website: www.ohsu.edu/croet/face
Telephone: 503-494-2281

Oregon OSHA
Website: www.orosha.org
Telephone: (503) 378-3272

Other information resources listed on p. 4

October 2010 HA9

Oregon Fatality Assessment and Control Evaluation
Center for Research on Occupational and Environmental Toxicology
Oregon Health & Science University

This booklet was produced with support from Oregon OSHA. Oregon Fatality Assessment and Control Evaluation (OR-FACE) is a project of the Center for Research on Occupational and Environmental Toxicology (CROET) at Oregon Health & Science University (OHSU), sponsored by the National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (2U60OH008472-06), through the Oregon Public Health Division.

FATAL HAZARDS IN YARDING OPERATIONS

Yarding turn
Swinging log in turn
Sliding pole
Skyline cable
Carriage return

Yarder collapse
Anchor failure
Runaway pickup
Warming fire

Bulldozer choker
Towing hook
Skidder passenger
Skidder off road

Helicopter logging

Backing log truck
Loaded yarder
Unsecured boom