

TEACHING GUIDE

Health and Safety for Forestry Workers: “Be a Safety ACE”

VIRTUAL REALITY TRAINING



Prepared by



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Purpose of this Guide

This guide is designed to provide educators and employers with information and guidance on how to deliver a safety and health curriculum using virtual and augmented reality technology. This training provides an immersive experience for workers who perform high-risk wildfire mitigation activities, such as tree thinning, brush clearing, pruning, and site preparation. Within this virtual world, participants are asked to make decisions and implement best practices to protect their health and wellbeing. The training can be delivered on multiple delivery platforms. The desktop computer and mobile platforms have the advantage of being fully functional without internet connectivity. The activity worksheets provide a forum for discussing and identifying workplace hazards and controls.

Project Team

Nancy Simcox, MS, Continuing Education Programs, Department of Environmental and Occupational Health Sciences, University of Washington

Brian Cleveley, Virtual Technology and Design, University of Idaho

Karin Hatheway-Dial, Department of Accounting and MIS, University of Idaho

Elyse Vaartstra, Virtual Technology and Design, University of Idaho

Andy Perleberg, Professor and Extension Forestry Specialist, Washington State University

Becky Yost, Continuing Education Programs, Department of Environmental and Occupational Health Sciences, University of Washington

Emma Wilson, Virtual Technology and Design, University of Idaho

McKenna Enright, Virtual Technology and Design, University of Idaho

Advisory Members

Connor Craig, Wildfire Home Protection, LLC

Adam Swedberg, Swedberg Contracting

Vladimir Avalos, Ramos Reforestation, Inc

José Contreras, Ramos Reforestation, Inc

Lance Grove, Logging Technical Specialist, Division of Occupational Safety and Health, Washington State Department of Labor & Industries

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Sample Training Agenda for Workers

Activity	Time	Materials
Pre-Training (Optional)	5 min	Pre-Training Assessment
Introduction to New Technology	5 min	Engage students in brief discussion of their experience with VR/AR and games like Pokémon Go.
Technology Setup & Practice <ul style="list-style-type: none"> • Safety and comfort using virtual reality • Motion sickness • Guardian system • Best body stance for VR use 	15 min	Oculus Quest headsets and controllers Android tablets Desktop computer Vimeo videos
Begin the “Be a Safety ACE” Training <ul style="list-style-type: none"> • What to Expect in Our Virtual World • Why Job Health and Safety • Chainsaw Injuries 	10 min	Equipment props
Immerse Yourself in the Virtual Reality – “Be a Forestry Safety Ace”	10 min	Oculus Quest headsets and controllers Android tablets Desktop Computer
Identify Hazards on the Job <ul style="list-style-type: none"> • What is a job hazard? • What at work affects your health? 	15 min	Activity Options What is a Job Hazard - Activity Sheet #1 Hazard Identification - Activity Sheet #2 Fatigue is a Hazard - Activity Sheet #3
Solutions for Hazard Control <ul style="list-style-type: none"> • What are the solutions for hazard control? • Which solutions are best? • What solutions can prevent injuries and illnesses when working in the forest? 	20 min	Activity Options Solutions for Hazard Control - Activity Sheet #4 Let’s Prevent Fatigue - Activity Sheet #5 Let’s Practice - Activity Sheet #6
Summary & Post-Training Assessment	10 min	You ACED This Training - Activity Sheet #7 Post Training Assessment
TOTAL	~90 min	

ACE: Awareness, Safety Culture and Personal Protective Equipment

The goal of this ACE training is to motivate employers and employees to strengthen their health and safety activities and efforts in forest settings. An effective health and safety program includes the following elements, which will be explored and emphasized in this training:

- Management commitment to safety.
- Hazard identification.
- Safety controls and policies.
- Training and equipment preparation.
- Personal protective equipment (PPE).

Due to wildfire risks, there are increasing efforts to reduce the fuel load in forested areas as a strategy to improve resilience to fire. Unfortunately, the workforce performing these tasks receive little training and information on occupational health and safety, especially by small companies. The creators of this ACE training worked with small contractors, forestry workers, and regulators to identify occupational hazards and protective measures during forest fuels reduction. The team identified the following topics as important for supplementing existing safety training: situational awareness, chainsaw safety, sleep, fatigue, safety culture, and the use of personal protective equipment.

The team created badges in English and Spanish (see below) for the virtual reality training called ACE that represents several safety themes. During the training, students click on the ACE badges to learn and review some safety measures and principles for preventing injuries and illnesses. These badges are placed throughout the program to guide learning.



ACE: In this training, ACE stands for three important concepts when working in the forest: situational **A**wareness, safety **C**ulture, and personal protective **E**quipment.

Awareness

It is up to the employer to implement systems for injury prevention and to devote resources that eliminate hazards and raise the awareness of safety in the workforce. Good work policies, procedures, and training developed by the employer provide the guidance for everyone to maintain a high level of situational awareness and to prevent life-threatening incidents and near misses. For example, assessments of broken branches or dead trees that could be falling objects should be done before workers enter areas. In addition, being aware of what is happening in the work environment and knowing the location of all coworkers are very important for recognizing potential hazards and staying safe in the forest.

Safety Culture

A positive safety culture is one in which all managers, supervisors, and employees prioritize safety above all else and behave in ways that maximize their own safety and the safety of those around them. Research has shown that work organizational factors—such as training, safety meetings, worksite inspections, rest breaks, pace of work, access to language interpreters, and good relationships with supervisors—are associated with positive injury outcomes (Wilmsen, 2019). Worker participation in all aspects of safety is key to the support of a positive safety culture and reduction in injuries and illnesses.

Personal Protective Equipment (PPE)

There are many ways to reduce the hazards in work, and personal protective equipment (PPE) is just one of them. There is a hierarchy of solutions that employers use to prevent injuries and illnesses. In this training, we review the levels of hazard control and the systems and strategies that are needed to prevent injuries and illnesses. The best solution is to remove or isolate the hazard away from the worker. However, some hazards in the forest cannot be removed or isolated. In these circumstances, the hazards should be recognized, assessed, and addressed with the work team so that the best strategy for injury prevention is applied. In the hierarchy of solutions, PPE is only one solution and is considered the solution of last resort. Personal protective equipment is used as a way to protect the head, eyes, ears, feet, hands, legs, lungs, and other body parts from dangerous equipment, moving objects, fast moving machinery, and inhalable dust or chemicals, but should always be used in addition to implementation of more effective strategies. For example, selecting and using a tool that has a safety guard and maintaining equipment are solutions that should be considered along with the use of PPE.



Photo credit: www.istockphoto.com/BakiBG

Introduction to Using Virtual Reality to Promote Health and Safety on the Job

There are multiple ways to experience this training—with computers, VR headsets, and tablets. This training module can be used in the classroom or in the field. The desktop computer and mobile platforms are fully functional without internet connectivity.

Learning Objectives

By the end of this introductory section, students should be able to:

- Define the meaning of virtual reality and augmented reality.
- Use headsets with controllers, Android tablets, or computer simulations.
- List the symptoms of motion sickness.

Materials Needed

- Flipchart paper and markers or whiteboard with sticky notes
- VR headsets and controllers and/or Android tablets and/or computer-based station
- LCD projector and screen

Time Needed: 10 minutes

Instructor Notes

- ▶ Explain how to use a virtual reality (VR) training program and demonstrate the use of the headsets with controllers, Android tablets, or computer simulations to the group.
- ▶ Explain the risk of motion sickness.
- ▶ Describe the virtual practice session and the forestry scenes that students will see when they enter the virtual world.

Definitions of Computer-based, Virtual Reality (VR), and Augmented Reality (AR)

- A **computer-based** simulation is a base-level immersive virtual world in which students can interact with the training modules with very low risk of motion sickness. Additionally, instructors can show the training modules to larger groups of students.
- **Virtual Reality (VR)** with free-standing headsets provides a simulation where students are immersed within an environment to perform a series of actions. Virtual reality is the term used to describe a three-dimensional, interactive computer-generated environment. In other words, a person inhabits a virtual world where they engage in activities.
- **Augmented Reality (AR)** blends the virtual and physical worlds by placing digital objects in a physical place and enabling users to interact with these objects. Augmented reality is delivered via mobile devices, including tablets and smartphones.

Why is VR simulation beneficial?

- Allows participation in a real-life situation without getting hurt.
- Gives the opportunity to practice and make decisions safely.
- Makes time for reflection on work hazards, controls, and experiences.
- Builds muscle memory in the brain.
- Increases learning retention and engagement.

Symptoms of motion sickness or car sickness when using VR headsets

Uneasiness, dizziness, nausea, disorientation, headaches, eye strain

- ▶ Ask students if they have experienced motion sickness or car sickness. If so, explain that it is possible that similar symptoms may occur when using VR headsets.
- ▶ If students experience any symptoms associated with motion sickness or car sickness, ask them to stop using the headset immediately. For those who do not wish to try the headset because they know they get motion sickness, show the computer-based simulation as an alternative. The AR program is also another activity available on the tablet.
- ▶ Inform students that when they are using the VR headset they should: 1) move slowly and 2) only move in a forward direction to minimize potential motion sickness.

Tips for maximizing safety and comfort while using the VR

- Adjust the straps so the headset is balanced and centered.
- Stand a few seconds with the headset on to acclimate to the new perspective.
- Ensure that the play space is free from hazards because the headset produces an immersive experience that can distract and block the student's perception of the actual surroundings.
- Don't swing the head around quickly.
- Use the joysticks on the controllers for moving forward in the virtual world.

Instructor notes

Watch the video, "ACE Guardian Set-up and Start App," for instructions on how to set up the Guardian system for safe use in your space before teaching the lessons.

English: <https://vimeo.com/727209992/b23173c711>

Spanish: <https://vimeo.com/727211185/bfc0b8628b>



The Oculus button on the right controller will enable the user to pause or quit the application.



The menu button on the left controller enables the user to access the options window.

How to Use the VR System

The headset contains a virtual boundary system feature called the Guardian to help students stay in a designated play space. The pass-through camera can help students stay inside the preset play space boundaries in the Guardian System and help alert them if they approach boundaries or go outside them.

- ▶ Tell students to watch the video for setting up the Guardian System:
 - English: <https://vimeo.com/727215553/c000961681>
 - Spanish: <https://vimeo.com/727215569/55f3128f88>
- Select “Create Guardian” with index trigger button on the controller.
- Select “Confirm” floor level by putting the controller on the floor.
- Select “Switch to Stationery Boundary” with index trigger button on the controller.
- Select “Confirm.”
- ▶ Let students know that if they see the floor and walls of their location, they have stepped out of the safe Guardian System zone and need to return back into the area.
- ▶ Tell students to refer to the Oculus health and safety website for more information about how to use the headsets safely: <https://www.oculus.com/legal/health-and-safety-warnings>



Charging headset before use

- All headsets should be charged several hours before training begins.
- Check battery levels of controllers and headsets.

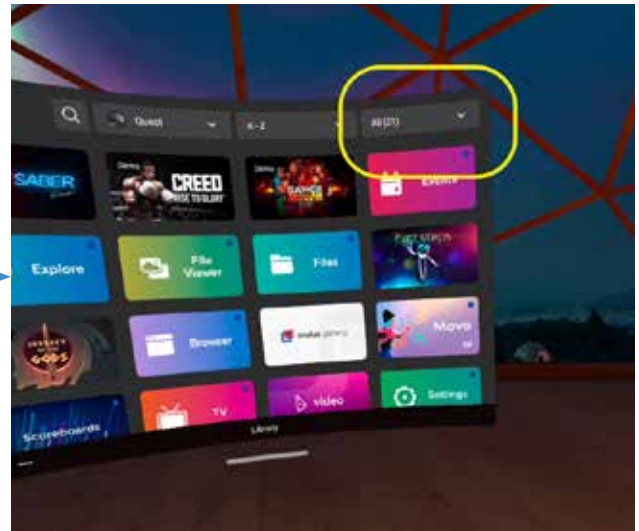
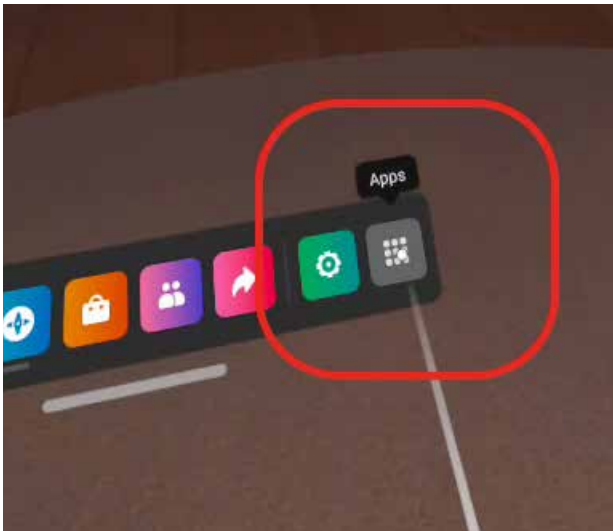
How to turn your headset off

- Push the little button on the right-hand side of the headset.
- Select “Power Off” with index trigger button on the controller.

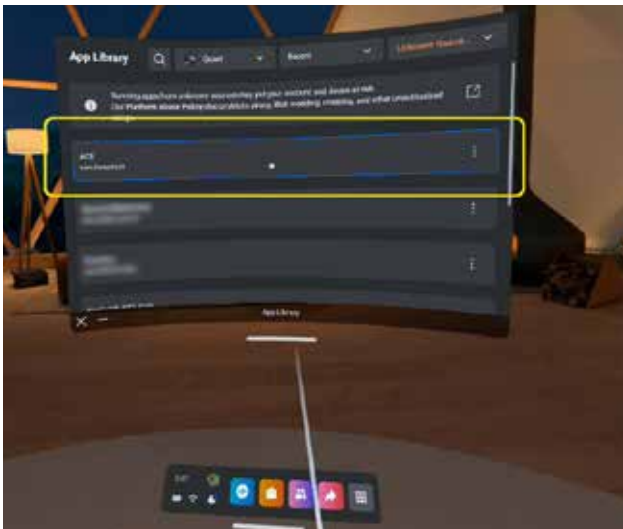
Opening Up the VR program

To open the app and begin, follow these instructions, starting in upper left-hand corner and continuing clockwise:

1. From the main opening menu, click on the 9-square grid.
2. In the upper right corner of the App Library, select the ALL pull-down menu—then select Unknown Sources at the bottom of the menu.



3. With Unknown Sources active—select the ACE App.



Language Selection

This VR training is available in English or Spanish.

- Inform students that they will be asked to select a language preference.

VR Tutorial Session

Because some students may be new to virtual reality technology, we developed a tutorial session. Once the simulation is entered, there is a button to select for practicing. If students already know how to use virtual reality technology, tell them to skip this section.

- **Explain:** Use both joysticks to navigate inside the world. The right joystick turns you in different directions and the left joystick moves you. Select the index trigger button to point and select items.

Pop Up Activities

Instructor notes

When students are doing the VR training, “ACE badges” are present to provide safety information. Students will be asked to select an ACE badge and apply this information in the virtual world and when doing the activity sheets. Review the information in the pop ups.

Pop Up Activity: The box below is the content of the ACE Badge Pop Ups for the shop.

ACE BADGE POP UPS—SHOP

Truck	Flammable and combustible liquids must not be transported in the driver compartment or in any passenger-occupied area of any machine or vehicle. In some cases, these liquids cannot be transported in any passenger occupied vehicle.
Ear Plugs & Muffs	Use hearing protection, such as disposable/reusable earplugs or earmuffs, to prevent hearing loss and fatigue (feeling tired).
Gas Container	All containers used to store gas, oil, chemicals, etc. must be in approved containers for that substance and be properly marked.
Lunch Boxes on Counter	Electrolytes are important as they help balance your body's water and PH levels and move nutrients into your cells. To replace the electrolytes in your body, you should eat high-energy or easily digested foods, such as rice dishes, sandwiches, fruit, yogurt, and muesli or granola bars, and drink water.
Hard Hat	All employees must wear an ANSI approved hard hat whenever there is the potential exposure to flying or falling objects. If electrical hazards are present when required to wear a hard hat, an ANSI-approved non-conductive hard hat is required.
PPE	Select the PPE to take to the site.

Pop Up Activity: The box below is the content of the ACE Badge Pop Ups for the tailgate toolbox talk.

ACE BADGE POP UPS—TAILGATE

Chainsaw on truck	Check the controls, the chain brake, the chain tension, spark arrester screen, suspension mounts, and all the bolts and handles on the chainsaw to make sure they are functioning properly. Make sure the clutch cover is not broken or exposing the chain or sprocket. Sharpen chain teeth, then file down rakers. A sharp chain cuts straight and requires less force to make the cut.
Chainsaw with gas can	When adding fuel to the chainsaw, make sure you are far away from any source of ignition. Start the saw on the ground, with chain brake engaged, and 10 feet from fueling area. Never fuel-up when saw is hot.

Pop Up Activity: The box below is the content of the ACE Badge Pop Ups for the forest scene.

ACE BADGE POP UPS—FOREST SCENE

Brush removal	Identify and be aware of dangerous plants, insects, and other objects in the brush. Cut and pull brush in small amounts. Be aware if a partner is working nearby and may affect the material you are tackling. Avoid heavy loads or ask for help from others. Walking, lifting, pulling, and carrying heavy loads in steep and uneven terrain can lead to strains of the back, slips, trips, and falls. When lifting, keep back straight, knees bent, and load close to body.
Fatigue meter	Employers are responsible for managing the risk of harm at work when you may be fatigued. Supervisors should encourage breaks during the day. See the meter go up after breaks and rest periods!



Fatigue meter

The fatigue meter shows the different levels of energy to indicate the need for breaks and rest periods. In the VR training, students get to interact with this meter.

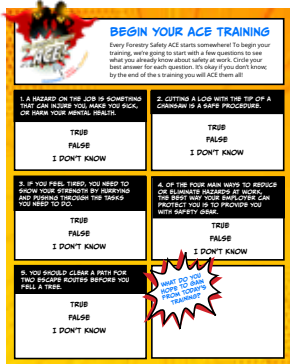


Escape paths

Clear paths for two escape routes. You should be able to make an escape without turning your back on the falling tree. Your retreat distance should be a minimum of 20 feet from the falling tree. Be sure to use the route that is on the side of the cut; do not use a route that puts you in the danger zone directly behind the tree unless there is an unforeseen emergency that develops.

Begin the “Be a Safety ACE” Training

In this training, ACE stands for three important concepts when working in the forest: situational **A**wareness, safety **C**ulture, and personal protective **E**quipment (PPE).



Learning Objectives

By the end of the training, students should be able to:

- Describe how people can get hurt while working in the forest.
- Explain the best ways to prevent injuries and illnesses from happening.
- List best practices and resources that help create a safe and healthy work environment during wildfire mitigation forestry activities, such as tree thinning, brush clearing, pruning, and site preparation.

Instructor Notes

Explain: We are now going to conduct a pre-training assessment activity. After each question, please circle your best answer—if you're pretty sure it's either true or false, pick that answer **or** pick the answer that makes the most sense. If you really don't know, choose, "I don't know."

Please note: This assessment can also be done verbally as a group activity. We'll check in again at the end of the training about what you've learned.

- ▶ After students fill in the "Begin Your ACE Training sheet, show students the video, "Ace Guardian Set-up and Start App."

What to Expect in Our Virtual World

Describe, or show on a screen when feasible, what the students will see in the virtual reality headset or on the computer. There are two different scenes in this virtual reality training. A Vimeo video can be shown for each scene. Students will be asked to interact with information throughout the training, such as ACE badge pop ups that provide important safety regulations and other information.

- Shop English: <https://vimeo.com/662699587/d1c1408875>
- Forest English: <https://vimeo.com/727204826/d517179901>
- Shop Spanish: <https://vimeo.com/703521615/955128a075>
- Forest Spanish: <https://vimeo.com/723580225/904117bbaf>

Why Job Health and Safety?

This training focuses on the hazards and safety solutions when performing wildfire mitigation forestry activities, such as tree thinning, brush clearing, pruning, and site preparation.

- ▶ Show students the photograph of Pablo with fallen tree (Appendix 1, page 24) and read the accompanying statement, either in English or Spanish.



The worker next to me was not paying attention. He cut a tree, and it dropped on me.

El trabajador a un lado de me no estaba poniendo atención. Cortó un árbol y cayó sobre me.

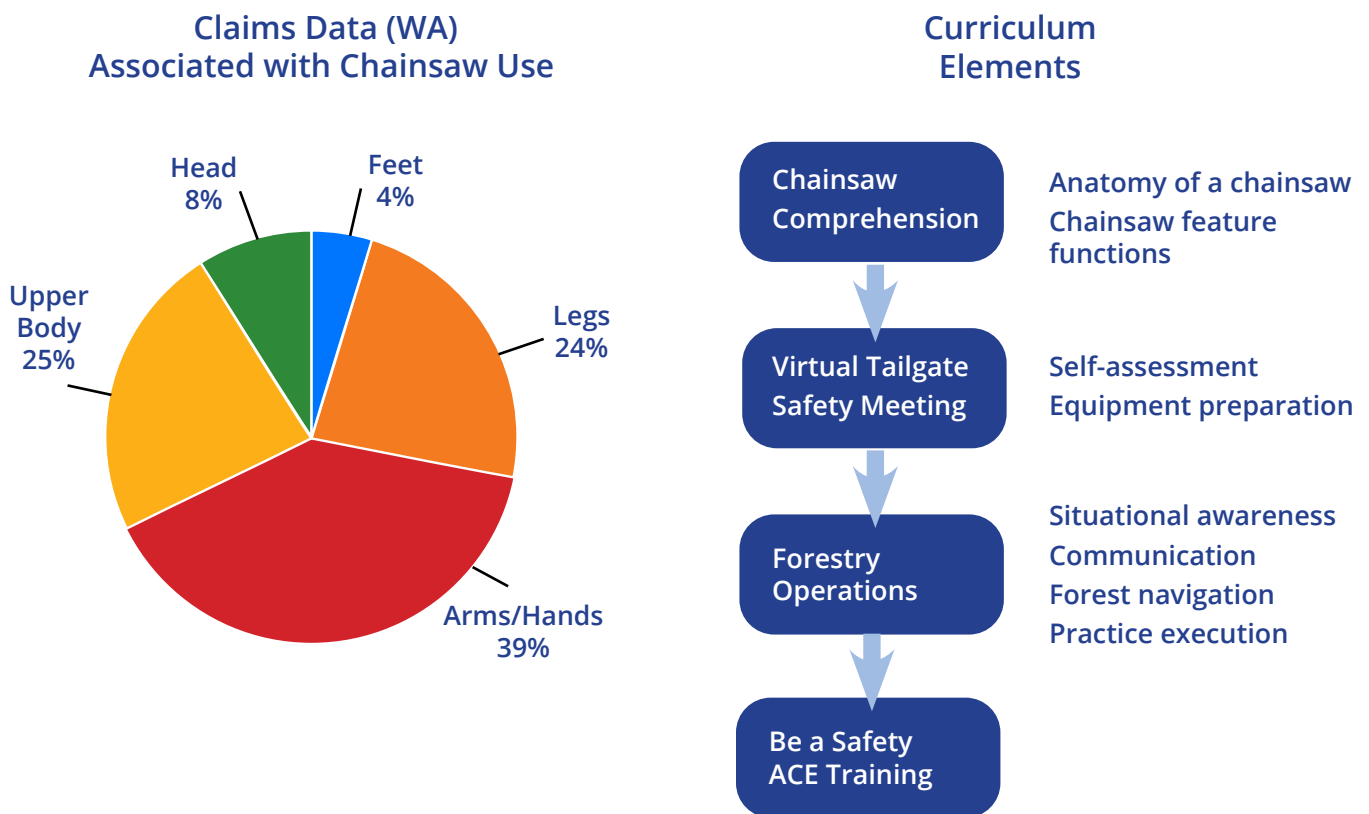
- ▶ Ask students: “Have you seen this happen before? If this happens, it is due to a system failure at many levels in your workplace. It is not the fault of one person.”
- ▶ Use these points for discussion with students:
 - ***The most common injuries experienced by forestry workers are cuts, back strain, and broken bones.*** The leading cause of injuries for forestry workers is being struck by an object, such as a falling tree or branch. Slips, trips/falls, chainsaw kickback, and repetitive stress also cause injury and illness. Heat and fatigue are hazards that also contribute to injuries and illness.
 - ***Workplaces that implement effective health and safety programs have 15–35% fewer injuries and illnesses*** (OSHA, 2012).
 - ***Most workplace deaths, injuries, and illnesses are preventable.*** You have the right to be safe when you are working. Washington State Department of Labor & Industries requires employers to create and follow an accident prevention plan to address safety and health hazards in the workplace. Employers are responsible for developing and implementing the safety and health rules, policies, and procedures. An effective program engages workers and ensures that they are properly trained in all elements of the health and safety plan.
 - ***Accidents are preventable.*** An accident prevention plan is a long-term commitment to plan, identify, assess, and prevent hazards in the workplace. The plan includes regular inspections, updates, and corrective actions to address the risks in an organization. To learn more visit the Washington State Department of Labor & Industries website (see Resources, page 22).
 - ***You have the right to ask for information about things you think are dangerous at work.*** Employers must give workers the information they ask for. If questions arise about safety, encourage workers to talk to their boss, supervisor, or union/worker representative. Tell them to explain any concerns, potential solutions, and benefits. Document concerns. If the problem does not get solved, contact WA Labor & Industries or other organizations for assistance. Call 1-800-423-7233 or complete an online form: <https://www.lni.wa.gov/forms-publications/F418-052-000.pdf>.

Chainsaw Injuries

Each year, thousands of people in the United States are treated in hospital emergency rooms for chainsaw injuries. We summarized the injury claims data from the Washington State Labor & Industries workers' compensation claims system associated with chainsaw use (NAICS 113 and NAICS 1153 & OIICS Source code 7221) from 2011–2021 to show where most injuries occur on the body (see pie chart below). It is common for more injuries to occur on the left side of the body because of how the chainsaw is held during cutting.

In a virtual world, workers and supervisors can respond and make decisions related to hazardous conditions in the forest—a practice that can help them face real-life situations without real-life consequences of injury or illness (National Safety Council 2020). It is a good tool to use for new employees during orientation training.

This 90-minute ACE training can be integrated into a curriculum that covers chainsaw safety comprehension, equipment preparation, and other key forestry operations as a way to increase knowledge and raise awareness about health and safety. It can also be used as an example or case study of how to apply systems thinking for hazard control and implementation of solutions in any workplace. Systems thinking involves moving from observing events or data to identifying and changing patterns of behavior at all levels of an organization.



ACE Training Lesson 1: Hazard Identification

Learning Objectives

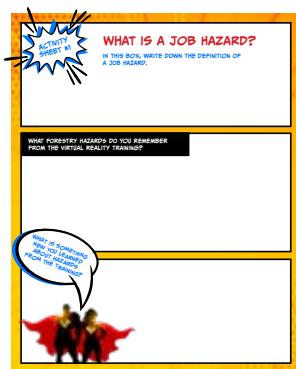
By the end of this lesson, students will be able to:

- List 3 examples of hazards that occur in the forest during thinning, cutting, and clearing trees and brush.
- List the health effects of three common hazards.
- Describe the impact of fatigue as a workplace hazard.

Time Needed: 15 minutes

Instructor Notes

Hand out VR headsets to students. Students will explore a virtual forest setting. After viewing, put students into small groups to discuss what was observed in the virtual world. Instructors have the option of using any of the activity sheets to facilitate discussions and reinforce concepts covered in the VR training. The activity sheets can be completed by the full class, by small groups, or by individuals either in written or verbal form.

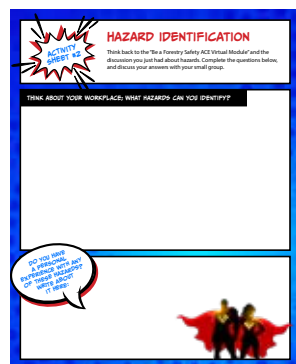


What is a Job Hazard? - Activity Sheet #1

Instructor Notes

Explain: A hazard is something that can injure you, kill you, make you sick, or harm your mental health. There are many types of hazards. The ones you are most likely familiar with are safety hazards, which can cause injuries right away—like tools, machinery, knives, hot surfaces, or slippery ground. There are also hazards that can make you sick, or cause damage to different systems—such as your respiratory system, musculoskeletal system, or hearing—after you have been exposed to them over time.

- ▶ Put students into groups of 3–4 to discuss some familiar hazards, such as slippery surfaces, sharp tools, etc. Ask students to complete Activity Sheet #1, "What is a Job Hazard?"



Hazards Identification - Activity Sheet #2

Instructor Notes

Explain: As you immerse yourself in the VR environment, think about the hazards you see. Think about how each hazard could harm you if you were working in this setting. Think about the safety hazards from the equipment as well as the health hazards, such as noise and fatigue. Assign a person in your group to record answers.

- ▶ Put students into groups of 3–4 to discuss the hazards observed in the virtual reality training. Ask students to complete Activity Sheet #2, "Hazard Identification."

Table 1 lists some of the hazards and health effects of working in the forest to clear brush and small trees. Instructors may use this table to facilitate the discussion and help students recognize and think about the many hazards that exist in the forest.

Table 1. Hazards and Health Effects

Hazards	Effects
Tripping	Cuts, head injuries, foot injuries, eye injuries, concussion, death
Being struck by objects	Cuts, head injuries, foot injuries, eye injuries, concussion, death
Chainsaw kick back	Cuts, head injuries, leg injuries, other traumatic injuries, death
Tools and equipment	Cuts, traumatic injuries
Electrical	Burns, electrical shocks, death
Fire	Burns, respiratory illness, death
Poisonous plants, insect bites, etc.	Rash, respiratory illness, other allergic responses; ticks may cause Lyme disease
Ergonomic risks—bending, reaching, repetitive motion, standing a lot	Pains, aches, leg/foot pain, knee injuries, joint problems, back problems
Vibration	Pain in hands, tingling, numbness and poor control, fatigue, poor circulation, Raynaud’s disease (fingers turn white), long-term carpal tunnel syndrome
Discrimination and harassment	Depression, difficulty sleeping or eating, difficulty thinking, stress for fear of retaliation, mental health, getting last pick of tools and most undesirable jobs
Heavy lifting	Back injury, strains, falls, trips
Stress—pressure to work fast	Fall-related and tripping-related injuries, fatigue, careless operation
Gasoline and chemicals	Eye/skin irritation, dermatitis, headache, dizziness
Noise	Ear pain, ringing of ears, loss of hearing, fatigue
Weather/outdoor conditions	Fall-related injuries, hypothermia in cold weather, hyperthermia in hot weather, heat stroke
Fatigue	Tiredness, stress, slower reactions

Fatigue is a Hazard - Activity Sheet #3

Instructor Notes

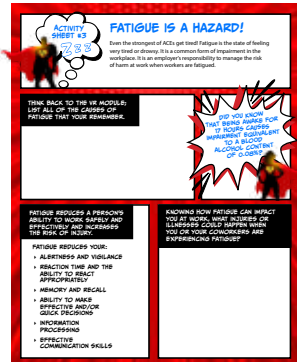
Explain: Fatigue is a state of tiredness or exhaustion that results in physical and/or mental impairment and may increase risk of workplace errors or accidents. Fatigue is a normal condition, and most workers will be fatigued at some time on the job. Job demands, work schedules, quantity and quality of sleep, and environmental conditions (heat, cold, noise) are some of the work-related factors that can cause fatigue. It is an employer's responsibility to manage the risk of injury at work that may be caused by fatigue.

The extent of fatigue depends on the job being done, characteristics of the individual, the social environment, and the organization's culture and practices. Fatigue can occur over a short time or build up over days and weeks. Everyone has the potential to be impacted by sleep loss and experience fatigue. For some supervisors and workers, fatigue may be worn as a mantle of heroism and loyalty when promotion is seen as the reward. This type of workplace culture can lead to an unsafe environment. Workers should report fatigue to supervisors, employers, or union/worker representative. By incorporating knowledge of fatigue management strategies into their safety plans, companies and individuals can implement appropriate measures to reduce the risk of fatigue-related incidents.

- ▶ Put students into groups of 3–4. Tell them to think about how fatigue relates to health and safety on the job. Ask them to complete Activity Sheet #3, "Fatigue is a Hazard."

Some factors to consider

- Around-the-clock working time arrangements can create sleep loss and a physiological disruption leading to reduced alertness and performance.
- All workplaces are affected by fatigue. There is an increased risk of fatigue-related incidents when duties have non-standard start times or commute times exceed 45 minutes.
- The forest industry recognizes that fatigue can be a contributing or immediate causal factor in incidents. Controlled rest periods and frequent water breaks reduce fatigue risk.
- Risk of fatigue increases when a person gets less than 8 hours of sleep within 24 hours.
- Long breaks typically provide a significant opportunity to recover from sleep loss accumulated over a sequence of work periods. A long break is defined as a period of two nights of sleep with a non-working day in between.
- Changing shifts or restricting overtime at work is beneficial so that employees get the sleep they need.



ACE Training Lesson 2: Solutions for Hazard Control

Learning Objectives

By the end of this lesson, students will be able to:

- Describe the four most effective ways to control hazards at work.
- List examples of ways to prevent or control hazards during forestry work.
- Explain what employers and employees should do to reduce the risks of fatigue.

Time Needed: 20 minutes

Instructor Notes

Before you present this lesson:

- Review the list below of specific ways to reduce or eliminate tripping hazards in a forest. Refer to the examples of controls in Table 2 (see page 19) for discussion and answers.

Explain: There are hazards in every workplace and ways to remove or eliminate these hazards. Let's find solutions for preventing "tripping hazards" in the forest.

► Write some of the possible solutions that students suggest on a flip chart or white board.

If you need more solutions, examples include:

- Assess the site before starting work. Employers are required to conduct a safety survey of the worksite before starting the job.
- Clear branches and debris in areas where workers will be removing trees.
- Designate walking paths as much as possible.
- Mark off areas where workers should not work because of hazardous terrain.
- Put out "caution" tape, cones, or signs in areas that require special attention.
- Find a stable position on the ground to better control the saw.
- Train workers to maintain 3 points of secure contact when stepping over slash or debris.
- Wear appropriate boots.
- Take breaks, drink water, and have rest periods during the shift.
- Don't jump off stumps, logs, trucks, equipment, or other high objects.

Explain: There are often several ways to control a hazard, but some are better than others. When modifications are made to a job or worksite, it is important to confirm the safety of the solutions.

► Hand out Appendix 3 (page 30) to students and describe the hierarchy of solutions that employers should use to prevent injuries and illnesses.

1

REMOVE THE HAZARD

The most effective strategy is always to remove or eliminate the hazard.

3

IMPROVE POLICIES & PROCEDURES

Change the way we do work.

2

REDUCE THE HAZARD

Reduce worker exposure to the hazard.

4

WEAR PPE

Wearing Personal Protective Equipment (PPE) is the strategy to use if options 1, 2, and 3 are not possible.

1 *Remove the Hazard*

The best control measures remove the hazard from the workplace or keep it isolated away from workers so it can't hurt anyone. This way, the workplace itself is safer, and the responsibility for safety doesn't fall on individual workers. Here are some examples:

- Prune trees with an extension pole saw, keeping both feet on the ground, instead of scaling a ladder or climbing the tree.
 - Use safer chemicals and get rid of hazardous ones.
 - Use machines instead of doing jobs by hand.
- ▶ Ask students: "Let's focus on some solutions for eliminating tripping hazards in a forest." Students may answer that identifying areas that should not be entered and removing branches are the items on the list that actually remove the hazard.

2 *Control or Reduce the Hazard*

If you can't eliminate or remove the hazard, you can put in engineering controls that remove hazardous conditions or place a barrier between the worker and the hazard. Here are some general examples:

- Safety guards on a chainsaw to shield the worker.
 - Chainsaw should have a front hand guard and chain brake to protect hand/fingers from the bar and chain.
 - Safety guards on tools and other equipment.
- ▶ Ask students: "What are some solutions for reducing tripping hazards in a forest?" Students may answer that designating walking paths or trails around the site is one way to control tripping hazards.

3 *Improve Work Policies and Procedures*

If you can't completely eliminate a hazard or keep it away from workers, good safety policies can reduce your exposure to hazards. Here are some examples:

- Conduct safety training on how to work around hazards.
 - Restrict access to a work area.
 - Store gasoline in approved and properly marked containers.
 - Take regular breaks to avoid fatigue.
 - Review chainsaw kickback procedures routinely.
 - Ask co-worker to help lift a heavy object.
 - Assign enough people to do the job safely (lifting, etc.).
 - Prepare two escape routes before felling a tree (use the route that is on the side of the cut; do not use a route that puts you in the danger zone directly behind the tree unless there is an unforeseen emergency that develops).
- ▶ Ask students: "Can you think of solutions for tripping hazards that involve work policies and procedures?" Students may answer with solutions like putting up signage or ribbons to identify areas of concern, regular breaks to avoid fatigue, and procedures that cover how to maintain 3 points of secure contact when stepping over slash.

4 Use Personal Protective Equipment

Personal protective equipment (PPE) is the least effective way to control hazards. However, you should use it if it's all you have. Here are some examples:

- Gloves, boots, hard hats.
- Hearing and eye protectors.
- Chaps.

► Ask students: "Why should PPE be considered the solution of last resort? "

Here are some possible responses:

- It doesn't get rid of or minimize the hazard itself.
 - Workers may not want to wear it because it can be uncomfortable or hot and may make it hard to communicate or do work.
 - It has to fit properly and be used correctly at the right time to work.
 - It has to be right for the particular hazard, such as the right respirator cartridge or glove for the chemical being used.
- Ask students: "Which of the solutions for tripping in the forest involve protective clothing and equipment?" Students may answer that wearing caulk boots is one option. Other types of shoes may be needed depending on terrain and conditions.

Solutions for Chainsaw Kickback

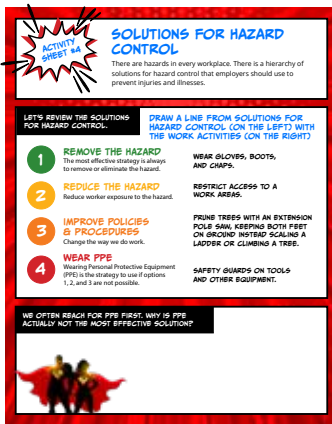
Discuss possible solutions for preventing chainsaw kickback. Examples include:

- Conduct safety audits.
- Educate and train employees regularly.
- Inspect and maintain equipment.
- Use proper-sized saw and bar and the proper chain for the size and species of the material being cut.
- Examine the material to assess its physics. If you cut in certain places, gravity and tension in the tree could cause it to collapse, roll, or pinch your saw bar.
- Find a stable position to control the saw.
- Maintain a solid grip (but not squeezing) on the front and rear handles at all times. Top or left hand should grasp handle in a natural cant, keeping left thumb securely hooked (but not squeezing) on one side of the handle bar with fingers gripped (but not squeezing) on opposite side of handle. This grip and keeping the tip from coming in contact with something else are the two most important ways to prevent kickback.
- Always be aware of where the tip of the bar is and don't let it make contact with an object, such as a leaning tree, branch, rock, ground, or other trees underneath or behind where the bucked trees are piled.
- Take breaks, don't rush through a task, and communicate with your fellow workers.

Table 2 below lists solutions for controlling some of the hazards in the forest when clearing brush and removing small trees. Instructors may use the table below to facilitate discussion and make sure the students recognize some of the common hazards and their solutions. The examples in Table 2 show that many systems need to be applied in the forest to maintain a safe working environment.

Table 2. Hazards and Solutions

Hazards	Solutions
Tripping	Assess area for tripping hazards and dead branches, remove hazards, clear a walking path, train, take breaks, drink water, wear boots (caulks)
Being struck by objects	Assess trees for dead branches, do not work underneath dangerous branches, flag dangerous trees with tape, mark off areas that others should not enter, train, wear hard hat and safety glasses
Chainsaw kickback	Use chainsaw guard, train, cut-resistant gloves and chaps, review safety laws for teens under 18
Tools and equipment	Select the correct tool for the job, inspect condition of tools/equipment, conduct regular maintenance, provide proper training, use PPE as needed
Electrical	Restrict access in forest if electrical hazards exist, follow protocols for contacting utility company, turn off electricity where applicable, implement lockout tagout procedures
Poisonous plants and insect bites (ticks)	Remove the plants, flag areas to avoid, use PPE, use insect repellent, wash skin thoroughly after shift
Ergonomic hazards: heavy lifting, bending, reaching, repetitive motion, standing a lot, awkward postures	Change work design and flow, use mechanical equipment rather than manual lifting, ask for assistance from coworkers to lift heavy objects, cut small logs, rotate tasks to prevent long-term repetitive motion, use tarps for materials, take breaks, monitor level of fatigue, train, wear PPE (boots-caulks)
Vibration from equipment and machinery	Use newer chainsaws that have less vibration, wear vibration resistant gloves
Discrimination and harassment	Set and enforce policy of zero tolerance for harassment and discrimination, establish reporting protocols and disciplinary measures, train
Stress—pressure to work fast	Establish appropriate staffing and scheduling, create procedures for reporting, take regular breaks, monitor level of fatigue
Gasoline and chemicals	Use electric equipment or battery-operated tools/equipment, store in properly labeled containers, select safer chemicals, train, wear PPE
Noise	Select equipment that is quieter, implement administrative controls such as keeping distance from noisy operations being done by others on site, minimize time of exposure to high noise levels with rotation of duties, use hearing protection like ear muffs and/or plugs
Weather/outdoor conditions	Provide adequate drinking water, wear warm clothing/gloves/hat, provide cooling areas that have air conditioning or shade during hot weather, take frequent breaks, train to recognize symptoms of hypothermia and heat stress, wear proper boots/footwear
Fatigue	Set appropriate overtime policies, monitor employee schedules and pace of work, add breaks, drink water and eat, train on good health and wellness (sleep, fatigue, etc.)



Solutions for Hazard Control - Activity Sheet #4

Instructor Notes

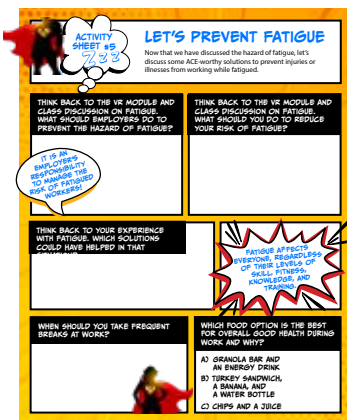
Explain: By using the “Solutions for Hazard Control,” activity sheet, you can think about how to prevent injuries and illnesses in the lesson. This is the way to think about every workplace hazard: How can we “fix the workplace” so we don’t have to “fix the worker” (relying on personal protective equipment or lots of safety rules that might get skipped).

We’ve talked about the importance of being able to go into a workplace and identify hazards. This is the first step toward knowing how hazards can be reduced and injuries prevented.

It is your employer’s responsibility to control the hazards in the workplace. However, you play an important role in protecting yourself and others by recognizing hazards on the job, alerting supervisors and co-workers, and following safety rules.

Review the different types of solutions for hazard control. We often put PPE first. Discuss why PPE is actually not the most effective solution.

- ▶ Put students into groups of 3–4. Ask them to complete Activity Sheet #4, “Solutions for Hazard Control.”



Let's Prevent Fatigue - Activity Sheet #5

Instructor Notes

Explain: There are many risk factors that contribute to fatigue as a workplace hazard. Employers are responsible for managing the risk of injury at work. Remember, fatigue may increase your risk of injury.

- ▶ Put students into groups of 3–4. Tell them to discuss some solutions to prevent injuries and illnesses while working when fatigued. Ask them to complete Activity Sheet #5: Let’s Prevent Fatigue.”

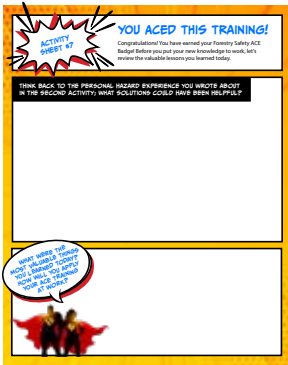


Let's Practice - Activity Sheet #6

Instructor Notes

Explain: There are many hazards and solutions shown in the VR training. Select two hazards and brainstorm solutions for hazard control.

- ▶ Put students into groups of 3–4. Ask them to practice and complete Activity Sheet #6 “Let’s Practice.”



Summary

Time Needed: 10 minutes

Instructor Notes:

Explain: Think about the solutions that can prevent injuries and illnesses when you work in the forest. Complete Activity Sheet #7, You ACED This Training.

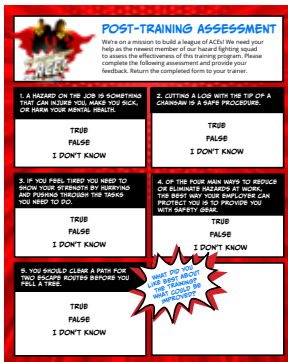
Elements of an effective health and safety program

Remind supervisors and workers that there are many systems that must be in place to stay safe in the workplace:

- Management commitment.
- Hazard identification.
- Safety controls and policies.
- Training and equipment preparation.
- Personal protective equipment (PPE).

Remember:

- You know how to recognize hazards.
- You have ideas about what the employer can do to fix the workplace and what workers can do to work safely.
- Follow the safety rules, but also think for yourself and find ways to share your ideas.
- There are many programs and systems that must be in place for an effective health and safety plan.



Post-Training Assessment

Instructor Notes

Explain: We are now going to conduct a Post-Training Assessment activity. After each question, please circle your best answer—if you're pretty sure it's either true or false, pick that answer **or** pick the answer that makes the most sense. If you really don't know, choose, "I don't know."

- ▶ Discuss the answers with the students (see Appendix 4, page 31).

Resources

- ACOEM Presidential Task Force on Fatigue Risk Management, ACOEM Guidance Statement, Fatigue Risk Management in the Workplace, February 2012:
<https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.593.2465&rep=rep1&type=pdf>
- Garland, J. Glossary of Forestry Services: with Motivation for Understanding/Glosario de servicios forestales:con motivación para la comprensión, 2012:
<https://osha.oregon.gov/edu/grants/train/Documents/grant-edu-ForestryServicesGlossary-ENG-SPN.pdf>
- International Association of Oil & Gas Producers, Managing fatigue in the workplace,
<https://www.iogp.org/managing-fatigue-in-the-workplace/>
- National Safety Council. Work to Zero Safety Technology 2020 Report.
<https://www.nsc.org/faforms/work-to-zero-safety-technology-2020>
- Northwest Forest Worker Center (MFWC), The Four Elements of Safety, February 2015:
https://firebasestorage.googleapis.com/v0/b/nwforestworkers-f633c.appspot.com/o/PDF%2F4_elements_guide.pdf?alt=media&ken=5960dbd4-84b0-436f-bf04-63f7c8bece3b
- Oculus, Health and Safety Warnings: <https://www.oculus.com/legal/health-and-safety-warnings>
- Occupational Safety and Health Administration (OSHA), Injury and Illness Prevention Programs White Paper, January 2012: <https://www.osha.gov/sites/default/files/OSHAwhite-paper-january2012sm.pdf>
- Oregon Healthy Workforce Center, Health Impacts Safety: <https://www.ohsu.edu/sites/default/files/2019-08/OccHealthSci-Outreach-TWH1-Health-impacts-safety-sleep.pdf>
- Queensland Government, Preventing and Managing Fatigue-related Risk in the Workplace, 2020:
https://www.worksafe.qld.gov.au/_data/assets/pdf_file/0018/26109/preventing-and-managing-fatigue-related-risk-in-the-workplace.pdf
- University of Washington Pacific Northwest Agricultural Safety and Health Center (UW PNASH), Northwest Forest Worker Safety: https://deohs.washington.edu/pnash/index.php/forest_safety
- UW PNASH, Staying Hydrated at Work Poster: <https://deohs.washington.edu/pnash/node/784>
- UW PNASH, Forest Worker Safety Talks: <https://deohs.washington.edu/pnash/sites/deohs.washington.edu/pnash/files/documents/ForestWorkerSafetyTalks-English.pdf>
- UW PNASH, Forest Worker Safety Talks, Platicas Sobre Seguridad para Los Trabajadores Forestales:
https://deohs.washington.edu/pnash/sites/deohs.washington.edu/pnash/files/documents/PNASH_FWSafetyTalks_EngSpn_6.15.18.pdf
- Washington State Department of Labor & Industries, Alleged Safety or Health Hazards, July 2021:
<https://www.lni.wa.gov/forms-publications/F418-052-000.pdf>
- Washington State Department of Labor & Industries, Accident Prevention Program (APP):
[https://www.lni.wa.gov/safety-health/preventing-injuries-illnesses/create-a-safety-program/accident-prevention-program#:~:text=Accident%20Prevention%20Program%20\(APP\),as%20their%20cornerstone%20safety%20program](https://www.lni.wa.gov/safety-health/preventing-injuries-illnesses/create-a-safety-program/accident-prevention-program#:~:text=Accident%20Prevention%20Program%20(APP),as%20their%20cornerstone%20safety%20program)
- Carl Wilmsen, A. Butch de Castro, Diane Bush & Marcy J. Harrington (2019): System Failure: Work Organization and Injury Outcomes among Latino Forest Workers, Journal of Agromedicine, DOI: 10.1080/1059924X.2019.1567421.
- Worksafe BC, Fatigue Risk in the Workplace: Fatigue Impairment - WorkSafeBC:
<https://www.worksafebc.com/en/health-safety/hazards-exposures/fatigue-impairment>

Appendix 1: Injured Worker—English



**The worker next to me was not paying attention.
He cut a tree and it dropped on me.**

Photo credit: Carl Willmsen; Source: UW PNASH, Forest Worker Safety Talks, Platicas Sobre Seguridad para Los Trabajadores Forestales, https://deohs.washington.edu/pnash/sites/deohs.washington.edu.pnash/files/documents/PNASH_FWSafetyTalks_EngSpn_6.15.18.pdf

Appendix 1: Injured Worker—Spanish



El trabajador a un lado de me no estaba poniendo atención. Cortó un árbol y cayó sobre me.

Photo credit: Carl Willmsen; Source: UW PNASH, Forest Worker Safety Talks, Platicas Sobre Seguridad para Los Trabajadores Forestales, https://deohs.washington.edu/pnash/sites/deohs.washington.edu.pnash/files/documents/PNASH_FWSafetyTalks_EngSpn_6.15.18.pdf

HEALTH IMPACTS SAFETY



- **Too little sleep causes:**
 - accidents, incidents and errors
 - health problems
- **Lifestyle and work can both influence:**
 - how much we sleep
 - how well we sleep

Safety Meeting Guide

TWH 1: What's sleep got to do with it?

<http://ow.ly/jHa00>

INSTRUCTIONS: Hold the guide with this side facing you and the other side facing your committee. Then share the information on this page.

Our safety committee meeting today is about a 35 year old truck driver who fell asleep at the wheel, causing a crash that killed a passenger in another vehicle. Multiple other vehicles were involved in this accident and charges were pressed against the truck driver.

We know that too little sleep can cause accidents. We also know that too little sleep, or sleeping at the wrong time, can add to health problems like obesity and high blood pressure. There are things that organizations can do to help employees increase how much sleep they get.



So here are some ways we can improve our sleep.

- Share information at your workplace about the importance of sleep and of good sleep hygiene practices.
- Discuss lifestyle choices or behaviors that help promote our ability to sleep, such as:
 - Establish a very regular and relaxing bedtime routine.
 - Avoid exercising, or ingesting caffeine or alcohol too close to bedtime as these will prevent or disturb sleep.
- For supervisors, think about ways your company can change shift or overtime requirements, or support 'power naps' at work so employees get the sleep they need.

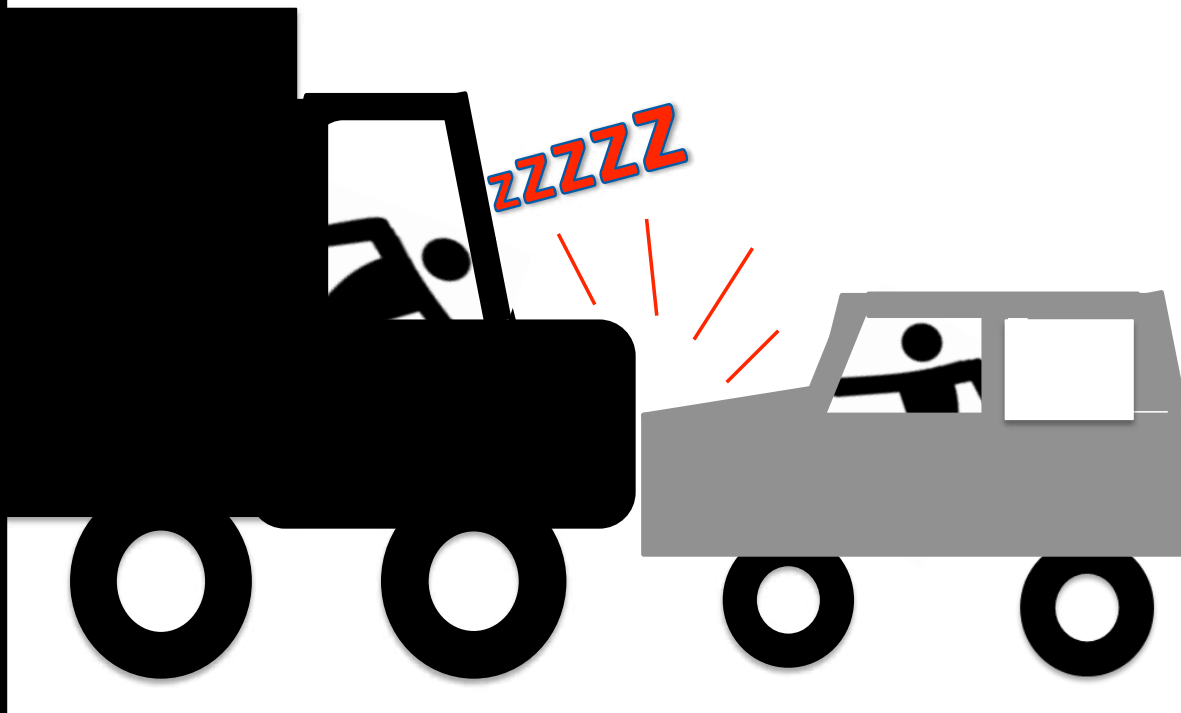
ASK: "Does anyone have more ideas or comments to share?"

Pause for discussion. Then see if there are ways to take action.

END WITH ACTION PLAN (ideas for what to ask or say).

- How much sleep do you get most nights?
 - Consider self-monitoring your bed and wake times, or use an app to monitor sleep for one week. Then set up a goal to prepare and go to bed earlier and at more regular times for one week to get more sleep.
- Have you ever had a "near miss" that you think was related to being tired?
- Brainstorm hazards for poor sleep and fatigue in your workplace.
- Are there things you have found that helps you get more regular sleep?

¡LA SALUD IMPACTA LA SEGURIDAD!



- **Dormir poco causa:**
 - **accidentes, incidentes y errores**
 - **problemas de salud**
- **Estilo de vida y el trabajo pueden influir:**
 - **cuánto duermes**
 - **qué tan bien duermes**

Guía de seguridad para reuniones

TWH 1: ¿Qué tiene que ver mi sueño con esto?

<http://ow.ly/iHa00>

INSTRUCCIONES: Con este lado de la guía hacia ti y el otro lado hacia tu comité, comparte la información en esta hoja.

Hoy nuestra reunión del comité de seguridad es sobre un conductor de camiones de 35 años que se durmió tras el volante, causando un choque que mató a un pasajero de otro vehículo. Hubieron varios vehículos en este accidente y acusaron del crimen al conductor de camiones.



Sabemos que dormir poco puede ocasionar accidentes. También sabemos que dormir poco, o dormir a la hora equivocada, contribuye a los problemas de salud, como obesidad y presión alta. Hay cosas que las organizaciones pueden hacer para ayudar a los trabajadores a dormir más.

Aquí hay unas maneras para mejorar nuestro sueño.

- Comparte información en tu entorno laboral sobre la importancia de buenos hábitos de higiene del sueño.
- Habla de los estilos de vida o comportamientos que promueven nuestra habilidad del sueño, tales como:
 - establecer una rutina regular y relajante a la hora de acostarte.
 - evitar el ejercicio, o beber cafeína o alcohol demasiado cerca de la hora de acostarte ya que éstas evitarán o interrumpirán el sueño.
- Para supervisores, piensen en maneras que tu compañía puede cambiar requisitos de turno o de tiempo extra, o apoya las 'siestas cortas' en el trabajo para que los trabajadores duerman lo que necesitan.

PREGUNTA: “¿alguien tiene ideas adicionales o comentarios para compartir?”
Pausa para charlar. Luego mira si hay cosas que hacer.

TERMINA CON PLAN DE ACCIÓN (ideas para preguntar o decir)

- ¿Cuánto duermes la mayoría de las noches?
 - Considera auto-monitorear tus horas de acostarte y despertarte, o usa una aplicación para monitorear el sueño durante una semana. Luego establece una meta para prepararte e irte a dormir temprano y hacerlo con más regularidad por una semana para dormir más.
- ¿Has visto algo que “por poco sucede” que crees tiene que ver con el cansancio?
- Aporta los peligros en tu entorno laboral por dormir poco y por fatiga.
- ¿Has descubierto cosas que te ayudan a dormir mejor?

Appendix 3: Solutions for Hazard Control



REMOVE THE HAZARD

The most effective strategy is always to remove or eliminate the hazard.



REDUCE THE HAZARD

Reduce worker exposure to the hazard.



IMPROVE POLICIES & PROCEDURES

Change the way we do work.



WEAR PPE

Wearing Personal Protective Equipment (PPE) is the strategy to use if options 1, 2, and 3 are not possible.

Appendix 3: Soluciones Para Controlar Los Riesgos

1

ELIMINAR EL RIESGO.

La estrategia más eficaz siempre es eliminar el riesgo.

2

CONTROLAR EL RIESGO.

Mantener a los trabajadores alejados del riesgo.

3

MEJORAR POLÍTICAS Y PROCEDIMIENTOS.

Cambiar nuestra manera de trabajar.

4

USAR EQUIPO DE PROTECCIÓN PERSONAL.

Usar el equipo de protección personal (EPP) es la estrategia a la que se debe recurrir si las opciones 1, 2 y 3 no son posibles.

Appendix 4: Answers to Post-Training Assessment

1. True

A hazard is something that can injure you, make you sick, or harm your mental health. For example, sharp tools are a hazard. Fatigue is a hazard.

2. False

Always be aware of where the tip of the bar is on the chainsaw, and don't let it make contact with an object, such as a leaning tree, branch, rock, or ground. Prevents chainsaw kickback.

3. False

Pace of work impacts the safety of everyone on site. Employers are responsible for managing the risk of harm at work when workers become fatigued. Breaks are part of an effective health and safety program.

4. False

In the hierarchy of controls and solutions, PPE is considered the solution of last resort. It does not remove the hazard itself, it may not be worn properly, it is sometimes difficult to communicate, and it may not fit. PPE should be considered when other strategies are not feasible.

5. True

Two escape routes are best practice when felling a tree. However, it is important to use the route that keeps you from going directly behind the tree. Stay out of the danger zones.

Appendix 5: Standalone Augmented Reality Refresher Trainings

The team developed two interactive stand-alone programs using augmented reality. These programs can be used on a tablet or smart phone (Android) as a refresher while in the field or in the classroom. These are short exercises (3–4 minutes). Students will receive instant feedback on their answers, with a thumbs up or thumbs down icon.

General AR Instructions on a tablet to tell students:

- Choose an open space that is well lit. Consider using outdoors.
- Prepare an open space that allows you to move around to get started.
- Turn on tablet and select program.
- Hold tablet until you see ACE badges on the floor.
- Click on the ACE badges.
- See the chainsaw or Joe, the forestry worker, image.
- Move your physical location and the tablet to adjust sizing.
- Walk around the chainsaw or Joe to see all the necessary parts.
- Onboarding Videos:
Onboarding AR English: <https://vimeo.com/727215553/c000961681>
Onboarding AR Spanish: <https://vimeo.com/727215569/55f3128f88>

Personal Protective Equipment AR

This training exercise identifies the common locations on the body that injuries occur when using a chainsaw. Students are asked to select the correct PPE for protection.

“My name is Joe. I’m a forestry worker. I work in one of the most hazardous jobs in the US. According to collected information, did you know that over 28,000 injuries occur each year from gas and electric chainsaw use.”

English: <https://vimeo.com/628650798/3e5c582a0e>

Spanish: <https://vimeo.com/703452616/27cc364e85>



Chainsaw Safety AR

This training reviews the anatomy of a chainsaw and asks students to select the appropriate chainsaw part. Review the anatomy of a chainsaw: Point the device's reticle at the chainsaw and reveal the component and its name. How well do you know the parts of a chainsaw? Students are asked to identify chainsaw parts.



Reticle

English	Spanish
Chain	Cadena
Chain Tension, Chain Bar, and Condition	Tension de cadena, espada y condicion
Front Hand Guard and Chain Brake	Proteccion de mano y freno de cadena
Front Handle	Agarradera Frontal
Manufacturers Warning	Advertencias del fabricante
Muffler	Silenciador
On/Off Switch and Throttle Control Lock	Interruptor de encendido y ahogador / bloqueo del acelerador
Rear Handle and Hand Guard	garradera trasera y cubierta de mano
Sprocket Cover Plate and Chain Catcher	Cubierta de engranaje y cubre cadena
Start Handle	Manija de inicio
Throttle Trigger	Acelerador
Throttle Trigger Lockout	Seguro del acelerador



How well do you know chainsaw safety?

Students are asked to select components related to safety on a chainsaw.

What component is key in preventing a broken or dislodged chain from striking the operator?

Which components will stop the chain when pressure is applied?

Which component in addition to the throttle lock is used to reduce chain speed as a protective measure?

Which component must be adjusted to the proper tension?

Review the anatomy of a chainsaw:

- English: <https://vimeo.com/717703321/53aac5eb66>
- Spanish: <https://vimeo.com/707611995/575e5be1a0>

