Chainsaw Operation for Vegetation Management

SUMMARY

This safe work practice for Chainsaw Operation for Vegetation Management establishes the minimum requirements for contractor safety management and ensures both health and safety expectations associated with the work performed on behalf of PG&E are understood and communicated. PG&E, as the hiring company and asset owner, has a primary interest to protect PG&E employees, contractor employees, and the general public from personal injury. This safe work practice fulfills the compliance requirements in the SAFE-3000 series guidance for contractor safety and the SAFE-1000 series guidance for employee safety. All safe work practices referenced herein are copyright of their respective owners, used with permission by PG&E. The active version of a regulation, standard, or other reference supersedes any older quotation, citation, or other information in this safe work practice.

TARGET AUDIENCE

PG&E employees and contractors performing vegetation management operations. Additionally, any person performing the work of contractors (at any tier) as defined as “medium” and “high” risk that perform work activities on behalf of PG&E on either PG&E-owned or customer-owned sites and assets.

SCOPE

This safe work practice includes compliance and conformance requirements of applicable federal, state, and national/international regulations and consensus standards pertaining to Chainsaw Operations. The information contained in this Safe Work Practice serves as the foundation for applicable tailboards, field guides, competency assessments, and slide decks as additional safety communication tools to aid in implementation to VM operations. Section 3: PG&E Administrative Controls provides a location for topics which may exceed minimum compliance requirements or conformance for enhanced safety measures.

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REQUIREMENTS

1 Hazard Categories

1.1 The Occupational Safety and Health Act requires employers to comply with safety and health standards promulgated by OSHA or by a state with an OSHA-approved state plan. In addition, pursuant to Section 5(a)(1), the General Duty Clause of the Act, employers must provide their employees with a workplace free from **recognized hazards** likely to cause death or serious physical harm. Employers can be cited for violating the General Duty Clause if there is a recognized hazard and they do not take reasonable steps to prevent or abate the hazard. However, failure to implement any recommendations in this document is not, in itself, a violation of the General Duty Clause. Citations can only be based on standards, regulations, and the General Duty Clause itself.

1.2 A hazard is a potential source of harm or adverse health effect on a person or persons and is often associated with a condition or activity that, if left uncontrolled, can result in an injury or illness. Below is a list of common hazards associated with vegetation management operations:

1. **Struck-by hazards** produce injuries caused by forcible contact or impact between the injured person and an object or piece of equipment. (https://www.osha.gov/dte/outreach/construction/focus_four/struckby/struckby_ig.pdf)

   a. Struck-by flying object

   b. Struck-by falling object

   c. Struck-by swinging object

   d. Stuck-by rolling object

2. **Caught-in or - Between hazards** are defined as injuries resulting from a person being squeezed, caught, crushed, pinched, or compressed between two or more objects, or between parts of an object. This includes individuals who get caught or crushed in operating equipment, between other mashing objects, between a moving and stationary object, or between two or more moving objects. (https://www.osha.gov/dte/outreach/construction/focus_four/caught/caught_iorb_ig.pdf)

   a. Cave-ins (trenching): Being pulled into or caught in machinery and equipment (this includes strangulation as the result of clothing caught in running machinery and equipment).

   b. Being compressed or crushed between rolling, sliding, or shifting objects such as semi-trailers and a dock wall, or between a truck frame and a hydraulic bed that is lowering.

   c. Material or part of the equipment gets positioned in such a way as it crushes the operator or a bystander.

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3. **Electrical hazard** refers to a dangerous condition where a worker could make electrical contact with energized equipment or a conductor, and from which the person may sustain an injury. Acronym: **BESAFE** (https://www.osha.gov/dte/outreach/construction/focus_four/electrocution/electr_ig.pdf)

    a. **B**urns : Electrical / thermal burns caused by contact either directly or indirectly to an electrical energy source.

    b. **E**lectrocution refers to a dangerous condition where a worker could make electrical contact with energized equipment and death occurs as a result.

    c. **S**hock refers to a dangerous condition where a worker could make electrical contact with energized equipment or a conductor, and from which the person may sustain an injury.

    d. **A**rc flash refers to a phenomenon where a flashover of electric current leaves its intended path and travels through the air from one conductor to another, or to ground. The results are often violent and when a human is in close proximity to the arc flash, serious injury and even death can occur.

    e. **F**ire caused by electrical source.

    f. **E**xplosion/ arc blast refers to the explosive burst of energy, commonly in the form of pressure waves that occurs during an arc fault or arc flash. The results are often violent and when a human is in close proximity to the arc blast, serious injury and even death can occur.

4. **Fall hazard** refers to any condition on a walking-working surface that exposes an employee to a risk of harm from a fall on the same level or to a lower level. (https://www.osha.gov/dte/outreach/construction/focus_four/falls/falls_ig.pdf)

    a. Slips and trips refers to a loss of balance caused by too little friction between a worker's feet and the surface they walk or work on and can be caused by uneven terrain, debris in the path of travel, wet surfaces, spills, or weather hazards like ice or snow.

    b. Fall to a lower level refers to a surface or area to which an employee could fall. Such surfaces or areas include, but are not limited to, ground levels, floors, roofs, ramps, runways, excavations, pits, tanks, materials, water, equipment, and similar surfaces and structures, or portions thereof.

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c. Swing fall is created by the pendulum effect, which can swing a fallen worker into a nearby surface, such as a wall or protruding beam. In addition to calculating the total fall clearance distance before beginning work on an elevated level, it is important to evaluate the swing fall hazard at the edges where a worker might fall. A worker who falls while connected to an anchor (unless it is directly overhead) will swing back and forth like a pendulum. Workers can be seriously injured if they strike objects during a swing fall. Installing the anchorage point directly above the work area (i.e., connected to an overhead attachment point with sufficient strength) will help prevent injury.

5. **Stored energy hazard** refers to the uncontrolled release of mechanical, pneumatic, hydraulic, or electrical energy when performing repairs or maintenance to the equipment.(https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.147)

6. **Chemical hazard** means any chemical which is classified as a physical hazard or a health hazard, a simple asphyxiant, combustible dust, pyrophoric gas, or hazard not otherwise classified. Toxic industrial chemicals can be in the gas, liquid, or solid state. They can be chemical hazards (e.g., carcinogens, reproductive hazards, corrosives, or agents that affect the lungs or blood) or physical hazards (e.g., flammable, combustible, explosive, or reactive).(https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1200)

7. **Fire hazard** is a condition or material that may start or contribute to the spread of fire. Fire requires three components to burn: fuel, oxygen, and a heat source. Below are different classifications of fire, based on fuel sources. (https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.155)

   a. "Class A fire" means a fire involving ordinary combustible materials such as paper, wood, cloth, and some rubber and plastic materials.

   b. "Class B fire" means a fire involving flammable or combustible liquids, flammable gases, greases and similar materials, and some rubber and plastic materials.

   c. "Class C fire" means a fire involving energized electrical equipment where safety to the employee requires the use of electrically nonconductive extinguishing media.

   d. "Class D fire" means a fire involving combustible metals such as magnesium, titanium, zirconium, sodium, lithium and potassium.

8. **Radiation hazard** includes ionizing and non-ionizing radiation. Non-ionizing radiation from electrical conductors and antenna refers to an electromagnetic field (EMF) produced most commonly by electrical conductors, cell phone antennas, and radio antennas, present in the workplace in proximity to electrical AC & DC lines and electrical equipment.

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a. Ionizing radiation includes alpha rays, beta rays, gamma rays, X-rays, neutrons, high-speed electrons, high-speed protons, and other atomic particles; but such term does not include sound or radio waves, or visible light, or infrared or ultraviolet light. (https://www.osha.gov/pls/oshaweb/owadisp.show_unique?p_table_name=STANDARDS&p_unique_file=1910_1096&p_anchor_name=)

b. Non-ionizing radiation The term electromagnetic radiation is restricted to that portion of the spectrum commonly defined as the radio frequency region, which for the purpose of this specification shall include the microwave frequency region.(https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.97)

9. **Biological hazard** include biological agents including bacteria, viruses, fungi, other microorganisms, and their associated toxins. They have the ability to adversely affect human health in a variety of ways, ranging from relatively mild, allergic reactions to serious medical conditions—even death. Some organisms, including various types of mold and Legionella bacteria, are found readily in the natural and built environment. Many are capable of spreading from person to person (e.g., bloodborne pathogens and influenza viruses), either directly or indirectly; some, including Zika virus, are transmitted by insect vectors. In some forms, biological agents can also be weaponized for use in bioterrorism or other crimes. (https://www.osha.gov/biological-agents)

a. Stinging and biting insects is a hazard when an insect present on the job site may sting, bite, or cause harm to a worker. This may cause immediate skin reaction, serious allergic reactions, delayed symptoms, and possible disease transmission.

b. Animals and reptiles are a hazard when an animal or reptile is present on the job site and is either provoked or believes it is threatened and causes harm to a worker.

c. Poisonous plants are a hazard when present on the job site and a worker is exposed to poisonous plants, plant parts, or extracts. An allergic reaction on the affected body part, usually the skin, may cause harm to the worker by negatively impacting their health.

d. Pathogenic microorganisms refers to an infectious biological agent that can cause disease or illness to its host. Examples include bacteria, viruses, fungi, and parasites.

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10. **Hazardous noise** is measured in units of sound pressure levels called decibels, using an A-weighted sound levels (dBA).Exposure to high levels of noise can cause permanent hearing loss. Neither surgery nor a hearing aid can help correct this type of hearing loss. Short term exposure to loud noise can also cause a temporary change in hearing (ears may feel stuffed up) or a ringing in the ears (tinnitus). These short-term problems may go away within a few minutes or hours after leaving the noise. However, repeated exposures to loud noise can lead to permanent tinnitus and/or hearing loss. Loud noise can create physical and psychological stress, reduce productivity, interfere with communication and concentration, and contribute to workplace accidents and injuries by making it difficult to hear warning signals. The effects of noise induced hearing loss can be profound, limiting your ability to hear high frequency sounds, understand speech, and seriously impairing your ability to communicate. (https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.95)

    a. PEL: The permissible exposure limit (PEL) for noise is 90 dBA, as an eight hour time-weighted average (TWA). The PEL is also referred to as a 100 percent "dose" noise exposure. [Table G-16]

    b. Exchange Rate: The standard utilizes a 5 decibel (dB)exchange rate.

    c. Maximum Continuous Noise: As interpreted from the table, exposure to continuous steady-state noise is limited to a maximum of 115 dBA.

    d. If the variations in noise level involve maxima at intervals of one second or less, it is to be considered continuous. [1910.95(b)(2)]

    e. Impulse Noise: The standard states that exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level. [Table G-16]

    f. Since the standard utilizes a 5 dB exchange rate, a TWA exposure of 95 dBA is equivalent to a dose of 200 percent, while a TWA exposure of 85 dBA is equivalent to a dose of 50 percent.

    g. Most modern noise measuring instruments provide readouts in both noise dose and TWA.

    h. Refer to 1910.95 Appendix A: Noise Exposure Computation for instructions and additional information for computing employee noise exposures.

11. **Ergonomic hazard** refers to a condition in the workplace that pose risk of injury to the musculoskeletal system of the worker. Ergonomic risk factors include overexertion, repetitive motion, vibration, contract stress, vibration, and extreme temperature. (https://www.osha.gov/ergonomics)

    a. Overexertion (ergonomic hazard) refers to a worker sustaining a musculoskeletal injury/ disorder (MSD) when the amount of work attempted exceeds the limits of the body parts doing the work.

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b. Repetitive motion (ergonomic hazard) refers to doing the same motion over and over or using certain types of positions or grips and can a worker to sustain a musculoskeletal injury/ disorder (MSD).

c. Vibration (ergonomic hazard) are classified into two general types: hand-arm vibration (HAV) and whole-body vibration (WBV). Hand-arm vibration exposure, besides being a known contributing factor to carpal tunnel syndrome and other ergonomic-related injuries, causes direct injury to the fingers and hand, affecting feeling, dexterity, and grip. Whole-body vibration (WBV) is a consideration when dealing with higher than expected levels of low back pain and injury in the workforce and is one of the most pervasive causes of lost time injuries according to the *Journal of the American Medical Association*.

d. Awkward Posture (ergonomic hazard) refers to positions of the body that deviate significantly from the neutral position while performing work activities.

e. Contract Stress/ Pressure (ergonomic hazard) happens when force is concentrated on a small area of the body, pinching or crushing tissue and causing discomfort and often pain.

f. Extreme Temperature (physical/ergonomic hazard) refers to air temperature is above 90 degrees Fahrenheit for a period of 2 days (extreme heat) or when the temperature is significantly below freezing or when it's at freezing levels and wind speed has increased (extreme cold).

12. **Psychological hazard** includes occupational stress as a result of coping with stressful situations found in any workplace. High hazard occupations especially require workers to deal with life-threatening situations with possible outcomes of injury and illnesses complicated by overwork, understaffing, tight schedules, paperwork, intricate or malfunctioning equipment, complex hierarchies of authority and skills, dependent and demanding clients, colleagues, and; all of these contribute to stress (https://www.osha.gov/recordkeeping/)

13. **Equipment / Tool hazard** refers to a condition in the workplace that pose risk of injury or illness to an operator, bystander or other workers if the equipment, is used in accordance with recognized health and safety regulations, is improperly maintained, or, or not used in a fashion that the manufacturer had intended. (https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.600)

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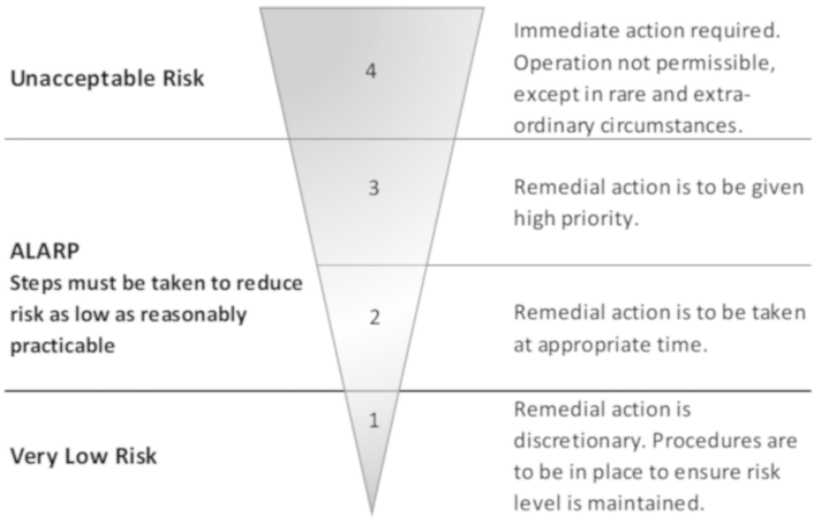
1.3 Applicable Chainsaw Operation Hazard Categories (Top 5 Most Common)

1. Struck-by hazards (flying objects, falling object, swinging object, rolling object, cut by chainsaw)
2. Electrical hazards (electrical shock, electrocution, burns, arc flash, arch blast)
3. Fall hazards (slips, trips, and falls to lower level)
4. Noise hazards
5. Ergonomic hazards (overexertion, repetitive motion, vibration, awkward posture, contact stress/pressure, extreme temperature)

2 Hazard Controls

2.1 The intent of these safe work practices is to prevent or mitigate hazards associated with vegetation management operations with a particular focus towards hazard identification and risk assessment performance criteria. The goal is to reduce risk to an **A**s **L**ow **a**s **R**easonably **P**ractical level (**ALARP** Model, see Figure 1), so that work can safely be conducted. If risk cannot be reduced to an acceptable level, all work must stop until appropriate controls are in place. Above is a list of hazard categories and hazards associated with vegetation management operations. While not all inclusive, this list is capable of providing several examples of hazards common to vegetation management operations.

Figure 1 ALARP Model According to ISO 31010-2019



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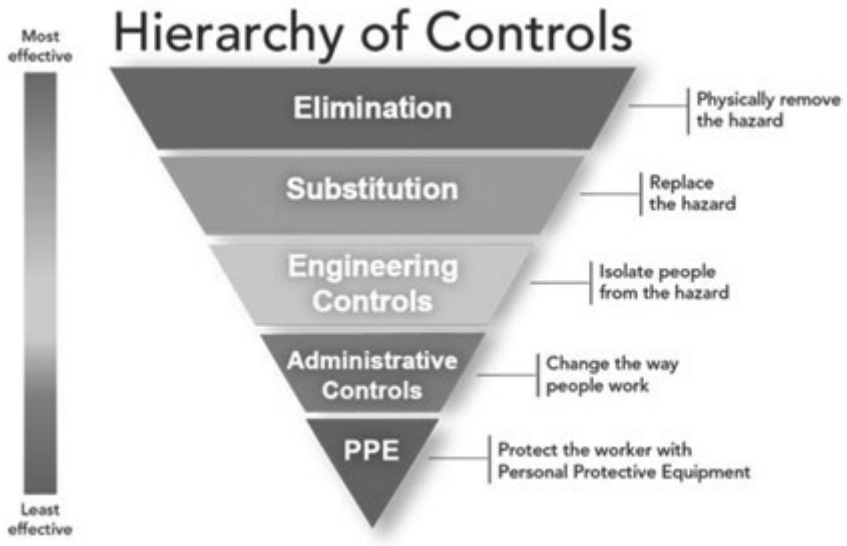
2.2 In order to establish an operating framework for addressing many different types of hazards, PG&E has adopted the National Institute of Occupational Safety and Health's (NIOSH) Hierarchy of Controls as an effective framework for mitigating hazards on the worksite.

According to NIOSH, "Controlling exposures to occupational hazards is the fundamental method of protecting workers. Traditionally, a hierarchy of controls has been used as a means of determining how to implement feasible and effective control solutions."

One representation of this hierarchy is as follows. The idea behind this hierarchy is that the control methods at the top of the graphic are potentially more effective and protective than those at the bottom. Following this hierarchy normally leads to the implementation of inherently safer systems, where the risk of illness or injury has been substantially reduced.



3 PG&E Administrative Controls

3.1 The chain break shall be engaged when starting the saw or whenever not actively cutting.

3.2 Aerial Chainsaw Use for Climbers/Aerial Lift Operators Tailboard

4 Federal OSHA Safety Compliance Requirements

4.1 Federal OSHA Requirements 1910 Subpart R Special Industries

1. Electric Power Generation, Transmission, and Distribution (1910.269)

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a. General (1910.269(a))

(1) Application (1910.269(a)(1))

- This section covers the operation and maintenance of electric power generation, control, transformation, transmission, and distribution lines and equipment. These provisions apply to: (1910.269(a)(1)(i))

  o Line-clearance tree trimming performed for the purpose of clearing space around electric power generation, transmission, or distribution lines or equipment and on behalf of an organization that operates, or that controls the operating procedures for, those lines or equipment, as follows: (1910.269(a)(1)(i)(E))

    ▪ Entire §1910.269, except paragraph (r)(1) of this section, applies to line-clearance tree trimming covered by the introductory text to paragraph (a)(1)(i)(E) of the section when performed by qualified employees (those who are knowledgeable in the construction and operation of the electric power generation, transmission, or distribution equipment involved, along with the associated hazards). (1910.269(a)(1)(i)(E)(1))

    ▪ Paragraphs (a)(2), (a)(3), (b), (c), (g), (k), (p), and (r) of this section apply to line-clearance tree trimming covered by the introductory text to paragraph (a)(1)(i)(E) of this section when performed by line-clearance tree trimmers who are not qualified employees. (1910.269(a)(1)(i)(E)(2))

- This section applies in addition to all other applicable standards contained in this part 1910. Employers covered under this section are not exempt from complying with other applicable provisions in part 1910 by the operation of §1910.5(c). Specific references in this section to other sections of part 1910 are for emphasis only. (1910.269(a)(1)(iii))

b. Line-clearance tree trimming. This paragraph provides additional requirements for line-clearance tree trimming and for equipment used in this type of work. (1910.269(r))

(1) Electrical hazards. This paragraph does not apply to qualified employees. (1910.269(r)(1))

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- Before an employee climbs, enters, or works around any tree, a determination shall be made of the nominal voltage of electric power lines posing a hazard to employees. However, a determination of the maximum nominal voltage to which an employee will be exposed may be made instead, if all lines are considered as energized at this maximum voltage. (1910.269(r)(1)(i))

- There shall be a second line-clearance tree trimmer within normal (that is, unassisted) voice communication under any of the following conditions: (1910.269(r)(1)(ii))

    - o If a line-clearance tree trimmer is to approach more closely than 3.05 meters (10 feet) to any conductor or electric apparatus energized at more than 750 volts; (1910.269(r)(1)(ii)(A))

    - o If branches or limbs being removed are closer to lines energized at more than 750 volts than the distances listed in Table R-5, Table R-6, Table R-7, and Table R-8; or (1910.269(r)(1)(ii)(B))

    - o If roping is necessary to remove branches or limbs from such conductors or apparatus. (1910.269(r)(1)(ii)(C))

- Line-clearance tree trimmers shall maintain the minimum approach distances from energized conductors given in Table R-5, Table R-6, Table R-7, and Table R-8. (1910.269(r)(1)(iii))

- Branches that are contacting exposed energized conductors or equipment or that are within the distances specified in Table R-5, Table R-6, Table R-7, and Table R-8 may be removed only through the use of insulating equipment. (1910.269(r)(1)(iv))

- Note to paragraph (1910.269(r)(1)(iv)): A tool constructed of a material that the employer can demonstrate has insulating qualities meeting paragraph (j)(1) of this section is considered as insulated under paragraph (r)(1)(iv) of this section if the tool is clean and dry.

- Ladders, platforms, and aerial devices may not be brought closer to an energized part than the distances listed in Table R-5, Table R-6, Table R-7, and Table R-8. (1910.269(r)(1)(v))

- Line-clearance tree trimming may not be performed when adverse weather conditions make the work hazardous in spite of the work practices required by this section. Each employee

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performing line-clearance tree trimming in the aftermath of a storm or under similar emergency conditions shall be trained in the special hazards related to this type of work. (1910.269(r)(1)(vi))

- Note to paragraph (1910.269(r)(1)(vi)): Thunderstorms in the immediate vicinity, high winds, snow storms, and ice storms are examples of adverse weather conditions that are presumed to make line-clearance tree trimming too hazardous to perform safely.

(2) Gasoline-engine power saws. Gasoline-engine power saw operations shall meet the requirements of § 1910.266(e) and the following: (1910.269(r)(5))

- Each power saw weighing more than 6.8 kilograms (15 pounds, service weight) that is used in trees shall be supported by a separate line, except when work is performed from an aerial lift and except during topping or removing operations where no supporting limb will be available. (1910.269(r)(5)(i))

- Each power saw shall be equipped with a control that will return the saw to idling speed when released. (1910.269(r)(5)(ii))

- Each power saw shall be equipped with a clutch and shall be so adjusted that the clutch will not engage the chain drive at idling speed. (1910.269(r)(5)(iii))

- A power saw shall be started on the ground or where it is otherwise firmly supported. Drop starting of saws over 6.8 kilograms (15 pounds), other than chain saws, is permitted outside of the bucket of an aerial lift only if the area below the lift is clear of personnel. (1910.269(r)(5)(iv))

- Note to paragraph (1910.269(r)(5)(iv)): Paragraph (e)(2)(vi) of § 1910.266 prohibits drop starting of chain saws

- A power saw engine may be started and operated only when all employees other than the operator are clear of the saw. (1910.269(r)(5)(v))

- A power saw may not be running when the saw is being carried up into a tree by an employee. (1910.269(r)(5)(vi))

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- Power saw engines shall be stopped for all cleaning, refueling, adjustments, and repairs to the saw or motor, except as the manufacturer's servicing procedures require otherwise. (1910.269(r)(5)(vii))

(3) Backpack power units for use in pruning and clearing. (1910.269(r)(6))

- While a backpack power unit is running, no one other than the operator may be within 3.05 meters (10 feet) of the cutting head of a brush saw. (1910.269(r)(6)(i))
- A backpack power unit shall be equipped with a quick shutoff switch readily accessible to the operator. (1910.269(r)(6)(ii))
- Backpack power unit engines shall be stopped for all cleaning, refueling, adjustments, and repairs to the saw or motor, except as the manufacturer's servicing procedures require otherwise. (1910.269(r)(6)(iii))

(4) Rope. (1910.269(r)(7))

- Rope shall be inspected before each use and, if unsafe (for example, because of damage or defect), may not be used. (1910.269(r)(7)(ii))
- Rope shall be stored away from cutting edges and sharp tools. Rope contact with corrosive chemicals, gas, and oil shall be avoided. (1910.269(r)(7)(iii))
- When stored, rope shall be coiled and piled, or shall be suspended, so that air can circulate through the coils. (1910.269(r)(7)(iv))
- Rope ends shall be secured to prevent their unraveling. (1910.269(r)(7)(v))
- A rope that is wet, that is contaminated to the extent that its insulating capacity is impaired, or that is otherwise not considered to be insulated for the voltage involved may not be used near exposed energized lines. (1910.269(r)(7)(vii))

(5) Basic. Each employee shall be tied in with a climbing rope and safety saddle when the employee is working above the ground in a tree, unless he or she is ascending into the tree. (1910.269(r)(8))

2. Logging operations (1910.266)

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a. Scope and application. (1910.266(b))

(1) This standard establishes safety practices, means, methods and operations for all types of logging, regardless of the end use of the wood. These types of logging include, but are not limited to, pulpwood and timber harvesting and the logging of sawlogs, veneer bolts, poles, pilings and other forest products. This standard does not cover the construction or use of cable yarding systems. (1910.266(b)(1))

(2) This standard applies to all logging operations as defined by this section. (1910.266(b)(2))

(3) Hazards and working conditions not specifically addressed by this section are covered by other applicable sections of Part 1910. (1910.266(b)(3))

b. General requirements. (1910.266(d))

(1) Personal protective equipment. (1910.266(d)(1))

- The employer shall assure that personal protective equipment, including any personal protective equipment provided by an employee, is inspected before initial use during each workshift. Defects or damage shall be repaired or the unserviceable personal protective equipment shall be replaced before work is commenced. (1910.266(d)(1)(ii))

- The employer shall assure that each employee wears foot protection, such as heavy-duty logging boots that are waterproof or water repellent, cover and provide support to the ankle. The employer shall assure that each employee who operates a chain saw wears foot protection that is constructed with cut-resistant material which will protect the employee against contact with a running chain saw. Sharp, calk-soled boots or other slip-resistant type boots may be worn where the employer demonstrates that they are necessary for the employee's job, the terrain, the timber type, and the weather conditions, provided that foot protection otherwise required by this paragraph is met. (1910.266(d)(1)(v))

- The employer shall provide, at no cost to the employee, and assure that each employee who works in an area where there is potential for head injury from falling or flying objects wears head protection meeting the requirements of subpart I of Part 1910. (1910.266(d)(1)(vi))

- The employer shall provide, at no cost to the employee, and assure that each employee wears the following:

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(1910.266(d)(1)(vii))

- o Eye protection meeting the requirements of subpart I of Part 1910 where there is potential for eye injury due to falling or flying objects; and (1910.266(d)(1)(vii)(A))

- o Face protection meeting the requirements of subpart I of Part 1910 where there is potential for facial injury such as, but not limited to, operating a chipper. Logger-type mesh screens may be worn by employees performing chain-saw operations and yarding. (1910.266(d)(1)(vii)(B))

(2) First-aid kits. (1910.266(d)(2))

- The employer shall provide first-aid kits at each work site where trees are being cut (e.g., felling, buckling, limbing), at each active landing, and on each employee transport vehicle. The number of first-aid kits and the content of each kit shall reflect the degree of isolation, the number of employees, and the hazards reasonably anticipated at the work site. (1910.266(d)(2)(i))

- At a minimum, each first-aid kit shall contain the items listed in Appendix A at all times. (1910.266(d)(2)(ii))

- The employer also may have the number and content of first-aid kits reviewed and approved annually by a health care provider. (1910.266(d)(2)(iii))

- The employer shall maintain the contents of each first-aid kit in a serviceable condition. (1910.266(d)(2)(iv))

(3) Fire extinguishers. The employer shall provide and maintain portable fire extinguishers on each machine and vehicle in accordance with the requirements of subpart L of Part 1910. (1910.266(d)(4))

(4) Environmental conditions. All work shall terminate and each employee shall move to a place of safety when environmental conditions, such as but not limited to, electrical storms, strong winds which may affect the fall of a tree, heavy rain or snow, extreme cold, dense fog, fires, mudslides, and darkness, create a hazard for the employee in the performance of the job. (1910.266(d)(5))

(5) Work areas. (1910.266(d)(6))

- Employees shall be spaced and the duties of each employee shall be organized so the actions of one employee will not create

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a hazard for any other employee. (1910.266(d)(6)(i))

- Work areas shall be assigned so that trees cannot fall into an adjacent occupied work area. The distance between adjacent occupied work areas shall be at least two tree lengths of the trees being felled. The distance between adjacent occupied work areas shall reflect the degree of slope, the density of the growth, the height of the trees, the soil structure and other hazards reasonably anticipated at that work site. A distance of greater than two tree lengths shall be maintained between adjacent occupied work areas on any slope where rolling or sliding of trees or logs is reasonably foreseeable. (1910.266(d)(6)(ii))

- Each employee performing a logging operation at a logging work site shall work in a position or location that is within visual or audible contact with another employee. (1910.266(d)(6)(iii))

- The employer shall account for each employee at the end of each workshift. (1910.266(d)(6)(iv))

(6) Signaling and signal equipment. (1910.266(d)(7))

- Hand signals or audible contact, such as but not limited to, whistles, horns, or radios, shall be utilized whenever noise, distance, restricted visibility, or other factors prevent clear understanding of normal voice communications between employees. (1910.266(d)(7)(i))

- Engine noise, such as from a chain saw, is not an acceptable means of signaling. Other locally and regionally recognized signals may be used. (1910.266(d)(7)(ii))

- Only a designated person shall give signals, except in an emergency. (1910.266(d)(7)(iii))

(7) Overhead electric lines. (1910.266(d)(8))

- Logging operations near overhead electric lines shall be done in accordance with the requirements of 29 CFR 1910.333(c)(3). (1910.266(d)(8)(i))

- The employer shall notify the power company immediately if a felled tree makes contact with any power line. Each employee shall remain clear of the area until the power company advises that there are no electrical hazards. (1910.266(d)(8)(ii))

(8) Flammable and combustible liquids. (1910.266(d)(9))

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- Flammable and combustible liquids shall be stored, handled, transported, and used in accordance with the requirements of subpart H of Part 1910. (1910.266(d)(9)(i))
- Flammable and combustible liquids shall not be transported in the driver compartment or in any passenger-occupied area of a machine or vehicle. (1910.266(d)(9)(ii))
- Each machine, vehicle and portable powered tool shall be shut off during fueling. Diesel-powered machines and vehicles may be fueled while they are at idle, provided that continued operation is intended and that the employer follows safe fueling and operating procedures. (1910.266(d)(9)(iii))

c. Hand and portable powered tools. (1910.266(e))

(1) Chain saws. (1910.266(e)(2))

- Each chain saw placed into initial service after the effective date of this section shall be equipped with a chain brake and shall otherwise meet the requirements of the ANSI B175.1-1991 "Safety Requirements for Gasoline-Powered Chain Saws", which is incorporated by reference as specified in Sec. 1910.6. Each chain saw placed into service before the effective date of this section shall be equipped with a protective device that minimizes chain-saw kickback. No chain-saw kickback device shall be removed or otherwise disabled. (1910.266(e)(2)(i))
- Each gasoline-powered chain saw shall be equipped with a continuous pressure throttle control system which will stop the chain when pressure on the throttle is released. (1910.266(e)(2)(ii))
- The chain saw shall be operated and adjusted in accordance with the manufacturer's instructions. (1910.266(e)(2)(iii))
- The chain saw shall be fueled at least 10 feet (3 m) from any open flame or other source of ignition. (1910.266(e)(2)(iv))
- The chain saw shall be started at least 10 feet (3 m) from the fueling area. (1910.266(e)(2)(v))
- The chain saw shall be started on the ground or where otherwise firmly supported. Drop starting a chain saw is prohibited. (1910.266(e)(2)(vi))
- The chain saw shall be started with the chain brake engaged. (1910.266(e)(2)(vii))

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- The chain saw shall be held with the thumbs and fingers of both hands encircling the handles during operation unless the employer demonstrates that a greater hazard is posed by keeping both hands on the chain saw in that particular situation. (1910.266(e)(2)(viii))
- The chain-saw operator shall be certain of footing before starting to cut. The chain saw shall not be used in a position or at a distance that could cause the operator to become off-balance, to have insecure footing, or to relinquish a firm grip on the saw. (1910.266(e)(2)(ix))
- Prior to felling any tree, the chain-saw operator shall clear away brush or other potential obstacles which might interfere with cutting the tree or using the retreat path. (1910.266(e)(2)(x))
- The chain saw shall not be used to cut directly overhead. (1910.266(e)(2)(xi))
- The chain saw shall be carried in a manner that will prevent operator contact with the cutting chain and muffler. (1910.266(e)(2)(xii))
- The chain saw shall be shut off or the throttle released before the feller starts his retreat. (1910.266(e)(2)(xiii))
- The chain saw shall be shut down or the chain brake shall be engaged whenever a saw is carried further than 50 feet (15.2 m). The chain saw shall be shut down or the chain brake shall be engaged when a saw is carried less than 50 feet if conditions such as, but not limited to, the terrain, underbrush and slippery surfaces, may create a hazard for an employee. (1910.266(e)(2)(xiiv))

d. Tree harvesting. (1910.266(h))

(1) General requirements. (1910.266(h)(1))

- Trees shall not be felled in a manner that may create a hazard for an employee, such as but not limited to, striking a rope, cable, power line, or machine. (1910.266(h)(1)(i))
- The immediate supervisor shall be consulted when unfamiliar or unusually hazardous conditions necessitate the supervisor's approval before cutting is commenced. (1910.266(h)(1)(ii))
- While manual felling is in progress, no yarding machine shall be operated within two tree lengths of trees being manually felled. EXCEPTION: This provision does not apply to yarding machines performing tree pulling operations. (1910.266(h)(1)(iii))

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- No employee shall approach a feller closer than two tree lengths of trees being felled until the feller has acknowledged that it is safe to do so, unless the employer demonstrates that a team of employees is necessary to manually fell a particular tree. (1910.266(h)(1)(iv))
- No employee shall approach a mechanical felling operation closer than two tree lengths of the trees being felled until the machine operator has acknowledged that it is safe to do so. (1910.266(h)(1)(v))
- Each danger tree shall be felled, removed or avoided. Each danger tree, including lodged trees and snags, shall be felled or removed using mechanical or other techniques that minimize employee exposure before work is commenced in the area of the danger tree. If the danger tree is not felled or removed, it shall be marked and no work shall be conducted within two tree lengths of the danger tree unless the employer demonstrates that a shorter distance will not create a hazard for an employee. (1910.266(h)(1)(vi))
- Each danger tree shall be carefully checked for signs of loose bark, broken branches and limbs or other damage before they are felled or removed. Accessible loose bark and other damage that may create a hazard for an employee shall be removed or held in place before felling or removing the tree. (1910.266(h)(1)(vii))
- Felling on any slope where rolling or sliding of trees or logs is reasonably foreseeable shall be done uphill from, or on the same level as, previously felled trees. (1910.266(h)(1)(viii))
- Domino felling of trees is prohibited. (1910.266(h)(1)(ix))

  NOTE to paragraph (h)(1)(ix): The definition of domino felling does not include the felling of a single danger tree by felling another single tree into it.

(2) Manual felling. (1910.266(h)(2))

- Before felling is started, the feller shall plan and clear a retreat path. The retreat path shall extend diagonally away from the expected felling line unless the employer demonstrates that such a retreat path poses a greater hazard than an alternate path. Once the backcut has been made the feller shall immediately move a safe distance away from the tree on the retreat path. (1910.266(h)(2)(i))
- Before each tree is felled, conditions such as, but not limited to, snow and ice accumulation, the wind, the lean of tree, dead

limbs, and the location of other trees, shall be evaluated by the feller and precautions taken so a hazard is not created for an employee. (1910.266(h)(2)(ii))

- Each tree shall be checked for accumulations of snow and ice. Accumulations of snow and ice that may create a hazard for an employee shall be removed before felling is commenced in the area or the area shall be avoided. (1910.266(h)(2)(iii))
- When a spring pole or other tree under stress is cut, no employee other than the feller shall be closer than two trees lengths when the stress is released. (1910.266(h)(2)(iv))
- An undercut shall be made in each tree being felled unless the employer demonstrates that felling the particular tree without an undercut will not create a hazard for an employee. The undercut shall be of a size so the tree will not split and will fall in the intended direction. (1910.266(h)(2)(v))
- A backcut shall be made in each tree being felled. The backcut shall leave sufficient hinge wood to hold the tree to the stump during most of its fall so that the hinge is able to guide the tree's fall in the intended direction. (1910.266(h)(2)(vi))
- The backcut shall be above the level of the horizontal facecut in order to provide an adequate platform to prevent kickback. EXCEPTION: The backcut may be at or below the horizontal facecut in tree pulling operations. (1910.266(h)(2)(vii))

  NOTE to paragraph (h)(2)(vii):This requirement does not apply to open face felling where two angled facecuts rather than a horizontal facecut are used.

(3) Limbing and bucking. (1910.266(h)(3))

- Limbing and bucking on any slope where rolling or sliding of trees or logs is reasonably foreseeable shall be done on the uphill side of each tree or log. (1910.266(h)(3)(i))
- Before bucking or limbing wind-thrown trees, precautions shall be taken to prevent the root wad, butt or logs from striking an employee. These precautions include, but are not limited to, chocking or moving the tree to a stable position. (1910.266(h)(3)(ii))

e. Appendices. Appendices A and B of this section are mandatory. The information contained in Appendix C of this section is informational and is not intended to create any additional obligations not otherwise imposed or to detract from existing regulations. (1910.266(j))

5 Cal OSHA Safety Compliance Requirements

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5.1 Cal OSHA Title 8 Article 38 Line Clearance Tree Trimming Operations Section 2950 Application Safety Compliance Requirements Applicable to Tree Felling and Chainsaw Operation (title8/2950)

1. This article shall apply to all line clearance tree trimming operations performed in the vicinity of exposed energized overhead conductors and equipment where any part of the employee's body, tools or equipment being used, or parts of trees being worked upon, is likely to come within the distances specified in Table 1 of this section. (title8/2950(a))

2. Minimum approach distances to energized conductors for persons other than qualified line clearance tree trimmers and trainees shall be maintained in accordance with Table 1. (title8/2950(b))

   Exception No. 1 to paragraph (title8/2950(b)): A qualified tree worker as defined in the General Industry Safety Orders (GISO), Section 3420(b) may perform tree trimming activities within 10 feet, but no closer than 1 foot, of energized low voltage (600 volts or less) power lines and conductors, provided the provisions in GISO Section 3423 related to such work are met.

   Exception No. 2 to paragraph (title8/2950(b)): A qualified telecommunication worker as defined in Section 8601 of the Telecommunication Safety Orders when performing restoration work or other emergency work, provided the employee is trained and experienced in the special techniques and work procedures required to avoid the hazards of line clearance tree trimming operations.

   Exception No. 3 to paragraph (title8/2950(b)): A qualified electrical worker as defined in Section 2700 of the High Voltage Electrical Safety Orders when performing restoration work or other emergency work, provided the employee is trained and experienced in the special techniques and work procedures required to avoid the hazards of line clearance tree trimming operations.

   Table 1. Minimum approach distances to energized conductors for persons other than qualified line-clearance tree trimmers and trainees.

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*Nominal voltage in kilovolts (kV) phase to phase**	*Distance* *ft-in*	*Meters*
0.0 to 1.0	10-00	3.05
1.1 to 15.0	10-00	3.05
15.1 to 36.0	10-00	3.05
36.1 to 50.0	10-00	3.05
50.1 to 72.5	10-09	3.28
72.6 to 121.0	12-04	3.76
138.0 to 145.0	13-02	4
161.0 to 169.0	14-00	4.24
230.0 to 242.0	16-05	4.97
345.0 to 362.0	20-05	6.17
500.0 to 550.0	26-08	8.05
785.0 to 800.0	35-00	10.55

*Exceeds phase to ground minimum approach distances per the federal standard, 29 CFR 1910.333.

Note 1 to Table 1(title8/2950(b)): Minimum approach distances to energized conductors for qualified line clearance tree trimmers and trainees as defined in Section 2700 are provided in the provisions and references of Section 2951 of these Orders.

Note 2 to Table 1(title8/2950(b)): Additional requirements for Tree Work, Maintenance or Removal, are contained in Article

5.2 Cal OSHA Title 8 Article 38 Line Clearance Tree Trimming Operations Section 2951 Safety Compliance Requirements Applicable to Tree Felling and Chainsaw Operation (title8/2951)

1. Prior to commencing line clearance tree trimming operations, the employer shall ensure that an inspection of the work locations is made in order to identify potential hazards and a tail gate briefing is conducted to discuss the work procedures to be followed. A determination shall be made of the nominal voltage of electric power lines posing a hazard to employees. However, a determination of the maximum nominal voltage to which an employee will be exposed may be made instead, if all lines are considered as energized at this maximum voltage. (title8/2951(a))

2. Only qualified line clearance tree trimmers, or trainees under the direct supervision and instruction of qualified line clearance tree trimmers, shall be permitted to perform line clearance tree trimming operations as described in Section 2950. Under no circumstances shall the minimum approach distances specified in Section 2940.2, be violated. (title8/2951(b))

3. The employee in charge of each independent crew shall coordinate the de-energizing and re-energizing of high-voltage lines with the operator of the high-voltage line(s). (title8/2951(c))

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4. During all tree trimming operations performed in accordance with the requirements of subsection (b) above, there shall be another qualified line clearance tree trimmer or trainee within normal (that is, unassisted) voice communication at each work location to render immediate assistance. (title8/2951(d))

   Note to (title8/2951(d)): A qualified high-voltage electrical worker shall be permitted to be the second employee, provided the employee doing the line clearance tree trimming is a qualified line clearance tree trimmer.

5. Branches contacting energized conductors or equipment shall be removed only by using nonconductive equipment. (title8/2951(e))

6. With the exception of emergency restoration procedures, line clearance tree trimming work shall not be performed when adverse weather conditions such as thunderstorms in the immediate vicinity, high winds, snow storms or ice storms, make the work hazardous in spite of the work practices required by this section. (title8/2951(f))

   Note to (title8/2951(f)): A high wind is one which would expose an employee to being blown from an elevated location, or cause an employee or material handling equipment to lose control of the material being handled, or expose the employee to other hazards not controlled by the requirements of this section. Winds exceeding 40 miles per hour, or 30 miles per hour if material handling is involved, meet this criteria unless precautions are taken to protect employees from the hazards described herein.

7. Rope. (title8/2951(i))

   a. When stored, rope shall be coiled and piled, or shall be suspended, so that air can circulate through the coils. (title8/2951(i)(1))

   b. A rope that is wet, that is contaminated to the extent that its insulating capacity is impaired, or that is otherwise not considered to be insulated for the voltage involved shall not be used near exposed energized lines. (title8/2951(i)(2)))

5.3 Cal OSHA Title 8 Article 12 Tree Work Maintenance or Removal Section 3420. Scope and Definition. Safety Compliance Requirements Applicable to Tree Felling and Chainsaw Operation (title8/3420)

1. Scope. This standard applies to work performed and equipment used in tree and ornamental palm maintenance and removal. (title8/3420(a))

   Note 1: Requirements for fall protection in date palm operations and for ladders attached to date palms are provided in the General Industry Safety Orders, Sections 3458 and 3458.1.

   Note 2: For line clearance tree trimming operations in proximity to high voltage energized conductors, refer to the provisions of Article 38 of the High-Voltage Electrical Safety Orders, Title 8, California Code of Regulations.

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5.4 Cal OSHA Title 8 Article 12 Tree Work Maintenance or Removal Section 3421 General Safety Compliance Requirements Applicable to Tree Felling and Chainsaw Operation (title8/3421)

1. An Injury and Illness Prevention Program shall be implemented and maintained in accordance with Section 3203 of these Orders. (title8/3421(a))

2. Each work location where tree trimming, tree repairing or removal is to be done, shall be under the direction of a qualified tree worker. (title8/3421(b))

3. Employees shall be trained and instructed in areas that include, but are not limited to the following: (title8/3421(c))

    a. The hazards involved in their job assignments. (title8/3421(c)(1))

    b. The proper and safe use of all equipment, including, but not limited to, safety equipment and personal protective equipment. (title8/3421(c)(2))

    c. The identification of, and preventive measures relating to, common poisonous plants and harmful animals. (title8/3421(c)(3))

    d. Operations that include pesticide and fertilizer applications for employers whose employees are exposed to, or engage in, such operations. (title8/3421(c)(4))

    e. The recognition and avoidance of electrical hazards applicable to employee job assignments including the instructions and training outlined in Section 3423 for tree work performed in proximity to energized power lines and conductors. (title8/3421(c)(5))

4. Training shall be documented by the employer to certify that the employee has satisfactorily completed the training program prior to performing the job assignment without the oversight and observation of a qualified person. (title8/3421(d))

5. The employer shall provide refresher or additional training on applicable provisions of this standard for any employee who has (title8/3421(e)):

    a. Been observed to violate the requirements of this Article (title8/3421(e)(1));

    b. Been involved in an accident or near miss incident (title8/3421(e)(2)); or

    c. Receives a new job assignment that includes the use of equipment, machinery, tools or safety-related work practices that the employee is unfamiliar with. (title8/3421(e)(3))

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6. A job briefing shall be conducted by a qualified tree worker before each work assignment is begun. Such job briefing shall include the description of the hazards unique to the work assignment, the appropriate work procedures to be followed, the appropriate personal protective equipment needed, and any other items necessary to ensure that the work can be accomplished safely. Additional job briefings shall be held if significant changes which might affect the safety of the employees occur during the course of the work. (title8/3421(f))

7. All equipment shall be operated by qualified persons, and where required, qualified tree workers. (title8/3421(g))

8. Except for the inspections required by Sections 3422(j) and 3424(a)(2), all other equipment and safety devices shall be inspected prior to daily use by a qualified tree worker and any found to be defective shall be immediately repaired or removed from service. (title8/3421(h))

9. An adequate supply of potable water shall be provided in accordance with the requirements of Section 3363 of these Orders. (title8/3421(i))

10. Where vehicular or pedestrian traffic may endanger employees, traffic control shall be provided that conforms to the requirements of Sections 1598 and 1599 of the Construction Safety Orders. (title8/3421(j))

11. Internal combustion engine fuel tanks shall be refilled in accordance with Section 3319 of these Orders. (title8/3421(k))

12. The employer shall establish rescue procedures and provide training in emergency response. Training in aerial rescue procedures shall be provided for employees whose job assignments may require them to perform aerial rescues. (title8/3421(l))

13. The employer shall provide training in first aid and cardiopulmonary resuscitation (CPR). For field work involving two or more employees at a work location at least two trained persons in first aid and CPR shall be available. All new employees shall be trained in first aid and CPR within 90 days of their hiring dates. First aid and CPR training shall be performed by a certified instructor and shall be equal to that of the American Red Cross or the Mine Safety and Health Administration. (title8/3421(m))

14. When employees are required to work in areas in which the noise levels exceed the allowable standards for occupational noise, the employer shall provide hearing protection and training as required in Article 105 of these Orders. (title8/3421(n))

5.5 Cal OSHA Title 8 Article 12 Tree Work Maintenance or Removal Section 3425 Portable Power Hand Tools Requirements Applicable to Tree Felling and Chainsaw Operation (title8/3425)

1. Power Saws. (title8/3425(a))

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a. Power saws shall be operated and maintained in accordance with the manufacturer's instructions. (title8/3425(a)(1))

b. A power saw shall be started on the ground or where it is otherwise firmly held or supported to prevent unintended movement of the saw. Chain saws shall not be drop started. Power saws shall not be started from an elevated position unless the area below is clear of personnel. (title8/3425(a)(2))

c. Power saws weighing more than fifteen pounds (service weight) that are used in trees shall be supported by a separate line or tool lanyard, except when working from an aerial-lift device or during topping or removing operations where no supporting limb is available. (title8/3425(a)(3))

d. All power saws shall be equipped with a constant pressure control that will return the saw to idling speed when released. (title8/3425(a)(4))

e. A power saw engine shall not be started and operated unless all employees other than the operator are clear of the saw. (title8/3425(a)(5))

f. A power saw shall not be running when the saw is being carried up into a tree by an employee. (title8/3425(a)(6))

g. Power saws shall be equipped with a clutch and be so adjusted that the chain drive will not engage at idling speed. (title8/3425(a)(7))

h. Power saw engines shall be stopped when carried for a distance greater than 100 feet, or in hazardous conditions such as slippery surfaces or heavy underbrush. Chain brakes shall be engaged or the saw engine stopped when the saw is carried a distance greater than 10 feet. (title8/3425(a)(8))

i. The saw shall be stopped for all cleaning, refueling, adjustments, and repairs to the saw or engine where practicable, except where manufacturers' instructions require otherwise. (title8/3425(a)(9))

j. Tree workers shall use a second point of attachment such as a work-positioning lanyard or double-crotched rope when operating a chain saw in a tree, unless the employer demonstrates that a greater hazard is posed by using a second point of attachment while operating chain saws in that particular situation. (title8/3425(a)(10))

k. While a powered pole saw or brush saw is running, no one shall be permitted within 10 feet of the cutting head, except the operator. (title8/3425(a)(11))

l. Powered saws shall be equipped with a quick shutoff switch readily accessible to the operator. (title8/3425(a)(12))

5.6 Cal OSHA Title 8 Article 12 Tree Work Maintenance or Removal Section 3426 Hand Tools Requirements Applicable to Tree Felling and Chainsaw Operation (title8/3426)

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1. General. (title8/3426(a))

    a. Hand tools shall be used in accordance with Section 3556 of these Orders. (title8/3426(a)(1))

    b. When climbing into a tree, tree workers shall not carry hand tools and equipment in their hands unless they are tools used to assist them in their climbing. Tools other than ropes or throwlines shall not be thrown into a tree, out of a tree or between workers aloft. (title8/3426(a)(2))

    c. Employees shall maintain a safe working distance from other employees when using hand tools. (title8/3426(a)(3))

    d. Chopping tools shall be swung away from the feet, legs, and body. (title8/3426(a)(4))

    e. Chopping tools shall not be driven as wedges or used to drive metal wedges unless specifically designed to be driven or to be used to drive wedges. (title8/3426(a)(5))

    f. Hand tools and equipment shall be properly stored or placed in plain sight out of the immediate work area when not in use. (title8/3426(a)(6))

2. Pruners and Saws. (title8/3426(b))

    a. Pole pruners, pole saws, and other similar tools shall be equipped with non-conducting poles and actuating cords. (title8/3426(b)(1))

    b. Pole pruners and pole saws shall be hung securely in a vertical position to prevent dislodging. Pole pruners or pole saws shall not be hung on utility wires or cables, or left in the tree overnight. Pole saws shall be hung so that the sharp edge is away from the employee. (title8/3426(b)(2))

5.7 Cal OSHA Title 8 Article 12 Tree Work Maintenance or Removal Section 3427 Safe Work Procedures Requirements Applicable to Tree Felling and Chainsaw Operation (title8/3427)

1. Climbing and Access. (title8/3427(a))

    a. Prior to climbing the tree, the employer shall ensure that the tree, including the root collar, is visually inspected by a qualified tree worker who shall determine and ensure a safe method of entry into the tree. The location of all electrical conductors and equipment within the work area shall be identified in relation to the work being performed. Climbing lines, ropes, lanyards, and other climbing equipment shall be inspected in accordance with the provisions of Section 3422(j) of this Article 12. (title8/3427(a)(1))

        (1) Only when a tree cannot be safely accessed by climbing or the use of aerial devices, a qualified tree worker may be hoisted into position by

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using an approved tree worker's saddle secured to a crane's hook that shall be closed with a positive locking device. The tree worker's saddle shall also be secured to an independent line attached above the crane hook, and the following criteria shall be met: (title8/3427(a)(1)(A))

- All climbing equipment, lines and rigging shall have a minimum breaking strength of at least 5,000 pounds. (title8/3427(a)(1)(A)(1))

(2) Documentation of employee training required by Section 3427(a)(1)(B) shall be maintained as prescribed by Section 3203 of these Orders. (title8/3427(a)(1)(C))

- When working aloft, employees shall wear a tree workers' saddle and have at least two means of being secured, such as a climbing line and a work positioning lanyard. (title8/3427(a)(1)(c)(2))

- Employees shall be tied in or secured while ascending the tree and remain tied in or secured until the work is completed and they have returned to the ground. (title8/3427(a)(1)(c)(3A))

    - Employees shall not work from or leave a ladder to gain access to a tree unless the employee is tied in or otherwise secured to the tree. (title8/3427(a)(1)(c)(3B))

    - Exception to (title8/3427(a)(1)(c)(3B)): Employees may work from a self-supporting ladder in accordance with the manufacturer's instructions.

- The tie-in point shall be established on or around the main leader or a major upright branch of the tree as high as necessary using branches with a wide crotch to prevent any binding of the climbing line. The crotch selected for tying-in shall be over the work area as nearly as possible, but located in such a way that a slip or fall would not permit the employee to come in contact with any electrical conductor, equipment or other hazard. (title8/3427(a)(1)(c)(4))

2. Pruning, Trimming and Tree Removal Operations. (title8/3427(b))

    a. The employer shall establish a method of verbal or visual communication which shall be reviewed during the job briefing, prior to the start of pruning or removal operations. The verbal or visual communication system shall use an established command and response system or pre-arranged, two-way hand signals. The communication method shall be clearly understood and used during all rigging operations. The command “stand clear” from aloft and the

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response “all clear” from the ground are some terms that may be used for verbal communication. (title8/3427(b)(1))

b. A drop zone shall be established prior to the start of pruning or removal operations. Employees not directly involved in the pruning or removal operation shall stay out of the pre-established drop zone until it has been communicated by a qualified tree worker directly involved in the operation that it is safe to enter the drop zone. Employees shall be positioned and their duties organized so that the actions of one employee will not create a hazard for any other worker. (title8/3427(b)(2))

c. Only qualified tree workers directly involved in the operation shall be permitted in the drop zone when a load is being suspended by a rigging system. (title8/3427(b)(3))

d. When a rigging system is necessary, a qualified tree worker shall determine the appropriate rigging system for the removal project based on factors that include, but are not limited to, the species, size, weight, and length of tree sections or limbs being removed. (title8/3427(b)(4))

e. When it is necessary to remove branches or sections of a tree that will be removed, a qualified tree worker who is trained and experienced in rigging operations shall determine whether the tree can withstand the strain of the lowering procedures. If the determination is that the tree cannot do so, other means of removing the tree shall be considered. (title8/3427(b)(5))

f. Wedges, block and tackle, rope, and other lowering devices shall be used when there is a danger that a tree or trees being removed may fall in the wrong direction or damage property. All limbs and sections shall be removed to a height and width sufficient to allow the tree to fall clear of any wires or other objects in the vicinity. (title8/3427(b)(6))

g. Separate ropes for lowering limbs shall be attached to limbs which cannot be dropped or are too heavy to be controlled by hand. Climbing lines shall not be attached to the same crotch as ropes used for lowering limbs. (title8/3427(b)(7))

h. Cut branches (hangers) shall be removed from the tree prior to leaving the job site. (title8/3427(b)(8))

i. When an employee is elevated above 12 feet in any tree work operations including climbing ladders, climbing into the tree or using an aerial device, a second employee shall be present to render immediate assistance. (title8/3427(b)(9))

j. Palm frond skirts shall be removed from the top down. Qualified tree workers performing this work shall be supported by a climbing line and a false crotch

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attached above the frond skirt, or they shall work from an aerial device. (title8/3427(b)(10))

Exception to (title8/3427(b)(10)): Fronds may be trimmed from below the dead frond accumulation only when a qualified tree worker who is competent and experienced in palm tree work and the hazards associated with removing dead fronds makes a determination that this task can be safely performed from below.

NOTE: Because palm frond skirts have the potential of unexpectedly releasing onto a worker below, the ANSI Z133.1-2006 standard “Arboricultural Operations - Safety Requirements” Section 8.2.7 states that tree workers shall never attempt to remove palm frond skirts of three years or more growth by positioning themselves below the work areas while being supported by a lanyard.

k. When dry conditions exist, no employee shall smoke in or near dead palm fronds. All chain saws used under such conditions shall have mufflers and spark arresters in good working condition. (title8/3427(b)(11))

3. Felling. (title8/3427(c))

a. The work area shall be cleared to permit safe working conditions before any cutting is started. (title8/3427(c)(1))

b. A planned escape route for all workers shall be prepared before cutting any standing tree or trunk. (title8/3427(c)(2))

c. A notch and back cut shall be used to establish a hinge when felling trees over 5 inches in diameter. (title8/3427(c)(3))

(1) Notches and back cuts shall be made at a height that enables the chain-saw operator to safely begin the cut, control the tree or trunk, and have freedom of movement for escape. (title8/3427(c)(3)(A))

(2) The notch cut used shall be a conventional notch, an open-faced notch, or a Humboldt notch as defined in Section 3420(b). (title8/3427(c)(3)(B))

(3) The notch depth shall not exceed one-third of the diameter of the tree. (title8/3427(c)(3)(C))

(4) The back cut shall not penetrate into the predetermined hinge area. (title8/3427(c)(3)(D))

(5) With a conventional notch or Humboldt notch, the back cut shall be 1 to 2 inches above the apex of the notch to provide an adequate platform to prevent kick-back of the tree or trunk. With an open-face notch (greater

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than 70 degrees), the back cut shall be at the same level as the apex of the notch. (title8/3427(c)(3)(E))

(6) The two saw cuts that form a notch shall not cross at the point where they meet. (title8/3427(c)(3)(F))

d. Just before the tree or trunk is ready to fall, an audible warning shall be given to those in the area. Pre-arranged, two-way hand signals may also be used as a warning, provided that only qualified persons shall give such signals. All non-involved personnel in the vicinity shall be safely out of range before the tree or trunk falls. (title8/3427(c)(4))

e. Prior to the start of any tree felling or removal operations, the hazards and relevant factors pertaining to the tree and the site are to be considered by undertaking actions that include, but are not limited to, the following: (title8/3427(c)(5))

(1) Identifying potential hazards in the area surrounding the tree to be removed, including nearby trees. (title8/3427(c)(5)(A))

(2) Determining the species and shape of the tree. (title8/3427(c)(5)(B))

(3) Evaluating the lean of the tree. (title8/3427(c)(5)(C))

(4) Inspecting for loose limbs and wood chunks, or other overhead material. (title8/3427(c)(5)(D))

(5) Evaluating the wind force and direction. (title8/3427(c)(5)(E))

(6) Identifying decayed or weak spots in the tree. (title8/3427(c)(5)(F))

(7) Providing a means to protect other persons, property, and electrical conductors. (title8/3427(c)(5)(G))

(8) Evaluating the terrain characteristics and/or limitations of the work area; and (title8/3427(c)(5)(H))

(9) Identifying evidence of bees or other wildlife habitation in the tree that may present hazards. (title8/3427(c)(5)(I))

4. Bucking. (title8/3427(d))

a. The employee shall work from the uphill side whenever possible during limbing or bucking operations. (title8/3427(d)(1))

b. The employee shall block the log during bucking operations to prevent rolling, when necessary. (title8/3427(d)(2))

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c. When bucking trunks of trees, wedges shall be used when necessary to prevent binding the chain saw guide bar or chain. (title8/3427(d)(3))

5.8 Cal OSHA Title 8 Article 20 Hand and Portable Powered Tools and Equipment Section 3556 General Requirements Applicable to Tree Felling and Chainsaw Operation (title8/3556)

1. Each employer shall be responsible for the safe condition of tools and equipment used by employees, including tools and equipment which may be furnished by employees. (title8/3556(a))

2. All tools shall be restricted to the use for which they are intended. (title8/3556(b))

3. Unsafe hand tools shall not be used. (title8/3556(c))

5.9 Cal OSHA Title 8 Article 20 Hand and Portable Powered Tools and Equipment Section 3564 Portable Winches Requirements Applicable to Tree Felling and Chainsaw Operation (title8/3564)

1. Portable winches shall be secured against accidental shifting while in use. (title8/3564(a))

2. Portable winches shall be fitted with limit switches if employees have access to areas from which it is possible to be drawn into the winch. (title8/3564(b))

5.10 Cal OSHA Title 8 Subchapter 13 Logging and Sawmill Safety Orders Article 1 Applicable to Tree Felling and Chainsaw Operation

1. Introduction (title8/6248)

Title. These Orders shall be known as the LOGGING AND SAWMILL SAFETY ORDERS.

Application. These Orders establish minimum standards and apply to all places of employment in California where logging and sawmill operations as defined below are conducted.

Logging Operations. Cultivation and harvesting of timber, including access, falling and bucking, yarding, loading, and transportation of logs.

Note to (title8/6248): Equipment and processes not covered by these orders may be governed by other applicable safety orders.

5.11 Cal OSHA Title 8 Subchapter 13 Logging and Sawmill Safety Orders Article 1.5 Accident Prevention and First Aid Applicable to Tree Felling and Chainsaw Operation

1. Accident Prevention Program Requirements (title8/6250)

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2. First Aid (title8/6251)

   a. First-aid material shall be provided and personnel made available for care of injured employees. Means of communication such as an operable two-way radio, phone, or radio/phone shall be provided and the names, addresses, and the telephone numbers of physicians, hospitals, and ambulances to be called shall be made readily available at all operations. Citizens' band radios are permitted only as a secondary means of communication. (title8/6251(a))

   b. All necessary first-aid materials shall be provided at any active camp, mill, log landing, or other active operation and shall consist in part of a rigid stretcher, 2 acceptable blankets (1 blanket for warmth and 1 waterproof blanket), and a first-aid kit. The blankets and the contents of the first-aid kit shall be kept in dustproof and moisture proof containers. (title8/6251(b))

   c. Crew vehicles shall carry a first-aid kit. First-aid kits shall be kept fully supplied. (title8/6251(c))

   d. First-aid and cardiopulmonary resuscitation (CPR) training shall be provided as follows: (title8/6251(d))

      (1) At logging operations and portable sawmill operations, employers shall arrange to have each employee trained so they have a valid first-aid and CPR certificate issued by the American Red Cross, the American Heart Association, or other nationally recognized agency. Provided a person or persons having a valid first aid and CPR certificate are readily accessible at the work site to render first aid, new employees shall receive the required training within six months from the date of hire. (title8/6251(d)(2))

      Exception to (title8/6251(d)(2)): Log truck drivers are not required to receive first-aid and CPR training if they are not involved with falling, yarding, skidding, or processing logs.

   e. Adequate transportation to medical care shall be arranged and made available for injured persons at all camps, mills, log landings, or other operations. Such transportation shall be of a nature to render comfort to the injured. Employees requiring the use of a stretcher or whose injuries are of an otherwise serious nature shall be accompanied to medical attention by a competent person in addition to the vehicle driver. (title8/6251(e))

5.12 Cal OSHA Title 8 Subchapter 13 Logging and Sawmill Safety Orders Article 2 Logging Operations - General Applicable to Tree Felling and Chainsaw Operation Section

1. Planning (title8/6252)

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Plans shall be made in advance for the safety of workers, including provisions for the emergency rescue in logging operations, and persons in charge shall make sure that the plans are followed. (title8/6252)

2. Weather Conditions (title8/6253)

   No work should be started or continued in timbered areas during periods of high winds, extremely heavy fogs, and other hazardous weather conditions. When vision is impaired by darkness, adequate lighting shall be provided.

3. Footgear (title8/6254)

   Calked boots or lug-soled boots shall be worn when their use is warranted. (title8/6254)

4. Head Protection (title8/6255)

5. Slippery Surfaces (title8/6256)

   Safety tread or other nonslip material shall be installed and maintained on all steel decks of machines used by employees in the performance of their duties. (title8/6256)

6. Embedded Objects (title8/6257)

   Embedded Objects Requirements Applicable to Tree Felling and Chainsaw Operation Embedded metal, rock, ceramic, glass, and all other foreign objects, which can damage head rig saws, shall be located and removed from logs prior to milling. (title8/6257)

   Exception to (title8/6257): When off bearers are protected from any hazard of injury if the head rig saw and/or object explodes, shatters or breaks upon contact, location and removal of such objects shall not be required.

7. Checking Systems (title8/6258)

   All persons shall work within the vocal range of other employees or a procedure shall be established for periodically checking their location and welfare. All employees shall be accounted for at the end of each workday. (title8/6258)

8. Trees and Snags (title8/6259)

   a. All trees and snags which appear to be dangerous to any operation shall be felled. If hand falling presents extreme hazards, other methods shall be used. (title8/6259(a))

   b. Snags shall be carefully checked for dangerous bark in preparation for falling. Accessible loose bark shall be removed before falling. (title8/6259(b))

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c. Whenever trees or snags are equipment-felled, they should be pulled by a line or pushed by a boom of sufficient length to keep the equipment in the clear, unless the equipment is specifically designed for this purpose. (title8/6259(c))

9. Fuels, Oil and Other Flammable Liquids (title8/6262)

a. Flammable liquids shall be stored and transported in closed containers that are Underwriters Laboratories Inc. (UL) listed or classified, Factory Mutual (FM) approved, or other approved flammable liquid containers properly marked. (title8/6262(a))

b. An approved pump designed for the fuel to be used shall be provided to service the fuel tanks of all equipment, unless fueling is done by gravity flow with a metal-to-metal contact between the container and the fuel tank. When a hose is used, it shall be of a type designed to handle fuels. (title8/6262(b))

c. No gasoline or LPG equipment shall be fueled when the engine is running, except when refueling by a vacuum refueling system in connection with the engine. (title8/6262(c))

d. Open lights, open flames, sparking or arcing equipment, except that which is an integral part of automotive equipment, shall not be used near fuel storage tanks or internal-combustion engine equipment while they are being filled or fueled. (title8/6262(d))

e. Smoking shall not be permitted on any vehicle carrying flammable liquids, unless such liquids are in the fuel tank or a safety container outside the passenger compartment. (title8/6262(e))

10. Cal OSHA Title 8 Subchapter 13 Logging and Sawmill Safety Orders Article 2 Logging Operations - General Section 6263 Hand Tools Requirements Applicable to Tree Felling and Chainsaw Operation (title8/6263)

a. The employers shall be responsible for the safe condition of their tools. All tools shall be restricted to the use for which they are intended, and should be used only by employees who are required and qualified to use such tools. (title8/6263(a))

b. Periodic inspections shall be made to ensure all tools are in safe condition. Tools with defective handles shall be immediately repaired or removed from the job. (title8/6263(b))

c. Battered, laminated, or crystallized iron wedges, chisels, punches, hammers, and similar equipment, mushroomed more than 1/4-inch from the body of the tool, shall be replaced or properly repaired. (title8/6263(c))

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d. Exceptionally hard hammers, wedges, and similar tools shall not be used. (title8/6263(d))

e. Only one end of a peeling bar shall have a cutting edge. The other end shall be cut off square with the length of the bar or have a rounded end. (title8/6263(e))

f. Cutting tools shall be kept sharp and properly shaped. (title8/6263(h))

g. Hand tools shall be sheathed or boxed if transported with passengers in the passenger compartment of a vehicle. If not contained in a box, the sheathed tools shall be fastened to the vehicle. (title8/6263(i))

h. Proper storage facilities shall be provided for hand tools. (title8/6263(j))

5.13 Cal OSHA Title 8 Subchapter 13 Logging and Sawmill Safety Orders Article 5 Falling and Bucking Requirements Applicable to Tree Felling and Chainsaw Operation

1. Falling Trees (title8/6275)

a. While falling, fallers shall be so located that they will not endanger other employees. In steep country, one set of fallers shall not work immediately up the slope from other fallers. (title8/6275(a))

b. Fallers and buckers shall not work near any running lines, guylines, or other units of the operation so that they could endanger themselves or other employees. (title8/6275(b))

c. The head faller shall keep informed of the location of buckers or other employees placed or passing in the vicinity of trees being felled. Fallers shall be within visible or audible signaling distance of another worker at all times. (title8/6275(c))

d. Special precautions shall be taken to prevent felling trees into power lines. (title8/6275(d))

e. After a determination by a qualified person(s) (e.g. tree faller) as to the safest tree dislodgment procedure, lodged trees shall be dislodged at the first opportunity by one of the following methods: (title8/6275(e))

(1) Pulling or pushing to the ground by mechanical equipment in accordance with the requirements in Sections 6259 and 6286, or; (title8/6275(e)(1))

(2) Falling another tree onto the lodged tree by a qualified person. Multiple sequential tree falling (domino tree falling) is prohibited. (title8/6275(e)(2))

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f. When a lodged tree is left unattended, a qualified person shall flag the area in proximity to the tree(s) (i.e. hazardous area) with warning tape or ribbon in a manner which will ensure the lodged tree and the hazardous area are readily identifiable. (title8/6275(f))

Note: For the purposes of subsection (6) the hazardous area refers to the area where an employee could be struck by a lodged tree which becomes dislodged.

g. Employees shall be prohibited from working under lodged trees. (title8/6275(g))

2. Traffic (title8/6276)

An employee shall be stationed to direct traffic when there is a probability of danger in falling a tree adjacent to a railroad, cat road, motor road, or trail. Warning signs shall be posted on motor roads in areas of cutting. (title8/6276)

3. Escape Paths (title8/6278)

a. Adjacent material shall be cleared from around the tree to be felled so there is sufficient room to use saws and axes and to permit a quick getaway. (title8/6278(a))

b. A way of escape shall be determined, arranged and kept clear before the tree is felled. The point of escape should be well back and to one side. Workers shall not stand beside or near the stump as the tree falls. (title8/6278(b))

4. Falling Cuts (title8/6279)

a. Undercuts shall be of a size to guide the trees in the intended direction and minimize the possibility of splitting. (title8/6279(a))

b. In trees of sound wood and no perceptible lean, the undercut shall be no less than 1/4 the diameter of the tree and the face opening shall be no less than 1/5 the diameter of the tree. (title8/6279(b))

c. The backcut shall always be started at or above the level of the horizontal cut of the undercut. (title8/6279(c))

d. Trees shall not be left standing after the undercut is made under normal conditions. (title8/6279(d))

5. Warning Cry (title8/6280)

a. Fallers shall give timely audible warning to buckers and other persons in the vicinity of a tree to be felled, indicating the direction of fall and taking notice that such persons not only hear the warning cry and are out of reach of the tree, but also in the clear of logs, fallen trees, snags, or other trees which may be struck

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by the falling tree. Fallers shall stop saw motors when giving such warning. (title8/6280(a))

b. Employees shall not approach a faller's work area until the faller has acknowledged the signal to approach. (title8/6280(b))

6. Bucking (title8/6281)

a. All logs which may roll shall be propped, blocked, or bucked from the uphill side. (title8/6281(a))

b. Wedges shall be driven with a tool designed for hammering. They shall not be driven with the side of a doublebitted axe. (title8/6281(b))

c. If it is obviously hazardous to cut a log clear through, the log shall remain uncut, marked conspicuously, and the supervisor notified. (title8/6281(c))

d. Trees yarded for bucking shall be placed to minimize hazard to employees. (title8/6281(d))

e. Spring poles, limbs and trees under stress shall be cut so that an employee is clear when the tension is released. (title8/6281(e))

7. Ripping Logs (title8/6282)

a. Logs shall be securely chocked or strapped before they are ripped. (title8/6282(a))

b. If workers walk the log to rip it, sufficient holding wood shall be left or other positive means to prevent splitting before they dismount to complete the cut. (title8/6282(b))

8. Portable Chain Saw Operations (title8/6283)

a. Employees, such as fallers, buckers, limbers, choppers, landing chasers, and others performing similar operations, who operate chain saws, shall use leg protection such as chaps, pads, inserts, or other protective garments or devices that are labeled as meeting the specifications of ASTM F 1897-98, Standard Specification for Leg Protection for Chain Saw Users. Exceptions: 1) High climbers described in Section 6287. 2) Employees, with employer's concurrence, who use a chain saw incidental to their normal assigned tasks. (title8/6283(a))

b. Each chain saw placed in service on or after May 5, 1995 shall be equipped with a chain brake and shall otherwise be provided with a label or plate stating that it meets the requirements of the ANSI B175.1-1991 "Safety Requirements for Gasoline-Powered Chain Saws". Chain saws placed in service before May

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5, 1995 shall be equipped with a protective device that minimizes chain-saw kickback. No chain-saw kickback device shall be removed or otherwise disabled. (title8/6283(b))

c. Chain saws shall be stopped and employees shall use the escape path when the tree starts to fall. (title8/6283(c))

d. All chain saws shall be equipped with a control that when released returns the saw to idling speed. (title8/6283(d))

e. Power saw motors shall be stopped when carried for a distance greater than from tree to tree, not to exceed 100 feet, or in hazardous conditions such as slippery surfaces or heavy underbrush. The saw shall be at idle speed when carried short distances. (title8/6283(e))

f. Exhaust manifolds on gasoline motors shall be constructed and maintained so that exhaust fumes are directed away from the operator. (title8/6283(f))

g. Power saws shall be equipped with a clutch so adjusted that at idling speed it will not engage the chain drive. (title8/6283(g))

h. Loose material that may catch the saw shall be removed. (title8/6283(h))

i. All power saws shall be equipped with a positive off-and-on switch. (title8/6283(i))

j. Power cables on electric units shall be properly insulated. Care shall be taken to see that cables are in the clear at all times. (title8/6283(j))

k. Electric saw and generator units shall be bonded together and grounded. (title8/6283(k))

l. The cable on electric units shall be disconnected while moving the saw through brush and thickets, or where the character of the ground obstructs the free movement of the fallers. (title8/6283(l))

m. Every employer shall instruct and enforce a safe practice procedure including the rules listed below: (title8/6283(m))

   (1) Inspect the saw daily to assure that all handles and guards are in place and tight, all controls function properly, and the muffler is operative (title8/6283(m)(1))

   (2) Properly instruct operators on safe operation and adjustment. (title8/6283(m)(2))

   (3) Always keep a firm grip on the saw. (title8/6283(m)(3))

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(4) Fuel the saw only in conditions not conducive to fire hazards. (title8/6283(m)(4))

(5) Start the saw at least 10 feet away from fueling areas. (title8/6283(m)(5))

(6) Start the saw only when firmly supported. (title8/6283(m)(6))

(7) Do not use the chain saw or other engine fuels for starting fires or for use as a cleaning solvent. (title8/6283(m)(7))

Exception to (title8/6283(m)(7)): When approved by the fire authority, diesel fuel may be used to start warming fires provided the employer assures that in the particular situation it does not create a hazard for employees

(8) Use proper methods to avoid kickbacks. (title8/6283(m)(8))

9. Tree Jacking (title8/6285)

a. Hydraulic tree jacks purchased after January 1, 1980, shall be equipped with: (title8/6285(a))

(1) An operable load check valve, velocity fuse or equivalent device. When hoses are used with a jack, the device shall be installed between the ram and the first piece of hose out from the jack. (title8/6285(a)(1))

(2) An operable pressure gauge. (title8/6285(a)(2))

b. If two or more tree jacks are used and operated with one pump, a one way flow valve shall be used to isolate the hydraulic fluid from one jack to another jack, should failure occur in the system. (title8/6285(b))

c. Hydraulic tree jacks shall have enough lift power and be of sufficient in number for the trees to be jacked and felled. (title8/6285(c))

d. A metal plate shall be placed between the ram and the saw cuts when using a hydraulic jack. The metal plate or pad shall be of sufficient area and have a surface design to prevent the plate or pad from sinking into the wood or slipping. (title8/6285(d))

e. If the faller is pumping the jack at the base of the tree, wedges shall be used as a follow-up method while using tree jacks. The wedges shall be progressively moved in as the tree is jacked. (title8/6285(e))

10. Tree Pulling (title8/6286)

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a. Positive communications shall be maintained at all times between the tree pulling machine and the faller while tree pulling. Citizens band radios are not considered positive communications. (title8/6286(a))

b. An audible signal shall be blown when the initial pull is made on the tree and the line is tightened. (title8/6286(b))

c. A choker, choker bell, or a line with a sleeve shackle shall be used as the means of attachment around the tree when tree pulling. The bight on the line shall be only that necessary to hold the choker or line around the tree. (title8/6286(c))

d. The tree pulling machine shall be equipped with a torque converter, fluid coupler, or an equivalent device to insure a steady, even pull on the line attached around the tree. (title8/6286(d))

e. The tree pulling line shall have as straight and direct path from the machine to the tree as possible. Physical obstructions, which prevent a steady even pull on the tree pulling line, shall be removed or the line shall be rerouted. (title8/6286(e))

f. The use of siwashing, in lieu of using a block and strap, for the purpose of changing the tree pulling lead, is prohibited. (title8/6286(f))

6 National/International Consensus Standards

6.1 ANSI Z133 2017 Arboricultural Operations Safety Requirements Applicable to Tree Felling and Chainsaw Operation

1. General (ANSI Z133-2017-1)

a. Scope. This standard contains arboriculture safety requirements for pruning, repairing, maintaining, and removing trees; cutting brush; and for using equipment in such operations. (Note: Terms specific to the safe practice of arboriculture appear in boldface type at first use and are defined in Annex A, Glossary of Terms for ANSI Z133.) (ANSI Z133-2017-1.1)

b. Purpose. The purpose of this document is to provide safety standards for arborists and other workers engaged in arboricultural operations. It is intended as a guide to federal, state, and local authorities in drafting their regulations and may be adopted in whole or in part. (ANSI Z133-2017-1.2)

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c. Application. This standard is intended to serve as a reference for safety requirements that will apply to all employers or persons engaged in the business, trade, or performance of arboriculture for pay, operations of which include, but are not limited to, tree pruning, repairing, or maintaining; removing trees; cutting brush; or performing pest or soil management. (ANSI Z133-2017-1.3)

This standard may require situational modifications in response to personnel emergencies and is not intended to limit the options available to emergency responders. (ANSI Z133-2017-1.3)

d. Responsibilities of the Employee. Each person (employee or otherwise) shall be responsible for his/her own safety while at work and shall comply with the appropriate federal or state occupational safety and health standards and all rules, regulations, and orders that are applicable to his/her own actions and conduct. (ANSI Z133-2017-1.4)

2. General Safety Requirements

a. General (ANSI Z133-2017-3)

(1) Tools and equipment used in arboricultural operations shall comply with applicable OSHA regulations and/or ANSI standards. In the absence of applicable OSHA/ANSI guidance, the requirements of this standard shall be followed. (ANSI Z133-2017-3.1.1)

(2) Employers shall instruct their employees in the proper use, inspection, and maintenance of personal protective equipment (PPE), tools (hand and powered), and other equipment, including ropes and lines. (ANSI Z133-2017-3.1.2)

(3) Employers shall require that appropriate safety-related work practices be followed in accordance with applicable OSHA and consensus standards, including, but not limited to ANSI and ASTM. As applicable, manufacturers' recommendations should be followed. See Section 5, Safe Use of Vehicles, Mobile and Towed Equipment Used in Arboriculture, for specific standards regarding vehicles and mobile equipment. (ANSI Z133-2017-3.1.3)

b. Emergency Procedures and Readiness (ANSI Z133-2017-3.2)

(1) All personnel engaged in arboricultural operations shall be instructed in the correct procedures for emergency response, including 911 calls and other applicable emergency phone numbers. (ANSI Z133-2017-3.2.1)

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(2) The employer shall provide and maintain a first-aid kit that meets the requirements of ANSI Z308.1, with contents appropriate for the type of job and number of workers. (ANSI Z133-2017-3.2.2)

(3) Instruction shall be provided in the identification, preventive measures, and first-aid treatment of common poisonous plants (poison ivy, poison oak, and poison sumac), stinging and biting insects, and other pests found in the area in which work is to be performed. (ANSI Z133-2017-3.2.3)

(4) Employees who may be faced with a rescue decision shall receive training in emergency response and rescue procedures appropriate and applicable to the work to be performed, as well as training to recognize the hazards inherent in rescue efforts (see Annex F, Aerial Rescue Flowchart). (ANSI Z133-2017-3.2.4)

(5) For field crews involving two or more workers at a work location, at least two workers trained in first aid/CPR shall be available. However, only one trained person need be available if all new employees are trained in first aid within three months of their hiring dates. (ANSI Z133-2017-3.2.5)

c. Personal Protective Equipment (PPE) (ANSI Z133-2017-3.3)

(1) Personal protective equipment (PPE), as outlined in this section, shall be required when there is a reasonable probability of injury or illness that can be prevented by such protection. (ANSI Z133-2017-3.3.1)

(2) The employer shall assess the worksite to determine if hazards are present or are likely to be present and what type of personal protective equipment is required. (ANSI Z133-2017-3.3.2)

(3) Training shall be provided on the inspection, use, care, maintenance, fit, and replacement of personal protective equipment. (ANSI Z133-2017-3.3.3)

(4) Workers engaged in arboricultural operations shall wear head protection (helmets) that conforms to ANSI Z89.1. Class E helmets shall be worn when working in proximity to electrical conductors in accordance with ANSI Z89.1. Workers shall not place reliance on the dielectric capabilities of such helmets. (ANSI Z133-2017-3.3.4)

(5) Hearing protection provided by the employer shall be worn when it is not practical to decrease or isolate noise levels that exceed acceptable standards. The employer shall provide employees protection against the effects of noise exposure when sound levels exceed an 8-hour, time-weighted average (TWA) of 85 decibels (dB). (ANSI Z133-2017-3.3.5)

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(6) Eye protection shall comply with ANSI Z87.1 and shall be worn when engaged in arboricultural operations. (ANSI Z133-2017-3.3.6)

(7) Clothing and footwear appropriate to the known worksite hazards shall be approved by the employer and worn by the employee. (ANSI Z133-2017-3.3.7)

(8) Cut-resistant leg protection that meets or exceeds ASTM F1414 and ASTM F1897 shall be worn while operating a chain saw during ground operations. Cut-resistant leg protection shall be maintained in accordance with manufacturer's recommendations. (ANSI Z133-2017-3.3.8)

(9) Face protection shall comply with applicable federal regulations as well as with ANSI Z87.1. (ANSI Z133-2017-3.3.9)

(10) Respiratory protection shall comply with applicable federal regulations and with ANSI Z88.2. (ANSI Z133-2017-3.3.10)

d. Job Briefing and Worksite Set-up (ANSI Z133-2017-3.4)

(1) A qualified arborist shall determine whether direct supervision is needed on a worksite. (ANSI Z133-2017-3.4.1)

(2) Before digging, underground utilities shall be marked by utility-locating services. (ANSI Z133-2017-3.4.2)

- Many utility-based locating services will not locate privately owned underground lines, such as, but not limited to, irrigation, electrical wires, and propane lines. Further resources or research may be necessary to locate underground utilities on private properties. (ANSI Z133-2017-3.4.2.1)

(3) A job briefing shall be performed by the qualified arborist in charge before the start of each job. The briefing shall be communicated to all affected workers. An employee working alone need not conduct a job briefing. However, the employer shall ensure that the tasks are being performed as if a briefing were required. (ANSI Z133-2017-3.4.3)

(4) Before commencing operations, a communication protocol shall be established or reviewed between arborists aloft and personnel working on the ground. Verbal communication by voice or radio shall employ a command and response (C&R) protocol. "Stand Clear" as the "C" from aloft and "Clear" as the "R" from the ground are examples. Hand signals or whistles may also be used. Eye contact with, or line-of-sight between, the arborist aloft and the ground person should also be established when communicating. (ANSI Z133-2017-3.4.4)

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(5) The arborist in charge shall establish a plan to safely manage the worksite. Communications among arborists aloft and other workers on the ground shall be established before commencing operations. Predetermined, non-verbal communication such as whistles, two-way hand signals, or radios may also be used. (ANSI Z133-2017-3.4.5)

(6) When dropping or lowering trunks, branches, fruit, or equipment, a landing area (drop zone) should be designated. (ANSI Z133-2017-3.4.6)

- People and valuable objects shall be protected or excluded from the drop zone when active. (ANSI Z133-2017-3.4.6.1)
- A visible drop zone may be designated as an aid to avoidance of falling objects. (ANSI Z133-2017-3.4.6.2)

(7) An inspection shall be made by a qualified arborist to determine whether an electrical hazard exists before performing arboricultural operations. (ANSI Z133-2017-3.4.7)

(8) A qualified arborist shall visually inspect the tree, including the root collar and the area immediately surrounding the tree, for hazards before anyone climbs, otherwise enters, or performs any work on the tree. (ANSI Z133-2017-3.4.8)

(9) When definite indicators of decay, weakly attached branches, or dead bark are seen, the qualified arborist shall determine if the tree can withstand the forces to be applied during the work. (ANSI Z133-2017-3.4.9)

- If there is question as to the condition of the tree, relative to the task to be performed, work shall not commence until a more thorough assessment can be made. (ANSI Z133-2017-3.4.9.1)

(10) A second arborist, an arborist trainee, or other worker trained in emergency procedures shall be within visual or voice communication during arboricultural operations above 12 feet (3.65 m) that are not subject to the requirements of Subsection 4.3.9. (ANSI Z133-2017-3.4.10)

3. Portable Power Hand Tools (ANSI Z133-2017-6)

a. General (ANSI Z133-2017-6.1)

(1) All applicable requirements in Section 3, General Safety Requirements, shall apply to this section. (ANSI Z133-2017-6.1.1)

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(2) The purpose of this section is to provide guidelines for arborists and other workers pertaining to the safe use and care of portable power hand tools. (ANSI Z133-2017-6.1.2)

(3) The employer should follow the manufacturers' operating, maintenance, and safety instructions, unless the employer demonstrates that a greater hazard is posed by following the manufacturers' instructions. (ANSI Z133-2017-6.1.3)

(4) Before starting or operating portable power hand tools, the operators shall communicate with and ensure that all other workers are clear of the equipment, the swing arc of the cutting attachment, and the immediate worksite. (ANSI Z133-2017-6.1.4)

(5) Communication shall be established between the arborists working aloft, either in a tree or from an aerial device, and arborists and other workers on the ground, before starting or otherwise using any portable power hand tools. The command "stand clear" from aloft and the response "clear" from the ground are terms that may be used for this purpose. Pre-arranged, two-way hand signals may also be used. Workers shall stay out of the drop zone until it has been communicated by the qualified arborist, qualified arborist trainee, or worker aloft that it is safe to enter. (ANSI Z133-2017-6.1.5)

(6) When a chain saw or power hand tool is carried aloft and is not in use, it shall be secured against falling. (ANSI Z133-2017-6.1.6) The items contained in Section 6.1, General, shall always be included in the review of this section.

b. Chain Saws (ANSI Z133-2017-6.3)

(1) The items contained in Section 6.1, General, shall always be included in the review of this section. (ANSI Z133-2017-6.3.1)

(2) Chain saws shall not be operated unless the manufacturers' safety devices are in proper working order. Chain saw safety devices shall not be removed or modified. (ANSI Z133-2017-6.3.2)

(3) A stable body position shall be maintained when starting a chain saw. (ANSI Z133-2017-6.3.3)

(4) Drop-starting a chain saw is prohibited. A chain saw shall be started with the chain brake engaged and the operator holding the saw firmly in a manner that minimizes movement of the saw when pulling the starter handle. (ANSI Z133-2017-6.3.4)

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(5) A chain saw shall be operated with two hands at all times, one hand on each handle with thumbs wrapped around the handles. (ANSI Z133-2017-6.3.5)

- The operator shall operate the chain saw with the left hand and thumb gripped firmly around the forward handle and the right hand and thumb gripped firmly around the rear handle, unless it is not practicable, and the employer demonstrates that a greater hazard is posed by operating the chain saw that way in that particular situation. (ANSI Z133-2017-6.3.5.1)

(6) Arborists shall be tied in and use a second means of being secured [e.g., lanyard (work- positioning lanyard) or second climbing line] when operating a chain saw in a tree. Using two work-positioning lanyards or both ends of a two-in-one work-positioning lanyard shall not be considered acceptable as two means of being secured when using a chain saw in a tree. (ANSI Z133-2017-6.3.6)

Exception to (ANSI Z133-2017-6.3.6): When the employer demonstrates that a greater hazard is posed by using a second means of being secured while operating a chain saw in that particular situation.

(7) The chain brake shall be engaged or the engine shut off before setting a chain saw down. (ANSI Z133-2017-6.3.7)

(8) When a chain saw is being carried more than two steps, the chain brake shall be engaged or the engine shut off. The chain saw shall be carried in a manner that will prevent operator contact with the cutting chain and the muffler. (ANSI Z133-2017-6.3.8)

(9) The chain saw operator shall be certain of a stable body position before starting to cut. The chain saw shall not be used in a position or at a distance that could cause the operator to become off-balance, have insecure footing, or relinquish a firm grip on the saw. A chain saw shall not be used above shoulder height unless the employer demonstrates that a greater hazard is posed by operating the chain saw that way in that particular situation. (ANSI Z133-2017-6.3.9)

c. Powered Pole Tools and Backpack Power Units (ANSI Z133-2017-6.4)

(1) The items contained in Section 6.1, General, shall always be included in the review of this section. (ANSI Z133-2017-6.4.1)

(2) Powered pole tools with poles made of metal or other conductive material shall not be used in operations where electrical hazards exist. See Subsection 8.3.5 of this standard. (ANSI Z133-2017-6.4.2)

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4. Hand Tools and Ladders (ANSI Z133-2017-7)

   a. General (ANSI Z133-2017-7.1)

      (1) All applicable requirements in Section 3, General Safety Requirements, shall apply to this section. (ANSI Z133-2017-7.1.1)

      (2) Correct hand tools and equipment shall be selected for the job. (ANSI Z133-2017-7.1.2)

      (3) Hand tools and equipment that have been made unsafe by damage or defect, including tools with loose or cracked heads or cracked, splintered, or weakened handles, shall not be used. (ANSI Z133-2017-7.1.3)

      (4) Workers shall maintain a safe working distance from other workers when using hand tools and equipment. (ANSI Z133-2017-7.1.4)

      (5) When climbing into a tree, arborists shall not carry hand tools and equipment in their hands unless the tools are used to assist them in climbing. Tools other than ropes or throwlines shall not be thrown into a tree or between workers aloft. (ANSI Z133-2017-7.1.5)

      (6) Arborist climbing lines or handlines (line, handline) may be used for raising and lowering hand tools and equipment. Arborists should raise or lower hand tools and equipment in a manner such that the cutting edge will not contact the arborist climbing line or handline. (ANSI Z133-2017-7.1.6)

      (7) Hand tools and equipment shall be properly stored or placed in plain sight out of the immediate worksite when not in use. (ANSI Z133-2017-7.1.7)

   b. Cant Hooks, Cant Dogs, Peaveys, and Tongs (ANSI Z133-2017-7.2)

      (1) The items contained in Section 7.1, General, shall always be included in the review of this section. (ANSI Z133-2017-7.2.1)

      (2) Cant hooks, cant dogs, peaveys, and tongs should be firmly set before applying force. (ANSI Z133-2017-7.2.2)

      (3) Points of hooks shall be at least 2 inches (5 cm) long and kept sharp. (ANSI Z133-2017-7.2.3)

      (4) Arborists and other workers shall always stand uphill from rolling logs, and all workers shall be warned and in the clear before logs are moved. (ANSI Z133-2017-7.2.4)

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c. Wedges, Chisels, and Gouges (ANSI Z133-2017-7.3)

(1) The items contained in Section 7.1, General, shall always be included in the review of this section. (ANSI Z133-2017-7.3.1)

(2) Eye protection shall be used during impact operations. (ANSI Z133-2017-7.3.4)

(3) Only wood, plastic, or soft-metal wedges shall be used while operating chain saws. (ANSI Z133-2017-7.3.5)

d. Chopping Tools (ANSI Z133-2017-7.4)

(1) The items contained in Section 7.1, General, shall always be included in the review of this section. (ANSI Z133-2017-7.4.1)

(2) Chopping tools should not be used while working aloft. (ANSI Z133-2017-7.4.2)

(3) Chopping tools shall not be used as wedges or used to drive metal wedges. (ANSI Z133-2017-7.4.3)

(4) Chopping tools shall be swung away from the feet, legs, and body, using the minimum force practical for function and control. (ANSI Z133-2017-7.4.4)

(5) When swinging tools such as grub hoes, mattocks, and axes, a secure grip, firm footing, and clearance of workers and overhead hazards shall be maintained. (ANSI Z133-2017-7.4.5)

5. Tree Climbing (ANSI Z133-2017-8)

a. Tree Removal (ANSI Z133-2017-8.6)

(1) Before beginning any tree removal operation, the chain saw operator and/or crew leader shall carefully consider relevant factors pertaining to the tree and site and shall take appropriate actions to ensure a safe removal operation. Factors to include may be, but are not limited to, tree decay, tree lean, and wind (see Annex C.3, Manual Tree Felling Procedure, for a more inclusive list). (ANSI Z133-2017-8.6.1)

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(2) The crew leader shall assess the number of workers necessary for the tree removal operations, develop a tree removal work plan, and communicate the work plan and job task assignments in a job briefing with the crew prior to beginning the tree removal work. In addition, a method of verbal, audible, or visual communication as set forth in Subsection 8.5.11 shall be discussed and established during the job briefing prior to the start of tree removal operations. (ANSI Z133-2017-8.6.2)

(3) A drop zone shall be established prior to the start of piecing-down tree removal operations. Workers shall stay out of the drop zone until it has been communicated by a qualified arborist, a qualified arborist trainee, or the worker aloft directly involved in the piecing-down tree removal operation that it is safe to enter. (ANSI Z133-2017-8.6.3)

(4) In manual tree felling operations, non-involved workers shall be positioned at a distance from the tree at least two (2.0) times the height of the tree or trunk being removed until the chain saw operator and/or crew leader communicates that it is safe to approach more closely. Involved workers other than the chain saw operator, including but not limited to those who handle ropes/taglines, come-alongs/winches, etc., shall be positioned at a distance from the tree at least one-and-one-half (1.5) times the height of the tree or trunk being removed until the chain saw operator and/or crew leader communicates that it is safe to approach more closely. (ANSI Z133-2017-8.6.4)

(5) A planned retreat/escape path for all workers involved in the tree removal operation shall be prepared before piecing down tree parts or manual tree felling. (ANSI Z133-2017-8.6.5)

- During manual tree felling, the preferred retreat/escape path for the chain saw operator is 45 degrees on either side of a line drawn opposite the intended direction of the fall. (ANSI Z133-2017-8.6.5.1)
- To the extent practical, the retreat/escape path shall be cleared of obstructions and objects that would hinder retreat. (ANSI Z133-2017-8.6.5.2)
- The chain saw operator shall use this path for egress once the felling cuts have been completed or the tree begins to fall. (ANSI Z133-2017-8.6.5.3)
- Other involved workers shall have and use retreat/escape paths that do not hinder other retreating workers or expose any involved workers to increased hazard. (ANSI Z133-2017-8.6.5.4)

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(6) When it is necessary to use rigging to shorten or remove branches or to block down pieces of the tree, the qualified arborist shall consider whether the tree can withstand the strain of the lowering procedures. If the qualified arborist determines that the tree cannot withstand the strain of the lowering procedures, other means of removing the tree shall be implemented. (ANSI Z133-2017-8.6.6)

(7) A rope should be attached to all trees and stems greater than 5 inches (12.7 cm) in diameter at breast height (dbh) being felled to provide stabilization and/or directional pull where assisted directional felling is required. (ANSI Z133-2017-8.6.7)

(8) When there is a risk of damage to property from a tree piece or tree falling in an unintended direction, rope(s), block and tackle, come-alongs/winches, wire cable (except where an electrical hazard exists), or other appropriate devices shall be used to control the direction of fall. (ANSI Z133-2017-8.6.8)

- Loaders, skid steers, or other heavy equipment shall not be used to push over trees that are being manually felled while any worker is within 1-1/2 times the height of the tree being felled. The heavy equipment being utilized shall be of the appropriate size for the task and shall offer appropriate protection for the operator. (ANSI Z133-2017-8.6.8.1)

(9) Wedges should be used when determined to be necessary to prevent binding of the guide bar or chain when felling trees or stems. Wedges may be used as an aid in directional tree felling. (ANSI Z133-2017-8.6.9)

(10) All equipment used for tree removal operations shall be in good working condition. Tree removal equipment and its connecting links shall be inspected immediately before use and removed from service if found to be defective, damaged, or overloaded. (ANSI Z133-2017-8.6.10)

(11) Tree limbs shall be removed to a height and width sufficient to allow the tree parts or tree to fall clear of hazards, such as utility wires and/or other objects in the vicinity. (ANSI Z133-2017-8.6.11)

(12) During manual tree felling operations, notches shall be used on all trees and trunks greater than 5 inches (12. 7 cm) dbh. (ANSI Z133-2017-8.6.12)

(13) When manually felling trees, notches and back cuts shall be made at a height that enables the chain saw operator to safely begin the cut, control the tree or trunk, and have freedom of movement toward a retreat/escape path. (ANSI Z133-2017-8.6.13)

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- The two cuts that form the notch shall meet at a point called the apex and shall not cross that point or go beyond the point where they meet. (ANSI Z133-2017-8.6.13.1)
- The notch cut used shall be an open-face notch, a conventional notch, or a Humboldt notch. (ANSI Z133-2017-8.6.13.2)
- Notches shall be 45 degrees or greater and wide enough to guide the fall of the tree or trunk. (ANSI Z133-2017-8.6.13.3)
- Notch depth should not exceed one-third the diameter of the tree. (ANSI Z133-2017-8.6.13.4)
- Saw cuts made to form the notch and back cut shall leave suitable hinge wood to adequately control the fall of the tree. (ANSI Z133-2017-8.6.13.5)
- With an open-face notch (greater than 70 degrees), the back cut should be at the same level as the apex of the notch. With a conventional notch or Humboldt notch, the back cut shall be 1 to 2 inches (2.5 to 5 cm) above the apex of the notch to provide an adequate platform to reduce kickback potential of the tree or trunk. (ANSI Z133-2017-8.6.13.6)

(14) The hazard of barber chair should be considered when cutting trees under tension. Steps to prevent the sudden splitting of trunk wood should be taken. Preventive steps may include, but are not limited to, various back cut methods; wrapping a ratchet strap, rope, or chain around the tree above the notch and back cut area; or relieving the tension in or on the tree by slackening pull ropes or removing upper parts of the tree prior to felling. (ANSI Z133-2017-8.6.14)

(15) Before making the back cut, there shall be a command such as "stand clear" from the arborist operating the chain saw and a response such as "clear" from the workers supporting the removal operation. Pre-arranged, two-way hand signals or two-way audible devices such as air horn or whistle signals may also be used. Only designated persons shall give such signals. (ANSI Z133-2017-8.6.15)

(16) During manual tree felling operations, involved workers shall keep visual contact with the tree or trunk until it is on the ground. (ANSI Z133-2017-8.6.16)

Exception to (ANSI Z133-2017-8.6.16): When the tree or trunk begins to fall, the worker at the base of the tree shall immediately move a safe distance away from the tree or trunk using the retreat/escape path.

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6.2 ANSI B175.1-2012 Internal Combustion Engine-Powered Hand-Held Chainsaws-Safety and Environmental Requirements (place holder)

6.3 FS 5100-1D-2013 USDA/USFS Standard for Spark Arresters for Internal Combustion Engines

1. Scope. (5100-1d-2013-1)

    a. Purpose and Applicability. This standard establishes the minimum performance and maintenance requirements of spark arresters for single and multiposition small internal combustion engines used in proximity to grass, brush, timber, and similar cellulose materials. This standard provides methods for arrester performance evaluation, size selection, and determination of application position.

    Federal, State, and local laws govern when and where the use of spark arresters is required. During periods of very high or extreme fire danger, arresters meeting this standard may not give complete protection against exhaust spark fires. Additional measures, including complete shutdown of operations, may be required during such periods. (5100-1d-2013-1.1)

2. Applicable Documents. (5100-1d-2013-2)

    a. Non-Government Publications. Unless otherwise specified, the issues of these documents are those in effect on the date of testing:

    b. Society of Automotive Engineers (SAE)

        (1) Surface Vehicle Recommended Practice J350 - Spark Arrester Test Procedure for Medium

        (2) Size Engines

    c. Surface Vehicle Recommended Practice J335 –Multiposition Small Engine Exhaust System Fire Ignition Suppression Copies of SAE Standard and Recommended Practice are available from the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096-0001. (5100-1d-2013-2.1)

3. Interpretation and Definitions. (5100-1d-2013-3)

    a. Interpretation. To carry out the provisions of this document, the word shall is to be understood as mandatory. (5100-1d-2013-3.1)

    b. Definitions. (5100-1d-2013-3.2)

        (1) Application engine: The engine for which the spark arrester is designed. If the spark arrester is to be used on multiple engines, the application engine is the one with the highest design horsepower.

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(2) Arresting effectiveness: For centrifugal type spark arresters, the ratio of carbon test material larger than 0.023 inch trapped by the spark arrester to the total carbon test material introduced at the arrester inlet, expressed as a percentage.

(3) Arrester clean-out effectiveness: For centrifugal type spark arresters, the ratio of carbon test material removed during cleanout to the total carbon test material introduced at the arrester inlet, expressed as a percentage.

(4) Accredited laboratory: A laboratory which is has been approved by the USDA Forest Service to test spark arresters and report test results per the appropriate test specification. A list of accredited laboratories is provided in appendix A.

(5) Centrifugal type spark arrester: A type of spark arrester that uses baffles, traps, and/or vanes to remove debris from exhaust flow.

(6) Durable label: A label which has a life expectancy equivalent to that of its substrate. A durable label must be capable of withstanding expected environmental and operating conditions without deterioration.

(7) Emissions durability period (EDP): See “useful life.”

(8) Endurance test: For screen type spark arresters which are installed on single position engines of 50 horsepower (37.3 kW) or greater, a test which demonstrates the candidate spark arrester can endure 100 hours of operation when installed on an appropriately sized engine running at specified operating conditions.

(9) Exhaust system: For screen type spark arresters which are installed on single position engines of 50 horsepower (37.3 kW) or greater, a test which demonstrates the candidate spark arrester can endure 100 hours of operation when installed on an appropriately sized engine running at specified operating conditions.

(10) Multiposition small engine (MSE): A small, portable internal combustion engine operable in more than one orientation. Examples include chain saws, weed trimmers, and brush cutters.

(11) MSE endurance test: For multiposition small engines with nonservicable exhaust systems, a test which demonstrates the candidate spark arrester can withstand the useful life of the engine.

(12) Screen effective area: The total area of screen through which exhaust gases pass (for Screen type spark arresters only). The effective area is smaller than the physical screen area due to screen geometry and obstructions created during fabrication (straps, welds, etc.).

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(13) Screen type spark arrester: A type of spark arrester which uses a screen mesh to trap exhaust debris.

(14) Single position engine: An engine designed to be operated in a single orientation.

(15) Spark arrester: Any device which limits or prevents the discharge of debris from the exhaust system of a combustion engine.

(16) Useful life: The average amount of time that the spark arrester exhaust system is estimated to function when installed new.

4. Performance Requirements (5100-1d-2013-4)

a. Centrifugal Type Spark Arresters. (5100-1d-2013-4.1)

(1) Test Requirements. Centrifugal spark arresters shall be tested by an accredited laboratory per the requirements of SAE J350. All required test data specified herein must be obtained using the methods described in the test specification. (5100-1d-2013-4.1.1)

(2) Arresting Effectiveness. Arresting effectiveness shall be, at minimum, 80 percent at all test points. (5100-1d-2013-4.1.2)

(3) Mounting and Installation. The spark arrester shall be mounted in a manner which requires 100 percent of the exhaust gas to pass through the arrester. The spark arrester may not be mounted at an angle of more than 45 degrees from the orientation used during qualification testing. If the spark arrester can be mounted in more than one orientation, the inlet must be clearly identified to prevent improper installation. (5100-1d-2013-4.1.3)

(4) Cleanout and Maintenance. The spark arrester shall have provisions for disposal of accumulated particles without the removal of the clamping or mounting devices from the stack, pipe, or manifold assembly. Removable items (other than fasteners) shall be indexed to one position to prevent improper assembly. A written procedure, which clearly describes the cleanout and maintenance procedure shall be provided. (5100-1d-2013-4.1.4)

(5) Marking and Identification. The spark arrester shall be permanently identified with the spark arrester model designation and the manufacturer’s name or trademark. The markings shall be clearly imprinted in 1/8 inch (3.2 mm) or larger type and be readily visible without removal of the arrester from the engine. Acceptable methods of identification are metal stamping, etching, dot peening, or durable labels. (5100-1d-2013-4.1.5)

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b. Screen Type Spark Arresters (Single Position Engines). (5100-1d-2013-4.2)

(1) Test Requirements. Screen type spark arresters shall be tested by an accredited laboratory per the requirements of SAE J350. All required test data specified herein must be obtained using the methods described in the test specification. (5100-1d-2013-4.2.1)

(2) Screen Geometry. Screen type arresters shall have no screen or housing openings greater than 0.023 inch (0.58 mm). The total area of all screen openings shall not be less than twice the exhaust port area measured at the smallest restriction between the exhaust manifold and spark arrester. For a system with multiple exhaust ports, each exhaust port area (at the smallest restriction) will be added to obtain the total exhaust port area. (5100-1d-2013-4.2.2)

(3) Screen Material. Screen material shall be resistant to the high temperatures and corrosive materials present in internal combustion engine exhaust flow. (5100-1d-2013-4.2.3)

(4) Endurance Test. Screen type spark arresters with an application engine of 50 horsepower (37.3 kW) or greater shall be tested for 100 hours as outlined in SAE J350. (5100-1d-2013-4.2.4)

(5) Mounting and Installation. The spark arrester shall be mounted in a manner which requires 100 percent of the exhaust gas to pass through the arrester. If the spark arrester can be mounted in more than one orientation, the inlet must be clearly identified to prevent improper installation. (5100-1d-2013-4.2.5)

(6) Cleanout and Maintenance. The spark arrester shall be easily removable with the use of simple handtools. Welds, rivets, or permanent fasteners are not acceptable. Removable items (other than fasteners) shall be indexed to one position to prevent improper assembly. A written procedure, which clearly describes the cleanout and maintenance procedure shall be provided. (5100-1d-2013-4.2.6)

(7) Marking and Identification. The spark arrester shall be permanently identified with the spark arrester model designation, the manufacturer’s name or trademark, and the words “SCREEN TYPE.” The markings shall be clearly imprinted in 1/8 inch (3.2 mm) or larger type and be readily visible without removal of the arrester from the engine. Acceptable methods of identification are metal stamping, etching, dot peening, or durable labels. (5100-1d-2013-4.2.7)

c. Multiposition Small Engines (MSE). (5100-1d-2013-4.3)

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(1) Test Requirements. Multiposition small engine spark arresters shall be tested by an accredited laboratory per the requirements of SAE J335. All required test data specified herein must be obtained using the methods described in the test specification. (5100-1d-2013-4.3.1)

(2) Arresting Effectiveness. The spark arrester used with the engine exhaust system shall be designed to retain or destroy 90 percent or more of the carbon particles having a major diameter greater than 0.023 inch (0.584 mm). (5100-1d-2013-4.3.2)

(3) Screen Geometry. Spark arresting screens shall have no screen or housing openings greater than 0.023 inch (0.58 mm). (5100-1d-2013-4.3.3)

(4) Screen Material. Screen material shall be resistant to the high temperatures and corrosive materials present in internal combustion engine exhaust flow. (5100-1d-2013-4.3.4)

(5) Debris Accumulation. (5100-1d-2013-4.3.5)

- External pockets. The exhaust system shall be designed so that there are no external pockets in area surrounding the exhaust system where flammable material could accumulate. (5100-1d-2013-4.3.5.1)

- Internal pockets. An area on the outer surface area of the exhaust system forming an internal pocket shall be either closed or the surface temperature inside the internal pocket shall not exceed 550 °F (288 °C). This applies only to front mounted chain saw exhaust systems. (5100-1d-2013-4.3.5.2)

(6) Exposed Surface Temperature. Exposed exhaust surface temperatures shall not exceed 550 °F (288 °C). (5100-1d-2013-4.3.6)

(7) Exhaust Gas Temperature. Exhaust gas temperature shall not exceed 475 °F (246 °C). (5100-1d-2013-4.3.7)

(8) Cleanout, Maintenance, and Endurance Testing. (5100-1d-2013-4.3.8)

- Non-Sealed Exhaust Systems. Exhaust systems shall provide for the easy removal of the spark arrester screen for inspection, cleaning, or replacement without major disassembly of the power head or removal of the exhaust system from the engine. (5100-1d-2013-4.3.8.1)

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- Sealed Exhaust Systems. Spark arrester screens installed on sealed, nonserviceable exhaust systems shall have a service life greater than or equal to the manufacturer's defined useful life, when installed and tested in accordance with the procedures outlined in SAE J335. Spark arrester screens meeting these requirements need not be removable. (5100-1d-2013-4.3.8.2)

(9) Marking and Identification. The power unit shall be identified by the manufacturer name or trademark and model number. The exhaust system shall be identified by a unique model ID. Due to size restrictions, a partial marking may be used, provided it uniquely identifies the exhaust system. Acceptable methods of identification are metal stamping, etching, dot peening, or durable labels.

The exhaust system shall be identified by the manufacturer name or trademark and model number. Due to space limitations in these exhaust systems, partial marking is acceptable provided the marking uniquely identifies the unit. (5100-1d-2013-4.3.9)

d. Waiver of Physical Testing. Spark arresters, which are of similar design to products already qualified to this specification, may be waived from physical testing, provided only minor changes exist between the candidate spark arrester and the previously qualified unit. Examples of minor changes include, but are not limited to, the following:

(1) Changes in manufacturer or model name.

(2) Changes to mounting brackets or hardware.

(3) Changes to the exhaust system, which do not affect spark arresting capabilities.

Waivers of physical testing shall be at the discretion of the USDA Forest Service, San Dimas Technology and Development Center. (5100-1d-2013-4.4)

e. Exemptions. Engines possessing the special equipment specified below have been demonstrated to present a minimal risk of exhaust-spark fires and are exempt from the requirements of this standard. (5100-1d-2013-4.5)

(1) Turbochargers. Turbocharged engines do not require a spark arrester, provided 100 percent of exhaust gases flow through the turbine wheel and the turbocharger does not have a wastegate. (5100-1d-2013-4.5.1)

(2) Diesel Particulate Filters. Engines using a diesel particulate filter (DPF) do not require a spark arrester, provided the following requirements are met:

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- 100% of exhaust gases flow through the DPF.
- The equipment provides the operator with a visual or audible warning (i.e. dashboard light, message center, or alarm) when the filter requires regeneration, manual cleaning, or replacement. (5100-1d-2013-4.5.2)

5. SPARK ARRESTER SELECTION AND INSTALLATION. Spark arresters being used on single position engines other than the application engine shall conform to the requirements specified below. Spark arrester applications not meeting these requirements must undergo qualification testing. (5100-1d-2013-5)

   a. Engine Performance Requirements. The spark arrester selected shall be rated at an exhaust flow rate greater than or equal to that at which it is rated. The exhaust flow rate shall be determined using the manufacturer's recommended maximum speed and power for intermittent operation or maximum governed speed. Tables for determining flow rates of internal combustion engines are provided in appendix B. (5100-1d-2013-5.1)

   b. Exhaust System Integration. (5100-1d-2013-5.2)

      (1) Screen Type Spark Arresters (Single Position Engines). A screen type spark arrester may only be used on the exhaust system for which it was qualified. The same exhaust system may be used on multiple engines, provided the engine's exhaust flow rate does not exceed the qualified flow rate for the system. (5100-1d-2013-5.2.1)

6. Appendix A – Accredited Laboratories (5100-1d-2013-App A)

   The following laboratories have been accredited by the USDA Forest Service, San Dimas Technology and Development Center for the testing of spark arrester exhaust systems. Only the laboratories listed below may be used for qualification testing to this standard.

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Test Specification	Accredited Laboratory*	Contact Information
SAE J350 (Spark Arresters for Medium Sized Engines)	USDA Forest Service San Dimas Technology and Development Center	Email mailroom_wo_sdtdc @fs.fed.us Phone (909) 599-1267 Address 444 E. Bonita Ave San Dimas, CA 91773
SAE J335 (Multiposition Small Engine Exhaust System Fire Ignition Suppression)	Underwriters Laboratories (UL)	Email cec.us@us.ul.com Address 12 Laboratory Drive P.O. Box 13995 Research Triangle Park, NC 27709 USA
	DLG e.V	Email info@dlg.org Address Max-Eyth-Weg 1, D-64823 Groß-Umstadt, Germany
	CSA International	Email client.services@csa.ca Address 178 Rexdale Blvd. Toronto, Ontario Canada M9W 1R3

**Note: The USDA Forest Service San Dimas Technology and Development Center retains final authority over all qualifications, regardless of testing agency*

7. Appendix B – Flow Rate Calculation for Internal Combustion Engines (5100-1d-2013-App B)

   The equation provided below is to assist in the determination of engine exhaust flow rate.

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$$Q(CFM) = \eta \frac{2 \times D \times RPM}{S \times 1728}$$

where

D = Engine displacement (in^3)

RPM = Engine speed (revolutions per minute)

S = Number of strokes per cycle (2 or 4)

η = Volumetric efficiency

Typical values for volumetric efficiency are as follows:

Engine type	η (Volumetric efficiency)
2 or 4 cycle gasoline (naturally aspirated)	0.8
2 or 4 cycle diesel (naturally aspirated)	0.9
Turbocharged or supercharged engines	3.0

7 Appendices

7.1 First aid kits (Mandatory) (1910.266 App A)

The following list sets forth the minimally acceptable number and type of first-aid supplies for first-aid kits required under paragraph (d)(2) of the logging standard. The contents of the first-aid kit listed should be adequate for small work sites, consisting of approximately two to three employees. When larger operations or multiple operations are being conducted at the same location, additional first-aid kits should be provided at the work site or additional quantities of supplies should be included in the first-aid kits:

1. Gauze pads (at least 4 x 4 inches).
2. Two large gauze pads (at least 8 x 10 inches).
3. Box adhesive bandages (band-aids).
4. One package gauze roller bandage at least 2 inches wide.
5. Two triangular bandages.
6. Wound cleaning agent such as sealed moistened towelettes.

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7. Scissors.

8. At least one blanket.

9. Tweezers.

10. Adhesive tape.

11. Latex gloves.

12. Resuscitation equipment such as resuscitation bag, airway, or pocket mask.

13. Two elastic wraps.

14. Splint.

15. Directions for requesting emergency assistance.

7.2 First aid and CPR Training (Mandatory) (1910.266 App B)

The following is deemed to be the minimal acceptable first-aid and CPR training program for employees engaged in logging activities.

First-aid and CPR training shall be conducted using the conventional methods of training such as lecture, demonstration, practical exercise and examination (both written and practical). The length of training must be sufficient to assure that trainees understand the concepts of first aid and can demonstrate their ability to perform the various procedures contained in the outline below.

At a minimum, first-aid and CPR training shall consist of the following:

1. The definition of first aid.

2. Legal issues of applying first aid (Good Samaritan Laws).

3. Basic anatomy.

4. Patient assessment and first aid for the following:

   a. Respiratory arrest.

   b. Cardiac arrest.

   c. Hemorrhage.

   d. Lacerations/abrasions.

   e. Amputations.

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f. Musculoskeletal injuries.

g. Shock.

h. Eye injuries.

i. Burns.

j. Loss of consciousness.

k. Extreme temperature exposure (hypothermia/hyperthermia)

l. Paralysis

m. Poisoning.

n. Loss of mental functioning (psychosis/hallucinations, etc.). Artificial ventilation.

o. Drug overdose.

5. CPR.

6. Application of dressings and slings.

7. Treatment of strains, sprains, and fractures.

8. Immobilization of injured persons.

9. Handling and transporting injured persons.

10. Treatment of bites, stings, or contact with poisonous plants or animals.

7.3 Cal OSHA Regulations/Definitions Applicable to Chainsaw Operations

1. Definitions. Applicable to Chainsaw Operations (title8/3420(b))

a. Apex. The point at which two saw cuts meet to form a notch.

b. Back Cut. The cut made in the tree limb or trunk on the side opposite the intended direction of fall.

c. Bucking. The process of cutting the downed tree into appropriate lengths.

d. Climbing Hitch. A hitch used for securing a tree climber to the climbing line, permitting controlled ascent, descent, and work positioning.

e. Climbing Lines (Climbing Ropes). Rope that is designed by the manufacturer to support the climber while aloft in a tree.

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f. Climbing Spurs. Sharp devices strapped to a climber's lower legs to assist in climbing trees.

g. Come-along. A portable, hand-operated winching device, using cable or ropes to draw two objects closer together.

h. Crotch. Branch union; the angle formed by two branches in the tree.

i. Double-crotching. A climbing method that uses the rope's opposite end or a second rope to enhance stability.

j. Drop Zone. The area established by a qualified tree worker beneath employees aloft involved in tree work operations and/or where the potential exists for struck-by injuries from objects dropped or lowered from above.

k. Felling. Cutting down an entire tree or standing section of a tree in one piece, from the ground, by incorporation of a notch and back cut.

l. Frond. A large compound leaf of a palm.

m. False Crotch. A system, other than a natural crotch, used to support a climbing line.

n. Hinge. A strip of uncut wood fibers created between the face cut or notch and the back cut that helps control direction in tree felling or limb removal.

o. Leader. The stem or trunk of a tree usually growing in the upright position.

p. Limbing. The removal of branches from either standing or downed trees.

q. Notch. A wedge cut into the tree or tree section facing the intended direction of fall to control the felling direction.

(1) Conventional Notch. A directional felling cut into the side of a tree, facing the intended direction of fall and consisting of a horizontal face cut and an angle cut above it, creating a notch of approximately 45 degrees.

(2) Humboldt Notch. A directional felling cut into the side of a tree, facing the intended direction of fall and consisting of a horizontal face cut and an angled cut below it, creating a notch of approximately 45 degrees. A Humboldt notch is usually reserved for larger trees on steep slopes.

(3) Open-faced Notch. A directional felling cut into the side of the tree facing the intended direction of fall and consisting of two cuts creating a notch greater than 70 degrees.

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r. Ornamental Palm. A palm that is primarily for landscaping or scenery and not grown for the production and harvesting of fruits, such as dates for personal use or sale.

s. Palm Frond Skirt. One or more year's accumulation of dead and drooping palm fronds at the bottom of the palm's canopy and along its trunk.

t. Proximity. An area within 10 feet (3.05 meters) of energized overhead electrical conductors rated 50 kilovolts (kV) phase to phase or less. For overhead electrical conductors rated more that 50 kV phase to phase, the distance is increased 4/10 inch (10 millimeters) for each additional kV.

u. Prusik Loop. An endless loop of rope used to fashion the Prusik knot (which is a sliding friction knot). The endless loop may be spliced or knotted with, at minimum, a double fisherman's knot.

v. Qualified Tree Worker. An employee who, through related training and on-the-job experience, has demonstrated familiarity with the techniques and hazards of tree maintenance, removal, and the equipment used in the specific operations involved.

w. Root Collar. A flared area at the tree trunk base where the roots and trunk come together.

x. Rope(s). Includes climbing lines and climbing ropes unless otherwise stated, and includes all other ropes and lines used in tree work, maintenance and removal operations.

y. Secured (person). A tree worker that is safeguarded by utilizing a climbing system attached to the tree worker and connected to a tree or other stable support.

z. Split Tail. A short section of climbing line with one end connected by a self-closing, self-locking carabiner or snap hook to the suspension D-rings of the tree saddle and the opposite end connected to the climbing line by a climbing hitch.

aa. Tied In. When a tree worker's climbing line has been run through a natural or false crotch attached to the tree worker's saddle and completed with a climbing hitch or mechanical device, permitting controlled movement and work positioning.

bb. Tree Climbing System. A collection of equipment used together for work positioning in a tree and generally consisting of a tree worker's saddle, one or more climbing lines, one or more work positioning lanyards and associated hardware.

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cc. Tree Worker's Saddle. An arrangement of straps, fittings, and buckles or other elements in the form of a waist belt with a low attachment element or elements and connecting support encircling the legs, suitably arranged to support the body in a sitting position.

dd. Work-positioning Lanyard. For purposes of Article 12, a component of a tree climbing system consisting of a short section of approved rope, strap or line that has a rope snap or carabiner at either end, and that is used as a point of attachment to the tree or ornamental palm for securing the worker in the tree while aloft

2. Definitions and Glossary (title8/6249)

a. Adequate. Sufficient to reduce the risk to an acceptable minimum.

b. Back Cut or Felling Cut. Final cut in a felling operation, made on the opposite side of the tree from the undercut.

c. Bight. Area within the loop of a rope, its ends made fast; or the area within the angle formed by a line running through a block.

d. Binder. Wrapper tightening device.

e. Bolt. Short section of log or timber, rough sawn to length, from which shingles, laths, etc., are cut.

f. Brow Log. Log placed parallel to any roadway at a landing or dump to protect vehicles during loading or unloading.

g. Buck. Process of severing a tree into sections (logs or bolts).

h. Bucker. Worker who saws logs into desired lengths.

i. Bunk. Cross support for logs on a logging car or truck.

j. Carriage (Log Carriage). Framework mounted on wheels which runs on tracks or in grooves in a direction parallel to the face of the saw, and which contains apparatus to hold a log securely and advance it towards the saw.

k. Chaser. Member of the yarding crew who unhooks the logs at the landing.

l. Chock, Bunk Block or Cheese Block. Wedge that prevents logs from rolling off the bunks.

m. Choker. Wire rope with special attachments that is put around a log near its end to facilitate hauling or lifting.

n. Chunking Out. Clearing material from a specific area.

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o. Cross Haul, or Parbuckling. Rolling logs by means of rope or a power device.

p. Crummy. Vehicle used to transport employees to and from a job site.

q. D or Strap Socket. Socket with a closed loop for attaching to the end of a line or block.

r. Dead Man. Buried log or other object used as an anchor.

s. Division. Unless otherwise designated in this subchapter, the phrase "division" refers to the current Division of Occupational Safety and Health or any of its predecessors including the former Division of Industrial Safety. Reference to the former Division of Industrial Safety in these orders is meant to refer to its successor, the Division of Occupational Safety and Health or any subsequent successor organization.

t. Equivalent. Alternative design or features which will provide an equal degree or factor of safety.

u. Fair-lead. Device used to guide a rope coming from any direction to a drum or sheave without fouling.

v. Guarded. Protected by a cover, shield, rail, or other device, or by location, to reduce the probability of injury.

w. Guylines. Ropes used to stay or support spar trees, booms, etc.

x. Head Tree. Tree where loading and/or yarding takes place.

y. Hook Tender. Person who supervises the moving of logs from the woods to the place of loading.

z. Hot Deck. Deck from which logs are constantly being moved.

aa. Hydraulic Tree Jack. A mechanical device powered by internal pressure used to control the direction in which a tree is to be felled.

bb. Kicker. Mechanical device used to move logs or material.

cc. Knob. Metal ferrule attached to the end of a line.

dd. Landing. Any place where logs are laid after being yarded, awaiting loading.

ee. Leaner. Live or dead leaning trees.

ff. Lift Tree. Tree or trees between the head spar and tail anchor upon which the skyline is hung but not anchored.

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gg. Loading Boom. Any structure projecting from a pivot point to guide a log when it is lifted.

hh. Lodged Tree. A tree leaning against another tree or object which prevents its falling to the ground.

ii. Logging Machines. Mobile yarders, including donkeys, A-frames, towers, masts, and converted cranes used for cable logging.

jj. Nationally Recognized Testing Laboratory (NRTL). A laboratory which has been recognized by the Department of Labor, Occupational Safety and Health Administration (OSHA) as meeting the requirements of 29 CFR 1910.7.

kk. Operation, Show, Woods Layout, or Side. Any place where logging is being done.

ll. Road (Cable or Yarding). The road along which logs are yarded to the landing with one setting of the rigging.

mm. Root Wad. Ball of roots which extends above ground level when a tree is up-rooted.

nn. Rub Tree. See Siwash Tree.

oo. Running Lines. Any moving wire rope, distinguished from a stationary wire rope such as a guyline.

pp. Safety Factor. Calculated reduction factor which may be applied to laboratory test values to obtain safe working stresses.

qq. Shall. Mandatory requirement.

rr. Shoe. See Tree Jack.

ss. Show. See Operations.

tt. Side. Unit of a logging operation, including workers and equipment, that is sufficient to fall, buck, and load logs from an area.

uu. Slope. Increase in height over a horizontal distance, measured in percent. (An increase of one vertical foot over a horizontal distance of five feet is expressed as a 20% slope.)

vv. Snag. Any dead standing tree or portion thereof.

ww. Snubbing. Retarding or controlling the movement of logs or machines by means of looping the rope around a stationary object.

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xx. Spar Tree. Tree from which the top and limbs have been cut and used to support the blocks and ropes for various systems of logging.

yy. Spring Pole. Section of tree, sapling, limb, etc. which is, by virtue of its arrangement, in relation to other materials, under bending stress.

zz. Strap. Any short piece of line used for securing or holding together equipment or parts of equipment or for loading.

aaa. Straw Line. Small line used for miscellaneous purposes.

bbb. Topping. Cutting off the top section of a tree preparatory to rigging the tree.

ccc. Tractor. Track-laying or rubber-tired machine used to skid logs or build roads.

ddd. Tree Jack. Saddle with set of grooved rollers set between side plates, secured to a tree as a guide for lines.

eee. Tree Plates. Steel protectors spiked around a tree to prevent the guys from cutting into the tree.

fff. Turn. Single log or group of logs being yarded as a unit.

ggg. Undercut. Notch cut in the tree to guide the tree in falling.

hhh. Widow Maker. Overhanging limb or section of tree which could become dislodged and drop to the ground. (See also lodged tree.)

iii. Windfall. Tree felled by wind or other natural cause.

jjj. Work Area. Any area where job assignments are performed.

7.4 Annex C (Informative) General Safety Procedures That Apply to All Tree Work (ANSI Z133-2017-ANNEX C)

a. Manual Tree Felling Procedure. Before performing any work, conduct a site assessment and the following seven steps to determine whether a tree can be manually felled. (ANSI Z133-2017-C.3)

(1) Hazards and Obstacles Identification: Example of conditions to analyze include, but are not limited to (ANSI Z133-2017-C.3.1)

- tree size in relationship to the landing zone; (ANSI Z133-2017-C.3.1.a)
- selected direction of fall; (ANSI Z133-2017-C.3.1.b)

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- obstacles to avoid or clear from the felling path; (ANSI Z133-2017-C.3.1.c)
- vines or interlocking limbs; (ANSI Z133-2017-C.3.1.d)
- species and shape of tree; (ANSI Z133-2017-C.3.1.e)
- lean of tree; (ANSI Z133-2017-C.3.1.f)
- loose limbs, hangers, broken tops, chunks, or other overhead material; (ANSI Z133-2017-C.3.1.g)
- wind force and direction; (ANSI Z133-2017-C.3.1.h)
- decay, cavities, or weak spots throughout the tree; (ANSI Z133-2017-C.3.1.i)
- location of any electrical conductors or other wires; (ANSI Z133-2017-C.3.1.j)
- tree cables, bracing, lightning protection, or other tree hardware; (ANSI Z133-2017-C.3.1.k)
- size and terrain characteristics or limitations of work area; (ANSI Z133-2017-C.3.1.l)
- potential for flying debris from tree impact; (ANSI Z133-2017-C.3.1.m)
- adequate retreat path; (ANSI Z133-2017-C.3.1.n)
- evidence of bees or wildlife habitation in tree; (ANSI Z133-2017-C.3.1.o)
- poisonous plants; (ANSI Z133-2017-C.3.1.p)
- water hazards; (ANSI Z133-2017-C.3.1.q)
- ability to control access to worksite; (ANSI Z133-2017-C.3.1.r)
- authority to remove tree; (ANSI Z133-2017-C.3.1.s)
- quality of wood fiber in hinge area; (ANSI Z133-2017-C.3.1.t)
- root mass stability; (ANSI Z133-2017-C.3.1.u)
- ice or snow load; (ANSI Z133-2017-C.3.1.v)

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- throwback or bounceback potential; (ANSI Z133-2017-C.3.1.w)
- potential for spring poles; (ANSI Z133-2017-C.3.1.x)
- lodged trees or dead snags in area; (ANSI Z133-2017-C.3.1.y)
- access to tools or resources required for task; (ANSI Z133-2017-C.3.1.z)
- lightning damage; (ANSI Z133-2017-C.3.1.aa)
- potential for barber chair; (ANSI Z133-2017-C.3.1.bb)
- foreign objects, nails, wire fence, concrete, etc. (ANSI Z133-2017-C.3.1.cc)

(2) Lean(s): Determine side lean from the fall direction, then go 90 degrees adjacent and determine front or back lean. (Note: The side lean may influence the retreat path [escape route] as well as the back cut to be used. Heavy, forward-leaning trees may represent a risk of barber chair.) (ANSI Z133-2017-C.3.2)

(3) Retreat Path/Escape Route (planned retreat direction): Select a route that is 45 degrees to the rear of the tree and, when possible, to the opposite side of the natural side lean of the tree. (ANSI Z133-2017-C.3.3)

(4) Notch Plan: Select and cut a notch that is best suited to allow the tree to fall safely in the desired direction (open face, conventional, or Humboldt). (ANSI Z133-2017-C.3.4)

(5) Hinge Plan: Determine the type and characteristics of the hinge. Uncut wood between the notch and back cut is recommended to have a width that is 10 percent of dbh and a hinge length that is 80 percent of the tree's diameter. (ANSI Z133-2017-C.3.5)

(6) Back Cut Plan: Select and make a felling cut, such as bore cut, stepped cut(s), or level back cut(s); also use assistance, such as wedge(s), workline(s), or machinery Before making a back cut, give an audible command, such as "stand clear," and wait for a response, such as "all clear." (ANSI Z133-2017-C.3.6)

(7) Retreat: Use a retreat path (escape route) out to a safe distance. If the tree has not fallen, use workline(s) or machinery in place to start the fall of the tree. Once the tree is on the ground, wait for movement to stop and check for hanging or lodged hazards before approaching. (ANSI Z133-2017-C.3.7)

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7.5 Annex E (Informative) Weight of Green Logs (ANSI Z133-2017-ANNEX E)

Scientific name	Common name	Weight, lb per ft³	Weight of a 1-foot section, based on average diameter							
			10″	12″	14″	16″	18″	20″	22″	24″
Abies concolor	white fir	47	25	37	50	66	83	102	124	148
Abies procera	noble fir	29	16	23	31	41	51	63	77	91
Acer rubrum	red maple	50	27	39	53	70	88	109	132	157
Acer saccharinum	silver maple	45	25	35	48	63	79	98	119	141
Acer saccharum	sugar maple	56	31	44	60	78	99	122	148	176
Aesculus hippocastanum	horsechestnut	41	22	32	43	57	72	89	108	129
Alnus rubra	red alder	46	25	36	49	64	81	100	121	144
Betula papyrifera	paper birch	50	27	39	53	70	88	109	132	157
Calocedrus decurrens	incense-cedar	45	25	35	48	63	79	98	119	141
Carya illinoensis	pecan	61	33	48	65	85	108	133	161	192
Carya ovata	shagbark hickory	64	35	50	68	89	113	140	169	201
Celtis occidentalis	hackberry	50	27	39	53	70	88	109	132	157
Diospyros virginiana	persimmon	63	34	49	67	88	111	137	166	198
Eucalyptus camaldulensis	red gum	50	27	39	53	70	88	109	132	157
Fagus spp.	beech	54	29	42	58	75	95	118	142	169
Fraxinus americana	white ash	48	26	38	51	67	85	104	126	150
Fraxinus latifolia	Oregon ash	48	26	38	51	67	85	104	126	150
Fraxinus pennsylvanica	green ash	47	25	37	50	66	83	102	124	148
Gleditsia triacanthos	honeylocust	61	33	48	65	85	108	133	161	192
Juglans nigra	black walnut	58	32	45	62	81	102	126	153	182
Larix spp.	larch	51	28	40	54	71	90	111	135	160
Liquidambar styraciflua	sweetgum	55	30	43	58	77	97	120	145	173
Liriodendron tulipifera	yellow poplar, tuliptree	38	21	30	40	53	67	83	99	199
Melia azedarach	Chinaberry	50	27	39	53	70	88	109	132	157
Nyssa sylvatica	black gum	45	25	35	48	63	79	98	119	141
Picea rubens	red spruce	34	19	27	36	47	60	74	90	106
Picea sitchensis	Sitka spruce	32	17	25	34	45	56	70	84	100
Pinus contorta	lodgepole pine	39	21	30	41	55	69	85	103	122
Pinus elliottii	slash pine	58	32	45	62	81	102	126	153	182
Pinus lambertiana	sugar pine	52	28	41	55	72	92	113	137	163
Pinus monticola	western white pine	36	20	28	38	50	64	78	95	113
Pinus palustris	longleaf pine	55	30	43	58	77	97	120	145	173
Pinus ponderosa	ponderosa pine	46	25	36	49	64	81	100	121	144
Pinus strobus	eastern white pine	36	20	28	38	50	64	78	95	113
Pinus taeda	loblolly pine	53	29	41	56	74	93	116	140	166
Platanus occidentalis	sycamore	52	28	41	55	72	92	113	137	163
Populus spp.	cottonwood	49	27	38	52	68	86	107	129	154
Populus tremuloides	quaking aspen	43	23	34	46	60	76	94	114	135

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Scientific name	Common name	Weight, lb per ft³	Weight of a 1-foot section, based on average diameter							
			10″	12″	14″	16″	18″	20″	22″	24″
Prunus serotina	black cherry	45	25	35	48	63	79	98	119	141
Pseudotsuga menziesii	Douglas-fir	39	21	30	41	55	69	85	103	122
Quercus alba	white oak	62	34	48	66	86	109	135	163	194
Quercus coccinea	scarlet oak	64	35	50	68	89	113	140	169	201
Quercus kelloggii	California black oak	66	36	51	70	92	116	144	174	207
Quercus palustris	pin oak	64	35	50	68	89	113	140	169	201
Quercus robur	English oak	52	28	41	55	72	92	113	137	163
Quercus rubra	red oak	63	34	49	67	88	111	137	166	198
Quercus stellata	post oak	63	34	49	67	88	111	137	166	198
Quercus virginiana	live oak	76	41	60	81	106	134	166	200	238
Robinia pseudoacacia	black locust	58	32	45	62	81	102	126	153	182
Salix spp.	willow	32	17	25	34	45	56	70	84	100
Sequoia sempervirens	coast redwood	50	27	39	53	70	88	109	132	157
Taxodium distichum	baldcypress	51	28	40	54	71	90	111	135	160
Thuja plicata	western red cedar	28	15	22	30	39	49	61	74	88
Tilia americana	basswood	42	23	33	45	59	74	92	111	132
Tsuga canadensis	eastern hemlock	49	27	38	52	68	86	107	129	154
Tsuga heterophylla	western hemlock	41	22	32	43	57	72	89	108	129
Ulmus americana	American elm	54	29	42	58	75	95	118	142	169

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END of Requirements

IMPLEMENTATION RESPONSIBILITIES

The Vegetation Management Document Owner is responsible for the rollout and communication of this safe work practice as well as the periodic review of this document. Vegetation Management Operations is responsible for the distribution of this document.

GOVERNING DOCUMENT

TD-05, Vegetation Management Policy

RECORDS AND INFORMATION MANAGEMENT

PG&E records are company assets that must be managed with integrity to ensure authenticity and reliability. Each Line of Business (LOB) must manage Records and Information in accordance with the Enterprise Records and Information (ERIM) Policy, Standards and Enterprise Records Retention Schedule (ERRS). Each Line of Business (LOB) is also responsible for ensuring records are complete, accurate, verifiable and can be retrieved upon request. Refer to GOV-7101S, "Enterprise Records and Information Management Standard" for further records management guidance or contact ERIM at [redacted]@pge.com.

DOCUMENT RECISION

NA

DOCUMENT APPROVER

[redacted] Senior Director, Vegetation Management Operations

[redacted] Director, Vegetation Construction Management

DOCUMENT OWNER

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REVISION NOTES

Where?	What Changed?
NA	New manual