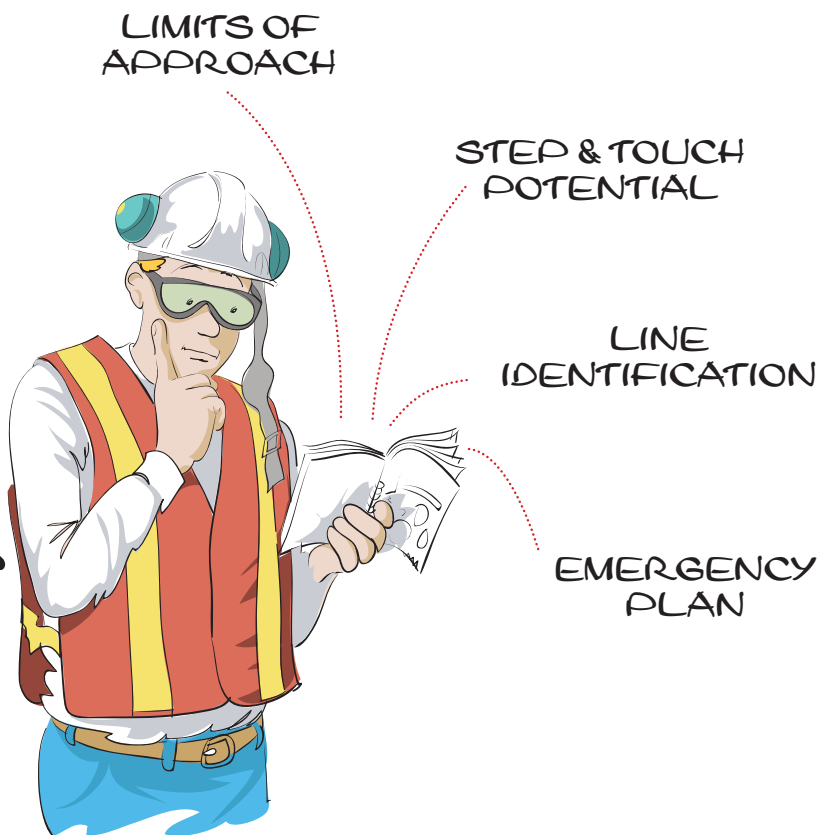


UTILITY
Tree Workers



Choosing to Work Safely

UTILITY Tree Workers Safety Guide



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BC HYDRO COORDINATOR, VEGETATION MAINTENANCE

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Introduction

This guide has been developed to provide basic safety information for apprentice Utility Arborists (UAs), groundworkers, slashers or others who can be exposed to serious electrical hazards when performing vegetation maintenance for BC Hydro. It also provides refresher information regarding Limits of Approach for Certified Utility Arborists (CUAs).

The guide is divided into 5 sections:

Section 1: Knowledge Required by All Workers provides information that BC Hydro expects all workers on site to know and understand before they commence vegetation maintenance activities.

Section 2: General Work Site Requirements provides proper procedures and safety measures that should be used at the job site. This section outlines the expectations that BC Hydro has of their Vegetation Contractors when carrying out vegetation maintenance activities.

Section 3: Certified Utility Arborist LOA Work Practices provides Limits of Approach information that includes examples of distances that CUAs must maintain for specific vegetation work on BC Hydro's distribution or transmission system. Distribution voltages range from 750V up to but not including 60kV. Transmission voltages range from 60kV to 550kV.

Section 4: Reference provides additional information that may assist in line identification.

Section 5: Bibliography

BC Hydro wants all contractors and their employees to better understand the hazards associated with working near the power system and the steps to be taken should there be an incident while working near the power system.

1. Knowledge Required by All Workers

This section provides information that is required by all workers before they begin any vegetation maintenance activities for BC Hydro.

There are five specific areas in which you must be familiar and knowledgeable:

- Tailboard Discussions
- Line Identification
- Limits of Approach
- Step and Touch Potential
- Emergency Plan

Because electricity is normally invisible, you should know that it can travel through objects and spread through the ground, and even travel through the air in certain conditions. Communicating with co-workers effectively, understanding step potential and touch potential, knowing line voltage and learning to judge distances accurately are basic requirements when working around electrical power lines.

After you have studied this section, you will be given a short quiz. If you do not understand any part of this guide, please ask for clarification.

If you do not apply the information in this guide when you are working around power lines, you do not meet the basic requirements for utility tree workers and you pose a serious hazard to yourself and your fellow workers.

You have a responsibility to continuously assess your own work environment and to work only within your capabilities. Any situations that exceed your training must be referred to your on-site supervisor.

1. Knowledge Required by All Workers

a. Tailboard Discussions

BC Hydro requires workers to hold a documented tailboard discussion any time two or more people are working at a job site. Tailboards are held before the work starts, during the work if there are any changes, and sometimes at the end of the work. All workers must participate in the tailboard, and should initial the tailboard document prior to commencing work. The following are some items that should be discussed at the tailboard:

- Procedures - how the job will be done.
- Hazards - the potential problem areas, unusual terrain features, and appropriate control measures.
- Person In Charge (PIC) – it will be necessary for your CUA to contact the PIC at the Control Centre if vegetation maintenance activities are carried out near power lines.
The PIC has operating authority for an assigned portion of the power system. The PIC is authorized to issue Safety Protection Guarantees, Live Line Permits and Assurance of No Reclose Permits for this portion of the power system. BC Hydro Control Centres have responsibility for monitoring, controlling and directing the operation of the power system.
- Line identification, Limits of Approach and the need for Safety Protection Guarantees or an Assurance of No Reclose. Your on-site supervisor must record the voltages, locations and circuit number(s) of the line(s) on the tailboard document before work commences.

1. Knowledge Required by All Workers

- Workers - the job tasks each worker on the team is responsible for.
- Organization - confirmation that each worker understands their responsibilities.
- Emergency Plan - a plan specific to the location that outlines who will be called and how injured workers will be attended to.
- Communications – what equipment (radio, cell phone, etc) is being used and who is in charge. The telephone numbers of the PIC, the Control Centre, the work location and local emergency numbers should be recorded.
- Traffic Control - who will be your traffic control person(s) (TCP) and who is the Certified Traffic Control Supervisor.

If others are part of your job (TCPs or contractors) they must be included in your Tailboard. **Remember, another documented Tailboard must be held during the job if there are changes in the plan or work crew.**

TAILBOARD DISCUSSIONS
ARE FOR PLANNING
WHAT GETS DONE AND
WHO DOES IT.



1. Knowledge Required by All Workers

b. Line Identification

BC Hydro uses special codes to describe the sections of power line throughout the province. These codes are known as line identification numbers, line ids or circuit numbers.

The most important reasons for you to understand line identifications (ids) are:

1. To determine the voltage of the line you are working near so you can correctly determine your Limits of Approach.
2. To be able to communicate your circuit location in case of an incident.

At the tailboard discussion, your on-site supervisor or CUA must give you the voltage of the power line you will be working near.

Distribution Circuit

25 F 51 PKL

- Refers to name of substation from which the circuit is fed. This example is "Port Kells Substation".
- Refers to a designated circuit number.
- Refers to "feeder" circuit. This letter may not always be on distribution operating diagrams.
- Refers to the voltage of the line (this example 25kV, or 25,000 volts). Allows you to accurately determine your Limits of Approach.

Note: 4 represents 4kV, 12 represents 12kV

1. Knowledge Required by All Workers

Transmission Circuit

60 L 12

Refers to a designated circuit number.

Refers to "Line Section".

Refers to the voltage of the line (this example 60kV, or 60,000 volts). Allows you to accurately determine your Limits of Approach.

Note: 1 represents 138 kV,
2 represents 230 kV or 287kV
3 represents 360 kV
5 represents 500 kV.

Further information to determine voltage of lines is given in the Reference Section. Refer to pages (56 to 60) for specific information on visual identification of line voltage.

Practice determining the voltage of the following examples:

A. 12F76MAN

B. 1250LOH

C. 25F62ANN

D. 1L48

E. 2L47

F. 5L32

Answers: A. 12kV B. 12kV C. 25kV D. 138kV E. 230kV or 287kV F. 500kV

1. Knowledge Required by All Workers

c. Limits of Approach (LOA)

Limits of Approach are the safe distances that you must maintain between your body and your equipment and live electrical lines or apparatus.

You are at risk in 2 different ways:

- Direct contact: Your body touches an energized conductor.
- Indirect contact: Your body touches something that is in direct contact with an energized conductor such as a tool, a branch, or the ground.

Both types of contact can be fatal.

You, your tools, and any material you handle must remain outside the Limits of Approach for your level of qualification. Strict adherence to the Limits of Approach prevents electric shock, burns and even death.

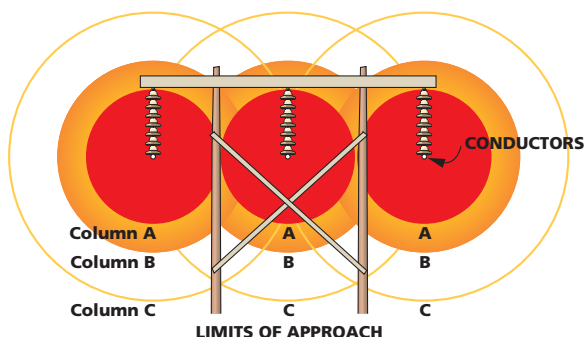
1. Knowledge Required by All Workers

i. Determining Your Limits of Approach

The Limits of Approach table you must follow is located in the WCB Regulation part 19.34. The columns in the table define Limits of Approach according to a worker's qualifications, their level of supervision, and their equipment. Normal work limits for Apprentice UAs, Groundworkers and Slashers are given in Column C of the table.

Voltage Range	Column A		Column B		Column C	
	Insulated Tool Limits for Certified Utility Arborists		Normal Work Limits for Certified Utility Arborists		Normal Work Limits for Apprentice Utility Arborists, Groundworkers and Slashers	
Phase to Phase	Metres	Feet	Metres	Feet	Metres	Feet
750 V to 20 kV	0.3	1	0.9	3	3	10
over 20 kV to 30 kV	0.5	1.5	1.2	4	3	10
over 30 kV to 75 kV	0.9	3	1.5	5	3	10
over 75 kV to 250 kV	2.1	7	3	10	4.5	15
over 250 kV to 325 kV	2.6	8.5	4.5	15	6	20
over 325 kV to 550 kV	3.7	12	6	20	6	20

Limits of Approach apply to *each* conductor you work around.



1. Knowledge Required by All Workers

If you are nearing Limits of Approach or are unsure where the exact limit is, confirm it with your site supervisor. Failing to comply with correct Limits of Approach could put yourself and others at significant risk.



CAREFULLY LOCATE ALL WIRES AND DETERMINE LOA DISTANCES BEFORE COMMENCING JOB.

The tailboard discussion will include information on the appropriate Limits of Approach for your work site. It may take some time to judge LOA distances correctly. Practice on known objects.

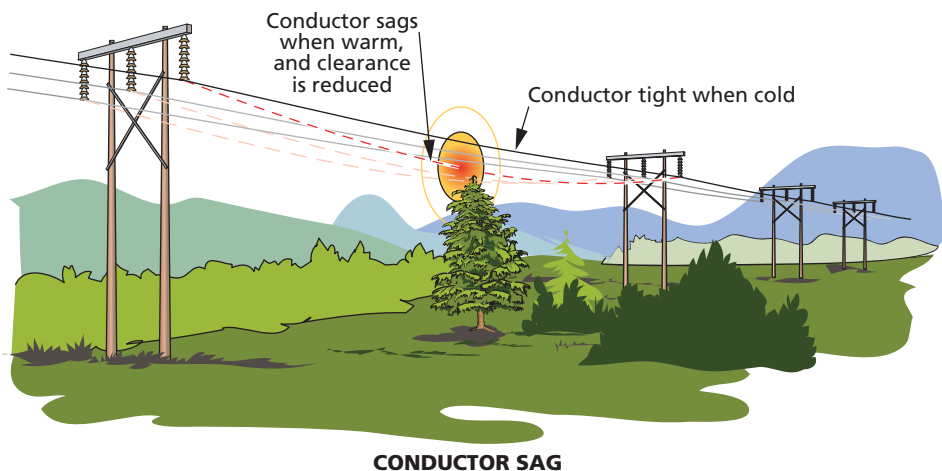
1. Knowledge Required by All Workers

ii. Using LOA in different work conditions

Changes in work conditions can effect your use of Limits of Approach. Key points to be aware of are:

Conductor Sag

As ambient temperature and circuit load changes, the height or sag of the conductor changes. A tree that was outside of Limits of Approach in the morning may be inside Limits of Approach in the afternoon.



1. Knowledge Required by All Workers

Extended Reach

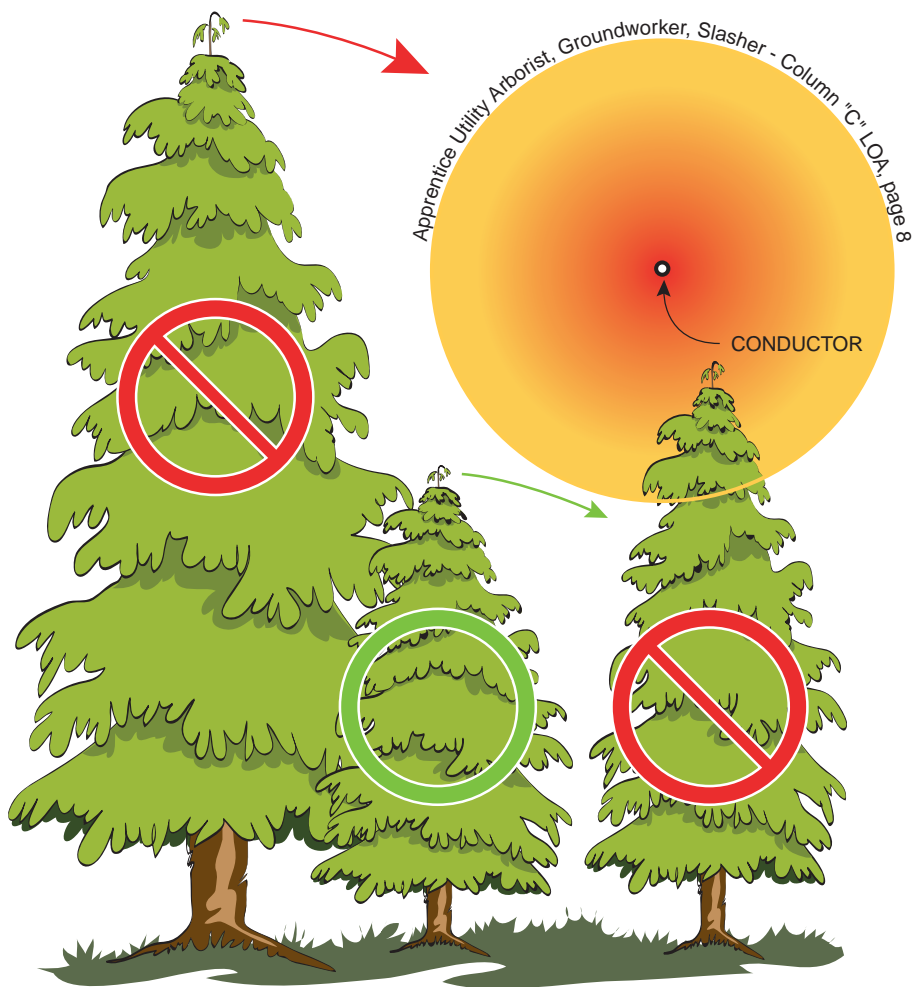
Items such as tools, equipment, and branches can extend your reach and effectively put you much closer to energized lines. Remember that it is not just your body you must consider with Limits of Approach, but also your "extended reach".



1. Knowledge Required by All Workers

Falling Vegetation

Be aware that vegetation attached to a tree may be outside your Limits of Approach but may have the potential to fall closer to the energized line and pose a danger of electrocution.



If the tree has the potential to fall within LOA, it must be removed by a CUA.

1. Knowledge Required by All Workers

Flashover

Flashover is the ability for an electrical arc to jump from one conductor to another or from a conductor to a grounded object because of the difference in electrical potential.

Flashover distances depend on the amount of voltage, the altitude and humidity, the shape and condition of the conductors and the distance between the two points.



If an electrical flash occurs, immediately call the PIC at the Control Centre.

1. Knowledge Required by All Workers

iii LOA Practice Scenarios

Try these scenarios to practice determining your Limits of Approach.

- A. You are a groundworker and find yourself on a job site in proximity to circuit 25F40 CAM. What Limits of Approach must you maintain for safety?
- B. You are a flagperson determining your Limits of Approach. The nearby line is 250kV. What is your LOA?
- C. You are a slasher and you have been sent to a job site that is near 500 kV lines. What are the Limits of Approach for you and other groundworkers on your team?

*Answers: A. 3.00 metres/10 feet B. 4.50 metres /15 feet
C. 6 metres/20 feet*

1. Knowledge Required by All Workers

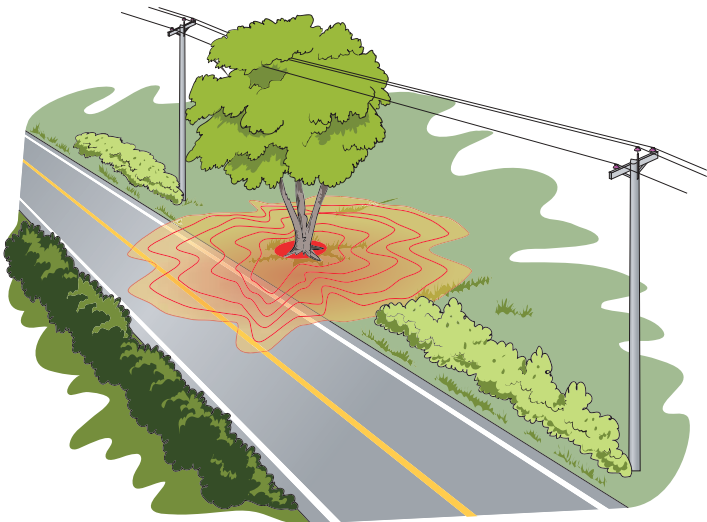
d. Step and Touch Potential

Two key safety hazards you must be aware of are Step Potential and Touch Potential. Both of these hazards are related to the movement of energy from the source outward through all paths to ground.

As previously discussed, electricity can harm you in two ways, direct contact (when your body touches a conductor) or indirect contact (when your body touches something that is in direct contact with an energized conductor). Step and Touch Potential are hazards of indirect contact.

i. The Ripple Effect

If anything makes contact with an energized line, such as a tree or an uninsulated boom on a truck, or if a broken power line falls to the ground or lands on a vehicle or fence, electricity will flow to the ground and spread out in irregular concentric circles. This is known as the **Ripple Effect**.



1. Knowledge Required by All Workers

Voltage is very high at the point where electricity makes contact with the ground.

The level of electrical intensity decreases as you move away from the point of contact. To reach a voltage of 0 on distribution lines, you need to be at least 10 metres (33 feet) from the point of contact. The minimum distance for 0 voltage for transmission lines varies:

Minimum distances from point of contact to ensure you are clear of the Ripple Effect.

Voltage	Distance*
---------	-----------

up to 60 kV	10.0m (33ft)
-------------	--------------

138 kV	10.0m (33ft)
--------	--------------

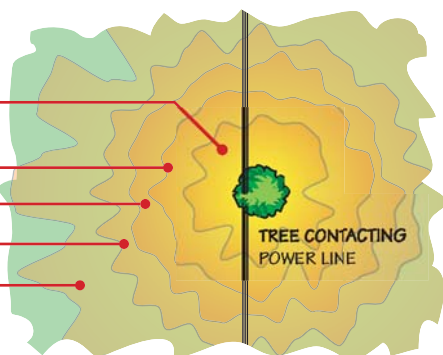
230 kV	14.5m (47.5ft)
--------	----------------

287 kV	18.0m (60ft)
--------	--------------

360 kV	22.0m (72ft)
--------	--------------

500 kV	32.0m (105ft)
--------	---------------

*Measured from base of tree

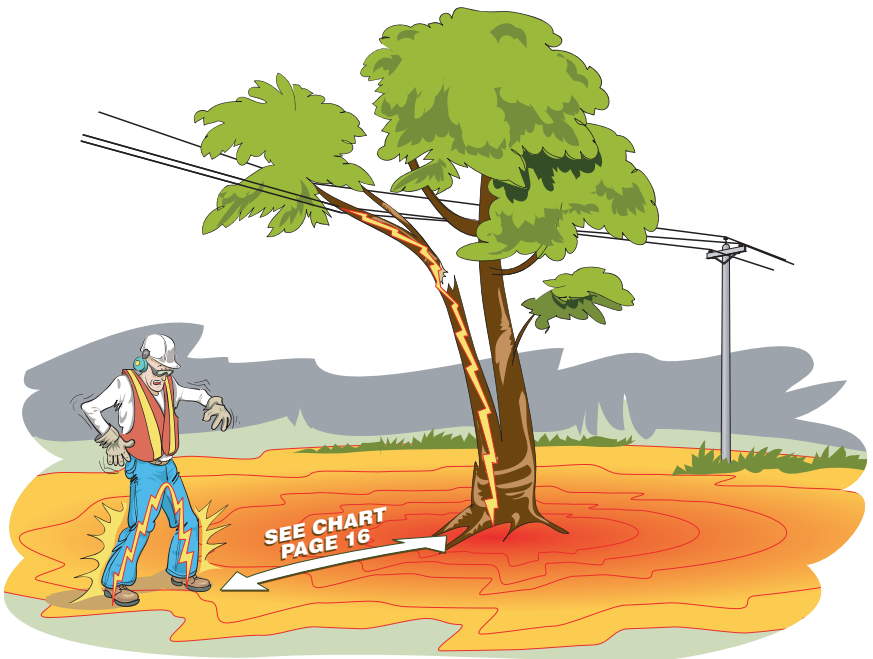


Note that distances are minimum, as they can vary based on conditions such as ground material, moisture and possible embedded objects such as metal pipes.

1. Knowledge Required by All Workers

ii. Step Potential

Since voltage changes as you move toward or away from the source of electricity, it is possible for you to "step" or bridge voltage differences. As your body can act as a conductor, the electricity may flow between your feet and through your body with devastating results. This is called **Step Potential**.



THERE'S ELECTRICITY IN THE GROUND. DON'T SPREAD YOUR FEET!

1. Knowledge Required by All Workers

iii. Touch Potential

Trees can be very conductive. If a tree comes into contact with an energized power line and you are touching the tree, or touching a ladder leaning against the tree, there will be a voltage difference between you and the ground. This will result in an electrical current flowing through your body to the ground which may result in serious injury. This is called **Touch Potential**.



A TREE BECOMES ENERGIZED WHEN PART OF IT TOUCHES HIGH VOLTAGE LINES.

1. Knowledge Required by All Workers

Another situation where touch potential could occur is if a vehicle contacts an energized line. Electricity could flow to the ground through you if you touch the vehicle.



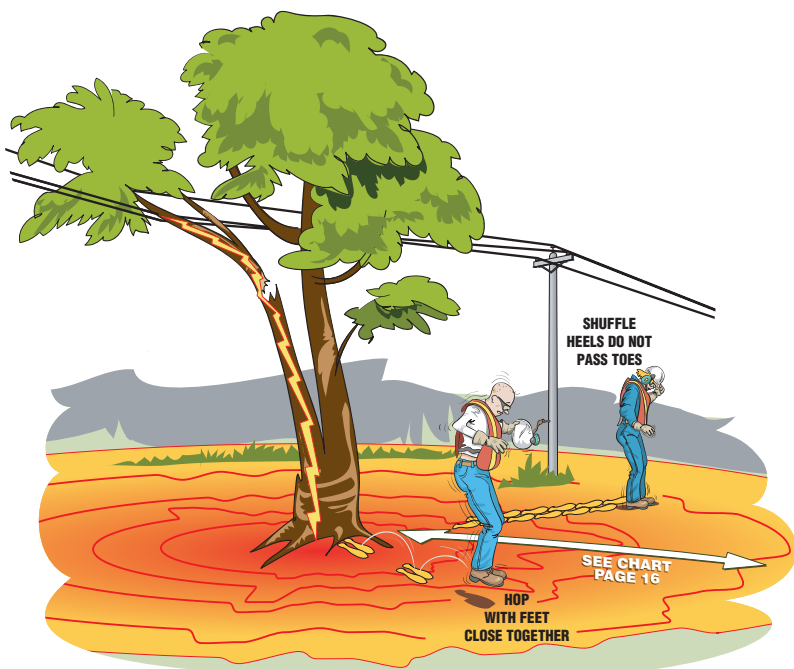
IF A VEHICLE CONTACTS AN ENERGIZED LINE, ELECTRICITY COULD FLOW TO THE GROUND AND THROUGH YOU IF YOU TOUCH THE VEHICLE.

1. Knowledge Required by All Workers

iv. Leaving the Energized Area - Shuffle or Hop

If the ground around you becomes energized, you can avoid a shock by keeping your feet close together and taking short, shuffle-like steps, until you are clear of the energized area, never allowing the heel of one foot to move beyond the toe of the other.

Alternately, you can hop with both feet together. See page 16 for specific voltages and distances.



Take a moment now to practice the shuffle and hop techniques to minimum distances.

Remember, if the ground becomes energized:

1. Don't panic.
2. Assess your options
3. Shuffle or hop away
4. Advise your site supervisor and the PIC at the Control Centre.

1. Knowledge Required by All Workers

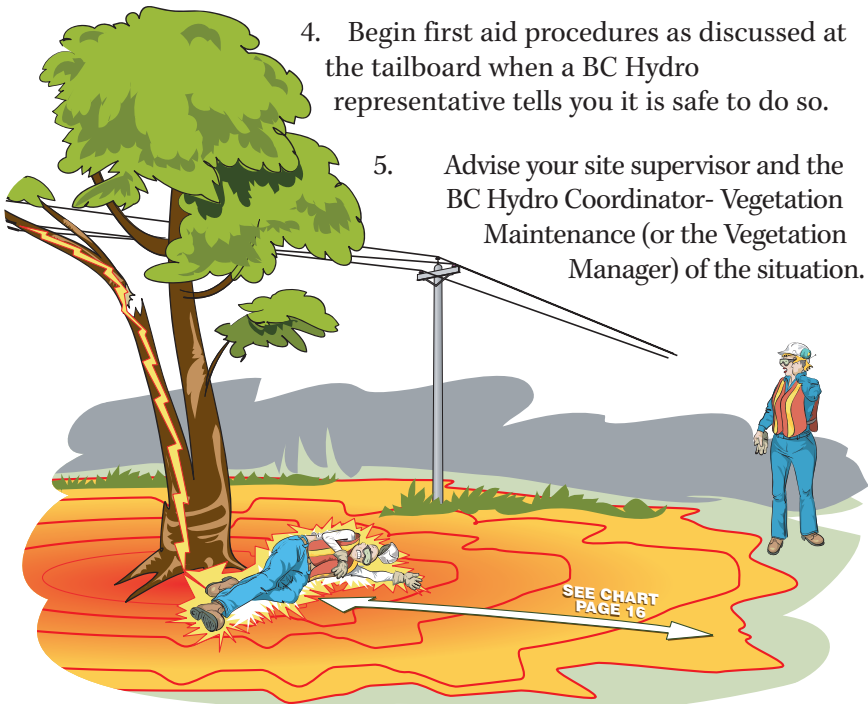
v. Make Area Safe Before Helping an Energized Worker

If a worker on your job site finds themselves in an energized area, you must remember the details of the emergency plan as discussed at the tailboard. Some steps to follow if you find yourself in this situation are:

1. Don't become the second victim by approaching or touching someone who is energized. Remember the concentric circle Ripple Effect and stay back the appropriate distance.
2. Ensure there is no further hazard to yourself or the public.
3. Contact the PIC at the Control Centre with the relevant circuit identification to have the circuit de-energized and grounded.

4. Begin first aid procedures as discussed at the tailboard when a BC Hydro representative tells you it is safe to do so.

5. Advise your site supervisor and the BC Hydro Coordinator- Vegetation Maintenance (or the Vegetation Manager) of the situation.



1. Knowledge Required by All Workers

e. Emergency Plan

Emergency plans are put in place to ensure workers know what to do in case of an accident or incident. An emergency plan that is specific to your work site must be developed by your site supervisor. All workers at your site must be familiar with the emergency plan.

The emergency plan should consider:

- The method of communication that will be used for the site and emergency phone numbers that you may need to help your fellow workers
- The first aid requirements and the method of evacuation you will use at your site
- Rescue procedures if there are climbers or workers in aerial lifts at your site

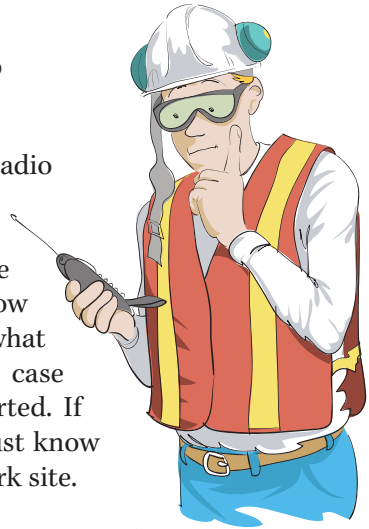
Details of the emergency plan must be reviewed with all workers at the tailboard discussion.

1. Knowledge Required by All Workers

i. Emergency Plan – Key Areas

A. How to access and operate radio equipment and cell phones

If you are not familiar with the radio equipment or cellular phone, take the time to learn how to use the equipment before going to the job site. It is important that you know how to use the equipment and what the emergency procedures are in case there is an emergency to be reported. If you are using a cell phone, you must know the contact cell number for the work site.



In areas of poor communication where autotel or cellular communication is not possible, a report-in system (Hydro radio or satellite phone) or a plan to contact help in an emergency is required.

B. The identity and location of circuit(s)

If there is an emergency that has to be reported, make sure that you identify the circuit and the location involved. This information will assist the Control Centre in de-energizing the circuit, if necessary, and dispatching assistance to ground the line and provide other emergency assistance.

C. Who to call, the location of the phone numbers and how to reach the Control Centre

The PSSP local component contains BC Hydro contact numbers.

BC Hydro recommends that you carry details of circuit locations and emergency phone numbers for your work site on your person at all times.

1. Knowledge Required by All Workers

ii First Aid

The name of your site first aid attendant will be given at the tailboard discussion. In case of emergency, you must always know who the first aid attendant is for your site.

First aid at your site must meet the requirements of the WCB Regulation Part 33 for First Aid Attendant ticket level, Transportation Endorsement and first aid equipment.

First Aid requirements vary depending on the hazards category, the number of workers, and the distance to the nearest hospital.

All work-related incidents involving injury or the potential for serious injury should immediately be reported to the BCHydro Coordinator, Vegetation Maintenance (or Vegetation Manager), and WCB.

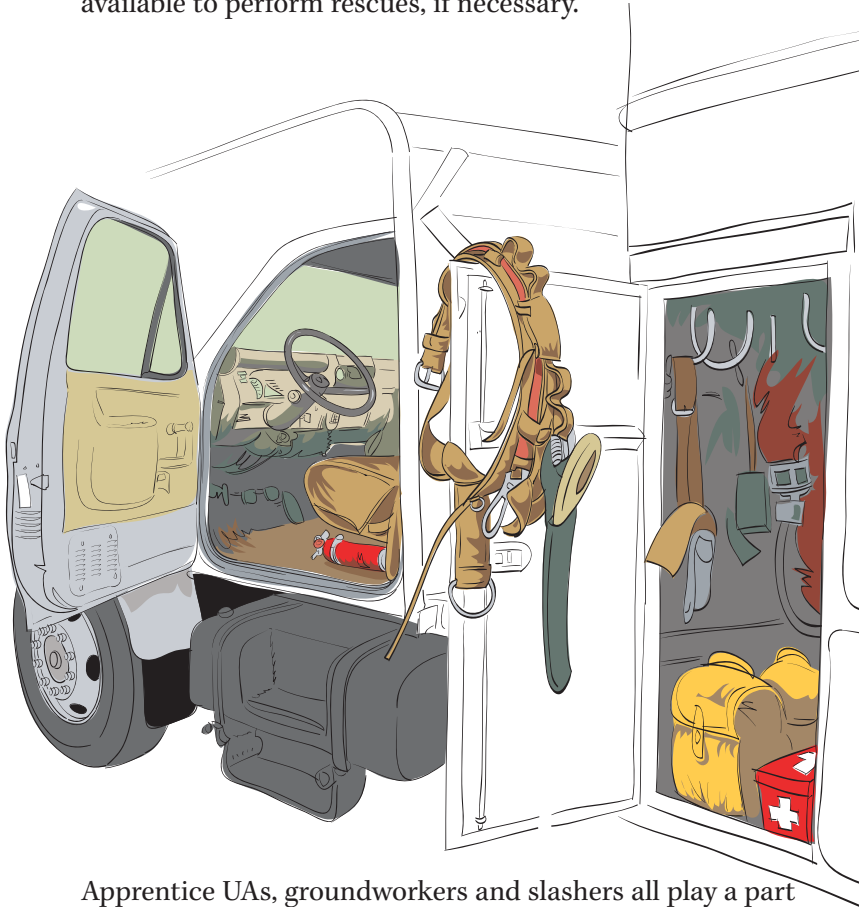


BE SURE A FIRST AID KIT IS READILY AVAILABLE, FULLY STOCKED,
AND EASY TO FIND.

1. Knowledge Required by All Workers

iii Rescue Procedures

An emergency plan must address rescue procedures for climbers or for workers in aerial lifts. Workers must be available to perform rescues, if necessary.



Apprentice UAs, groundworkers and slashers all play a part in the emergency plan. All workers must know the emergency plan details, location of the first aid kit, fire extinguishers and spill kits, relevant contact numbers and how to operate the communication equipment. Workers must also be able to communicate the line id and their location.

2. General Work Site Requirements

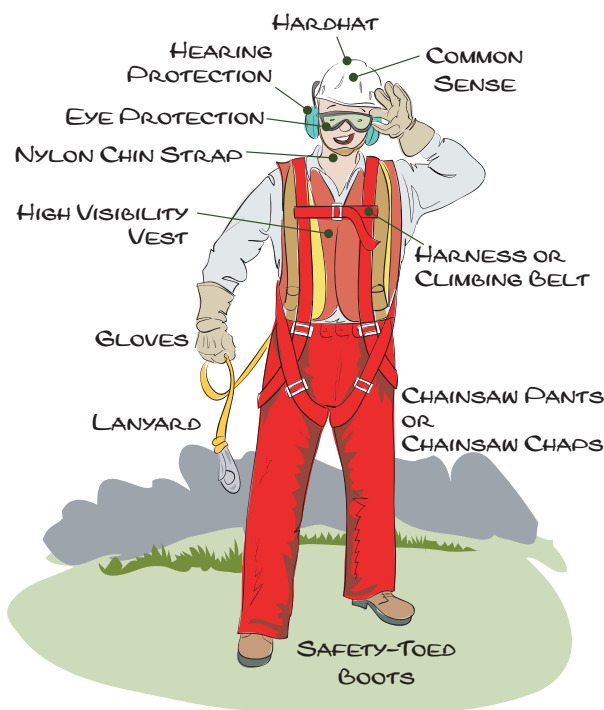
This section of the guide provides proper procedures and safety measures that you should use at the job site. The Coordinator, Vegetation Maintenance will be including some of these items in their inspections of your job site to ensure that BC Hydro's expectations regarding a contractor work site are met.

2. General Work Site Requirements

a. Personal Protective Equipment

Prior to daily work, you should carry out a personal protective equipment check. Make sure that you have the following safety equipment if it is required by the WCB for your work:

- protective safety glasses and face screens
- hard hat including a nylon chin strap if working over 3 metres (10 feet), in windy conditions, or when there is a likelihood of the hat being knocked off.
- chain saw pants or chaps, whistle, and pressure dressing
- safety toed boots
- ear muffs or ear plugs
- gloves
- harness and lanyard
- climbing belt and spurs
- high visibility clothing



2. General Work Site Requirements

b. Station Entry

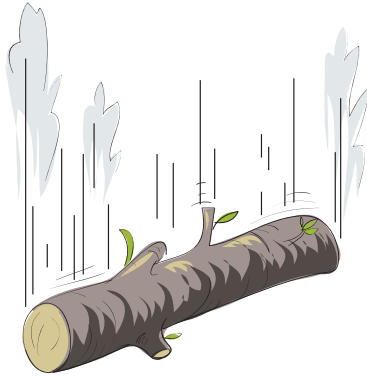
You are not to enter a substation or generating facility without being accompanied by a qualified worker authorized in BC Hydro's PSSP (Power System Safety Protection) program.



2. General Work Site Requirements

c. Tips and Precautions

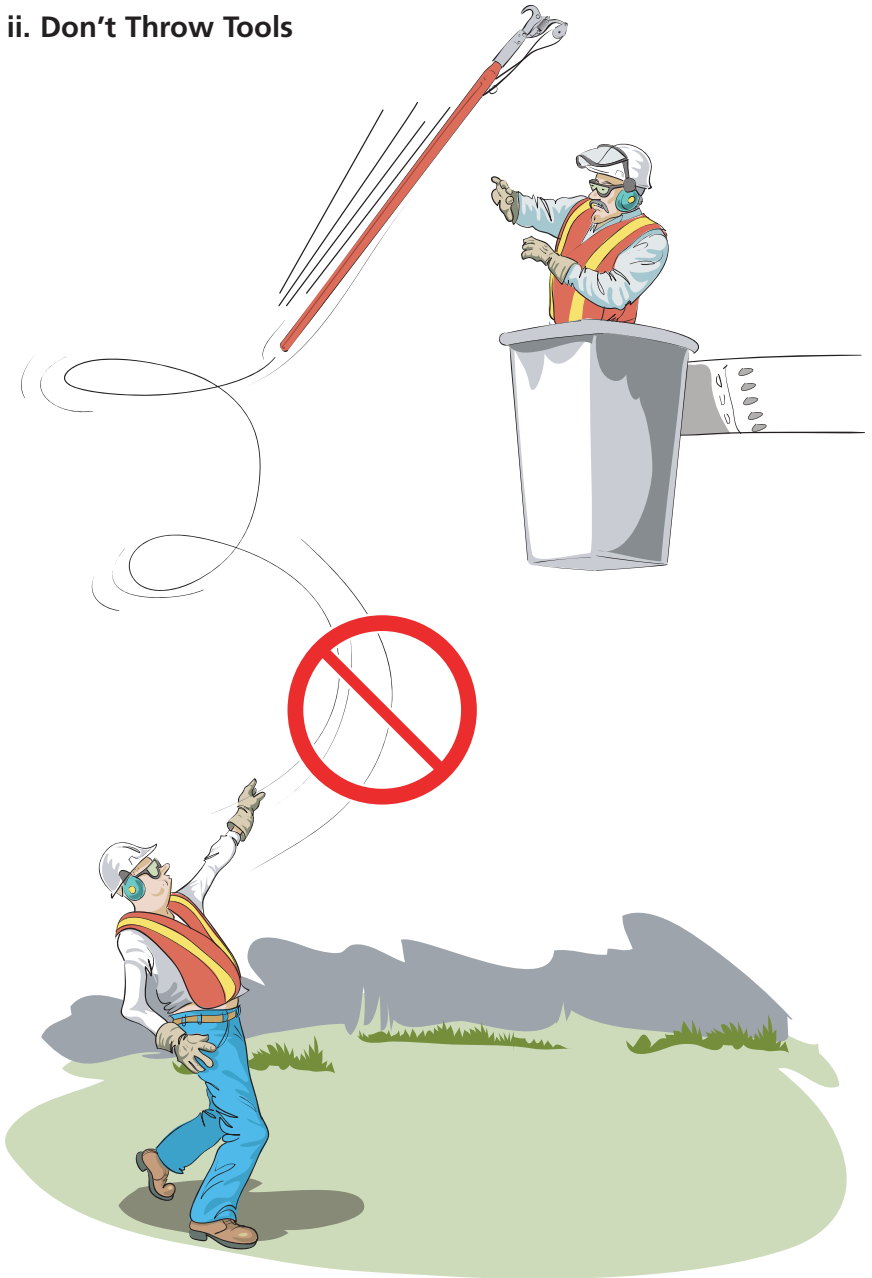
i. Stand Clear of Hazard Zones



STAND CLEAR OF HAZARD ZONES CREATED BY FALLING DEBRIS.

2. General Work Site Requirements

ii. Don't Throw Tools



DON'T THROW TOOLS. SHUT OFF POWER TOOLS BEFORE PASSING THEM TO A FELLOW WORKER.

2. General Work Site Requirements

iii. Important Responsibilities for Aerial Lifts

Aerial lifts shall not be considered as an insulated tool, only as a work platform. It is your responsibility to ensure that the truck is safely secured on firm ground with outriggers down and wheel chocks in place prior to work commencing. The truck could tip over or the boom could tip/lean into energized lines if the outriggers are not stabilizing the vehicle. You must know the correct emergency procedures to lower the boom in case of an emergency.



Wheel Chocks in place

Outriggers must
be down
before bucket
goes up

Groundsperson must know how
to operate the override
controls to lower the boom.

2. General Work Site Requirements

iv. Customer and Public Relations

No matter how busy you are or how difficult the job is, when the job creates some public interest it is important to remember these rules of thumb when dealing with a customer.

- Always be respectful and courteous.
- Tree pruning and removal can be an emotional issue for many customers.
- Customers are occasionally angry and are often uninformed of the importance of tree clearance to the powerline.
- Serious issues and all complaints should be immediately brought to the attention of the Coordinator, Vegetation Maintenance.



3. Certified Utility Arborist LOA Work Practices

This section of the guide provides detailed Limits of Approach information that CUAs use when working on vegetation maintenance near distribution or transmission lines. It includes examples of distances that CUAs must maintain for specific vegetation work on various distribution or transmission voltages. The distribution voltage example shown is for 25 kV. The transmission voltages include examples for 60 kV, 138 kV, 230 kV, 360 kV and 500 kV.

3. Certified Utility Arborist LOA Work Practices

a. Limits of Approach Table

Limits of Approach as per WCB Reg. Section 19.34 (Table 19-3)

Voltage Range	Column A		Column B		Column C	
	Insulated Tool Limits for Certified Utility Arborists		Normal Work Limits for Certified Utility Arborists		Normal Work Limits for Apprentice Utility Arborists, Groundworkers and Slashers	
Phase to Phase	Metres	Feet	Metres	Feet	Metres	Feet
750 V to 20 kV	0.3	1	0.9	3	3	10
over 20 kV to 30 kV	0.5	1.5	1.2	4	3	10
over 30 kV to 75 kV	0.9	3	1.5	5	3	10
over 75 kV to 250 kV	2.1	7	3	10	4.5	15
over 250 kV to 325 kV	2.6	8.5	4.5	15	6	20
over 325 kV to 550 kV	3.7	12	6	20	6	20

b. Rules for LOA to Energized Lines

- All workers** on the job must be informed of the voltages of the lines on which they are working.
- All workers** must observe the limits of approach as shown in the above chart. Under no circumstances shall the CUA or his/her dielectrically tested tools come closer to the energized conductor than the distances specified in the above table. The CUA must consider his/her position in relation to the energized line as follows:
 - Any inadvertent movement including a slip or fall shall not take the CUA inside the prescribed limits.
 - The CUAs **extended reach** shall not take him/her within the prescribed limits.
 - Once cut, tree limbs being handled can become an extension of the worker's body and must be considered in the Limits of Approach calculation.
- Certified Utility Arborists** (CUAs) are defined as those workers who have completed a recognized apprenticeship, have a minimum of 1200 hours of practical experience and are certified as a utility arborist by a recognized authority.

3. Certified Utility Arborist LOA Work Practices

4. Apprentice Utility Arborists are defined as those trainees who are not yet certified as utility arborists but who have completed a recognized course of instruction and obtained trainee status to make them familiar with the hazards involved. They must observe Column C limits of approach (see page 8) except when in the presence of, and under the direct supervision of, a Certified Utility Arborist or a qualified Electrical Worker. When under such direct supervision they may observe the same limits as the Certified Utility Arborist.

DIRECT SUPERVISION is defined as the certified utility arborist paying full attention to the work being done by the apprentice and within audible and visual distance to that apprentice so as to be able to stop immediately any incorrect action that could lead to a potential hazardous situation. On a lift truck this means not working, but watching the apprentice. In a climbing situation, being in the tree next to the apprentice, or on the ground watching, is acceptable as long as the CUA is paying full attention to the apprentice's movements, work habits, etc., and is within audible and visual contact at all times.

5. Limits of Approach:

- (a) Column C is the limit of approach for an apprentice utility arborist, a groundworker, or a slasher (except under conditions outlined in 4). Neither the worker, nor the tool being used, shall come closer than this limit to energized conductors or to any vegetation if any part of that vegetation is closer than this limit or could swing closer while being cut.
- (b) Column B is the normal limit of approach for a Certified Utility Arborist. Under no circumstance will the CUA or any conductive tool being used come closer than this limit to energized conductors. If conductive cutting tools such as chain saws are used, the same limits as listed in Column B shall also apply to the vegetation being cut. Vegetation closer than Column B must be cut using approved "insulated" tools.
- (c) Column A is a special limit of approach to be used by a Certified Utility Arborist trained in the use of "insulated" tools. The "insulated" tool must not encroach closer than Column A limits of approach and the CUA must not come closer than Column B limits to the energized conductor, or to any vegetation which is closer than Column A to the energized conductor.
 - (i) Up to 60 kV, vegetation closer than Column A limits of approach, but not touching an energized line may be removed by a Certified Utility Arborist using "insulated"

3. Certified Utility Arborist LOA Work Practices

5. cont'd...

tools from an insulated aerial lift only, or with the line de-energized and grounded or by a qualified Powerline Technician using approved live line methods.

- (ii) For conductors energized at 60 kV and above, vegetation closer than Column A limits of approach shall be removed only with the line de-energized and grounded or by a qualified Powerline Technician using approved live line methods.

Vegetation encroaching within Column B, that cannot be removed using an “insulated” aerial lift, must be restrained from encroaching within Column A limits, prior to removal.

- (iii) Limbs or branches that hang up on a conductor shall be removed by a qualified Electrical Worker authorized by BC Hydro, or with the line de-energized and grounded.
- (iv) Trees which, if felled, could come closer than Column A limits to the energized conductor must not be felled unless they are topped, or precautions are taken to prevent them from falling closer than column A limits.

6. Hazardous Areas.

As per WCB Reg. Section 19.30, before commencing tree pruning, slashing or removal in proximity to energized high voltage overhead conductors, the worksite must be inspected by a “qualified person” authorized by BC Hydro. The qualified person for the purpose of this inspection must be the Contractor Representative. Hazardous areas, including situations where any part of a tree to be pruned or felled is within or could come within the applicable minimum distance from an energized conductor as specified in WCB Reg. Section 19.24, Table 19-1, (which is the same as Column C), must be identified during this inspection.

Vegetation that is within limits of approach of WCB Reg. Section 19.24, Table 19-1 (which is the same as Column C), including trees that during removal or pruning may fall within these limits of approach, shall be considered hazardous and must be removed by a worker authorized by the owner of the power system to do such work, in accordance with WCB Reg. Section 19.32.

7. Assurance of No Reclose Permit (ANRP):

As per WCB Reg. Section 19.31, whenever tree work is to be done in proximity to energized conductors and/or the potential is present for vegetation to encroach on Column C Limits of Approach, an ANRP must be in effect.

3. Certified Utility Arborist LOA Work Practices

7. cont'd...

- An ANRP does not ensure the safety of the workers, but merely ensures that the circuit will not be re-energized after a circuit breaker operation due to a fault.
- Work shall not be started until the ANRP has been received from the PIC and recorded on the tailboard form.
- The ANRP must be returned to the PIC at a mutually agreed upon time and must be recorded on the tailboard form.
- The operating characteristics of transmission circuits are such that the need for an ANRP can change from the initial evaluation. Workers must continually monitor site conditions to ensure they don't exceed their capabilities and to ensure that an ANRP is in place when required.

NOTE:

1. "Insulated" aerial lifts used by Tree Trimming Contractors shall not be considered as an insulated work tool. They are only a work platform.
2. "Insulated" hand tools and aerial lifts shall be maintained in a clean condition and tested to a standard set by an authority acceptable to the WCB. The test period is normally a minimum of once per year.
3. Refer to WCB OH&S Regulation, Part 19.30 to 19.35 for further details and work procedures.

c. Further Information on LOA

i. Required Training

- BC Hydro requires that all Certified Utility Arborists (CUAs) complete PSSP modules 2, 3, and 4, be authorized to Category 4, and receive Local Component training before working near or within proximity of the power system.
- Apprentice UAs must complete PSSP modules two to four and will be authorized to Category 3.
- All workers must receive training in Line Identification, Limits of Approach, Step & Touch Potential, and Emergency Procedures.

3. Certified Utility Arborist LOA Work Practices

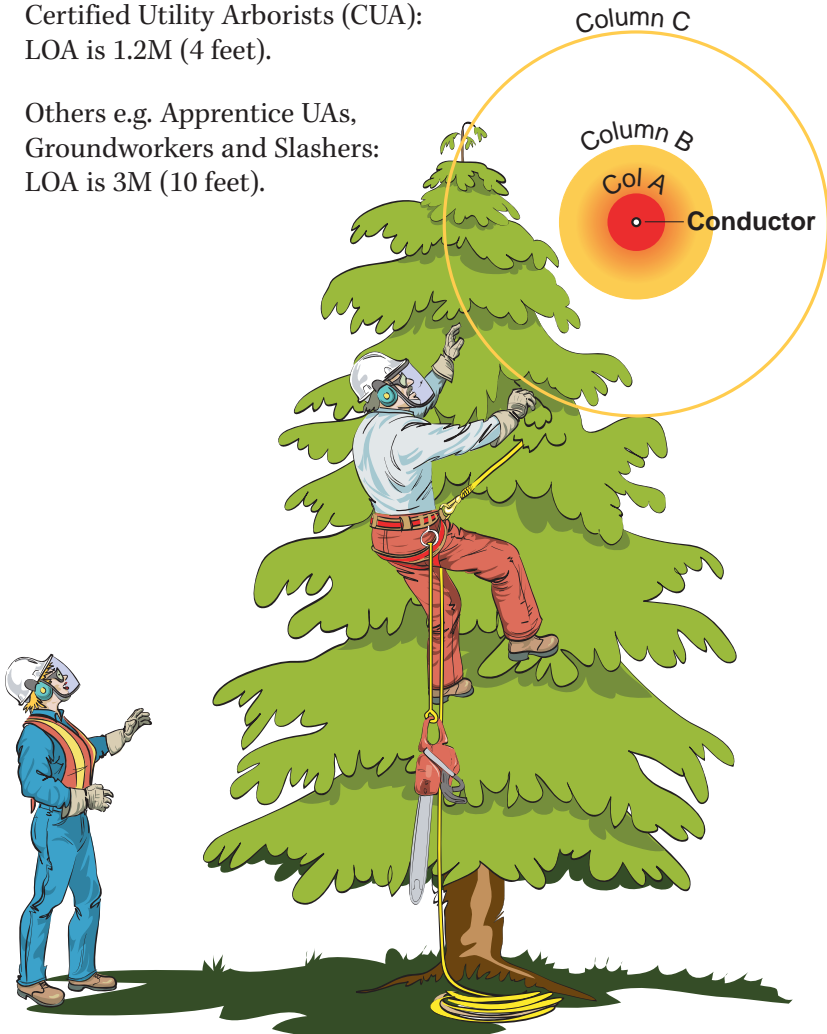
d. LOA Diagrams

i. Distribution

- 25 kV Energized Lines
- Vegetation Outside Column B LOA

Certified Utility Arborists (CUA):
LOA is 1.2M (4 feet).

Others e.g. Apprentice UAs,
Groundworkers and Slashers:
LOA is 3M (10 feet).



WHEN VEGETATION IS OUTSIDE COLUMN B LOA, CONDUCTIVE TOOLS MAY
BE USED BY CUA MAINTAINING THE LOA OF COLUMN B.

3. Certified Utility Arborist LOA Work Practices

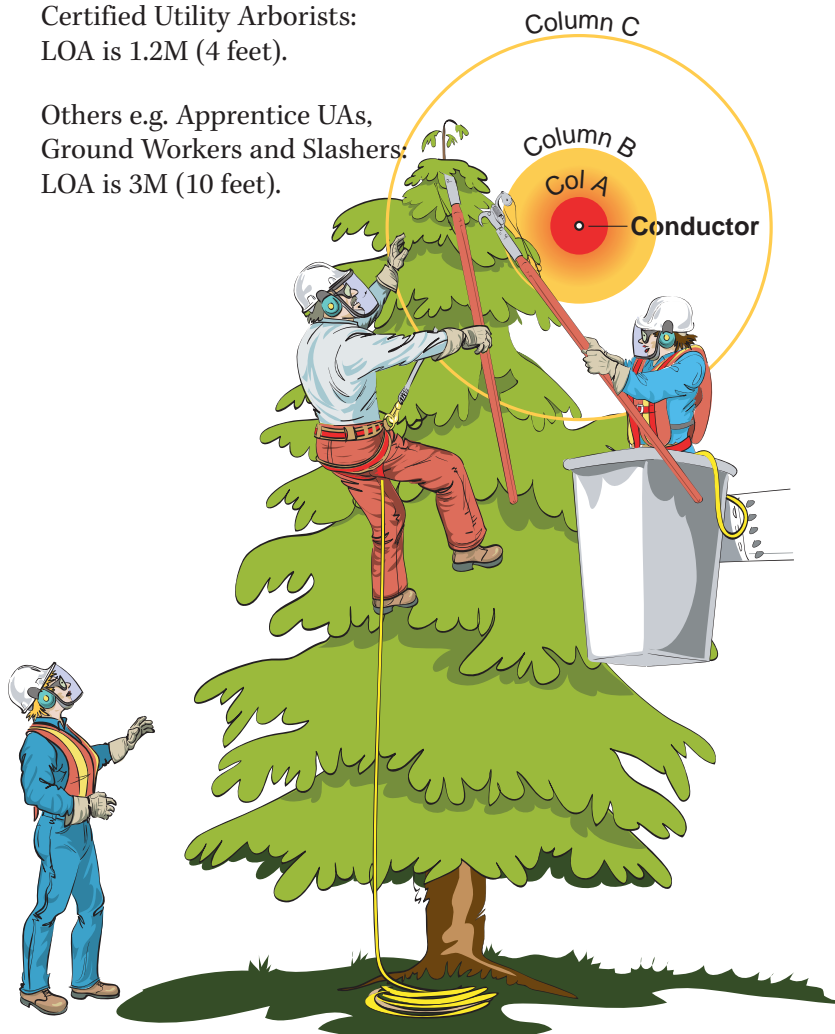
d. LOA Diagrams

i. Distribution

- 25 kV Energized Lines
- Vegetation Outside Column A LOA

Certified Utility Arborists:
LOA is 1.2M (4 feet).

Others e.g. Apprentice UAs,
Ground Workers and Slashers:
LOA is 3M (10 feet).



WHEN VEGETATION IS CLOSER THAN COLUMN B, ONLY INSULATED TOOLS MAY BE USED BY CUA.

3. Certified Utility Arborist LOA Work Practices

d. LOA Diagrams

i. Distribution

- 25 kV Energized Lines
- Vegetation inside Column A LOA but Not Touching Conductor

Certified Utility Arborists:
LOA is 1.2M (4 feet).

Others e.g.
Apprentice UAs,
Ground Workers
and Slashers:
LOA is 3M (10 feet).



ONLY INSULATED AND TESTED TOOLS FROM INSULATED BOOM
MAY BE USED BY CUA

3. Certified Utility Arborist LOA Work Practices

d. LOA Diagrams

i. Distribution

- 25 kV Energized Lines
- Vegetation touching conductor



LINE MUST BE DE-ENERGIZED AND GROUNDED IF VEGETATION IS TOUCHING CONDUCTOR, OR VEGETATION MUST BE REMOVED BY PLT USING LIVE LINE METHODS.

3. Certified Utility Arborist LOA Work Practices

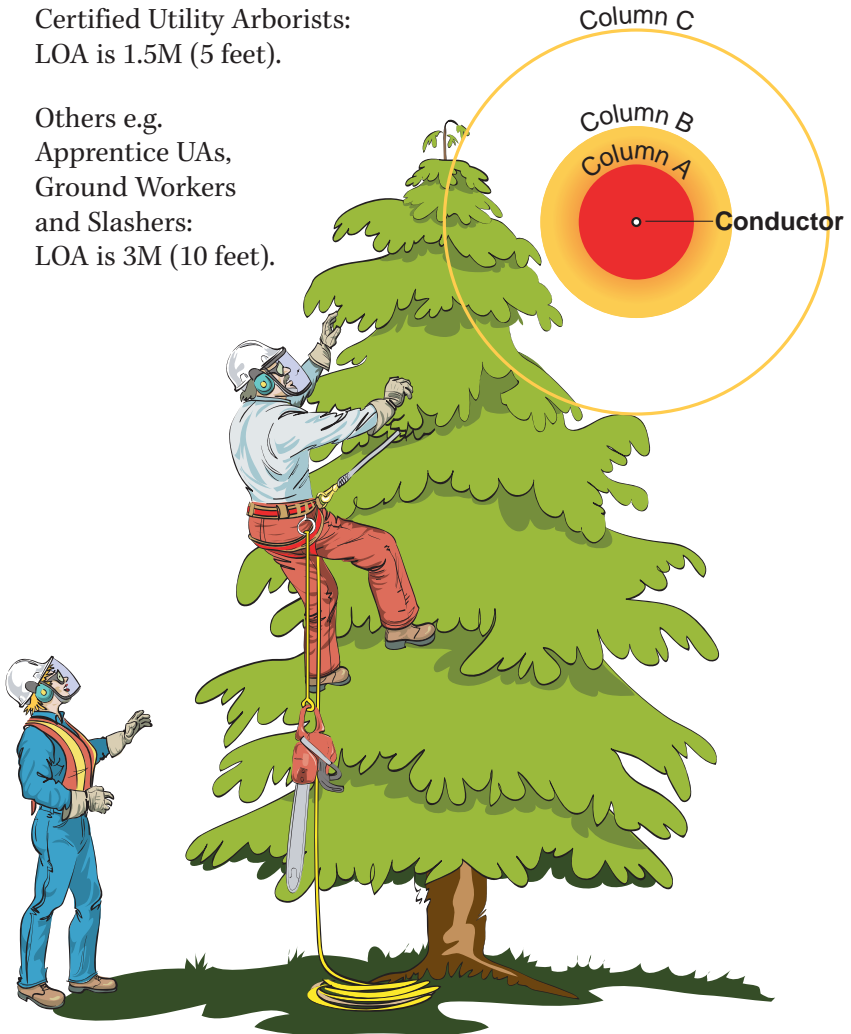
d. LOA Diagrams

ii. Transmission

- 60 kV Energized Lines
- Vegetation Outside Column B LOA

Certified Utility Arborists:
LOA is 1.5M (5 feet).

Others e.g.
Apprentice UAs,
Ground Workers
and Slashers:
LOA is 3M (10 feet).



CONDUCTIVE TOOLS MAY BE USED BY CUA.

3. Certified Utility Arborist LOA Work Practices

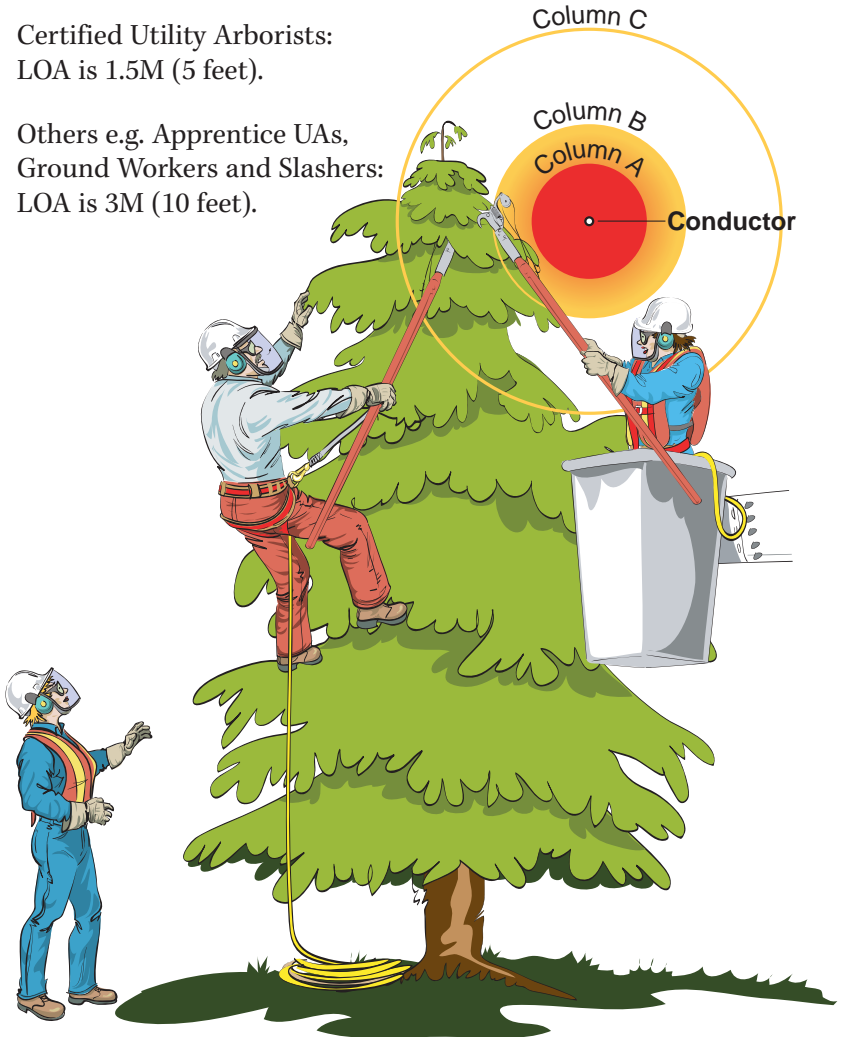
d. LOA Diagrams

ii. Transmission

- 60 kV Energized Lines
- Vegetation Outside Column A LOA

Certified Utility Arborists:
LOA is 1.5M (5 feet).

Others e.g. Apprentice UAs,
Ground Workers and Slashers:
LOA is 3M (10 feet).



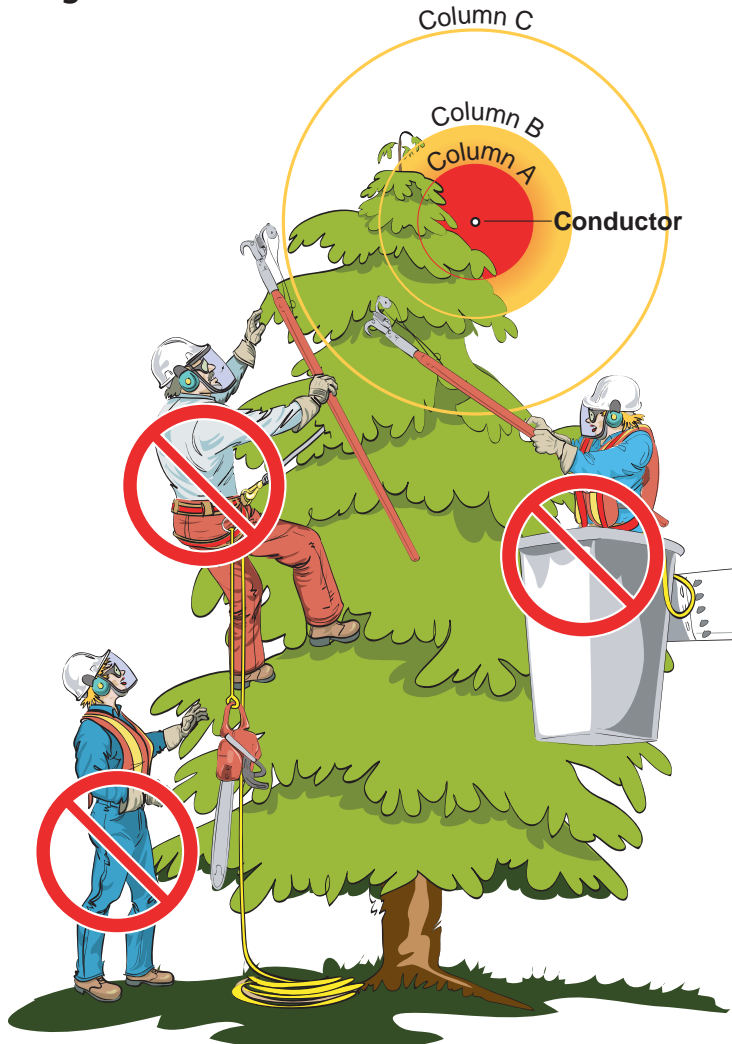
CUA MAY ONLY USE INSULATED TOOLS. WHEN TRIMMING FROM THE TREE, RESTRAINING METHODS MUST BE USED TO PREVENT LIMBS ENCRACHING WITHIN COLUMN A

3. Certified Utility Arborist LOA Work Practices

d. LOA Diagrams

ii. Transmission

- 60 kV Energized Lines
- Vegetation Inside Column A LOA



LINE MUST BE DE-ENERGIZED AND GROUNDED IF VEGETATION IS WITHIN .9M (THREE FEET), OR VEGETATION MUST BE REMOVED BY PLT USING LIVE LINE METHODS.

3. Certified Utility Arborist LOA Work Practices

d. LOA Diagrams

ii. Transmission

- 138 kV and 230 kV Energized Lines
- Vegetation Outside Column B LOA

Certified Utility Arborists:
LOA is 3M (10 feet).

Others e.g.
Apprentice UAs,
Ground Workers
and Slashers:
LOA is 4.5M (15 feet).

Column C

Column B

Column A

Conductor



CUA MAY USE CONDUCTIVE TOOLS.

3. Certified Utility Arborist LOA Work Practices

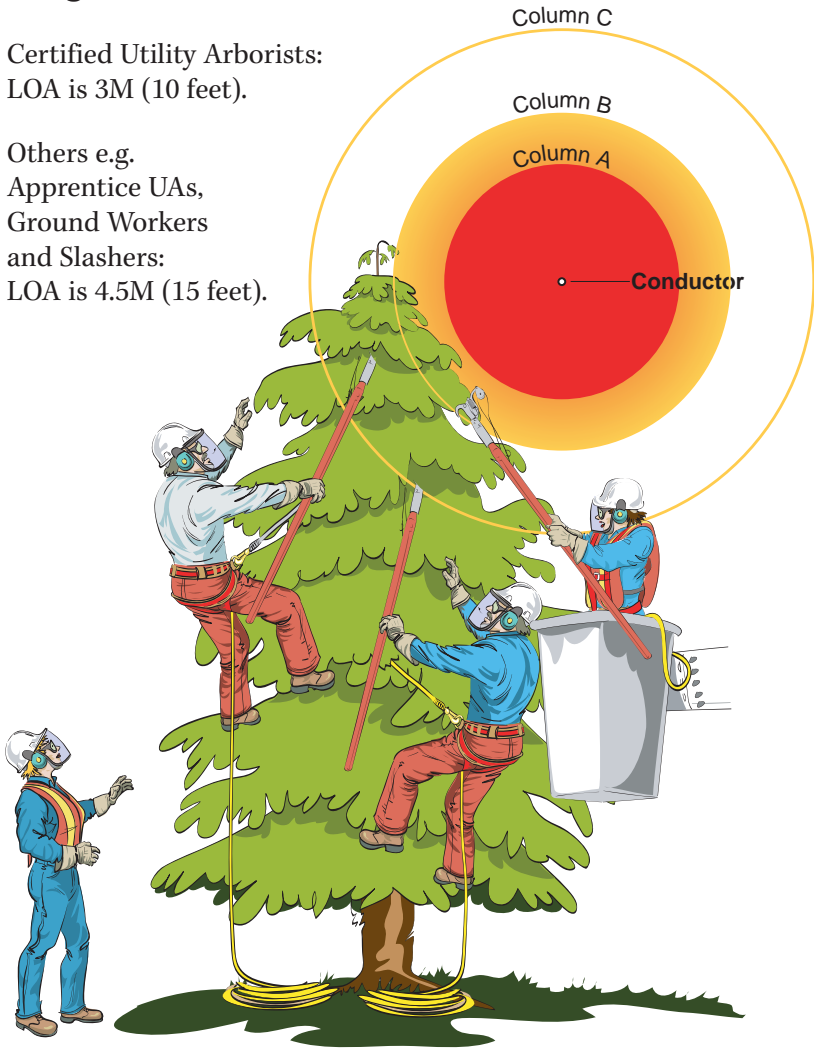
d. LOA Diagrams

ii. Transmission

- **138 kV and 230 kV Energized Lines**
- **Vegetation Outside Column A LOA**

Certified Utility Arborists:
LOA is 3M (10 feet).

Others e.g.
Apprentice UAs,
Ground Workers
and Slashers:
LOA is 4.5M (15 feet).



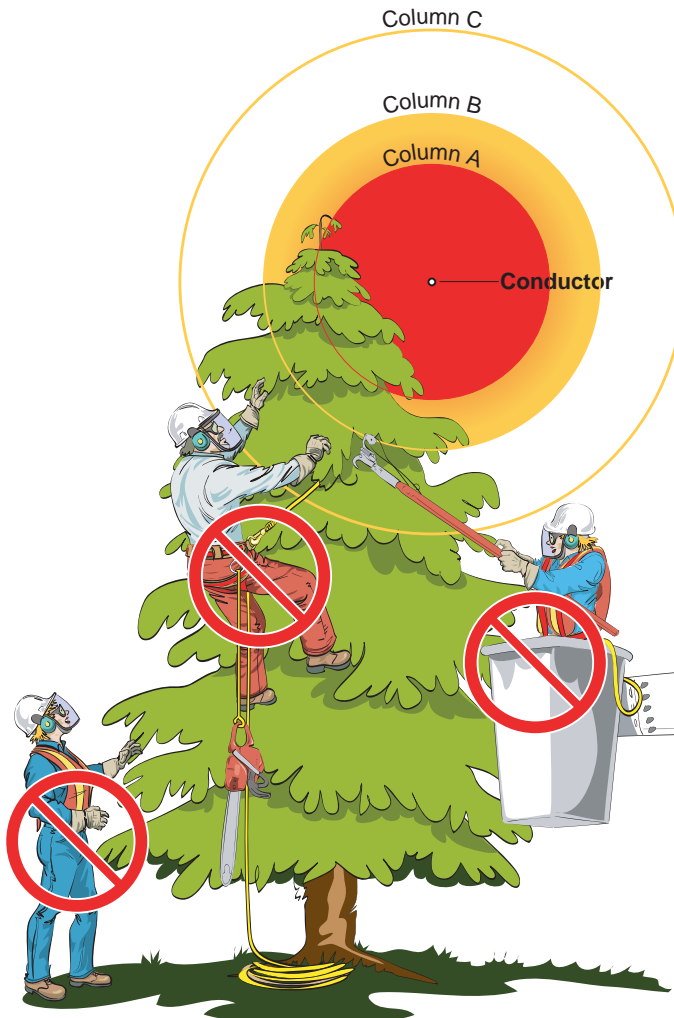
CUA MAY ONLY USE INSULATED TOOLS. WHEN TRIMMING FROM TREE, RESTRAINING METHODS MUST BE USED TO PREVENT LIMBS ENCROACHING WITHIN COLUMN A.

3. Certified Utility Arborist LOA Work Practices

d. LOA Diagrams

ii. Transmission

- 138 kV and 230 kV Energized Lines
- Vegetation Inside Column A LOA



3. Certified Utility Arborist LOA Work Practices

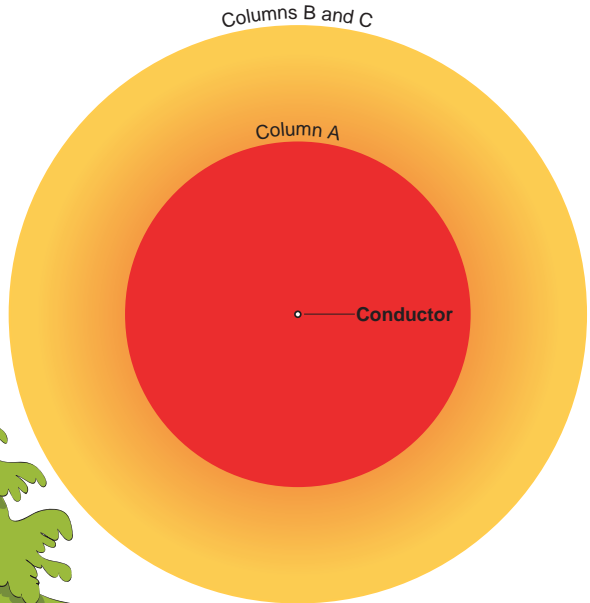
d. LOA Diagrams

ii. Transmission

- **360 kV and 500 kV Energized Lines**
- **Vegetation Outside Column B LOA**

Certified Utility Arborists:
LOA is 6M (20 feet).

Others e.g.
Apprentice UAs,
Ground Workers
and Slashers:
LOA is 6M (20 feet).



FOR VEGETATION OUTSIDE COLUMNS B AND C, CONDUCTIVE TOOLS MAY BE USED.

3. Certified Utility Arborist LOA Work Practices

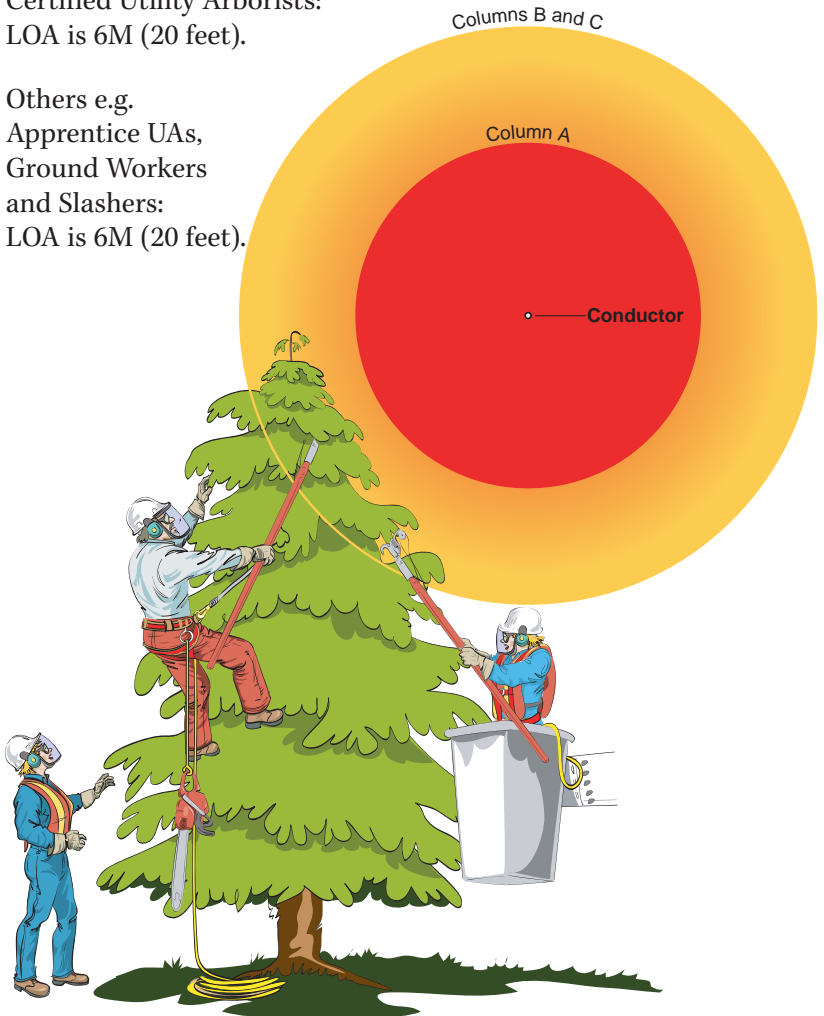
d. LOA Diagrams

ii. Transmission

- 360 kV and 500 kV Energized Lines
- Vegetation Outside Column A LOA

Certified Utility Arborists:
LOA is 6M (20 feet).

Others e.g.
Apprentice UAs,
Ground Workers
and Slashers:
LOA is 6M (20 feet).



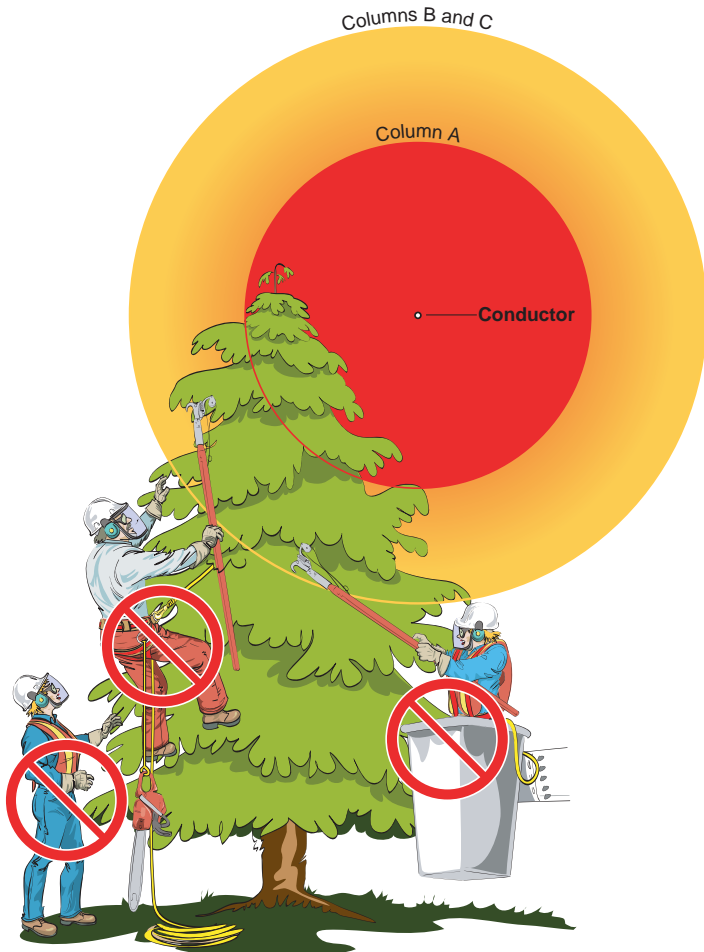
CUA MAY ONLY USE INSULATED TOOLS.
WHEN TRIMMING FROM TREE, RESTRAINING METHODS MUST BE USED
TO PREVENT LIMBS ENCRUCHING WITHIN COLUMN A.

3. Certified Utility Arborist LOA Work Practices

d. LOA Diagrams

ii. Transmission

- 360 kV and 500 kV Energized Lines
- Vegetation Inside Column A LOA



LINE MUST BE DE-ENERGIZED AND GROUNDED IF VEGETATION IS WITHIN 3.7M (12 FEET).

3. Certified Utility Arborist LOA Work Practices

e. Removing Vegetation In Contact with Power Lines

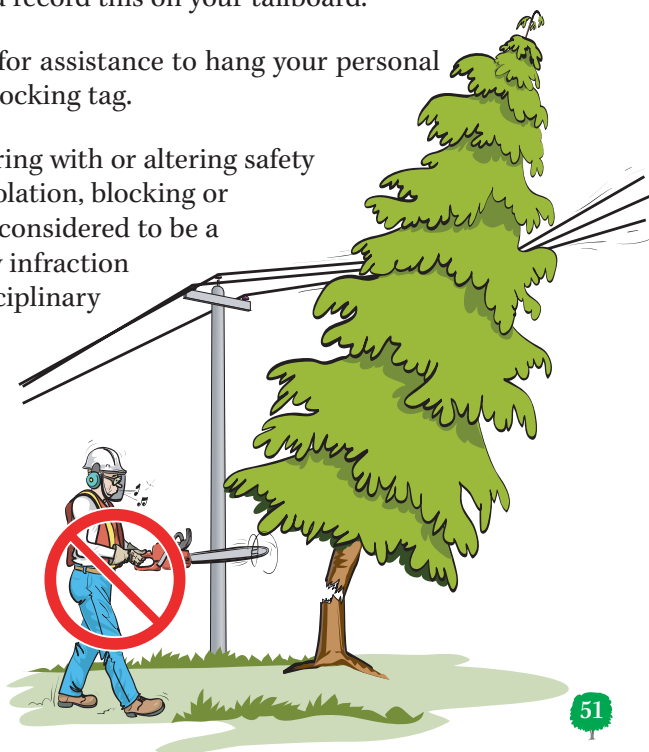
When you (a CUA) and your crew are required to work on an isolated and grounded circuit, e.g. for the removal of a tree or branch from a powerline, you will need to:

- Receive a Protection Extension for yourself and your crew **or...**
- Work under the direct supervision of a Powerline Technician (PLT) who has been issued a Clearance, **or...**
- Work under the direct supervision of a PLT who has taken Self Protection on the circuit.

Ask the PLT what additional protection has been provided for you (called either additional separation or enhanced isolation) and record this on your tailboard.

Ask the PLT for assistance to hang your personal grounding/blocking tag.

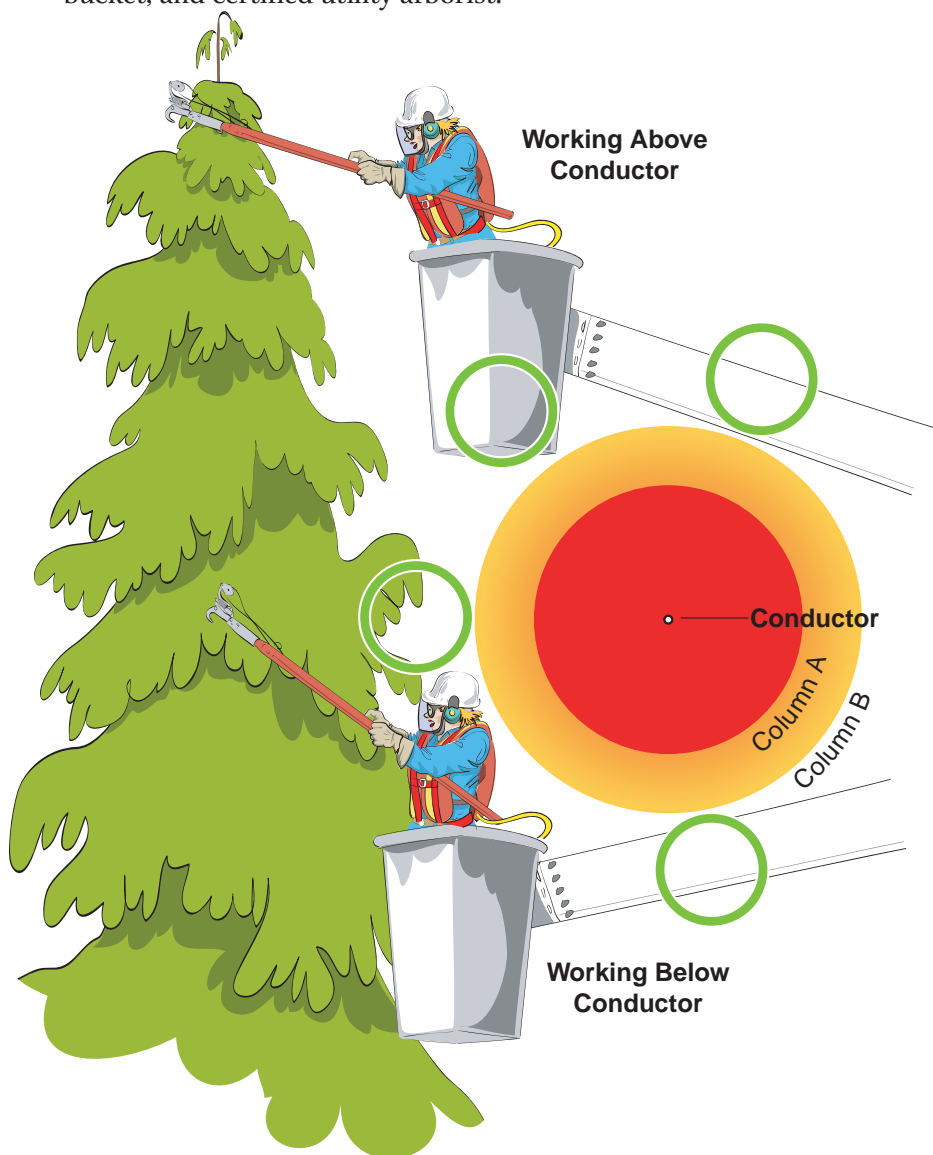
Note: Tampering with or altering safety protection isolation, blocking or grounding is considered to be a serious safety infraction requiring disciplinary action.



3. Certified Utility Arborist LOA Work Practices

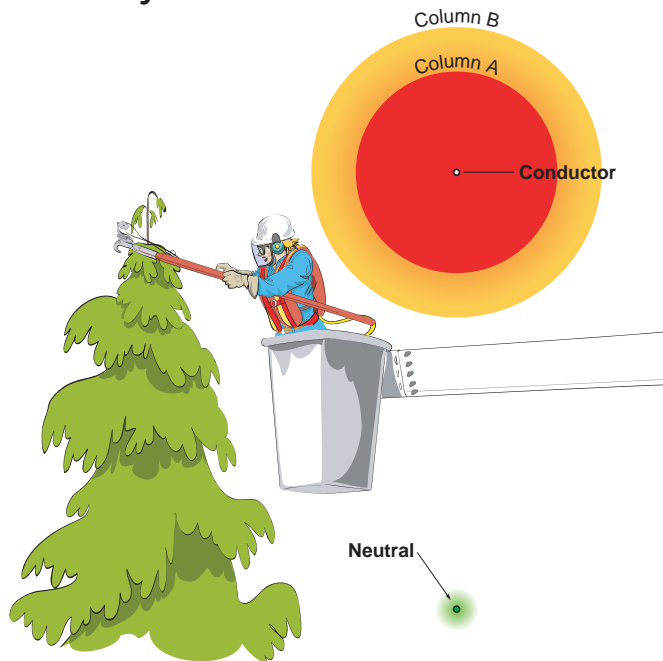
f. Working Above or Below Conductors

Limits of Approach Column B are mandatory for boom, bucket, and certified utility arborist.



3. Certified Utility Arborist LOA Work Practices

g. Working with Boom Between Primary Conductor and Neutral



The following conditions as outlined in WCB's letter of 1st August 1990 and 14 September 1990 should be followed for movement of the upper insulated boom and operator between energized conductors and the neutral:

1. The workers are Certified Utility Arborists.
2. The workers do not perform any work while the lift basket is traversing the area between the energized conductors and the neutral.
3. The integrity of the insulated boom is not diminished due to installation of a boom cover (guard). Debris may be lodged between the insulated boom and boom cover resulting in reduced dielectric strength.

3. Certified Utility Arborist LOA Work Practices

g. Working with Boom Between Primary Conductor and Neutral...cont'd

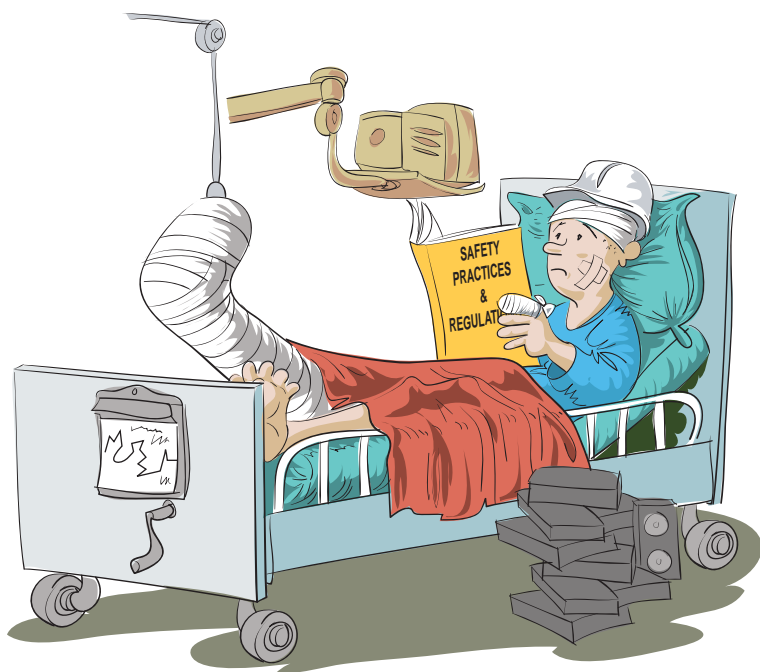
4. The aerial lift is maintained in accordance with the manufacturer's specification.
5. The operators' attention is directed specifically and solely to the task of positioning the boom and bucket.
6. The operator must maintain the "Normal Limits of Approach" as defined in Table 401.1 of the BC Hydro Safety Practice Regulations when passing between the neutral and phase conductors.
7. The operator must be provided with written work procedures defining the method by which the space between the neutral and phase conductors is to be traversed. These work procedures should require the operator to:
 - a. Maintain WCB Limits of Approach until the bucket is near the neutral, then...
 - b. Raise the bucket to a point 6" higher than the neutral, then...
 - c. move horizontally over the neutral conductor, then...
 - d. move vertically downward to WCB limits of approach and then into the work area.

WCB Limits of Approach must be maintained in all cases except when a Certified Utility Arborist is moving over a neutral conductor, at which time the BC Hydro "Normal Limits of Approach" must be maintained.

3. Certified Utility Arborist LOA Work Practices

h. Regulations

All workers should be familiar with the WCB Regulation, the B.C.Hydro Occupational Health & Safety Standards, and the Safety Practice Regulations.



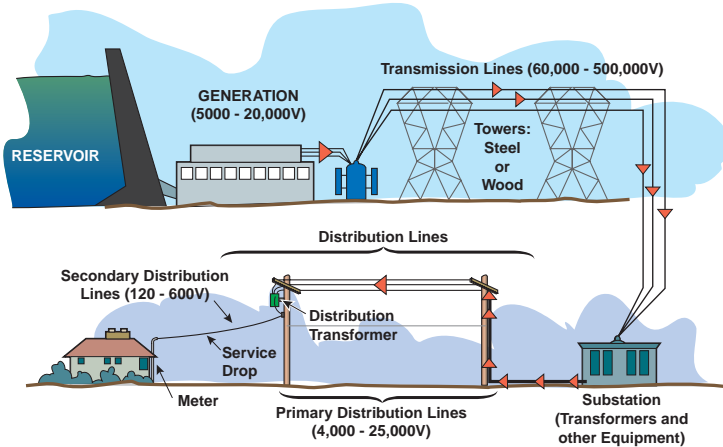
FOLLOW SAFETY LITERATURE TO PREVENT INJURY.

4. Reference

a. Further Information to Determine Line Voltages

i. Electrical Power System Overview

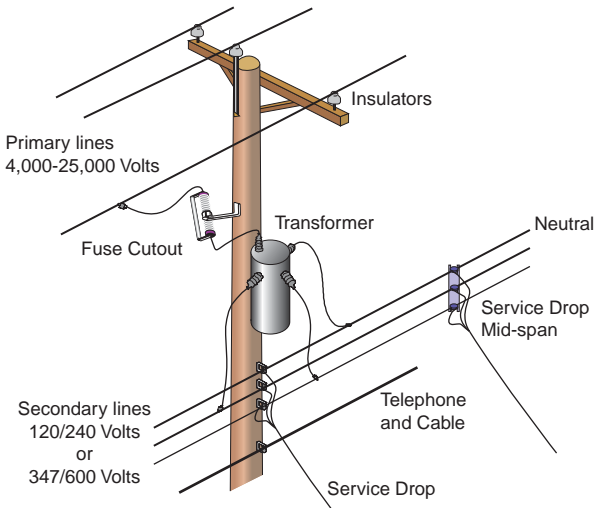
The following overview is provided to enable you to understand how BC Hydro's power system is linked.



- There are three parts to a typical electrical system:
 1. Power Generation
 2. Transmission and
 3. Distribution
- In British Columbia the majority of our electrical power comes from water generation.
- From generating plants, electricity is carried throughout the province by transmission lines on wood structures or steel towers (voltages vary from 60,000 to 500,000 volts) to substations for further distribution .
- From the substation the primary distribution voltages may range from 4,000 to 25,000 volts.
- Distribution transformers reduce the voltage to 120/240 volts for residential areas and up to 347/600 volts for some industrial areas.

4. Reference

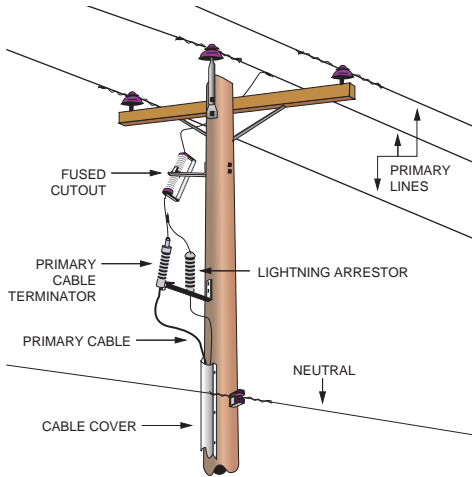
ii. Typical Distribution Pole



- Most distribution lines are on wooden or concrete poles with primary voltages that vary between 4,000 to 25,000 volts.
- The power lines are attached to insulators to prevent the flow of electricity to the ground.
- If the insulators are broken and the conductor contacts the cross arm there may be a flow of electricity down the pole making it hazardous to you.
- The fuse cutout acts like a circuit breaker in a house. If there is a power surge in the transformer due to a fault in the system, the fuse cutout may blow open preventing damage to the transformer and customers' equipment connected to it.

4. Reference

iii. Typical Distribution Underground Dip

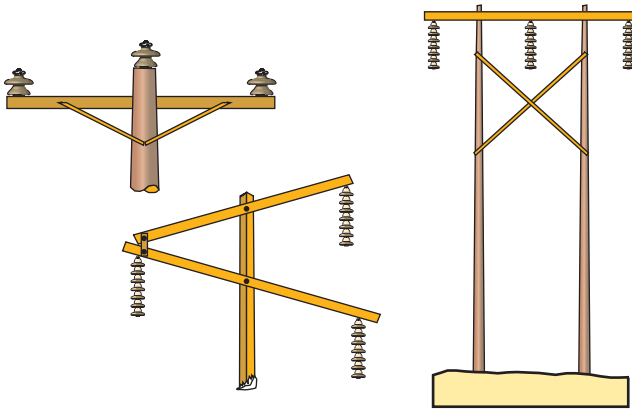


- Limits of Approach must be maintained from the primary conductor and through the cutout to the point where the cable is shielded.

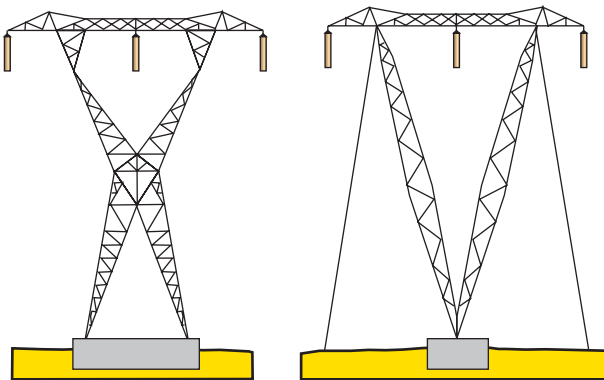
4. Reference

iv. Typical Transmission Structures

Transmission lines can be supported on wood, concrete or steel structures. The design can vary from single wood pole to multiple wood poles for 60 to 230 kV and steel structures for 138 to 500 kV.



Typical Wood Structures



Typical Steel Structures

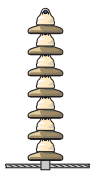
4. Reference

v. Insulator Information

The number of insulators on a string can be helpful in determining the voltage. The following represents the majority or common configurations normally found in BC Hydro and should be used as a guide only.

Typical Bell String Configurations

Bells	Voltage
3 or less	4 to 25kV Distribution
4	60kV
7	138kV
12/14	230kV
15	287kV
18	360kV
21-23	500kV



Example of 7 Bells

Bell type insulators are suspended from the structure with the conductor running on the bottom of the string of insulators. Voltages range from 60,000 to 500,000 volts.

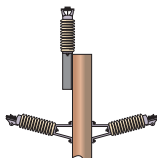


25,000V



60,000 Volts

Pin type insulators carry the conductor on top and are used for 60,000 volts or less.



Example of
post insulator
60,000 volts.

Post insulators are found on some 60 kV and 138 kV circuits.

5. Bibliography

- ☐ BC Hydro OSH Standards
- ☐ Safety Practice Regulation
- ☐ Power System Safety Protection Handbook
- ☐ Local Component
- ☐ Communication Chart for BC Hydro Repeater Systems
- ☐ WCB Occupational Health & Safety Regulation
- ☐ WORKSAFE Safe Work Practices For Utility Arborists
- ☐ WORKSAFE Working Safely Around Electricity
- ☐ WORKSAFE Fallers' and Buckers' Handbook
- ☐ MOTH Traffic Control Manual for Work on Roadways (field edition)
- ☐ Environmental Information & Guidelines for Contractors
- ☐ Handbook for Pesticide Applicators and Dispensers
- ☐ WCB Standard Practices for Pesticide Applicators
- ☐ WCB Safe Work Practices for Juvenile Spacing in Forestry

Notes

Notes

Utility Tree workers Safety Guide

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