**Electrical Hazards, Safety, Ladders, Fall Protection, and Code**

**Description**

Electricians work in many dangerous environments. Electric shock, burns, and falls are among the most common injuries suffered by electrical workers. Working safely and understanding hazards in the workplace are key factors in minimizing potential accidents. Developing and maintaining safe work habits, and ensuring work is done to the WorkSafe standards are essential for people starting work in the electrical trade. Many trades have safety hazards that are part of the job; however, the electrical trade can be among the most dangerous. One mistake could cause serious injury or death, so workers must always be conscientious and understand the potential for accidents. As an electrician, you are responsible for your safety and the safety of others. If the work practices are not up to standard and a mistake is made, other people could be injured or killed because of it.

The Canadian Electrical Code (CEC) sets the standards for electrical work in Canada. The main purpose of the CEC is to establish safety standards for the installation and maintenance of electrical equipment.

**Lesson Outcomes**

The student will be able to:

- Understand the new terminology introduced in this Activity Plan
- Identify some of the main electrocution and shock hazards in electrical work
- Understand general hazards and the importance of PPE (Personal Protective Equipment)
- Understand the importance of safe work habits in the electrical trade
- Demonstrate understanding of fall protection and ladder safety
- Have an understanding of the purpose of the CEC

**Assumptions**

The student will have:

- Little knowledge of electrical safety hazards but will be interested to learn about them
- Little knowledge of ladder safety, fall protection, and PPE
- No knowledge of electrical code requirements
**Terminology**

**Arc flash**: an undesired electric discharge that travels through the air between conductors or from a conductor to a ground. The resulting explosion can cause fires and serious harm to equipment and people.

**Canadian Electrical Code (CEC)**: the national standard for safe electrical installation and maintenance practices of electrical systems in all buildings, structures, and residences. Consideration has been given to the prevention of fire and shock hazards.

**Canadian Electrical Code Simplified, BC Book 1, House Wiring Guide**: a simplified book designed for residential homeowners to understand house wiring. It provides regulations to pass local inspection.

**Electric shock**: a current of electricity going through the body.

**Electrical overload**: happens when more amperage is put across an electrical wire or load than it is rated for or can handle—a common electrical fire hazard.

**Electrocution**: to cause death by passing electricity through someone’s body.

**Fall arrest**: a system that stops your fall before you hit the surface below: a full body harnesses connected by lanyards or lifelines to secure anchors, safety nets.

**Fall restraint/protection**: systems that prevent falling: safety belts, harnesses, guard rails.

**High voltage**: a voltage over 750 volts.

**Low voltage**: 31 volts to 750 volts.

**Personal Protective Equipment (PPE)**: specialized clothing or equipment worn by workers for protection against health and safety hazards. PPE is designed to protect many parts of the body; i.e., eyes, head, face, hands, feet, and ears.

**Short circuit**: a low-resistance connection established by accident or intention between two points in an electric circuit. The current tends to flow through the area of low resistance, bypassing the rest of the circuit.

**Estimated Time**

4–8 hours

**Recommended Number of Students**

20, based on *BC Technology Educators’ Best Practice Guide*

**Facilities**

Classroom or computer lab, or shop with access to computer with Internet and projector with sound

Shop class or similar for ladder safety and fall protection
**Tools**
Pens, pencils, lined paper step and extension ladders, safety harness, hoisting system

**Materials**
Computers or laptops for students, computer and projector with sound for teacher, copies or photocopies of *Working Safely Around Electricity* from WorksafeBC.

**Optional**
This would be a good opportunity to have a guest speaker talk about safety. More specifically, an electrical worker with knowledge of electrical safety and/or a WorksafeBC presenter to talk about injuries in the workplace or fall protection and/or ladder safety.

**Resources**

*An Introduction to Personal Fall Protection Equipment (WorkSafeBC)*

*A Bright Arc: A Video Guide to Powerline Safety*
[https://www.youtube.com/watch?v=6P3XX5c9LLA](https://www.youtube.com/watch?v=6P3XX5c9LLA)

*Construction—Toolbox Meeting Guides—Personal Protective Equipment (WorkSafeBC)*

*Ontario Electrical Safety Authority Video Gallery (three videos)*
- Your Life Is on the Line
- Electrical Safety Hazards at Home
- 10 Shocking Facts

*Fall Protection Can Save Your Life: WorkSafeBC*
[https://www.youtube.com/watch?v=FGYbrok1bHg](https://www.youtube.com/watch?v=FGYbrok1bHg)

*Ladder Safety (WorkSafeBC)*
[https://www.youtube.com/watch?v=BASYh-MVYlo](https://www.youtube.com/watch?v=BASYh-MVYlo)

*Safe Ladder Use (WorkSafeBC Construction Safety Series)*
**Working Safely Around Electricity (WorkSafeBC)**


**Activity Background**

The activities will cover three areas: electrical hazards and safety, ladder use and fall protection/arrest, and the Canadian Electrical Code.

Understanding electrical hazards and safety is paramount to electrical work. Safe practices must always be followed to ensure that the chance of accidents is minimized. Personal Protective Equipment (PPE) must always be used to keep workers safe.

Another topic and activity will be ladder safety and fall protection. Electricians must learn how to use ladders safely and understand the importance of fall safety and fall arrest in the workplace. Students will have a chance to practise safe use of ladders and fall protection.

The Canadian Electrical Code is a very large body of work, and students may find this component more difficult to understand. Students should understand that if they continue in the electrical trade and plan to become an apprentice, greater understanding of the electrical code is a very important part of the process. The intent is not to memorize the code but to have knowledge of the sections and know where to look to find specific details.

There will be many opportunities for class discussion on all of the topics covered during the activities. Specific sections of these topics may be explored in greater detail if the teacher feels they have the knowledge and/or resources to do so.
Activity 1: Electrical Hazards and Safety

This activity could start by students in groups previewing videos about electrical hazards and safety issues. Students should pick out the most important points in the videos. The students could then show their video to the class and lead a discussion or summarize the video. Alternatively, the teacher could show the electrical hazards and safety videos and discuss as a class. If this option is chosen, it’s important that the teacher previews the videos and takes notes for class discussion.

1. Have students pair up and generate 20 questions from “Working Safely Around Electricity.” The teacher will need to print off enough booklets for the groups. Students should cover topics from each section of the document and note the answers on a separate piece of paper. Give students ample time to complete.

2. Once complete, have students trade questions with another pair and answer the questions. Give students enough time to answer the questions. The teacher may determine the allotted time for answering questions.

3. Once complete, have the groups trade papers back and mark the answers from their answer keys. Another option for this activity would be for the teacher to generate questions from the document and have the students find the answers.

WorkSafeBC has some great toolbox meeting guides designed for employers. The “Construction—Toolbox Meeting Guides—Personal Protective Equipment—Tue Dec 17, 2013” section deals with general PPE like clothing, hearing, eye, face, and respirators.

The “Construction—Toolbox Meeting Guides—Electrical—Tue Dec 17, 2013” section deals with more specific issues around electrical work.

- Have students pair up and present some important information from their specific topic area. The topics are in PDF format and the students could print off copies or present from the class projector. These are documents that employers use for safety meetings, so it’s a great way for students to see how employees are continually trained to work safely.
Activity 2: Ladder Safety and Fall Protection

1. Show students videos on ladder safety and fall protection. See the WorkSafeBC links in the Resources section:
   - Ladder Safety
   - Fall Protection Can Save Your Life

2. Discuss issues surrounding the videos such as the difference between fall protection and fall arrest, choosing the correct ladder (performance or access), elevated platforms, and CSA classifications for ladders.

Ladder Safety Activity

1. Print copies or project the “Safe Ladder Use” PDF from WorkSafeBC (see the Resources section). As a class, go through the ladder safety document and pay particular attention to stepladder and extension ladder use.

2. The teacher should then have students in pairs safely set up and climb step and extension ladders.

   Use ladders no higher than 8–10 feet. The teacher should closely supervise this activity.

Fall Protection/Fall Arrest Activity

1. Print copies or project the WorkSafeBC PDF, “An Introduction to Personal Fall Protection Equipment” (see the Resources section). As a class, go through the fall protection document.

2. Have students individually put on and correctly size the harness. If possible have the students hoist each other off the ground via a pulley system so they can experience the discomfort of a fall protection harness.
Activity 3: Canadian Electrical Code

The teacher should explain to the class the purpose of the Canadian Electrical Code. Students will do a CEC exercise as part of Activity Plan 6: Circuit Concepts. The CEC is published by the Canadian Standards Association and covers the installation and maintenance of electrical equipment in Canada. The code uses a prescriptive model, outlining in detail the wiring methods that are acceptable. In the current edition, the code recognizes that other methods can be used to ensure safe installations, but these methods must be acceptable to the authority enforcing the code in a particular jurisdiction. Students should be made aware that the CEC is an ongoing tool that all apprentices will have to learn how to use during their training. The Resources section contains a link to a video giving further explanation of the code.

Evaluation Guidelines

The student:

• Participates in discussions
• Contributes to group work
• Demonstrates an understanding of terminology
• Demonstrates an understanding of electrical safety and hazards
• Demonstrates an understanding of fall protection and arrest
• Has some understanding of the Canadian Electrical Code
• Presents information to the class
• Generates and answers questions

Extension Activity

Have students find a video showing short circuits and arc flashes, and present it to the class to help them see what happens in these situations.