

Block A: Safety Related Functions



Plumbing Apprenticeship Program Level 1 Series

Block A: Safety Related Functions

BC Plumbing Apprenticeship, Level 1

SKILLEDTRADESBC

*BC PIPING ARTICULATION AND CURRICULUM SUBCOMMITTEE;
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Block A of the Plumbing Apprenticeship Program Level 1 Series features Skilled Trades BC industry-authority content on safety related functions in plumbing. Safety is a part of the job. When you take a job, you have a safety obligation to your employer, co-workers, family, and yourself. By recognizing and understanding the hazards in your work area, you can prevent the occurrence of many accidents. Most accidents are preventable. Both employees and employers must take responsibility for making the workplace safe.

Block A of the Plumbing Apprenticeship Program Level 1 Series focuses on the causes and results of workplace accidents, the short- and long-term hazards in the trades, general safety precautions and procedures, emergency equipment and facilities, how a workplace safety policy is established, lockout and tagout procedures, and ladder and scaffold usage.

Plumbing Apprenticeship Program Level 1 Series

The *Plumbing Apprenticeship Program Level 1 Series* offers comprehensive training materials designed to build on foundational skills and knowledge. The series is divided into four main blocks, each focusing on critical areas of plumbing systems and installations.

Block A: Safety Related Functions

(<https://a-safetyfunctions-bcplumbingapprli.pressbooks.tru.ca>)

A-1: Workplace Hazards

A-2: WorkSafeBC Regulations

A-3: Safe Handling of Hazardous Materials

A-4: Personal Safety Practices

A-5: Fire Safety

Block B: Tools and Equipment

(<https://b-handmeasuringtools-bcplumbingapprli.pressbooks.tru.ca>)

B-1: Use Hand Tools and Measuring Tools

B-2: Use Portable Power Tools and Use

B-3: Use Access Equipment

B-4: Use Rigging, Hoisting, Lifting and Positioning Equipment, and Rigging

B-5: Use Soldering and Brazing Equipment and Oxy-Fuel Cutting Equipment

B-6: Use Welding Equipment

Block C: Routine Trade Activities and Electrical Concepts

(<https://c-tradeactivities-electrical-bcplumbingapprli.pressbooks.tru.ca>)

C-1: Mathematics and Science

C-2: Electrical Concepts and Principles of Electricity
C-3: Drawings and Specifications
C-4: Codes, Regulations and Standards
C-5: Manufacturer and Supplier Documentation

Block D: Piping and Components

(<https://d-pipingcomponents-bcplumbingappri1.pressbooks.tru.ca>)

D-1: Install Pipe and Tubing
D-2: Install Valves
D-3: Install Fittings
D-4: Penetrate Structures

Plumbing Apprenticeship Program Overview and Upcoming Resources

- **Plumbing Apprenticeship Program Level 1 Series** (<https://openpress.trubox.ca/2024/12/13/plumbing-apprentice-level-1/>) can be found in the TRU Open Press Collection.
- **Plumbing Apprenticeship Program Level 2 Series** (<https://openpress.trubox.ca/2024/04/26/bc-plumbing-apprenticeship-level-2/>) can be found in the TRU Open Press Collection.
- **Plumbing Apprenticeship Program Level 3 Series** (<https://collection.bccampus.ca/search/?q=%22pl3%22>) can be found in the BCCampus Open Collection (<https://collection.bccampus.ca/>).
- **Plumbing Apprenticeship Program Level 4 Series** (<https://bccampus.ca/projects/archives/zed-cred-z-degrees/ztc-open-educational-resources-for-trades/>) can be found in the BCCampus Open Collection. (<https://collection.bccampus.ca/>) (Block F: Commission and Service will be available soon.)

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Safety Advisory

The current Standards and Regulation in BC can be obtained at the WorkSafeBC website: <http://www.worksafebc.com> (<http://www.worksafebc.com>)

Please note that it is always the responsibility of any person using these materials to inform themselves about the Occupational Health and Safety Regulation pertaining to their areas of work.

Symbol Legend



Important Information



Potentially Toxic/ Poisonous Situation



Required or Optional Resources



Potentially Flammable Situation



Complete a Self-Test



Possibly Explosive Situation



Use Protective Equipment



Potential Electric Shock

Acknowledgements

The development of the *Plumbing Apprenticeship Level 1* learning resources was a collaborative effort driven by a commitment to excellence in trades education. These resources were created to support apprentices and journeypersons in mastering the skills and knowledge essential to the piping trades. This achievement would not have been possible without the dedication and expertise of *Skilled Trades BC* and the *Piping Trades Articulation Committee*, whose contributions, leadership, and guidance have been instrumental in shaping high-quality, industry-aligned training resources. We extend our sincere gratitude for their contributions and ongoing stewardship in advancing the piping trades.

The content for *Block A: Safety Related Functions* (<https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/>) is adapted from the Piping Trades Apprenticeship Program from *SkilledTradesBC* (2019 Harmonized) and the Trades Access Common Core (TACC) (<https://collection.bccampus.ca/search/?q=%22Trades%20Access%20Common%20Core%22>) resources developed by Camosun College, originally created in 2015 and revised in 2019, and made available through BCcampus:

- Line A: Safe Work Practices: Competency A-1: Control Workplace Hazards (<https://collection.bccampus.ca/resource/tQtm8KNK>)
- Line A: Safe Work Practices: Competency A-2: Describe WorkSafeBC Regulations (<https://collection.bccampus.ca/resource/4x48JUby>)
- Line A: Safe Work Practices: Competency A-3: Handle Hazardous Materials Safely (<https://collection.bccampus.ca/resource/PMfB6kHM>)
- Line A: Safe Work Practices: Competency A-4: Describe Personal Safety Practices (<https://collection.bccampus.ca/resource/xQpDrgQM>)
- Line A: Safe Work Practices: Competency A-5: Describe Fire Safety (<https://collection.bccampus.ca/resource/VPwUd4rq>)

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- Trades Training BC

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Starting December 1, 2022, Industry Training Authority was officially renamed to SkilledTradesBC. Hear more in this video from SkilledTradesBC CEO, Shelley Gray, on what this means for the trades industry and British Columbians. Closed captioning and transcripts are available with this video, Introducing Skilled Trades BC (<https://www.youtube.com/watch?v=OQgwdP0rNog>) (2022) on YouTube.



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References

- Camosun College. (n.d.). *Line A: Safe work practices*. BCcampus. <https://collection.bccampus.ca/textbook/tQtm8KNK/>
- SkilledTradesBC. (2025). Plumber program outline (Implementation date: August 18, 2025; Last revised: December 16, 2025) [PDF]. Province of British Columbia. <https://skilledtradesbc.ca/media/2776/download>
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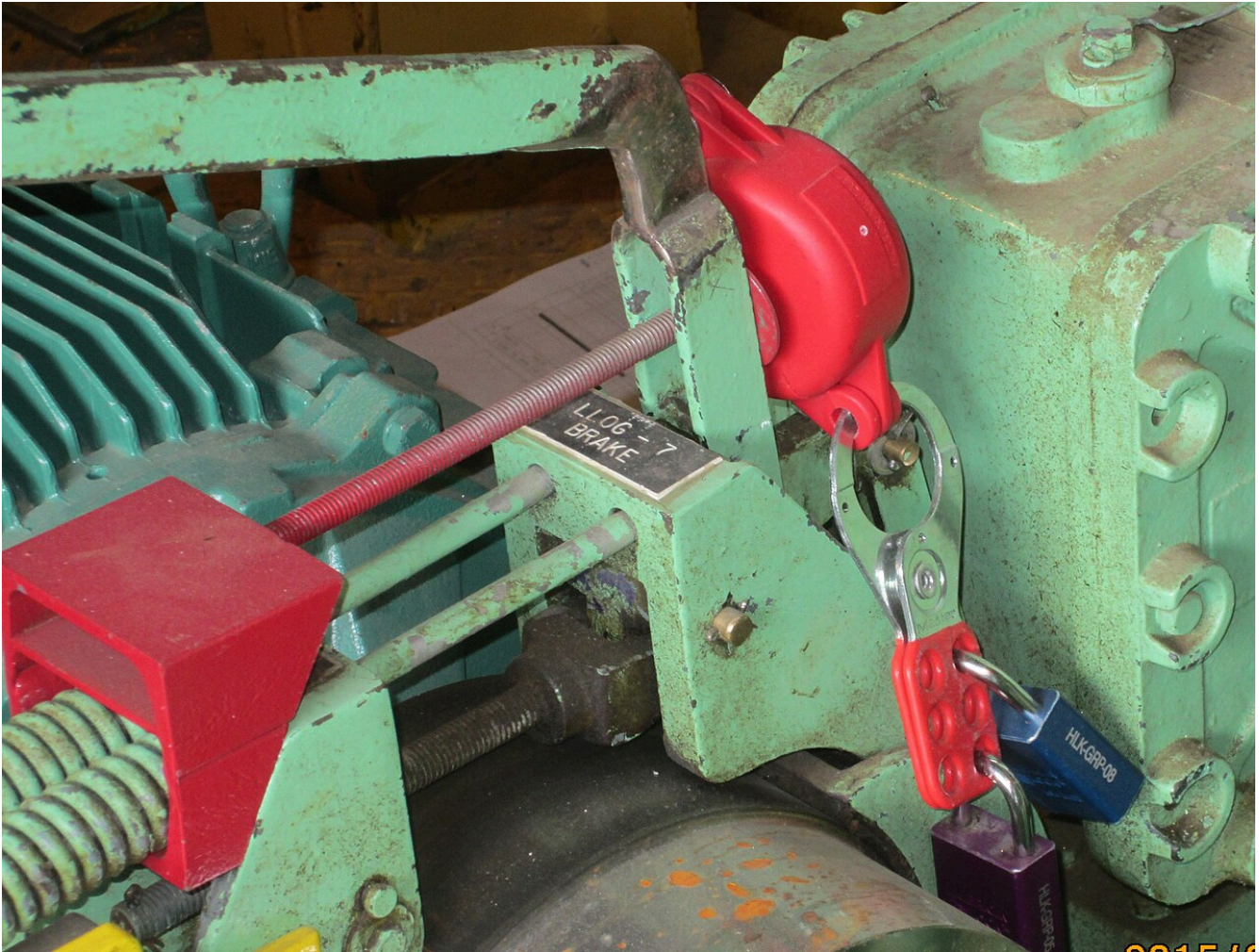
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A-1 WORKPLACE HAZARDS

Plumber Apprenticeship Program – Level 1



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A-1 Workplace Hazards Introduction

Safety is a part of the job. When you take a job, you have a safety obligation to your employer, co-workers, family, and yourself. By recognizing and understanding the hazards in your work area, you can prevent many accidents. Most accidents are preventable. Both employees and employers must take responsibility for making the workplace safe.

Learning Objectives

You must be familiar with the typical hazards that you may encounter in the workplace.

After completing this section, you should be able to describe:

- The causes and results of workplace accidents.
- The short- and long-term hazards in the trades.
- General safety precautions and procedures.
- Emergency equipment and facilities.
- How a workplace safety policy is established.
- Lockout and tagout procedures.
- Ladder and scaffold usage.



You will be required to reference publications and videos available online at WorkSafeBC. (<https://www.worksafebc.com/en>)

Terminology

The following terms will be used throughout this section. A complete list of terms for this section can be found in the **Glossary**.

- **accident:** An unplanned event that may or may not result in an injury or property damage (Section A-1.1).
- **airborne hazards:** Hazards made of tiny particles or gases that float in the air and can be breathed into

the lungs. (Section A-1.3)

- **angle of repose:** The steepest angle that soil or sand can be piled without sliding or falling. In trenching and excavation work, knowing the angle of repose helps workers decide how much to slope the sides of a trench so the soil stays stable and does not collapse. (Section A-1.2)
- **benching:** A way to make a trench safer by cutting the sides into flat steps, like stairs. These steps help support the soil and reduce the chance of the trench walls collapsing while workers are inside. (Section A-1.2)
- **egress:** A safe way to get out of a place. It usually refers to doors, hallways, stairs, or exits that people use to leave a building quickly and safely, especially in an emergency. (Section A-1.2)
- **hazard assessment:** Identifying **physical** and **health hazards** in the workplace. (Section A-1.1).
- **hydraulic shoring:** A way to keep a trench safe by using metal supports pushed into place with hydraulic pressure. These supports press against the trench walls to stop the soil from collapsing while workers are inside. (Section A-1.2)
- **indirect costs (of an injury):** Often overlooked; costs can amount to up to four times the direct cost of the injury; include administrative time dealing with the injury and medical care, loss of production, raises in premiums, replacing the injured employee's lost hours of employment by hiring another employee, loss of reputation and confidence in employees and clients, unwanted media attention, and more. (Section A-1.1)
- **Job Safety Analysis (JSA):** Each step of a task is examined for potential hazards. (Section A-1.1)
- **off-gassing:** The release of chemicals into the air from materials like paint, carpets, or new furniture. (Section A-1.3)
- **musculoskeletal injuries (MSI):** Injuries to muscles, joints, or tendons caused by lifting, repeating movements, or overworking the body. (Section A-1.3)
- **short-term hazard:** Any hazard that may cause injury and/or illness and that may be remedied in a short period of time. (Section A-1.2)
- **Task Safety Analysis (TSA):** Often used for routine or recurring tasks, which involves completing a pre-printed checklist. (Section A-1.1)
- **timber and plank shoring:** A way to keep a trench safe by using wooden boards and supports to hold up the sides of the trench. The wood is placed against the trench walls to help stop the soil from collapsing while workers are inside. (Section A-1.2)
- **trench shields (or trench boxes):** Prefabricated structures. These are not adjustable within the trench and are designed to protect the workers, should a collapse occur, whereas shoring is designed to prevent the walls from collapsing. (Figure 3, Section A-1.2)
- **trench shoring:** A way to hold up the sides of a trench so they do not fall in. Strong supports, such as metal or wooden panels, are placed against the trench walls to keep workers safe while they work inside. (Section A-1.2)
- **trench sloping:** A way to make a trench safer by cutting the sides at an angle instead of straight up and down. The sloped sides help stop the soil from collapsing into the trench. (Section A-1.2)
- **Workers' Compensation Boards (WCB):** Independent agents that enforce provincial mandates in the area of workers' health and safety and compensation. WorkSafeBC is the agent for WCB in British Columbia. (Section A-1.1)

A-1.1 Describe the Causes and Results of Accidents

Safety Culture



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Your health and well-being are your most valuable possessions. Many laws and regulations have been passed to ensure employee safety, yet every year thousands of serious injuries occur— often with serious long-term consequences for both employees and employers.

Safety is a learned behaviour and attitude; it is a way of working that must be incorporated into the company as a culture. Everybody in a company, from management to labourers, must be responsible for safety every day they come to work.

Companies with strong safety cultures usually have:

- Fewer at-risk behaviours
- Lower accident rates
- Less employee turnover
- Lower absenteeism
- Higher productivity

Most work-site safety rules are a matter of common sense, but people sometimes forget or ignore them in an effort to save time or energy.

The ultimate responsibility for on-the-job safety, however, rests with you. By following the practices in this section, you and your co-workers commit to working safely, and everyone benefits.

Main Causes of Accidents



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An **accident** is defined as an unplanned event that may or may not result in an injury or property damage. Some of the main causes of accidents include:

- Failure to communicate
- Poor work habits/complacency
- Alcohol or drug abuse
- Lack of skill/training
- Intentional acts
- Unsafe acts
- Rationalizing risks
- Unsafe conditions

Personal injury may be classified as either permanent or temporary. Either way, it is costly in terms of pain and lost time, wages, and productivity. It is far more beneficial to all involved if injury is avoided altogether from the outset. To ensure this, every effort should be made to identify and address potential **hazards**.

Workplace Hazards

To work safely, you must know the kinds of hazards to which you may be exposed and how to minimize the risk of injury. When hazards are identified and assessed, they can be addressed quickly, reducing the hazard potential and the likelihood of harm.

Watch the following video by WorkSafeBC (2010) on YouTube titled “Understanding Hazards and Risks” [1:59].



One or more interactive elements has been excluded from this version of the text. You can view them online here:
[#oembed-1](https://a-safetyfunctions-bcplumbingapp1.pressbooks.tru.ca/?p=1201#oembed-1)

If you are using a printed copy, you can scan the QR code with your digital device to go directly to the video:
Understanding Hazards and Risks. (<https://www.youtube.com/watch?v=aRvULYpobms>)



These hazards may be of an obvious nature—presenting immediate danger—or they may be very subtle and cause damage through exposure over a longer period of time. For example, many workers in noisy environments gradually lose their hearing without realizing it. This may result in high- or low-frequency hearing loss, depending on the intensity and duration of exposure.

Watch the following video by WorkSafeBC (2006) on YouTube titled “The Hearing Video (SD) | WorkSafeBC” [17:30].



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If you are using a printed copy, you can scan the QR code with your digital device to go directly to the video:
The Hearing Video (<https://www.youtube.com/watch?v=mbwElB6uVuU>)



Hazard Assessment



A critical first step in developing a comprehensive safety and health program is identifying physical and health hazards in the workplace. This process is known as a **hazard assessment**. An effective hazard assessment considers both categories.

Examples of **physical hazards** include moving objects, fluctuating temperatures, high-intensity lighting, rolling or pinching hazards, electrical connections, and sharp edges. Examples of **health hazards** include overexposure to harmful dusts, chemicals, or radiation.

There are several methods for recognizing hazards on the job site. Some are more complex than others. One common method is a **Job Safety Analysis (JSA)**, where each step of a task is examined for potential hazards. Another approach, often used for routine or recurring tasks, is a **Task Safety Analysis (TSA)**, which involves completing a pre-printed checklist.

Professionalism and Housekeeping



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One important part of safety and accident prevention is good housekeeping. We seldom think about it, but many unsafe conditions can be corrected before they result in injury. Good housekeeping is a necessity for a safe job site. When rubbish is allowed to accumulate on the job site or in the shop, it gets in the way and makes operations more dangerous. Time may also be lost if you just move rubbish from one place to another instead of using proper bins or disposal procedures.

A clean work environment also leads to pride in workmanship. An unorganized work area can slow your production and looks unprofessional. Keeping your work area clean and organized has many positive attributes. Some handy work area hints include:

- Before starting a project, remove unnecessary tools and equipment from your work area.

- Plan your work so tools needed for one task transition smoothly to the next.
- Place tools conveniently and slightly away from your immediate work area to avoid crowding.
- Never place tools inside equipment, as loose tools can cause damage or be forgotten.
- Remove tools and materials that are no longer required as you work.
- Use the correct tool for the job and never use damaged tools or equipment.
- Do not eat at your workbench; grease and crumbs can cause equipment failure.
- Clean up spills immediately to prevent slips and falls.
- Dispose of scrap material regularly in designated recycling or waste areas.
- At the end of the day, clean up so you can begin the next job safely and efficiently.

Role of the Workers' Compensation Board: Investigate, Inspect, Educate, and Compensate

Workers' Compensation Boards (WCB) are independent agents that enforce provincial mandates in the area of workers' health and safety and compensation. WorkSafe BC is the agent for WCB in British Columbia. We will talk more about this later but for now here is the link to the WorkSafeBC website (<https://www.worksafebc.com/en>).

WorkSafeBC is the agent for WCB in British Columbia, and fulfills its mandate in four key ways:

1. Inspecting and assessing workplaces for safety and health concerns.
2. Investigating injury claims and workplace incidents.
3. Educating employers and employees and, when necessary, assessing penalties.
4. Compensating workers for time lost due to injury.

Workers' Compensation Boards have the legislative authority to assess penalties for violations of health and safety regulations. The employer is ultimately held responsible for the actions of their workers and supervisors, although this does not relieve workers or supervisors of their responsibilities under the regulations. Both workers and supervisors can be held liable for the penalties prescribed under legislation.

Under the legislation, through its officers, the board is responsible for inspecting places of employment. Subsequently the board may issue orders and directions specifying the means for preventing injuries and industrial diseases.

Officers of the WCB are responsible for investigating accidents and the causes of industrial diseases, for assisting and advising employers and employees in the development of industrial health and safety programs, and for educating persons employed in industry about industrial health and safety.

Costs of Accidents and Injuries

The **direct costs** of an injury are the easiest to see and understand. These costs include emergency room and doctor visits, medical bills, medicines, rehabilitation, and lost wages. These direct costs are covered by a company's insurance.

Indirect costs of an injury are often overlooked. These costs can amount to up to four times the direct cost of the injury. Indirect costs include administrative time dealing with the injury and medical care, loss of production, raises in

premiums, replacing the injured employee's lost hours of employment by hiring another employee, loss of reputation and confidence in employees and clients, unwanted media attention, and more.

Many projects use a company's accident history or incident rate during the tender process and compare it to the other potential bidders when deciding which company to select. A higher rate of incidents may mean loss of a bid and, therefore, loss of work.

WCB Assessment and Penalty Costs

Every employer in British Columbia is issued a fee assessment to cover all of WorkSafeBC's operating costs. Assessments pay for inspections of the work site, for the training of workers, and for the direct costs of job site injuries.

It's important that you do not cause your employer to be charged and fined for infractions of the regulations. An employee who takes an unsafe shortcut on the job to save two minutes may end up costing their employer a lot of money. When the assessment goes up, it goes up for everyone on the payroll. In some cases, it can price a company out of business.

New and young workers have the highest accident rates. They're often eager to please and try to get a job done hastily. You can help yourself and your employer by practising safe working habits, ensuring that you are trained properly, and demonstrating a good safety attitude on the job site.

Visit [Top 7 Dangers for Young Workers \(https://www.worksafebc.com/en/health-safety/education-training-certification/young-new-worker/know-hazards\)](https://www.worksafebc.com/en/health-safety/education-training-certification/young-new-worker/know-hazards) on the WorkSafeBC (2016), website.



Self-Test A-1.1: Describe the Causes and Results of Accidents

Complete Self-Test A-1.1 and check your answers.

If you are using a printed copy, please find Self-Test A-1.1 and Answer Key at the end of this section. If you prefer, you can scan the QR code with your digital device to go directly to the interactive Self-Test.



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A-1.2 Describe Short-Term Hazards in the Trades

A **short-term hazard** can be described as any hazard that may cause injury and/or illness and that may be remedied in a short period of time. This section will discuss some of the short-term hazards likely to be encountered when working in the trades.

Slips, Trips, and Falls



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Slips, trips, and falls on walking and working surfaces are the cause of many injuries in the workplace. Some of these accidents are the result of environmental conditions and others happen because of poor housekeeping and careless behaviour. You can best avoid slips, trips, and falls by being aware of your surroundings and following some general walking- and work-surface guidelines:

- Keep all walking and working areas clean and dry.
- Keep all walking and working surfaces clear of clutter and debris.
- Install cables, extension cords, and hoses so that they will not become tripping hazards.
- Do not run on any work surface.
- If footing is unstable, use short steps with feet splayed out.

Excavations



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An **excavation** is the removal of ground material by digging in order to bury or access pipelines, conduits, foundations, etc. **Trenches** are special types of excavations in which the depth exceeds the width. Sometimes the terms *excavation* and *trench* are used interchangeably, but there is a difference. Because trenches are narrow, workers can easily become trapped.

Hazards involved with trench and excavation work include:

- Cave-ins and crushing
- Water accumulation
- Falling objects
- Collapse of adjacent structures
- Toxic gases in the soil

Cave-ins are the most common and deadliest hazard in excavation work. When dirt is removed from an excavation, the surrounding ground can become unstable, and gravity may cause it to collapse. If a trench is deeper than 1.2 metres (4 ft), you must be protected from cave-ins by either **trench shoring** or **sloping**. It is essential you understand and follow the appropriate shoring and sloping requirements before entering or working in or around an excavation.

Shoring

Several methods can be used to shore up a trench. **Hydraulic shoring** uses hydraulic pistons that are extended outward until they press prefabricated plates against the trench walls, as shown in Figure 1.



Figure 1 Prefabricated hydraulic shoring (Sbhirus/Wikimedia Commons) CC BY SA 3.0 (<https://creativecommons.org/licenses/by-sa/3.0/deed.en>)

Timber and plank shoring is used if the trench is too wide or too irregular for prefabricated shoring, as shown in Figure 2.

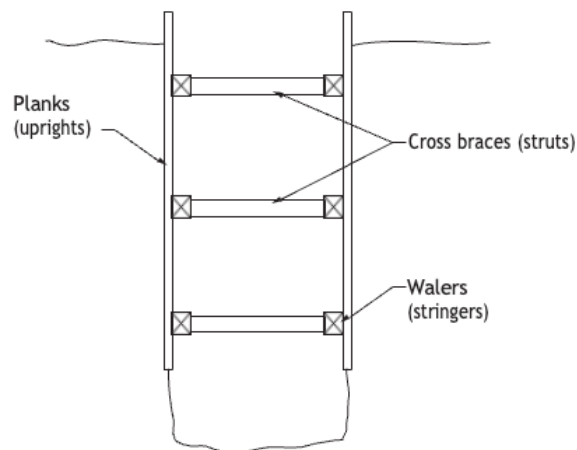


Figure 2 Parts of a timber and plank shoring system (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

The size and spacing of the parts of a timber and plank system are given in the WorkSafeBC OHS Regulation (<https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs->

regulation). Size and spacing vary depending upon the type of soil that the trench is dug into and the depth of the trench.

Planks may be spaced if the soil is stable, but must be close fitting if the soil is loose and free running. Plywood sheathing is sometimes used in place of planks.

Timber shoring is slow to install because it must be installed from the top down. It is unsafe for a worker to enter the trench before it is shored.

Trench shields or trench boxes are prefabricated structures (Figure 3). These are not adjustable within the trench and are designed to protect the workers, should a collapse occur, whereas shoring is designed to prevent the walls from collapsing.



Figure 3 Trench box (National Institute for Occupational Safety and Health/ Wikimedia Commons) Public Domain (https://en.wikipedia.org/wiki/public_domain).

Sloping

Sloping a trench creates a naturally stable slope, similar to that which loose excavated material forms when dumped on a level surface, known as the **angle of repose**. Unshored trench and excavation walls must be sloped flatter than the angle of repose, but in no case steeper than 3 horizontal to 4 vertical units unless otherwise specified in writing by a professional engineer (Figure 4).



Figure 4 Trench sloping (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

As demonstrated in Figure 5, sometimes a combination of sloping and shoring is used.

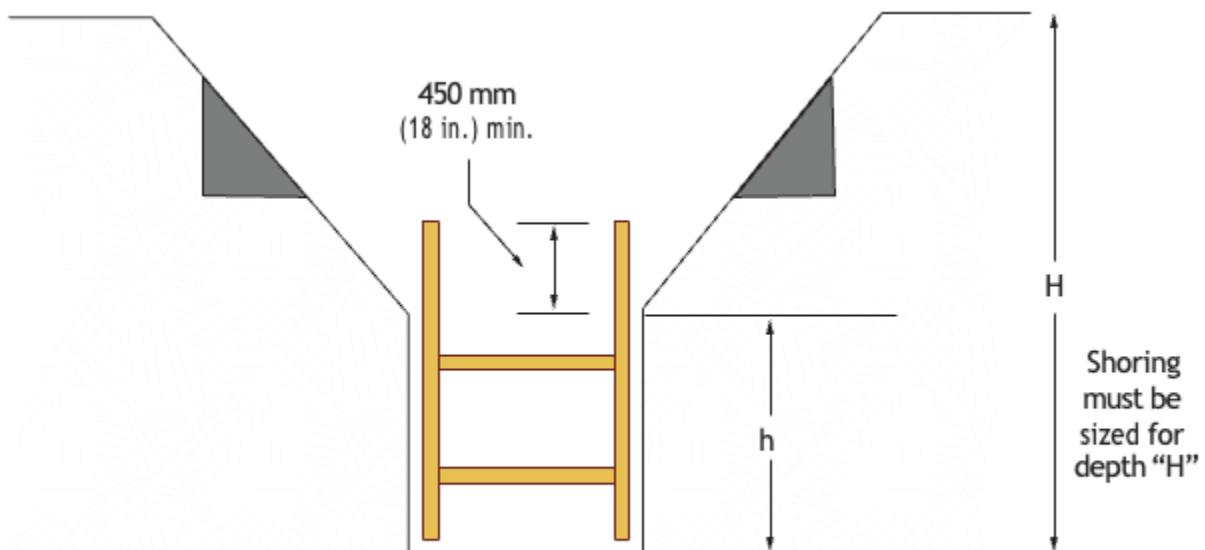


Figure 5 Combined sloping and shoring (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

Another method of sloping is called **benching**. All benched excavations 6.1 m (20 ft.) or less in depth shall have a maximum rise between benches of 1.2 m (4 ft.). For unrestricted worker access at any level, the width of the bench immediately above any particular rise shall not be less than 1.5 times the height of that rise. For example, in Figure 6 the minimum bench width for a 1.2 m (4 ft.) rise would be 1.8 m (6 ft.).

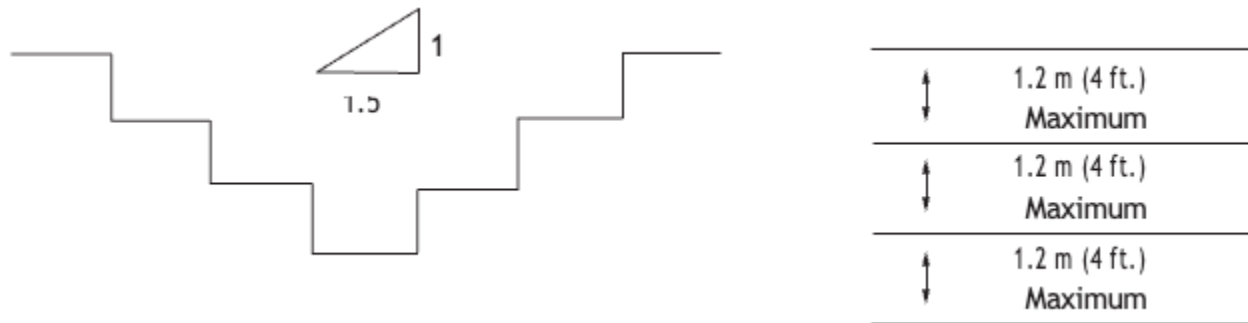


Figure 6 Benched excavation (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

Keep all piles of material and equipment at least two feet away from the edge of an excavation.

Loose rock, soil, materials and equipment on the face or near the excavation can fall or roll into the excavation, or overload and possibly collapse the excavation walls. When working in a trench, provide a safe means of access and egress for workers, such as a ladder, stairway, or ramp. Long trenches require multiple exit points.

Working Around Vehicles and Heavy Equipment

Workers are often required to work near vehicles and mobile equipment. It is the workers' responsibility to keep out of the way. When working near moving vehicles and equipment, workers should:

- Stay alert at all times and keep a safe distance.
- Stay out of the circle formed by the extended bucket of an excavator (swing).
- Never get into blind spots of operators.
- Maintain eye contact with the operator.
- Never stand under loads handled by lifting or digging equipment, or near vehicles being loaded or unloaded.
- Wear reflective or high-visibility vests, hard hats, steel-toed boots, and appropriate hearing protection while working near equipment.
- Alert the operator of any impending hazards, electrical wires, gas lines, sewer or water lines, etc.

Elevated Work



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Working in elevated situations can be very dangerous. Falls from elevated areas are one of the leading causes of fatalities among workers. While the risk of falls is high, there is much you can do to protect yourself. Using the appropriate personal protective equipment (PPE), practising good housekeeping habits, and staying alert at all times will help you stay safe when working at elevations. In later sections, we will cover the OHS Regulation related to scaffolding and fall protection; it is important that you make yourself aware of this before proceeding to work at elevations.

Confined Spaces



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A work area that is not meant for human habitation, with limited access and **egress** (a way to exit) where there is a potential risk, is known as a **confined space**. A confined space can be any enclosed space where there is a risk of death or serious injury from hazardous substances or dangerous conditions (e.g., lack of oxygen). You must understand the hazards and safety precautions for working in confined spaces.

Some examples of confined spaces that are fairly easy to identify include:

- Storage tanks, silos, vessels and vats
- Manholes, sewers and ductwork
- Combustion chambers in furnaces, etc.
- Unventilated or poorly ventilated rooms

Some places must be assessed at their location as confined spaces. It is not possible to provide a comprehensive detailed list of confined spaces, though many of the dangers associated with confined spaces are listed below:

- A lack of oxygen can occur due to a process or reaction.
- Poisonous gas, fumes or vapour can build up in sewers and manholes or enter tanks and vessels from connecting pipes.
- Liquids and solids can suddenly fill the space.
- Free-flowing solids such as grain can form a solid section and then suddenly collapse.
- Flammable vapours or residues left in tanks or vessels can explode or catch fire.
- Dust may be present in high concentrations in flour or grain silos.
- Hot conditions can lead to a dangerous increase in body temperature.

Video and Safety Materials: Confined Spaces

- Review the WorkSafeBC website for the most current information: Hazards of Confined Spaces (<https://www.worksafebc.com/en/resources/health-safety/books-guides/hazards-of-confined-spaces>)
- Refer to the Occupational Health & Safety Regulation, Part 9.1 [online]: Confined Spaces Definitions (<https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-09-confined-spaces>)
- Watch the video, *Confined Spaces: Safe Yesterday, Deadly Today* [3.25] by WorkSafeBC (2008) on YouTube.



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Electrical Hazards



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No matter what your trade, many jobs will require you to use or work around electrical equipment. Extension cords, power tools, and portable lights are among the many pieces of equipment that use electricity.

There are different types of electrical accidents, including:

- Burns
- Electric shock
- Explosions
- Falls caused by electric shock
- Fires



While the human body is a conductor of electricity, it is not a good one. Burns caused by electric shock are a result of

the heat caused by resistance to electrical current. Electrical burns often occur below the skin surface and can damage muscle and nerve tissue. In severe cases, electrical burns can be fatal.

The extent of injury due to electric shock depends on a combination of voltage and current and the body's resistance to the electricity passing through it—a condition that changes from person to person. An electric shock occurs when you become part of the electrical circuit; that is you contact a live portion of a circuit while in also in contact with a lower potential such as ground.

Even though you may normally deal with small voltages and current, the values are never far away from lethal levels. You can receive a shock or burn from any common electrical circuit. The severity of the electrical shock depends on a number of factors:

- The amount of current that passes through the body
- The path that the current takes through the body
- Type of voltage—AC or DC
- Voltage strength
- The length of time that the current flows within the body
- Condition of the skin and the body's chemical make-up
- Area of contact

Normal household current (plugs and light circuits) is generally limited by a **circuit breaker** to a value of 15 amperes. This device has been designed to trip and open a circuit if the 15-ampere value is exceeded and is designed to protect against property damage. It is possible to cause a fatal injury with a current flow of only 50 milliamperes (mA) or 5 one-hundredths of an ampere. The body is sensitive to relatively small values of current. In comparison, a 100-watt light bulb draws approximately 0.85 amperes (850 mA) of current when connected to a 120-volt source. Remember, we have 15 amperes available in each standard house circuit. Industrial circuits may have a required flow of several hundred amperes. In both cases, these are dangerous amounts!

Most fatal shocks occur when current passes through or near the heart. This is possible if the circuit passes from one arm to the other, from the right arm to the left leg, or from the left arm to the right leg. Figure 7 lists the effects of increasing amounts of current on the human body.

Table 1: Effects of Alternating Electric Current on the Human Body

Amount of Current	Effect
1 mA or less	No noticeable feeling experienced.
1–3 mA	Shock is just felt.
3–10 mA	Shock is painful. Individual can still use motor functions. Muscular control is not lost.
10–20 mA	Some individuals will experience a loss of voluntary muscular control.
20–50 mA	Individual cannot let go of the circuit. Breathing may become difficult.
50–200 mA	Ventricular fibrillation of the heart may occur, causing death. Severe muscular contraction and nerve damage are possible.
Over 200 mA	Heart paralysis may occur. Severe burns are possible.

Rescuing Shock Victims: First Aid for Electrical Shock Victims

Consult your employer's first aid attendant or medical personnel on acceptable procedures for dealing with local electrical shock emergencies. The most important things to know about assisting an electrical shock victim are listed below:

- Do not touch a victim who is still connected to the power source. If you touch a victim who is in contact with an electrical source, you will become part of the circuit too, resulting in another casualty.
- Safely remove the power from the victim.
- If you cannot de-energize the circuit, separate the victim from the live circuit by using a piece of non-conductive material such as a stick of lumber or wooden handle.
- If the shock victim is unconscious and has stopped breathing, start artificial respiration at once. Do not stop until a medical authority instructs you to stop.

Lockout and Tagout (LOTO)



Lockout tongs (Wtshymanski (<https://commons.wikimedia.org/wiki/User:Wtshymanski>)/Wikimedia Commons) CC BY-SA 4.0 (<https://creativecommons.org/licenses/by-sa/4.0/deed.en>)

A lockout or tagout system (LOTO) is designed to protect workers from hazardous energy while they work with machines or equipment. As the name implies, a lockout procedure systematically uses locking devices to completely secure equipment that controls or represent a hazard. It also ensures that equipment is de-energized before being maintained or repaired.

Energy sources can include:

- Hydraulic or pneumatic energy
- Mechanical and kinetic energy

- Gravitational and potential energy
- Electrical energy

The following assumptions are **unacceptable** where safety is concerned:

- It is not enough to simply throw a switch and start work.
- It is not enough to hang a “do not use” sign on a machine.
- It is not enough to tell everyone not to turn on the power.
- It is not enough to have everyone assure you that no one will activate the power.



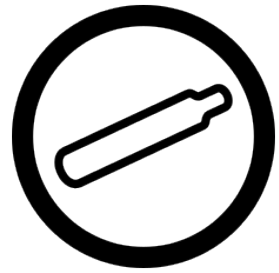
Specific lockout procedures will be covered in Section A-1.7 (#chapter-a-1-7-describe-lockout-and-tagout-procedures).

Compressed Gas



*Danger Compressed Gas (Bigguy637/
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Compressed air is used in shops and on-site for operating nailers, staplers, impact tools, equipment, and paint sprayers. However, cleaning objects, machinery, bench tops, clothing, and other items with compressed air is dangerous. Injuries can be caused by the air jet and by particles made airborne. If compressed air must be used to clean equipment, the nozzle pressure must remain below 10 psi (69 or 70 kPa) and personal protective equipment (PPE) must be worn to protect the worker's body, especially the eyes, against particles and dust under pressure.



Compressed air must never be used to clean yourself or clothing unless specifically designed for that purpose.



Figure 8 Do not clean yourself with compressed air (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

Compressed gases are often supplied to the job site in pressurized cylinders. Extreme caution should be used when working with these cylinders, as a damaged cylinder is an explosion hazard. A screw-on protective cap protects the cylinder valve. The cylinders and protective caps are usually black, although green and other colours are also used. The caps have right-hand threads (like all oxygen fittings) and come in various sizes to match the cylinders.

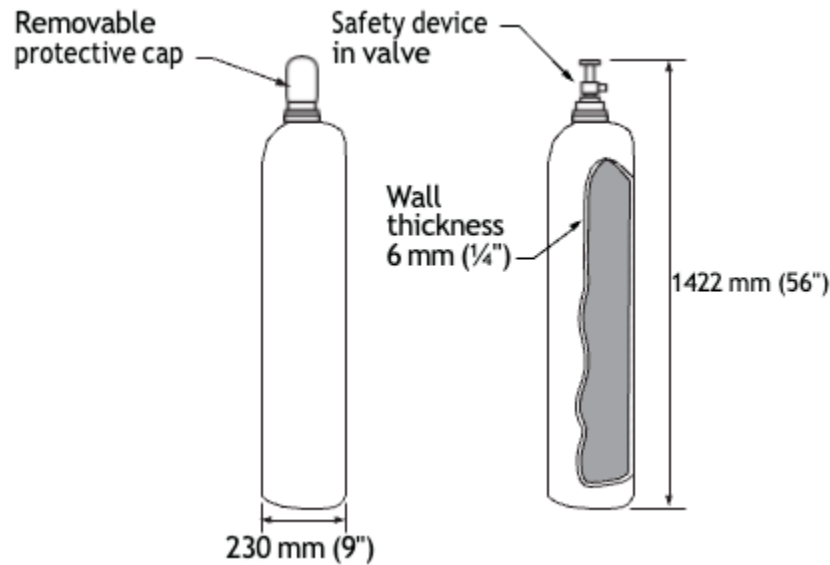


Figure 9 Pressurized cylinder (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)



The following safety procedures must be observed:

- Do not accept or use any compressed gas cylinder that does not have proper identification of contents.
- Always treat cylinders as if they are full, and handle accordingly.
- Never drop cylinders or let them strike each other violently.
- Protect cylinders and any related piping and fittings against damage.
- Do not use slings or magnets for hoisting cylinders.
- Transport cylinders securely on a hand truck whenever possible. NEVER drag them.
- Secure transported cylinders to a suitable cradle or platform to prevent movement or upset.
- Chalk "EMPTY" or "MT" on cylinders that are empty. Close valves and replace protective caps.
- For detailed handling procedures, consult the manufacturer, the supplier and the MSDS.

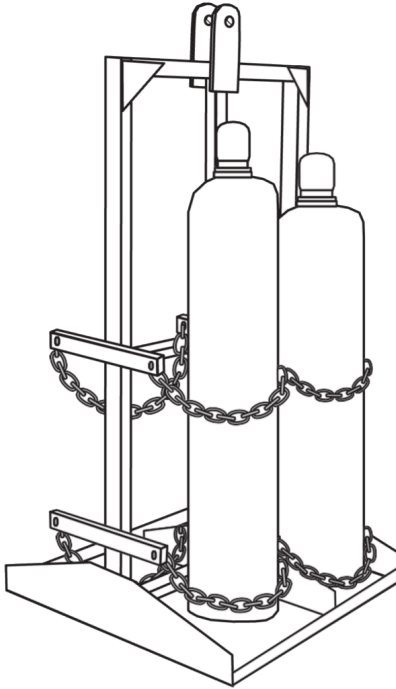


Figure 10 Oxyacetylene cart with lifting eye (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

Storing Cylinders



Compressed gas bottles (Ildar Sagdejev (Specious)/Wikimedia Commons) CC BY-SA 4.0 (<https://creativecommons.org/licenses/by-sa/4.0/deed.en>)

These safety measures must be observed when storing gas cylinders:

- Store cylinders upright in a safe, dry, well-ventilated location that is maintained specifically for this purpose.
- Never store different flammable and combustible materials such as oil and gasoline in the same area.
- Do not store cylinders near elevators, walkways, stairwells or exits, or in places where they could be damaged or knocked over.
- Do not store oxygen cylinders within 6 m (20 ft.) of cylinders containing flammable gases unless they are separated by a partition at least 1.5 m (5 ft.) high that has a fire- resistance rating of at least 30 minutes.
- Store empty and full cylinders separately.
- Prohibit smoking in the storage area.

Weather

Many jobs require that you work outside. Since work often continues during periods of hot, cold, and wet weather, you need to understand the hazards associated with weather and be properly prepared.

Cold Weather

When working outdoors during winter, workers need to protect themselves against loss of body heat. When your body temperature drops even a few degrees below normal, you can begin to shiver uncontrollably and become weak, drowsy, disoriented, unconscious, or even fatally ill.

Hypothermia is the condition in which your body loses heat at a rate greater than you are able to produce it.

Cold temperatures, wind, poorly insulated or wet clothing, immersion in water, and fatigue are some of the main factors that contribute to hypothermia.

The following guidelines can help you keep your body warm and avoid hypothermia, frostbite, and overexposure to the cold:

- Properly insulated headgear, footwear, and gloves are important. Heat loss is greatest from the head. Dress in layers.
- Wind causes cooling or “wind chill.” The stronger the wind at a given temperature, the cooler the wind chill will be.
- Water chills your body far more rapidly than air or wind. When working outdoors, always have proper waterproof clothing and extra dry clothes available.
- Even on a very cold day, strenuous activities can cause you to perspire. When you slow down to a normal pace, this moisture will add to the chilling effect.
- Cold-water immersion speeds up the process of cooling down the body. When you’re in the water, heat is conducted away from the body 25 times faster than in cold air. Severe hypothermia can develop rapidly if you are immersed in cold water without the protection of survival gear.

Hypothermia Danger Signs

The effects of hypothermia can be gradual and often go unnoticed until it's too late. Early intervention is very important. Work with a buddy. Always stay on the lookout for early signs of hypothermia in both yourself and your buddy.

Classic signs of hypothermia are known as the “*umbles*”: a worker mumbles, fumbles and stumbles. Other additional signs of hypothermia are:

- A drop in body temperature.
- Fatigue or drowsiness.
- Uncontrollable shivering.

Heat Stress

Heat stress occurs when abnormally hot air, humidity or extremely heavy exertion prevents your body from cooling itself fast enough.

Avoid heat stress through the following preventive measures:

- Drink plenty of water and avoid very cold water.
- Avoid alcoholic or caffeinated drinks; coffee and tea are diuretics.
- Do not overexert yourself.
- Wear lightweight, light-coloured clothing of natural material.
- Keep your head covered and face shaded.
- Wear loose-fitting clothing, so long as it doesn't create a hazard.
- Take frequent short breaks.
- Rest in the shade whenever possible.

Heat Exhaustion

Heat exhaustion usually occurs when people exercise heavily or work in warm, humid places where bodily fluids are lost through heavy sweating. When humidity is high, your sweat does not evaporate fast enough to cool your body.

Symptoms of heat exhaustion may include:

- Fatigue
- Irritability
- Headache
- Faintness
- Weak, rapid pulse
- Shallow breathing
- Cold, clammy skin
- Profuse perspiration

Treatment for heat exhaustion is as follows:

- Ask the person to lie down in a cool, shaded area or air-conditioned room.
- Elevate the feet. Massage the legs toward the heart. Give cold salt water ($\frac{1}{2}$ teaspoon to $\frac{1}{2}$ a glass of water) or a cool sweetened drink every 15 minutes until the victim recovers. Do not let the victim sit up, even after they feel recovered.

Heat Stroke

Heat exhaustion is often misinterpreted as heat stroke. Symptoms of heat stroke may include:

- Extremely high body temperature (106°F or higher)
- Hot, red, dry skin
- Absence of sweating
- Rapid pulse
- Convulsions
- Unconsciousness



Heat stroke is a life-threatening emergency—get immediate medical attention!

Treatment for heat stroke is as follows:

- Remove the victim from the heat.
- Have the victim lie down.
- Move all nearby objects, as heat stroke may cause convulsions or seizures.
- Lower the victim's body temperature quickly. This can be done by fanning; spraying with a cool mist; wrapping the victim in cold, wet sheets; or wiping with a wet cloth until the body temperature is reduced. Do not give stimulating beverages such as coffee, tea or soda. If available, a partially filled tub of cool water works best.



Self-Test A-1.2: Describe Short-Term Hazards in the Trades

Complete Self-Test A-1.2 and check your answers.

If you are using a printed copy, please find Self-Test A-1.2 and Answer Key at the end of this section. If you prefer, you can scan the QR code with your digital device to go directly to the interactive Self-Test.



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WorkSafeBC. (2008, September 9). *Confined spaces: Safe yesterday, deadly today* [Video]. YouTube. <https://www.youtube.com/watch?v=rUM7tnYcOjQ>

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A-1.3 Describe Long-term Hazards in the Trades

Long-term hazards may be described in two different ways:

- Hazards that don't result in injuries that have immediate effects
- Hazards which, through extended exposure, cause negative health effects such as respiratory diseases, repetitive strain injuries, skin diseases or hearing loss.



Airborne Hazards

Some job tasks may expose you to dust or gases which are **airborne hazards** that can make you sick or damage your lungs if you breathe them in. These materials can enter the bloodstream and travel to other parts of your body as well. If there is a hazard of airborne material in the workplace, conduct a risk assessment and, if necessary, implement an exposure-control plan.

Dusts



Road covered with dust (PickPik) Terms of Service
(<https://www.pickpik.com/terms-of-service>)

Health hazards are not limited to hazardous materials. For example, inhaling wood dust without proper protection can cause permanent lung damage even though wood is not a hazardous material. **Dusts** are fine particles that can remain suspended in the air and are less than 10 micrometers in size. Typical dust masks remove 95% of particles 0.3 microns in size or larger.

When hazardous dusts are present in the workplace, WorkSafeBC recommends taking the following actions (in order of importance):

- Control the production of hazardous dust by changing the process that produces it.
- If the process cannot be changed, install adequate ventilation to control the dust.
- If the dust cannot be controlled, restrict access to the area where the dust is present.

- If workers are required to work in areas where hazardous dust is present, they must wear appropriate personal protection. The use of an appropriate respirator for the conditions will ensure the worker's safety.

The above actions are ordered by level of long-term safety for the workers. Simple dust masks are not adequate to prevent injury from hazardous dusts. Use respirator-type masks with double head straps suited to the type of dust.

See the Section A-4: Describe Personal Safety Practices (#part-a-4-personal-safety-practices), for more information on respirators.

Airborne Fibres

Particles classed as **airborne fibres** are larger than particles in the “dust” class. Both dusts and fibres are carried in the air. Airborne fibres can be even more dangerous than the finest dusts. The composition of the fibres is the factor that determines the hazard—fibres from wood are irritants, while asbestos fibres are linked to lung cancer.

Asbestos



Asbestos by (Strange Happenings/Unsplash) Unsplash License
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Asbestos is a fibrous material that was used in many products up until the late 1980s because it added strength, heat resistance, and chemical resistance. During the past 20 years, exposure to asbestos is more common when old asbestos is removed or otherwise disturbed, rather than situations where new asbestos is installed. Workers repairing or renovating an old building may be at risk of exposure to asbestos used in the construction of that building.

Asbestos is a very hazardous material and requires extreme safety precautions. Its fibres are extremely fine and can stay in the air for hours. Workers exposed to asbestos-contaminated air can inhale these fibres. If handled without caution, asbestos can cause the serious condition known as **asbestosis**.

Asbestosis is a chronic lung disease resulting from prolonged exposure to asbestos fibres. The fibres gradually cause the lung to become scarred and stiff, making breathing difficult. Lung cancer may be caused by asbestos fibres in the lung.

For more information on working safely around asbestos, see the WorkSafeBC (2023) manual “Safe Work Practices for Handling Asbestos,” available at the website www.worksafebc.ca. (<http://www.worksafebc.ca/>)

Also watch Asbestos | WorkSafeBC [2:16] by WorkSafeBC (2009) on YouTube.



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If you are using a printed copy, you can scan the QR code with your digital device to go directly to the video:
WorkSafeBC video Asbestos (<https://youtu.be/jifoNSXvTuQ>)



Mould



Mould on concrete wall (fdplipe/FreeImages) Freeimages.com
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Mould can grow quickly on damp materials such as cardboard, paper, wood and drywall. As mould grows, it releases

spores into the air. Exposure to mould spores can affect your health, especially if you have allergies, asthma or a weak immune system.

Watch “Mould Exposure” [1:27] by WorkSafeBC (2010) on YouTube.



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Toxic Metals

The term **heavy metals** generally refers to the toxic metallic elements:

- Lead
- Mercury
- Arsenic
- Cadmium

These metals, or compounds containing these metals, tend to build up in the bodies of living organisms over a long period of time. Eventually the concentration of the metals reaches a point where they become toxic and pose a significant health hazard. These heavy metals can get into our bodies when we inhale contaminated dusts or ingest foods that have been exposed to or contain toxins.

Lead



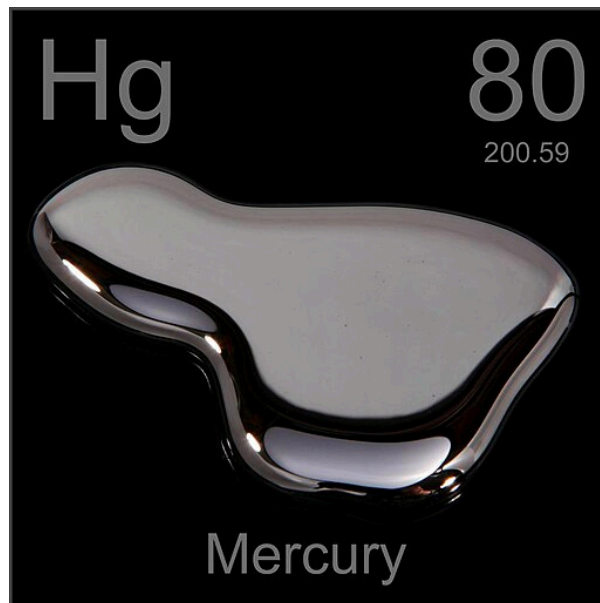
Lead (Chemical Elements – A Virtual Museum/Wikimedia Commons) CC BY 3.0 (<https://creativecommons.org/licenses/by/3.0/>)

Lead is a heavy metal occasionally found in old paint or plumbing solder. Sanding painted surfaces that contain lead produces airborne lead dust. Workers exposed to this dust risk inhaling it and may suffer from lead poisoning if proper safety precautions are not taken. Although lead has not been used in interior paints since the 1950s, refinishing lead-painted wood is still a significant hazard.

Symptoms of lead poisoning include:

- Digestive discomfort, constipation, anorexia, nausea
- Fatigue, weakness
- Personality change
- Headache
- Hearing loss
- Tremor, lack of coordination

Mercury



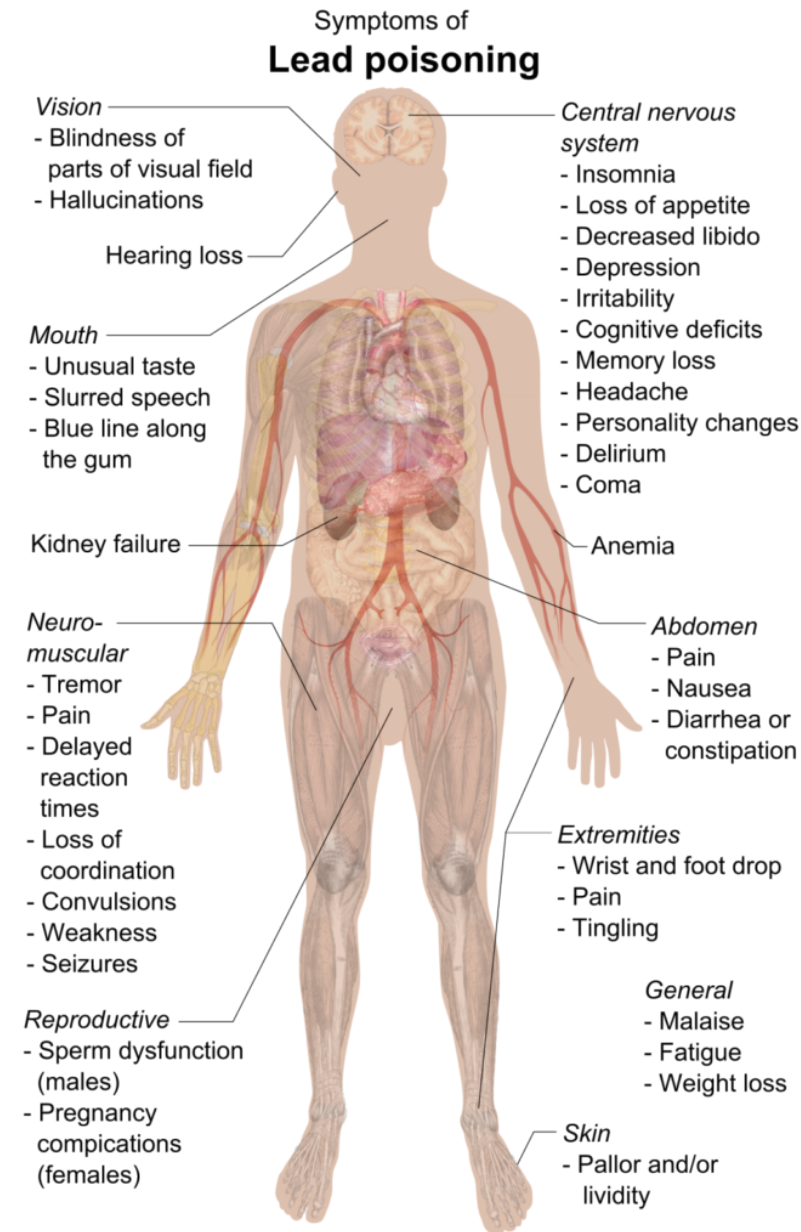
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Mercury is a heavy metal that was previously used in switches, fluorescent light bulbs, and many other applications. In 1990, elevated levels of mercury were found in persons exposed to interior latex (water-based) paint containing phenyl mercuric acetate, a preservative used to prolong the paint's shelf life.

Symptoms of mercury poisoning include:

- Muscle cramps or tremors
- Headache
- Intermittent fever
- Personality change

Regardless of whether paint is new or old, latex- or oil-based, always wear a respirator to prevent inhaling hazardous paint dust or vapours when sanding a painted surface.



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Arsenic



Arsenic (James St. John (<https://www.flickr.com/photos/jsjgeology/>)/Flickr) CC BY 2.0 (<https://creativecommons.org/licenses/by/2.0/deed.en>)

Arsenic is a heavy metal used in wood preservatives. Workers who are in contact with wood preservatives or pre-treated wood must follow the precautions outlined for the product.

Cadmium



Cadmium (https://commons.wikimedia.org/wiki/File:Cadmium_%28Element_-_48%29_3.jpg) by (James St. John/Wikimedia Commons) CC BY 2.0 (<https://creativecommons.org/licenses/by/2.0/deed.en>)

Nickel cadmium (NiCad) batteries contain **cadmium**, a highly toxic heavy metal. Always read manufacturer's instructions when charging and disposing of NiCad batteries. As long as NiCad batteries are kept sealed and are never short-circuited or severely overcharged, they are perfectly safe to use and do not vent toxic material.

Cadmium can also be found in older brazing material and stainless steel electrodes.

Vapours and Gases

A **gas** is a low-density chemical compound that normally fills the space in which it is released. It has no physical shape or form. **Vapour** is a gas produced by evaporation. Workplace tasks can produce several hazardous vapours and gases. Ultraviolet radiation, surface coatings, shielding gases, and welding electrode coatings are some sources of vapours and gases.

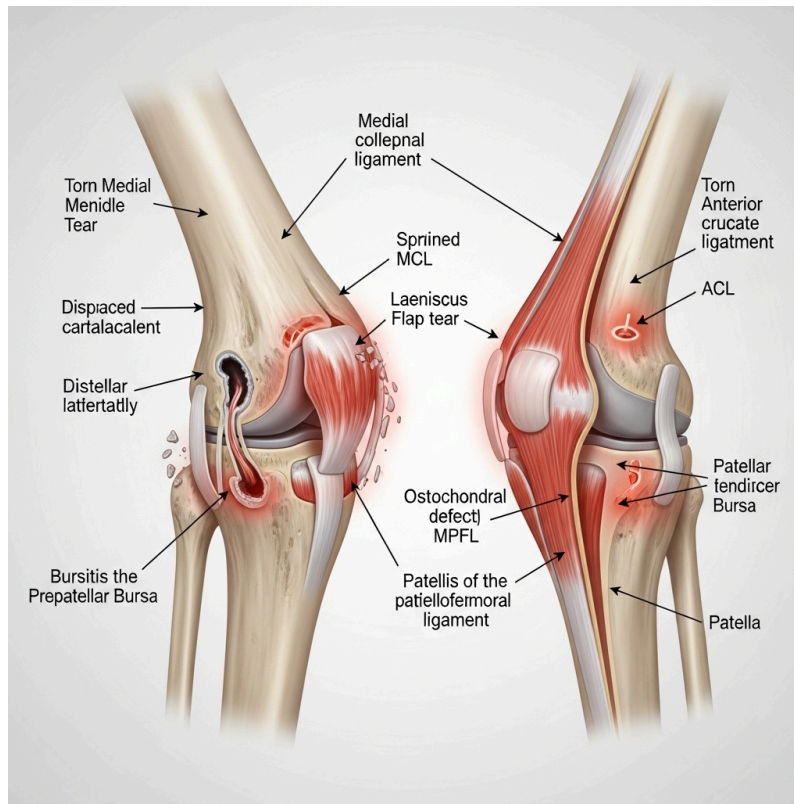
Off-Gassing



New car (pxhere) CC0 Public Domain (<https://creativecommons.org/publicdomain/zero/1.0/>)

Off-gassing is the release of chemicals from non-metallic substances. As an example, off-gassing is responsible for the distinctive “new car smell” in new automobiles. Anytime there’s an odour from a substance, that’s off-gassing. However, some off-gassing is odourless, which makes detection difficult. Many new construction materials have an off-gassing period in which they emit **volatile organic compounds (VOCs)**. VOCs are chemicals that often come from various household products like paints, lacquer, printers, pesticides, cleaning supplies, carpets and adhesives. VOCs are known to cause nose and throat irritation, headaches, nausea and even damage to the central nervous system. You should always increase ventilation during the period of VOC off-gassing and consider using an air purifier.

Musculoskeletal Injury



Detailed Anatomy of Knee Musculoskeletal Injuries (easy-peasy.ai) License
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Some of the tasks you will perform at work—such as lifting, reaching and repeating the same movements—can strain your body. These tasks can result in injury to the muscles, tendons, ligaments, nerves, blood vessels and joints of the neck, shoulders, arms, wrists, legs and back. These injuries are called **musculoskeletal injuries (MSI)**, or repetitive strain injuries (RSI), and typically result from overexertion or repetitive motion.

Watch “Carpal Tunnel Syndrome | WorkSafeBC” [1:49] by WorkSafeBC (2009).



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Occupational Skin Diseases



Hands and wrists showing industrial contact dermatitis due to long-term exposure to a solvent (kerosene). (National Institute for Occupational Safety and Health (NIOSH)-USA/Wikimedia Commons) Public Domain (https://en.wikipedia.org/wiki/public_domain)

Skin is susceptible to dermatitis caused by exposure to chemicals that strip oils from the skin. To prevent this condition, you must minimize contact with these chemicals. Occupational allergic contact dermatitis can be avoided by personal hygiene, engineering control methods, good housekeeping and personal protection. Personal hygiene—including hand washing—is very important to prevent contact dermatitis, but workers should be aware that excessive hand washing with soap and detergents can also damage the skin.

Hearing Loss

Exposure to loud noise over a long period of time can cause hearing loss, even if the noise is not loud enough to cause pain. Earplugs or earmuffs shall be worn in any shop or job site where the general or steady-state noise level exceeds 85 decibels. Basically, if you have to raise your voice to be heard by someone who is less than two feet away, you need to be wearing hearing protection.

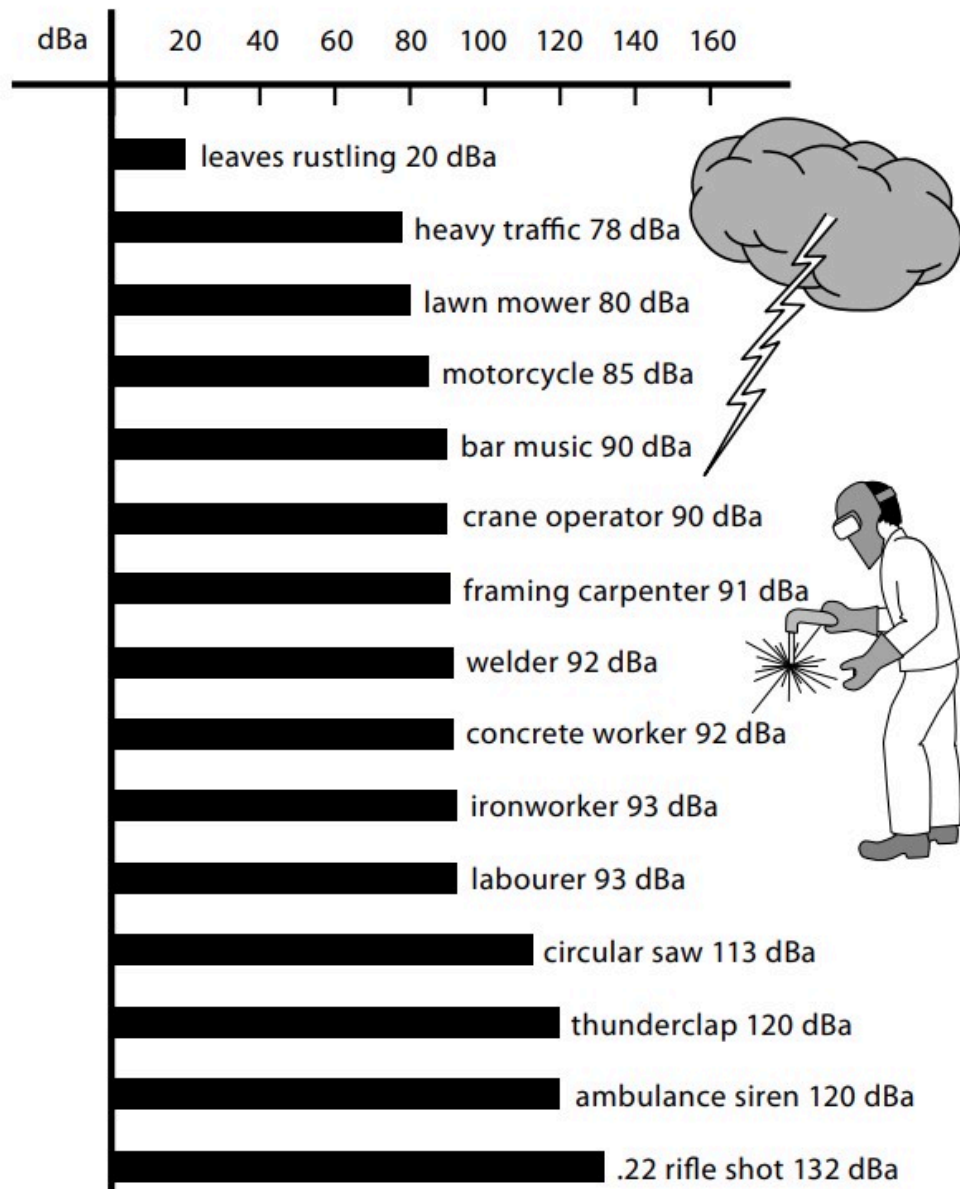


Figure 1 Noise levels (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)



Self-Test A-1.3: Describe Long-term Hazards in the Trades

Complete Self-Test A-1.3 and check your answers.

If you are using a printed copy, please find Self-Test A-1.3 and Answer Key at the end of this section. If you prefer, you can scan the QR code with your digital device to go directly to the interactive Self-Test.



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A-1.4 Describe General Safety Precautions and Procedures

Safety is the most important part of every job in the piping trades. Before any work begins, you must understand the potential hazards of the job site and the procedures that keep everyone safe. Every worker has the right and responsibility to receive a proper **safety orientation** before starting work. This orientation ensures you know where to go, what to do, and who to contact in an emergency.

Before you start working at a new job or a new work site, make sure you are given basic safety information. This basic information should include at least the following:

- A guided tour of the work area.
- A thorough explanation of your responsibilities.
- The location of first aid equipment and personnel.
- The location of emergency equipment.
- Personal protective equipment, if required.
- The method of reporting injuries.
- Plant safety rules.
- Plant safety training/orientation.
- Muster points/evacuation procedures.

Housekeeping

Good **housekeeping** is a necessity for a safe job site. Some good housekeeping procedures are:

- Do not block exits.
- Change burned-out light fixtures in work areas, walkways, and exits.
- Keep floors and work areas clean and dry.
- Organize materials, equipment, and tools.
- Keep steps and ladders in serviceable condition.
- Keep emergency equipment clean and unobstructed.
- Ensure that all signs and caution labels are in good condition and visible.
- Put waste products into properly labelled containers.

Safety Awareness

Being constantly aware of conditions that affect health and maintaining a safe working environment is the responsibility of all workers. You must be completely alert when you move about the job site and must have a constant **safety awareness** of your surroundings.

This should include:

- Identifying and fixing potential safety problems.
- Performing day-to-day work using the proper safety equipment.
- Checking the condition or operation of safety equipment and tools regularly.
- Identifying safety problems and unsafe work practices.
- Performing tasks safely to avoid danger to yourself or co-workers.
- Warning co-workers of potential hazards.

Horseplay

Horseplay, fighting, or practical jokes are inappropriate behaviours for a job site as they can be extremely dangerous and cause injuries.



Failure to follow known safety procedures or knowingly allowing uncontrolled hazardous situations to develop are safety violations with potentially serious consequences, not the least of which could be losing your job.

Respect for Others' Safety

Every person has the right to work in a safe environment. Everyone must work in accordance with good safety practices as discussed, instructed, and posted. Every person must also refrain from any unsafe act that might endanger themselves or fellow workers.

Proximity Work

Proximity work is work being performed near a hazard, but not in direct contact with it. Proximity work requires extra caution and awareness of the nearby hazard. The hazard may be hot piping, energized electrical equipment, or running motors and machinery. There may be special clearance requirements that require barricades or having a monitor watch you to maintain safe working distances.

When working with a crane near high-voltage power lines, use extreme caution should be used. Although you are not the operator of the crane, you may be doing the rigging or handling the load that the crane lifts.

Keep your distance from power lines! The area surrounding every live power line is referred to as the **absolute limit of approach**. It is strictly forbidden to move any crane boom, load line, or load into this area unless the power line has been de-energized. There are no exceptions.

This absolute limit of approach varies according to local, provincial, state and federal laws as well as crane manufacturer's recommendation, but generally it is as shown in Figure 1.

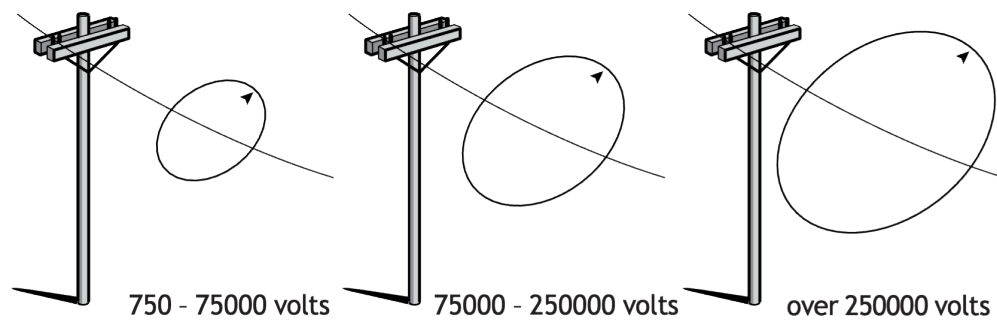


Figure 1 Limits of approach to power lines, according to voltage (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

Electrical Hazard Guidelines

In order to create a safe work environment, workers need to guard against contact with electrical voltages and control electrical currents. Make the environment safer by doing the following:

- Protect portable electrical equipment with an approved **ground fault circuit interrupter (GFCI)** when using the equipment outdoors.
- Ensure that all the cords are in good condition, with the caps and plugs well secured on the cables. Ensure the proper U-ground plug is in good working condition.
- Use cords of sufficient gauge for the amount of current used by the tools they are powering. Each tool is labelled with the power that it draws.
- Wear rubber boots when working in wet conditions and keep your feet dry.
- Tag any faulty tool that may result in a shock as “out of service.”
- Stay clear of overhead power lines and do not use ladders or long-handled paint rollers close to any electrical power line.
- Communicate with the electrician or power company to move or disconnect any cable you need moved or altered.
- Treat all conductors and bare wires—even apparently de-energized ones—as if they are energized until they are locked out and tagged.

Grounding Tools and Equipment

The WCB Occupational Health & Safety Regulation 19.15 Ground fault circuit interrupters (<https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-19-electrical-safety#SectionNumber:19.15>) requires that, when used outdoors or in a wet or damp location, portable electrical equipment, including temporary lighting, must be protected by an approved ground fault circuit interrupter (GFCI). Make sure that all the cords are in good condition, with the caps and plugs well secured on the cables.

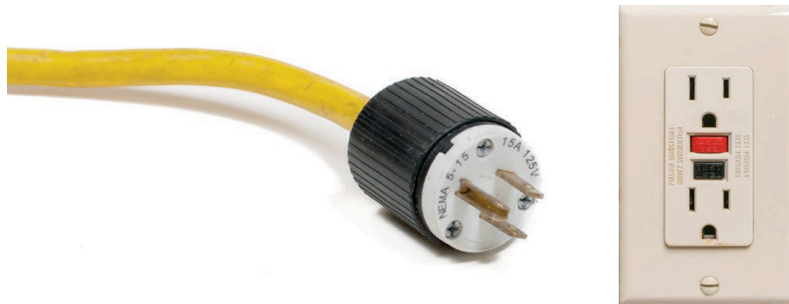


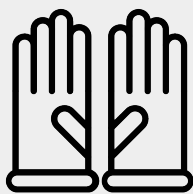
Figure 2 Grounded plug and socket (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

It is important that you use a three-wire cord and the proper U-ground prong on the cord. The third wire is connected to ground; therefore, the operator should not receive an electrical shock if the tool or equipment develops a short-circuit.

Double-insulated cords and tools are also effective in preventing shocks when using power tools. Before taking any electrical appliance or tool apart, lock out or disconnect the electrical power supply.

Tools

Think about safety before using any tool. Know how the tool works and some of the possible dangers of using it incorrectly. Make sure every tool you use is in good condition. Report any tool or piece of equipment that is broken or does not function properly to your immediate supervisor or tool crib attendant. Also, tag the equipment and remove it from service for repair or disposal.



Always protect yourself when you are using tools by wearing appropriate **personal protective equipment (PPE)**, such as safety gloves and eye protection.

Proper Tool Use

Only use tools for their intended function. Make sure the tool is the right size for the job. Do not modify or adapt a tool in a manner that might make it unsafe. Do not use power tools that haven't been tested and certified for use in Canada. Power tools must have a **Canadian testing certification label** (CSA, ULC).

General Hand Tool Safety

There are a number of general safety rules that you must follow when you use hand tools:

- Keep tools clean and in good working order. Wipe them with a light oil to prevent rusting.
- Never leave tools where they protrude or can fall and strike someone, particularly in an area where work is being done above ground level.
- Return tools to their proper place when not in use.
- Always wear safety goggles or a face shield to protect your eyes when using hand tools that may produce flying chips or particles, such as chisels and hammers.
- When using a sharp-edged tool, always cut away from the body.
- Make sure that all handles on tools (such as axes and hammers) are tight-fitting and adequately secured.
- Keep edge-cutting tools properly sharpened so that they do the job well and do not have to be forced because of dull edges.

General Power Tool Safety



Figure 3 Cutting iron with a metal cutting machine (byrev/rawpixel) CC0 license (<https://creativecommons.org/publicdomain/zero/1.0/>).

Be very careful when operating power tools and equipment. Before you attempt to operate any tool or piece of equipment, you must be fully trained by an experienced operator. Ensure that all guards are in place and function properly, and that all electrical connections are properly made.

Observe the following precautions when using equipment:

- Understand the correct operating procedures and safety precautions before operating a piece of equipment.
- Ensure that the tools are double insulated and properly **grounded**.
- Report defective or unsafe equipment to a responsible individual to prevent serious injury.
- Do not distract or interfere with the operator of a machine.
- Ensure that cords to electrically powered tools are in good condition, with no frayed parts or bare wires showing.

- Make sure all guards on tools such as saws and grinders are in place, function properly, and are not wedged open.
- Always keep long hair and beards confined and clothing snug to avoid snagging.



It is your responsibility to ensure that you are properly trained on a tool or piece of equipment. Remember: if you are not familiar with a piece of equipment, leave it alone!

Make sure that hand and power tools are inspected, serviced, repaired, sharpened or dressed to make them safe for use. Before using any tool, check the condition of all guards, tool retainers, power supply cords, extension cords, and other accessories. It is an unsafe practice to bypass, disconnect or remove guards, hoods or shields. Report any damage or defects and return the tool to the crib for tagout.

Always use the appropriate safety equipment to protect your eyes and face from flying particles during any drilling, grinding or buffing operations with an electric or pneumatic power tool (Figure 3).

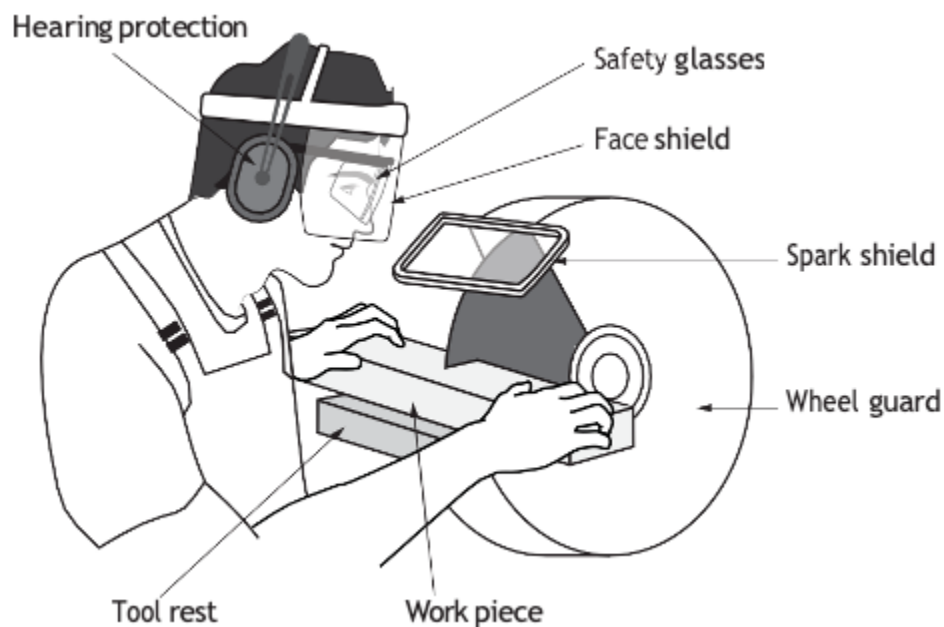


Figure 4 Use all safety devices (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

Ensure that the equipment or machine is free from obstruction and that all personnel are clear before the machinery is activated. Hold hand-held power tools firmly and with adequate control and assume a comfortable, balanced body position.

Possible injury comes from the functional or “working” part of the tool, which could be the drill, blade, disk, grinding wheel or other device. Shut off machinery if you are leaving the immediate area. Always disconnect, unplug or lock

out equipment before changing saw blades or grinding wheels and before making major adjustments or performing preventive maintenance.

Allow revolving machinery to stop on its own before leaving it. Do not slow down or stop a machine with your hands. Before you begin adjusting or cleaning any machine, make sure it is stopped and LOTO or disconnected from the power source.

Some power tools have arbors (shafts or spindles) for mounting grinding wheels or other rotating tools. Always check to see that the wheel, blade or other rotating tool is securely mounted on the arbor.

The importance of using power tools safely cannot be overemphasized. The two general types of power tools that you will use are electrical and pneumatically powered tools.



Avoid the use of electrical equipment in wet locations. If you must use electrical equipment in wet areas, make sure that a ground fault circuit interruption device is installed for your protection.

Do not lift or move an electric tool by its power supply cord. Supply cords are easily damaged and malfunctions can result from improper handling. Always remove plugs by grasping the plug and pulling it straight out of the wall receptacle.

Portable pneumatic (air-powered) tools present some of the same hazards as electrically powered tools, plus some that are unique to pneumatic tools. For example, you can trip over air supply hoses just as you can trip over electric tool cords. If an air hose is cut, broken or disconnected while under pressure, it can whip about and strike or injure someone.

Route air hoses overhead or out of the way so that they are not a tripping hazard; do not allow them to lie where they may be cut or run over by vehicles. The air blowing free from a hose can also cause chips, dirt and debris to fly about, causing irritating or dangerous conditions for the eyes and lungs.

Never point an air tool (e.g., an air chisel) in the direction of another person, as the tool may fly out and strike them. Never use compressed air to clean your clothing or blow air at any part of your body or another person. Air penetrating your skin can enter your bloodstream and cause death.

Ventilation



Figure 5 Industrial Ventilation (Peter H/Pixabay) Content License
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The environment in which you work is very important. The air around you may be filled with smoke from soldering or welding, fumes from chemicals used for cleaning, or mist from cleaners or paint. The pollutants can be harmful to your health. Incomplete combustion from carbon-based fuels can produce carbon monoxide. WorkSafeBC lists occupational exposure limits (OEL) for carbon monoxide at 25 parts per million (ppm) for an average of over 8 hours and 100 PPM for a 15-minute exposure.

Adequate **ventilation** is defined as the use of air movement to:

- Reduce concentrations of airborne contaminants to below the acceptable limits in the worker's breathing zone and work area.
- Prevent the buildup of combustible gases and vapours.
- Prevent oxygen-deficient or oxygen-enriched atmospheres from forming.

Many types of ventilation equipment may be found in workplaces. Regardless of where you are working, it is important to become familiar with and to use the ventilation equipment or systems.

If you are going to be working in a small, enclosed area or in a shop where fumes or exhaust are a hazard, make sure that there is an extraction system and that it functions properly.

Screens

Safety screens provide protection for people working near or walking by grinding, cutting or welding. Screens are available for sale, ready to use, or they can be manufactured. Manufactured screens are often made from fire blanket material. WorkSafeBC addresses screens for arc welding. Screens used for that application shall have a non-reflective finish.



Figure 6 Welder with an orange screen

Working in a Confined Space



Figure 7 Stará Amatérská Cave – entrance from the Cigánský Sinkhole – descent of a caver. (Jiří Komárek/Wikimedia Commons) CC BY-SA 4.0 (<https://creativecommons.org/licenses/by-sa/4.0/deed.en>)

Confined space describes any enclosed temporary working area that has limited access and egress and is not made for continuous human occupancy. Systematic procedures must be followed for any worker to enter a confined space.

If entering a confined space is unavoidable, supervisors are given the responsibility to ensure that all the necessary precautions are taken; to check safety at each stage; to follow all written procedures; and to ensure that all workers are suited for the work and properly trained before they enter the confined space.

Mechanical and electrical isolation of equipment is essential if it could otherwise inadvertently operate or be operated.

If gas, fumes or vapours could enter the confined space, supply piping needs to physically isolate airborne hazards. In all cases, check to ensure effective isolation and ventilation.

You may be able to increase the number of openings and therefore improve ventilation. Mechanical ventilation may be necessary to ensure an adequate supply of fresh air. This is essential where portable gas cylinders and diesel-fuelled equipment are used inside the space because of the dangers from buildup of engine exhaust. Breathing apparatus must be made available if it is not possible to maintain adequate oxygen levels for confined space entry.



Warning: Carbon monoxide in the exhaust from gasoline-fuelled engines is so dangerous that use of such equipment in confined spaces should never be allowed.

Air testing of the environment is necessary to ensure that it is free from both toxic and flammable vapours and that it is fit to breathe.

A competent person should carry out testing using a suitable gas detector that is correctly calibrated. Where the risk assessment indicates that conditions may change—or as a further precaution—continue monitoring the air to detect any changes.

The provision for non-sparking tools and specially protected lighting is essential where flammable or potentially explosive atmospheres are likely. In certain confined spaces (e.g., inside metal tanks), suitable precautions to prevent electric shock include use of extra-low-voltage equipment (typically less than 30 V) and, where necessary, residual current devices such as ground fault circuit interrupters (GFCIs).

Immediate means of communication must be made available for workers in confined spaces to call the standby person, and the standby person must have a means to call rescue personnel.

A rescue team with properly trained personnel and a rescue plan must be in place before any worker is allowed to enter a confined space. All lifelines, harnesses and lifting equipment must be approved for the application, and the standby person must be able to use the equipment to lift the person from the confined space.



See the WorkSafeBC document “Confined Space Entry Program: A Reference Manual. (<http://www.worksafebc.com/en/resources/health-safety/books-guides/confined-space-entry-program-a-reference-manual>)”

Flammable Liquids

All **flammable liquids** are volatile by nature, but it's the liquid's vapours (combined with air), rather than the liquid itself, that ignite and burn. The rate of evaporation varies from one liquid to another and increases with temperature. Increased temperature also increases vapour production, which creates a more hazardous condition.

Preventive fire safety precautions will be covered in Section A-5 Fire Safety.

Weather

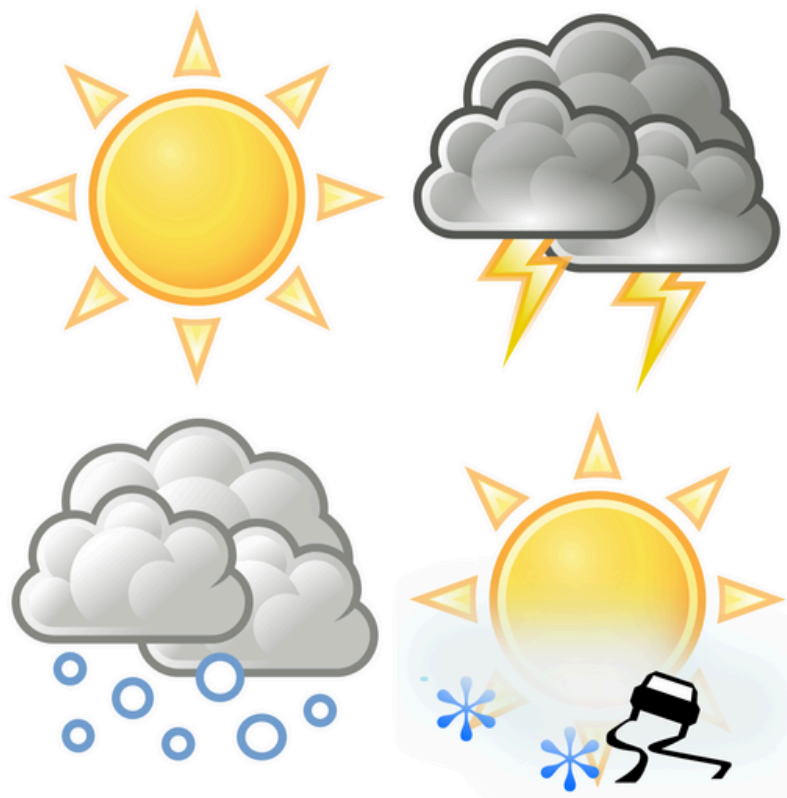


Figure 8 Weather symbols ([modified by Przykuta (<https://commons.wikimedia.org/wiki/User:Przykuta>)] The people from the Tango! project/Wikimedia Commons) CC BY-SA 3.0 (<https://creativecommons.org/licenses/by-sa/3.0/deed.en>)

Since tradespeople may have to work in poor weather, they must have adequate rain gear and warm clothing. Good rain gear is a necessity while working in areas where the annual rainfall is high. Keep the head, legs and feet dry because large amounts of body heat are lost from these areas. Ensure that rain gear will breathe so that perspiration is able to escape. Pants and jackets should be loose enough to allow full movement when working.

Rubber boots with steel toes and steel shanks are available to protect the feet. Use kneepads if the tasks require frequent kneeling. Not only do the pads protect knees, but they also help to keep them dry when ground conditions are wet.

Safety Precautions When Working at Elevations



Figure 9 Rope access painter (Alex Dos Santos/Pexels) Pexels license (<https://www.pexels.com/license/>).

Falls from elevated areas are one of the leading causes of fatalities in the workplace. While the risk of falls is high, there is much you can do to safeguard yourself. Following proper safety procedures and staying alert at all times will help you stay safe when working at an elevation.

Weather and Elevations

If your work area is exposed to the wind, construct a windbreak from plywood, polyethylene sheets or tarps. In high-rise

construction, it's common practice to provide a windbreak at each floor until the glazing has been completed. Strong winds can cause your body to lose heat much faster than if the air is still, so it's important to wear windproof clothing.

Snow and ice cause slips, trips, and falls. Remove snow and ice, if possible. Some areas can be treated with salt or snow melt; however, salt can damage some material, such as rebar, so it cannot be used everywhere. In the case of lightning, avoid working outside. Once inside, avoid metallic materials that may conduct electricity, such as pipes wires or conduits. If going inside is not an option, try to stay low and away from tall objects. Dry, low-lying areas are preferred when seeking shelter from lightning. Rain can cause standing water and can be uncomfortable to work in. Remove standing water, if possible, and wear appropriate clothes and footwear.

The sun can be another concern when working at elevations. Glare from directly facing the sun, or having it reflect off surfaces can be reduced by wearing darkened or tinted safety glasses.

Wall and Floor Openings

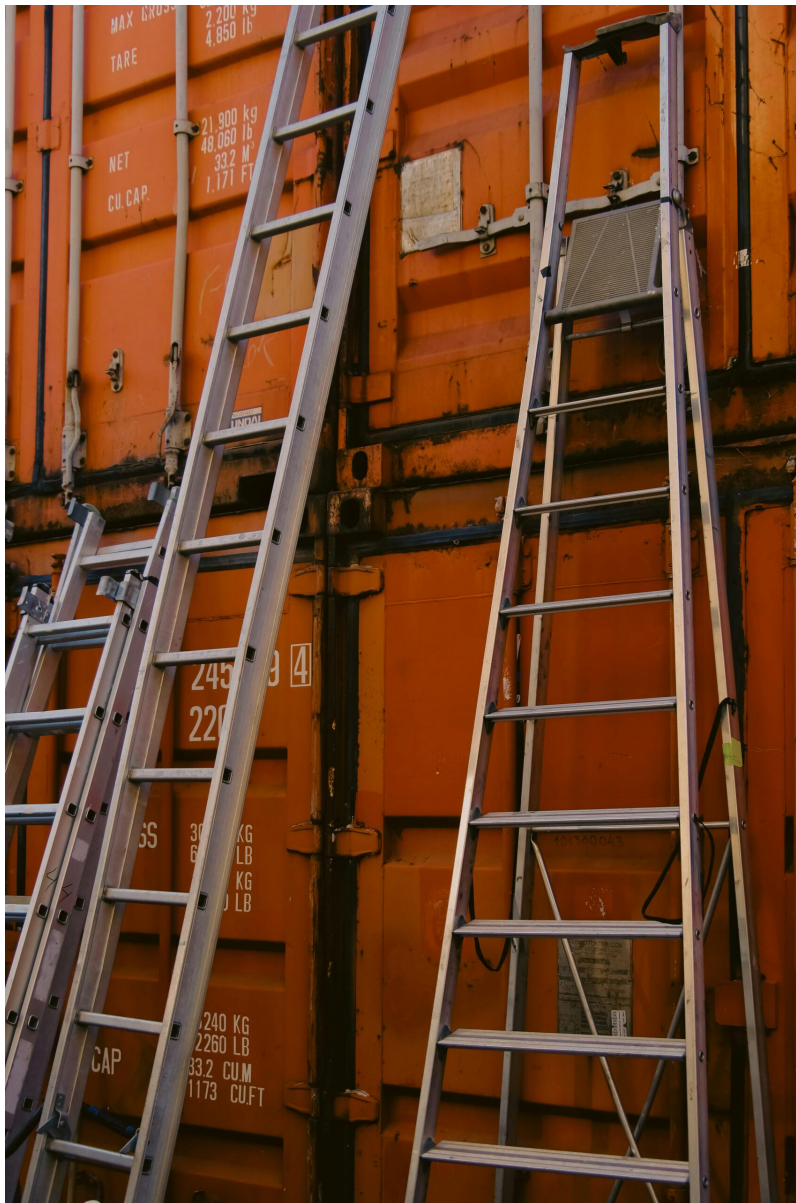
Any opening in a wall or floor is a safety hazard. For protection, openings can be either covered or guarded. Cover any hole whenever possible. When it is not practical to cover a hole, use barricades or guards. The types of guards and barricades used will vary from job to job.

There are different rules and procedures related to covering and guarding wall and floor openings. Use the WorkSafeBC regulations as a minimum guideline, but you will also need to become familiar with the policies on your job site.

Guards and Barriers

Except for work platforms (scaffolds) where fall protection is provided, guards are required whenever there is a drop of 1.22 m (4 ft.) or more. Guards and rails must be placed at stairways, openings in floors, and the edges of open floors. **Guardrails** consist of a top rail, a midrail, and a toe-board. The toe-board is to prevent tools and materials from dropping through the openings.

Ladders



Metal Ladders (Yulia Pribytkova/Pexels) Pexels license (<https://www.pexels.com/license/>).

Ladders are used to perform work in elevated locations. You may use ladders to do many jobs, and you must be familiar with the safe use of all types of ladders. Types of ladders and the proper use of each are covered below, and in more specific detail later in Section B-3.1 Use Access Equipment (<https://b-handmeasuringtools-bcplumbingappr1.pressbooks.tru.ca/chapter/b-3-1-describe-ladders-and-elevated-platforms/>).



Do not use metal ladders or wire-reinforced ladders near energized electrical equipment. Use fibreglass or unreinforced wood ladders where there are electrical hazards. Equipment that might be dangerous if contacted by a metal ladder includes junction boxes, fuse panels, overhead lines, and cable trays.

When climbing or working from a ladder, an important rule to protect yourself against a fall is to maintain three-point contact with the ladder at all times. This means that you either have two hands and one foot or two feet and one hand touching the ladder constantly.

The following precautions and procedures apply to all portable ladders:

- Inspect all portable ladders before use.
- Do not use ladders with loose, broken, or missing rungs, split side rails, or other dangerous defects.
- Make sure all parts or “members” of the aluminum ladder are straight, properly aligned, and not bent or damaged.
- Remove from use any aluminum ladder with bends, kinks, or other damage.
- Have damaged ladders repaired by an appropriate, reputable firm before putting them back into service.
- Use only transparent protective coatings or preservatives on wooden ladders, so that possible defects will remain visible on inspection (no paint).
- Never reach more than one arm’s length beyond the side of the ladder.
- Do not carry heavy or bulky items while going up or down ladders—maintain three points of contact.

Always face the ladder when climbing up or down. Ensure you only use ladders that:

- Bear the appropriate Canadian Standards Association (CSA) label.
- Are placed on a firm and level base.
- Are positioned so that the horizontal distance from the base to vertical plane of support follows the 1:4 ratio.
- Have sufficient length to project approximately 1 m (3 ft.) above the upper landing to which they provide access.
- Are secured when necessary to ensure stability during use.

Work Platforms

The term **work platforms** refers to a variety of different elevated or suspended work surfaces. This includes scaffolding and the more common **boom lift or scissor lift**. The chart in Figure 5 outlines the common types of work platforms.

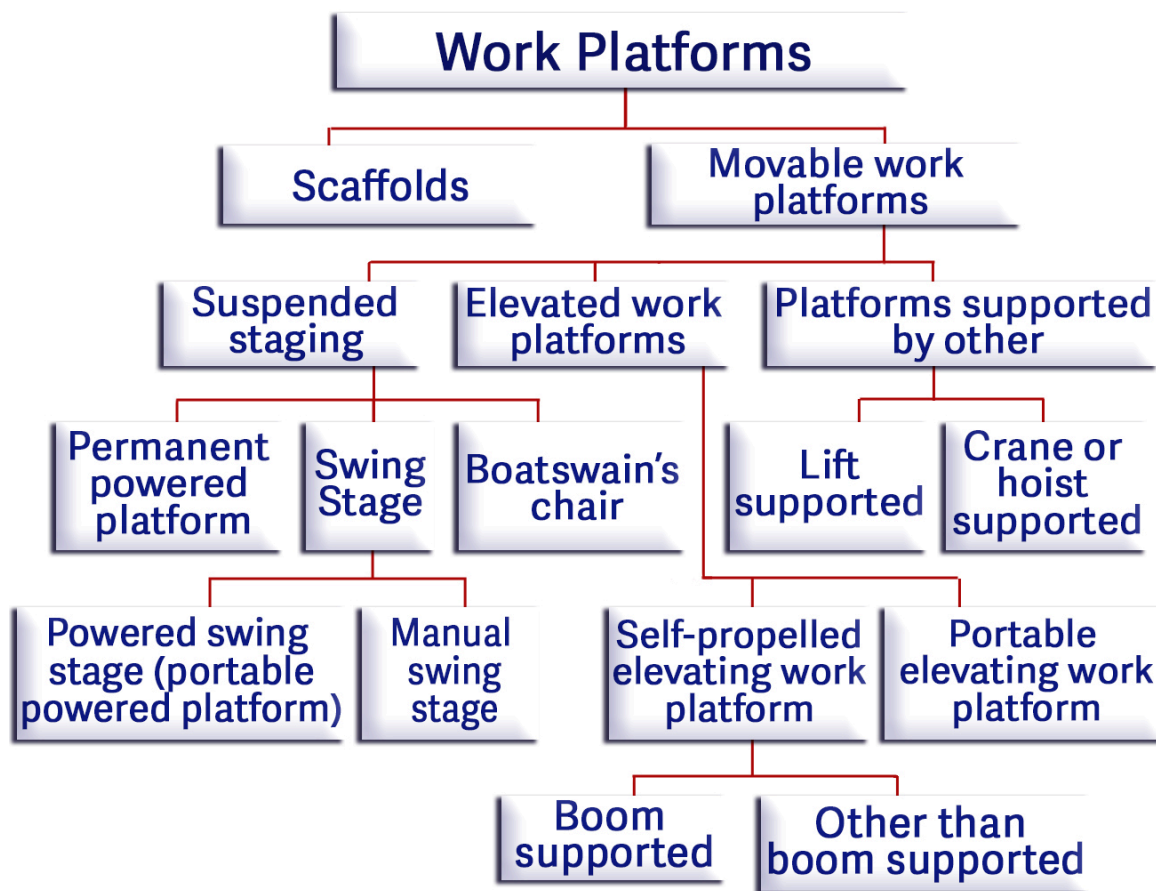


Figure 10 Work Platforms (Open Press; adapted from BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>) [Long Description (#fig5_longdesc)]

Guardrails

Temporary work platforms require guardrails where there is a drop of 3 m (10 ft.) or more. Guardrails consist of a top rail and a midrail. Toe-boards are also required in cases where materials or tools are placed on the work/travel surface and could fall off. The height of a guardrail should be between 1,020 and 1,120 mm (40–44 in.).

The midrail should be approximately halfway between the work or travel surface and the top rail. WorkSafeBC addresses guardrails in sections 4.54 (<https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-04-general-conditions#SectionNumber:4.54>) to 4.63 (<https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-04-general-conditions#SectionNumber:4.63>). Unless engineered, vertical posts must be a minimum 38 mm x 89mm (2" x 4" nominal lumber), and must be installed with the narrow dimension facing the open edge.



Figure 11 Guardrail and midrail (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)



Figure 12 Guardrail and midrail—close up. (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)



Guardrail construction requirements can be found in the WorkSafeBC OHS Regulation Part 4: General Conditions. (<https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-04-general-conditions>)



Self-Test A-1.4: Describe General Safety Precautions and Procedures

Complete Self-Test A-1.4 and check your answers.

If you are using a printed copy, please find Self-Test A-1.4 and Answer Key at the end of this section. If you prefer, you can scan the QR code with your digital device to go directly to the interactive Self-Test.



An interactive H5P element has been excluded from this version of the text. You can view it online here:
<https://a-safetyfunctions-bcplumbingappr1.pressbooks.tru.ca/?p=1207#h5p-7> (<https://a-safetyfunctions-bcplumbingappr1.pressbooks.tru.ca/?p=1207#h5p-7>)

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Long Description

Figure 5 Work Platforms [hierarchical diagram]

This diagram shows how **work platforms** are classified.

Work platforms are divided into **scaffolds** and **movable work platforms**.

Scaffolds include **suspended staging**, such as permanent powered platforms, swing stages, and boatswain's chairs. Swing stages may be powered or manual.

Movable work platforms include **elevating work platforms** and **platforms supported by other means**. Platforms supported by other means may be lift-supported or crane- or hoist-supported. Elevating work platforms may be self-propelled or portable, and self-propelled platforms may be boom-supported or supported by other designs.

Different types of work platforms have different risks and safety rules, so it is important to know which type you are using before starting work.

[Back to Figure 5]

A-1.5 Describe Emergency Equipment and Facilities

In any workplace, knowing where emergency equipment and facilities are located can make the difference between a minor incident and a serious injury. Before starting work, take time to learn where to find fire extinguishers, first aid stations, eye-wash stations, and emergency exits. Understanding these locations—and how to use the equipment properly—helps ensure quick and effective action in an emergency

Utilities

Each time you have a new work location, check the location of the shutoffs for all of the utilities; that way you will be prepared for an emergency. Before you perform any trench work with power tools or equipment, you must locate any possible underground utility services.

Watch the following video by WorkSafeBC (2010) on YouTube titled “Excavations: Pre-Excavation Requirements (3 of 6)” [2:12].



One or more interactive elements has been excluded from this version of the text. You can view them online here:
[#https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/?p=1209#oembed-1](https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/?p=1209#oembed-1) (#oembed-1)

If you are using a printed copy, you can scan the QR code with your digital device to go directly to the video:
Pre-excavation requirements (<https://www.youtube.com/watch?v=vagy1JPm0kk>)



Electrical



Figure 1 Indoor electrical panel (Kleison Leopoldino/Pexels) Pexels License (<https://www.pexels.com/license/>).

Electrical service panels may be temporary or permanent. Temporary service panels at the job site are located in a box mounted on a large pole or post driven into the ground. Inside the box is a panel with breakers and outlets to supply electrical power to the site. It should contain a main shutoff switch at the top and have several breakers that can be tripped when the circuit is overloaded by too many power tools on one circuit. The electrical panel must be properly grounded with ground rods/plates, according to the Canadian Electrical Code. The box must be waterproof and leak-proof, and the area in front of the box must be kept clear. Water must not be allowed to accumulate underfoot anywhere near the panel.

Electrical cords from the panel should be orderly and not allowed to become tangled. The box should be located at a convenient height so that workers can reach all the switches, breakers, and outlets without using a ladder or other assistance.

On very large jobs, you may find temporary electrical service boards on each floor of a high-rise building. A large cable supplies power to these boards. Keep the cable out of water and protect it from damage. Do not drag the cable when moving the service board—lift and carry it. You should know where the temporary service is located and learn how to shut off the power in an emergency.

Workers may use the building's permanent services only after they have been fully installed and approved by an authorized electrician. Make yourself aware of the location of the main panel or sub-panels being used, and learn how to shut them off in case of an emergency. If you must shut the power off, do so and notify your supervisor immediately.

Water Supply

Find out where the water shutoff is located at your job site. If a pipe breaks or bursts under water pressure, the water may damage material, tools and equipment, or work already done. Water may create an electrical hazard if it comes into contact with electrical panels or outlets. If you must shut the water off, do so and notify your supervisor at once.

Gas Supply

Locate the gas shutoff at your job site. Escaping gas can cause an explosion that could injure someone or do great damage. Gas shutoff valves are always at the gas meter that will be located outside the building. If you must shut off the gas, do so and notify your supervisor immediately.

Other Services

Other services, such as telephone and data, do not usually present any danger to people, and there is no way you can shut them off. If the lines for these services are broken or cut and/or if they must be located and repaired or moved, get in touch with the company that supplies the service.

Emergency Shutdown Systems

There are emergency shutdown systems or “panic buttons” in many shops. When you enter a shop or an industrial setting for the first time, locate the emergency shutdown. These are installed so that only one switch has to be thrown to kill the power to a large amount of equipment. These systems are to be used in the event of an emergency for immediate response.

Fire Control Systems



Figure 2 Fire alarm (u_rpnz0oibah/Pixabay) Content License (<https://pixabay.com/service/license-summary/>).

When in shops, you should make yourself aware of:

- Locations of all fire alarm pull stations.
- Locations and class of fire extinguishers.
- Fire drill procedures and the location of fire exits/muster points.

Be aware of the smoke and heat detectors and automatic sprinkler systems that are installed in your workplace, as they are vital equipment in modern buildings. Take some time to determine how the system in your workplace operates and where the fire extinguishers and hoses are located.

Fire extinguishers are designed to deal with fires when they first start. They are still necessary even though an area is protected by sprinkler systems. If you have any doubt whether you can safely extinguish the fire using a portable extinguisher, evacuate the area.

Emergency Wash Stations

There may be times when you are working with acids or other substances that may “burn” your flesh. If you accidentally splash or spill some corrosive substance on your skin, you will want to wash the affected area very quickly with large amounts of water to dilute the acid and minimize burning. For this reason, it is important to locate special emergency sinks or showers in the work site.



Figure 3 Emergency safety shower (OpenIcons/Pixabay)
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Emergency Exits



Figure 4 Green emergency exit sign (Rawpixel) CC0 Public Domain
(<https://creativecommons.org/publicdomain/zero/1.0/>)

When working on job sites, identify all emergency exits, stairways, and locations of fire extinguishers in case of an emergency. Ensure these are kept clear at all times.

First Aid Facilities



Figure 5 Easy access to first aid in an examination room (DIAC images/Wikimedia Commons) CC BY 2.0 (<https://creativecommons.org/licenses/by/2.0/deed.en>)

Every job site requires a minimum availability of first aid, as defined in the WorkSafeBC OHS Regulation, with a trained attendant usually available to handle a variety of emergencies, from minor cuts to major bleeding. Learn the location of first aid stations and who the first aid attendants are.

Emergency Contact/Phone Numbers

Emergency telephones should be conveniently located throughout the job site or in the plant, so that help can be summoned quickly for any accident. These telephones should be direct lines to the first aid facility. Also, for every employee there should be an emergency contact and phone number on record that can be called in case of an emergency.

Muster Point

As part of a job site emergency preparedness plan, an outside meeting place or **muster point** should be designated so employees can be accounted for and can await further instructions. The muster point should be a safe area and should generally be away from the building, upwind in case of a fire or leak, and out of the way of incoming emergency personnel.

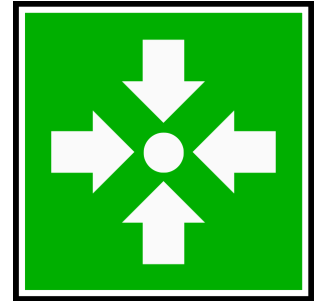


Figure 6 Assembly point/
muster point Sign (freesvg)
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Disaster Plan

As part of a job site emergency preparedness plan, all designated inside shelters, exits, evacuation routes and procedures, and outside meeting places should be identified. Exits and evacuation routes should be checked periodically to be sure they are not blocked. Exits should be of sufficient number and width, and in a location that workers can rapidly evacuate.



Self-Test A-1.5: Describe Emergency Equipment and Facilities

Complete Self-Test A-1.5 and check your answers.

If you are using a printed copy, please find Self-Test A-1.5 and Answer Key at the end of this section. If you prefer, you can scan the QR code with your digital device to go directly to the interactive Self-Test.





An interactive H5P element has been excluded from this version of the text. You can view it online here:
<https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/?p=1209#h5p-8> (<https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/?p=1209#h5p-8>)

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A-1.6 Describe How a Workplace Safety Policy is Established

Every organization is responsible for ensuring the safety and well-being of its workers. A workplace safety policy sets the foundation for this responsibility by outlining the company's overall commitment to health and safety. It serves as a guide for developing and maintaining a health and safety program that protects workers, prevents accidents, and ensures compliance with regulatory requirements.

Process

A health and safety program outlines the health and safety elements of an organization and includes objectives that make it possible for the company to achieve its primary goal: the protection of its workers at the workplace.

Part 3: Rights and Responsibilities of the Occupational Health and Safety Regulation specifies the minimum requirements to be contained in a health and safety program. Some of the requirements may not be applicable to every workplace. However, employers should consult with the occupational health and safety committee and conduct their own health and safety risk assessment to determine which hazards are present in the workplace. Once the hazards have been identified, the controls used to reduce exposure to these hazards should be clearly described in the health and safety program.



Read the following sections from **Part 3: Rights and Responsibilities** (<https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-03-rights-and-responsibilities>) / Occupational Health and Safety Programs of the OHS Regulation now:

- 3.1 When program required (<https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-03-rights-and-responsibilities#SectionNumber:3.1>)
- 3.2 Small operations (<https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-03-rights-and-responsibilities#SectionNumber:3.2>)
- 3.3 Contents of program (<https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-03-rights-and-responsibilities#SectionNumber:3.3>)

Employers may also be required to establish a joint health and safety committee as per the requirement of the Workers Compensation Act (<https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs->

regulation/workers-compensation-act) the following sections from Part 2 Division 5 – Joint Committees and Worker Representatives of the Act stipulate the requirements of a joint committee:

31 General requirement for employer to establish joint committee (<https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/workers-compensation-act/part-2-occupational-health-and-safety#SectionNumber:Part2Div5Sec31>)

- a. in each workplace where 20 or more workers of the employer are regularly employed, and
- b. in any other workplace for which a joint committee is required by order.

36 Duties and functions of joint committee (<https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/workers-compensation-act/part-2-occupational-health-and-safety#SectionNumber:Part2Div5Sec36>)

In relation to its workplace, a joint committee is responsible for the following duties and functions, which include:

- a. To identify situations that may be unhealthy or unsafe for workers and advise on effective systems for responding to those situations.
- b. To consider and expeditiously deal with complaints relating to the health and safety of workers.
- c. To consult with workers and the employer on issues related to occupational health and safety and occupational environment.
- d. To make recommendations to the employer and the workers for the improvement of the occupational health and safety and occupational environment of workers.
- e. To make recommendations to the employer on educational programs promoting the health and safety of workers and compliance with this Part and the regulations and to monitor their effectiveness.
- f. To advise the employer on programs and policies required under the regulations for the workplace and to monitor their effectiveness.
- g. To advise the employer on proposed changes to the workplace or the work processes that may affect the health or safety of workers.
- h. To ensure that accident investigations and regular inspections are carried out as required by this Part and the regulations.
- i. To participate in inspections, investigations and inquiries as provided in this Part and the regulations.
- j. To carry out any other duties and functions prescribed by regulation.

37 Joint committee procedure (<https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/workers-compensation-act/part-2-occupational-health-and-safety#SectionNumber:Part2Div5Sec37>)

- 1. Subject to the OHS provisions and the regulations, a joint committee must establish its own rules of procedure, including rules respecting how it is to perform its duties and functions.
- 2. A joint committee must meet regularly at least once each month, unless another schedule is permitted or required by regulation or order.

Many companies and industrial operations find that a joint safety and health committee is an excellent means of consultation within their organization. Safety committees are helpful in assigning group and individual responsibilities, in promoting positive attitudes toward safety, and in improving techniques for accident prevention.

Committee members gain valuable knowledge and understanding through the exchange of information at meetings. When appropriate, set aside part of the meeting for education. Invite members, suppliers, and professionals from outside organizations to discuss equipment and materials that relate to safety. Send members to seminars and ask them to report what they have learned. Invite management to address the committee.

Additionally, there is a need to educate new members in the work of the committee and in meeting procedures. To educate other workers, it is important for committee members to set an example by working safely.

Committees

As stated earlier, an employer is responsible for setting up a health and safety program. As part of the program, a health and safety committee must be established. The committee has the following responsibilities:

- Assisting in creating a safe place to work
- Recommending actions that will improve the effectiveness of the health and safety program
- Promoting enforcement of regulations

This committee shall generally have at least four members who are experienced in the workplace. The structure of the committee is outlined in the Occupational Health and Safety Regulation, and provisions are made for varying the selection of members according to the special needs of the organization. The membership of the committee must represent both employers and workers. It should encourage enthusiasm and collaboration and promote efficiency through continuity.

Employee Orientation

All workers should go through an orientation session the first time they come on each job site. If the job site hazards change, further orientation is required. Orientations and safety training must be documented.



WorkSafeBC has instructions for conducting the orientation, topics, and examples of hazards that should be covered. The sample checklist and other resources can be found under Young & new workers (<https://www.worksafebc.com/en/resources/health-safety/checklist/young-new-worker-orientation-checklist?lang=en>).

Job Safety Analysis

A job safety analysis (JSA) is a practical safety procedure that focusses on job tasks. The JSA enables workers to identify hazards associated with a job and develop safe work practices and procedures that will reduce or eliminate those risks. The act of creating a JSA encourages workers to be alert and work safely; it is a valuable tool for training new workers to perform a task safely and effectively.

There are three stages in performing a job safety analysis:

1. Identify the job steps.
2. Identify the potential hazards associated with each of the steps.
3. Determine preventive measures for each of the hazards.

Stage 1: Identify the Job Steps

Once a job has been chosen for a job safety analysis, it should then be broken down into a series of smaller steps. Each step is a part of the job that is necessary, and steps should be listed in the same order that they are performed on the job.

One way to identify the steps of a job is to observe an experienced worker perform that job in the same environment. Another is to gather input from other workers who have performed that same job.

This sequence of steps will become the basis of a safe work plan. It is important not to oversimplify, but at the same time you should not be too specific or you will end up with too many steps to the job. A rule of thumb is that most jobs can be broken into ten steps or less. If a job cannot be limited to ten steps, it may be necessary to break it down into more than one job, each with its own JSA.

Stage 2: Identify the Potential Job Hazards

Once you have recorded the basic job steps, you must next identify any hazards associated with each step. You can determine the hazards using observation and your personal experience; therefore, this stage requires a walk-through survey of the work area. In addition to noting the basic layout of the workplace and reviewing any history of occupational illnesses or injuries, things to look for during the walk-through survey include:

- Sources of electricity
- Sources of load noise
- Sources of motion, such as machines or processes where movement may exist that could result in an impact between personnel and equipment
- Sources of high temperatures that could result in burns, eye injuries or fire
- Types of chemicals used in the workplace
- Sources of harmful dusts
- Sources of light radiation such as welding, brazing, cutting, furnaces, heat treating, high-intensity lights, etc.
- Potential falling or dropping objects
- Sharp objects that could poke, cut, stab, or puncture
- Biohazards such as blood or other potentially infected material

This information will enable you to develop a list of potential hazards in the following basic hazard categories:

- Impact
- Penetration
- Compression (roll-over)
- Chemical
- Heat/cold
- Harmful dust

- Light (optical) radiation, and
- Biological

Your goal is to determine the worst-case scenario, consider potential consequences and identify how these consequences may change over time.

Stage 3: Determine the Preventive Measures for Each of the Hazards

When Stage 2 is complete, the employer should organize and analyze the data so that it may be efficiently used in determining the proper types of controls or preventive measures that are required to reduce or eliminate the potential hazards.

PPE is the last line of defence in protecting workers from hazards in the workplace. Before requiring workers to wear PPE to protect them from a specific hazard, the worker and employer must try to eliminate the hazard or reduce it as much as possible.

The following controls (listed from most to least effective) must be considered first:

1. **Elimination:** Can the hazard be eliminated from the workplace completely?

Example: perform a critical lift at night when other workers are not present.

2. **Substitution:** Can the hazard be replaced with something non-hazardous or less hazardous?

Example: replace a noisy machine with a quiet one; use safer chemicals.

3. **Engineering:** Can the physical work environment be changed to control the risk?

Example: enclose a piece of equipment to contain contaminants or isolate the noise source.

4. **Administrative:** Can changes be made to the work activities to make them safer?

Example: reduce the time workers are exposed to a hazard by rotating them to another task.

5. **Personal Protective Equipment (PPE):** When can PPE be used to protect workers?

If elimination, substitution, engineering and administrative controls do not effectively control the hazard, PPE may be necessary, either alone or in addition to other measures, to help protect workers. Remember, PPE is the last line of defence and is not the most effective safety measure because it places only a barrier between the worker and the hazard. The hazard still exists; so if the right PPE is not worn properly or when it is needed, or if the PPE fails (for example, gloves leak), the worker is not protected.

Be as specific as you can with the recommended procedures. Use statements that describe both what action is to be taken and how it is to be performed. For example, “Stand to the right side of the service box.”

Examine the sample JSA in Table 1 to see what job steps are necessary to replace a fluorescent light ballast, the associated hazards, and what preventive measures need to be taken. Note that the preventive measures are positioned to match the possible hazard and job steps.

Table 1: Sample Job Safety Analysis Document

Job Steps	Hazards	Preventive Measures
1. Identify the circuit to be worked on and de-energize it at the electrical panel.	- Shock hazard - Spark hazard	- Remove all watches, rings, and other current-conducting jewellery. - Wear electric shock-resistant footwear. - Wear safety glasses with side shields. - Lock out and tag out at the panel or switch with your own lock. - Where several people are working on the circuit, provide for additional locks with the use of a scissor clip.
2. Set up and climb stepladder in the desired work area.	Back injury or strain	Use proper lifting techniques. Ask for help when moving heavy or bulky objects.
	Tripping while carrying the ladder	Clear the floor area of any obstructions.
	Crushing/pinching of hands and fingers	Wear gloves when possible.
	Falling from ladder	- Inspect the ladder before use. Do not use a damaged ladder. - Have someone hold the ladder if it will provide more support. - Be sure to set up the ladder on an even/level surface. - Do not position the ladder in front of a closed door that can open into the ladder.
	Falling objects injuring people below	- Use barricades or signs to warn of the presence of the ladder and the potential of objects falling on workers below. - Require the use of hard hats.
3. Verify that the fixture is de-energized.	- Shock hazard - Spark hazard - Arc flashes	Use a voltage tester. Test it first on a known live circuit to make sure it works.

4. Remove old ballast and replace with new one.	• Cut hands/knuckles • Stab wound	• Apply force away from your body when prying with hand tools (like a screwdriver). • Use the right tool for the job. • Wear gloves when practical.
	• Eye injury	• Wear safety glasses if something may fly into your eye.
	• Exposure of eyes, skin, etc., to hazardous materials	• Read and understand the Material Safety Data Sheet (MSDS) for the materials you are using.
5. Re-energize the circuit and test the fixture.	• Arc flashes	• Always stand to the side of a service box when resetting a breaker.

A job safety analysis can help reduce accidents and injuries in the workplace, but only if the information is passed on to all of the workers who will be performing the job. After the JSA is complete, the workers who will perform the task should discuss the hazards and controls listed. Workers should ensure that all safety equipment and PPE that are required by the JSA are available.



Remember: it is important to ensure that all the basic steps that have been noted are in the correct order and suitable preventive measures are in place. The job foreman or supervisor will ensure that workers understand what they are required to do and the reasons for the preventive measures.

Each JSA will need to be reviewed and updated whenever new equipment, materials or processes are introduced, and after coffee or lunch breaks. Even if no changes have been made, new hazards may be discovered that were previously overlooked. If an injury or illness occurs, the JSA should be reviewed immediately and reassessed to prevent further accidents.

Job Site Safety Meetings

Safety meetings (“toolbox talks”) are a hands-on way to remind workers that health and safety are important on the job. The objective is to help workers recognize and control hazards at the work site. These meeting are a good opportunity to get input on JSAs.

- The meeting should be focused on the site and work conditions.

- The meeting should take place on the site or near the tools and equipment you are talking about.
- The subject should clearly let workers know exactly what you are going to talk about and why it's important.
- Hazards should be pinpointed, and the discussion should include what may happen if proper safety is not followed and how to control or prevent these hazards.
- Wherever possible, key points should be demonstrated using real tools, equipment and materials.
- In some cases, you could be asked to demonstrate what you have learned.
- Each meeting should take about five to ten minutes, if held daily or weekly.

Reporting Accidents

All accidents must be reported. Report the accident to the shop staff and then to the first aid attendant to ensure coverage, in case Workers' Compensation benefits are available. The first aid attendant will record all injuries in a log and complete the necessary WCB forms.

Investigations

As a safety precaution, all accidents should be investigated, whether there was an injury or not. This way, appropriate changes in work procedure can be identified if needed. WorkSafeBC safety officers will investigate accidents of a serious nature.

First Aid

Every job site requires a minimum level of first aid to be available. The requirements are based on the hazard level, surface travel time to a hospital, and the size of the workforce on the site. Because of these variables, the level of first aid requirements may differ from site to site.

Modern industrial settings and all BC training institutions are equipped with a first aid station with a trained attendant. The person who staffs that station is able to perform a wide variety of services, from bandaging minor cuts to stopping major bleeding and splinting broken bones.

Find out where the first aid station is, who staffs it, and what services are available. If you sustain an injury, no matter how minor, ensure that the incident is reported in the first aid station log.

Minor problems often develop into major problems; to ensure the WCB will cover you, report all injuries promptly.

Hearing

A workplace safety program should include a hearing protection program. This should include:

- Noise measurement
- Education and training
- Engineering noise control
- Hearing protection
- Posting of noise hazards
- Annual hearing tests
- Annual program review

Job Task Permits

Some tasks on a work site are identified as being hazardous enough to require special permits that ensure all safety precautions have been taken. Examples of these tasks include hot work, confined space work, and lockout procedures.

Hot Work Permits

Special considerations must be made when doing hot work. **Hot work** is simply any process or temporary work done that could result in a fire. Jobs that require cutting, grinding, drilling or welding of metals are all examples of hot work. Before starting any hot work it is best to determine whether the job can be done in a different way so as to avoid the risk of fire altogether. If there is no alternative to doing the hot work, then you will need to obtain a hot work permit from the job site's health and safety officer or foreman. Complete the permit, follow the precautions on the permit, and post the permit in the work area.

Confined Space Permit

A confined space entry permit is required and used to make everyone aware of work that will take place in a confined space. A written procedure must be carried out to assess the risk for working in a confined space by identifying the hazards present and to determine what precautions must be taken. The assessment must include information on the:

- Task
- Working environment
- Working materials
- Tools required
- Qualifications of the person doing the work
- Emergency rescue plan

The permit must bear the supervisor's name and must be posted at the entrance to the confined space. Other information required on the permit include:

- The type of work activity
- Names of the workers who are in the confined space
- What control measures or precautions were in place prior to entry and while workers were inside
- When the permit expires

Lockout

The workplace safety program must include lockout procedures and ensure they are followed. Section A-1.7 Describe Lockout and Tagout Procedures explains these procedures in detail.



Self-Test A-1.6: Describe How a Workplace Safety Policy Is Established

Complete Self-Test A-1.6 and check your answers.

If you are using a printed copy, please find Self-Test A-1.6 and Answer Key at the end of this section. If you prefer, you can scan the QR code with your digital device to go directly to the interactive Self-Test.



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A-1.7 Describe Lockout and Tag-out (LOTO) Procedures

Lockout and tag-out (LOTO) procedures are essential safety practices that help prevent injuries when working on machinery or piping systems. They ensure that all sources of hazardous energy are identified, isolated, and controlled before maintenance or repair work begins. Understanding how and why LOTO procedures are performed helps workers protect themselves and others from unexpected equipment movement or the release of stored energy.

Understanding System Operation

When performing maintenance or repair work, or when a machine is unsafe, it is critical to prevent the machine from moving or releasing energy unexpectedly. Lockout and tag-out (LOTO) procedures are used to control these hazards by identifying and isolating all sources of energy before work begins.

Simply turning off power or closing a valve may not be enough. Some systems store energy, such as electrical charge, pressure, or fluid, which must be released or tested before the equipment is safe. For example, pressurized piping must be fully depressurized before work starts.

Once equipment has been properly locked out and tagged out, it should be in a zero-energy state. Never assume equipment is safe—always test or verify that all energy has been removed before starting work.

Before applying any lockout procedure, workers must fully understand the system they are working on and the tasks being performed.

WorkSafeBC Regulations and Lockouts

De-energization and lockout procedures are described in Part 10: De-energization and Lockout (<https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-10-de-energization-and-lockout>) of the OHS Regulation.

Note the following:

1. You must use your own locks and keys.
2. You must not borrow another person's lock. If necessary, get extra locks from your supervisor.
3. You must remove your own locks.
4. You must not remove someone else's lock.
5. If you apply the first lock, you must ensure that the machinery cannot be operated.
6. In an emergency, a senior shift supervisor may remove someone else's lock, but only after every effort has been made to contact the person who put on the lock. The supervisor must ensure that the equipment will operate safely.

Identification Requirements

The following items must be identified and acted on as part of a lockout procedure:

- Identify all energy sources that influence or are connected to the machinery or equipment.
- Identify the correct electrical source and disconnect it in the following way:
 - For plugged-in equipment, pull the plug from the socket, and place the male end on the equipment where it is readily visible.
- Identify the correct breaker and switch it to the off position.
- Identify the equipment to be shut down.
- Identify the correct switch and turn it to the off position.

Situations Where Lockout is Required

Depending on the type of machine involved, in addition to electrical power, you must consider the following sources of energy:

- Hydraulic fluids under pressure
- Compressed air or gases
- Energy stored in springs
- Potential energy from suspended parts
- Electrical components that hold a charge
- Any other source that might cause mechanical movement

Lockout Equipment

There are many different types of locking systems. Put your personal lock on the switch using a scissor adapter or hasp, as shown in Figure 1. While this figure shows a single safety hasp and lock, it is also common to use more than one hasp when locking out.



Figure 1 Safety switch locked out (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

Chains and Cables

If you need to lock out equipment with more than one energy source, you can use a lockout cable instead of several individual locks to secure multiple disconnect switches (Figure 2). Run the cable through the locking hole of each safety disconnect being locked out. The cable diameter must be large enough to prevent the safety disconnect switches from being operated accidentally. A scissor lock adapter may also be used to apply multiple locks.



Figure 2 Cable lockout for multiple disconnects (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

Chains and cables can also be used to make valve handles inoperable (Figure 3).



Figure 3 Chains used to lock out valve handles (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

Support Blocks

Support blocks are physical devices used to secure equipment and prevent unintended movement, lowering, or shifting during maintenance or storage. These may include solid wood cribbing, engineered blocking systems, or adjustable support stands. Blocks must always be placed on stable, level ground and positioned to evenly distribute the load. When properly installed, they act as a critical secondary support in case of mechanical failure.

Never place any part of your body beneath suspended equipment or between a block and the equipment, as shifting or collapse can occur without warning.



Figure 4a. Heavy equipment stabilized using timber support blocks placed beneath the frame on level gravel to prevent downward movement. (Audrey Curran/TRU Open Press) CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)



Figure 4b. Engine and generator unit secured on cribbing blocks to maintain elevation and prevent shifting during servicing. (Audrey Curran/TRU Open Press) CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)



Figure 4c. Tracked equipment supported with blocking beneath the chassis to prevent movement while components are removed. (Audrey Curran/TRU Open Press) CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

Tags, Locks and Scissors

Lockout devices must provide a visual verification, must be locked as required, and must have a “DO NOT OPERATE” tag placed on them. The tag must have on it your name, the date and time, and the location and identity of the equipment being worked on. Combination locks are not to be used for locking out equipment.



Figure 5 Safety tag and scissor hasp with lock (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

Lockout for Circuit Breakers

Lock out the desired breaker. If there is access to the main breaker or disconnect that kills all power to the panel, and if no other workers need to lock out in that panel, then you may lock the panel door closed (Figure 5).



Figure 6 Breaker lockouts (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

Cord Locks

For plugged-in equipment, if the male end of the plug is in view and you do not leave the machine until you have finished working, a lock is not needed. If the plug is not in view, use an adapter and lock, or lock the cord to an object to prevent it from being reconnected to the circuit. Figure 6 shows a power cord plug lock.



Figure 7 Power cord plug lock (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

Lockout Station

A lockout station has keyed locks to be used only for equipment lockout. It also contains tags and lockout devices. Locks have one key that is kept with the installer of the lock. Once the work procedure is completed, the lock and key should be returned to the lockout station. These stations can be portable or mounted permanently to the wall where required.



Figure 8 Lockout station (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

Key Box System

Some machines are powered by multiple energy sources, so a single job may require locking out several controls at once. This can be managed efficiently and safely using a key box system. In this system, each energy-isolating device is

locked with its own lock (Lock Set A). The keys for those locks are then placed inside a locked key box, which is secured with a second set of locks (Lock Set B). Each worker involved attaches their personal lock to the key box to ensure the equipment cannot be re-energized until all workers have removed their locks. The key box itself is treated as a locked-out power source, and all lockout regulations apply. A key box lockout procedure checklist must be posted nearby to guide workers through the process.



Figure 9 Key box (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

Spades and Blinds

In the context of lockout, a **spade** is a round plate with a small tab that is placed between two pipe flanges in order to lock out certain piping sections. It is sometimes referred to as a **frying pan** (see Figure 12). The spade prevents cross-contamination and also allows work to be done on individual piping sections. The small tab lets workers see that the spade is in place, in the same way an indicator valve allows workers see whether a valve is in the open or closed position.

A **spectacle blind**, or spectacle flange, is two discs joined together resembling a pair of spectacles. These can be rotated in place, allowing flow through the opening in one of the discs or blocking the flange with the solid disc.



Figure 10 Spectacle blind (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)



Figure 11 Spectacle blind installed (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

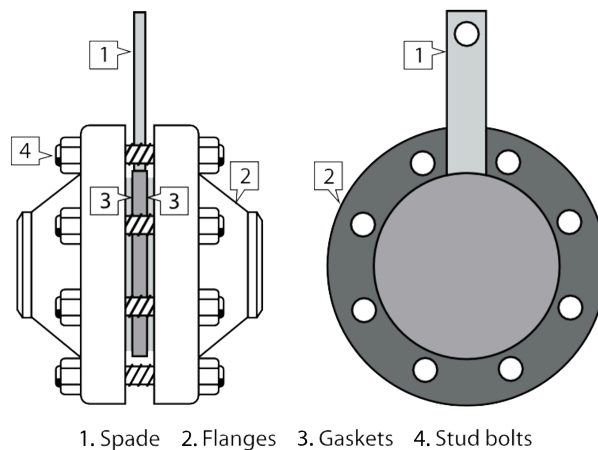


Figure 12 Spade parts (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

A **blind flange** (Figure 13) is used when the end of the pipe or valve is removed. An **open flange** can be closed off with a blind flange.



Figure 13 Blind flange (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)



Self-Test A-1.7: Describe Lockout and Tagout Procedures

Complete Self-Test A-1.7 and check your answers.

If you are using a printed copy, please find Self-Test A-1.7 and Answer Key at the end of this section. If you prefer, you can scan the QR code with your digital device to go directly to the interactive Self-Test.





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- **Figure 4a, 4b and 4c** Support blocks are by Audrey Curran, Thompson Rivers University, and is subject to the CC BY-NC-SA 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>) license of this resource.

Self-Test A-1.1: Describe the Causes and Results of Accidents

Complete Self-Test A-1.1 and check your answers.

1. A worker's personal safety is primarily whose responsibility?
 - a. Worker
 - b. Employer
 - c. Safety committee
 - d. Occupational Health & Safety officer
2. What is commonly found when comparing different types of workplace injury costs?
 - a. Direct costs are lower than indirect costs.
 - b. Direct costs are greater than indirect costs.
 - c. Direct costs of injury are the only costs of injury.
 - d. Indirect costs are the easiest to see and understand.
3. Which workers have the highest rate of workplace accidents and incidents?
 - a. Young workers
 - b. Part-time workers
 - c. Soon-to-be-retired workers
 - d. Temporary foreign workers
4. What authorization do Workers Compensation Board officers have at the workplace?
 - a. All of the choices
 - b. Issue penalties for safety infractions
 - c. Inspect workplaces for safety issues
 - d. Issue orders specifying injury prevention measures
5. Which description best reflects a culture of safety?
 - a. Employers make sure safety is mentioned once a week.
 - b. Workers use safe work habits when it is efficient to do so.
 - c. All workers and employers are committed to making safety a part of every day.
 - d. Workers use safe work habits when they know they are being watched by the Workers' Compensation Board.
6. Which phrase best describes the act of keeping your work area clean and free of scraps, rubbish, or spills?
 - a. Managing
 - b. Organizing
 - c. Housekeeping
 - d. Stacking and storing
7. A culture of safety means accepting that accidents happen and working the cost of accidents into a business plan.
 - a. True
 - b. False
8. Employees are responsible for training themselves in safe work practices.
 - a. True
 - b. False
9. A culture of safety is a daily commitment to safe, conscientious work.

- a. True
 - b. False
10. The Workers' Compensation Board is contracted by the employer.
- a. True
 - b. False
11. Some companies may choose to employ a different regulatory body than the Workers' Compensation Board.
- a. True
 - b. False

Answer Key: Self-Test A-1.1 is on the other page.

Answer Key: Self-Test A-1.1

1. a. Worker
2. a. Direct costs are less than indirect costs.
3. a. Young workers
4. a. All of the choices
5. c. All workers and employers are committed to making safety a part of every day.
6. c. Housekeeping
7. b. False
8. b. False
9. a. True
10. b. False
11. b. False

Self-Test A-I.2: Describe Short-term Hazards in the Trades

Complete Self-Test A-1.2 and check your answers.

1. Pointing an air hose at another person should be considered (select the best response):
 - a. Safe in most cases
 - b. Extremely dangerous
 - c. Okay if the other person agrees
 - d. Common practice in some shops
2. What is the maximum trench depth that a worker can work in before shoring or sloping is required?
 - a. 3 ft (0.914 m)
 - b. 4 ft (1.2 m)
 - c. 5 ft (1.52 m)
 - d. 20 ft (6.10 m)
3. What is an alternative to shoring to ensure a trench wall will not cave in?
 - a. Install guardrails to WCB specifications
 - b. Cover the trench when it is not occupied
 - c. Keep a pump running to remove groundwater
 - d. Slope the sides of the trench
4. Which of the following is a danger associated with confined-space work areas?
 - a. Has no means of entry
 - b. Too small to work in
 - c. Limited amount of ventilation
 - d. May be entered by untrained employees
5. Which of the following is the best and simplest way to avoid slips, trips, and falls?
 - a. Avoid winter work
 - b. Proper housekeeping
 - c. Always work sitting down
 - d. Tie off to an engineered anchor point
6. What is your best course of action if you notice a trip hazard?
 - a. Remove it
 - b. Walk around it
 - c. Report it to your supervisor
 - d. Watch to see if someone else notices it
7. How would you best describe a short-term hazard?
 - a. Hazard for young workers
 - b. Hazard for part-time workers
 - c. Hazard that is immediate and can be remedied quickly
 - d. Hazard that will soon be assessed for safety by a co-worker
8. Which of the following best defines the term *excavation*?
 - a. Larger than normal trench
 - b. Diesel powered mobile equipment

- c. Removal of ground materials for an installation or repair
 - d. Collapse of naturally occurring caverns or spaces in the ground
9. Your task is to install and bed a 300-m run of a 200-mm water main, 2 m underground in loose, sandy soil. What is your best option for protection from a cave-in?
 - a. Quick shovel
 - b. Hydro shoring
 - c. Hydraulic shoring
 - d. Single trench box
 10. Which of the following best defines the term *angle of repose*?
 - a. Watchful eye of the site superintendent
 - b. Slope with a rise of three units and a run of four units
 - c. Natural slope formed when excavated material is piled
 - d. Distance from the edge of a trench box to the edge of the trench
 11. A trench is too wide for prefabricated shoring. What is the best solution?
 - a. Angle of repose
 - b. Hydraulic shoring
 - c. Excavation netting
 - d. Timber and plank shoring
 12. An unshored trench must be sloped flatter than which of the following?
 - a. 90 degrees
 - b. Excavator
 - c. Angle of repose
 - d. Hydraulic shoring used
 13. Which of the following would not be considered a confined space?
 - a. Bilge hold
 - b. Wheat silo
 - c. Peanut butter vat
 - d. Mechanical room
 14. A confined space is considered safe for human occupation.
 - a. True
 - b. False
 15. Always assume if your workspace was deemed safe yesterday, it is safe today.
 - a. True
 - b. False
 16. Which of the following represents the lowest amperage at which electric shock can be fatal?
 - a. 50 mA
 - b. 5 A
 - c. 50 A
 - d. 500 A
 17. What device is intended to protect the user from shock hazard?
 - a. Multimeter
 - b. Circuit breaker
 - c. Ground fault circuit interrupter
 - d. Trouble light
 18. Your co-worker has become a part of an electric circuit and is being shocked. What is the best first option for

helping him?

- a. Call 911.
 - b. De-energize the circuit.
 - c. Separate him from the circuit with your hands.
 - d. Separate him from the circuit with a broom handle.
19. Low-pressure compressed air is excellent for removing sawdust from hands and boots.
- a. True
 - b. False
20. The majority of body heat loss can occur from the head.
- a. True
 - b. False
21. What happens to heat loss when your body is immersed in water?
- a. Very similar to wind chill
 - b. Greatest in the hands and feet
 - c. Radiated away at a slower rate than wind chill
 - d. Conducted away around 25 times faster than in cold air

Answer Key: Self-Test A-1.2 is on the other page.

Answer Key: Self-Test A-1.2

1. b. Extremely dangerous
2. b. 4 ft (1.2 m)
3. d. Slope the sides of the trench.
4. c. Limited amount of ventilation.
5. b. Proper housekeeping
6. a. Remove it
7. c. Hazard that is immediate and can be remedied quickly
8. c. Removal of ground materials for an installation or repair
9. c. Hydraulic shoring
10. c. Natural slope formed when excavated material is piled
11. d. Timber and plank shoring
12. c. Angle of repose
13. d. Mechanical room
14. b. False
15. b. False
16. a. 50 mA
17. c. Ground fault circuit interrupter
18. b. De-energize the circuit
19. b. False
20. a. True
21. d. Conducted away around 25 times faster than in cold air

Self-Test A-1.3: Describe Long-Term Hazards in the Trades

Complete Self-Test A-1.3 and check your answers.

1. Which of the following is typically not an airborne hazard?
 - a. Dust
 - b. Mould
 - c. Asbestos
 - d. Mercury
2. In what products can arsenic be found?
 - a. Paint
 - b. Cleaners
 - c. Welding fumes
 - d. Wood preservatives
3. Which of the following is termed a “heavy metal”?
 - a. Mercury
 - b. Asbestos
 - c. Forged steel
 - d. Ultraviolet radiation
4. Which of the following is not considered a potential source of hazardous vapours?
 - a. Dermatitis
 - b. Surface coatings
 - c. Ultraviolet radiation
 - d. Welding electrode coating
5. Always short circuit a NiCad battery before charging.
 - a. True
 - b. False
6. Cadmium is a heavy metal and is considered very toxic.
 - a. True
 - b. False
7. What is another term for *musculoskeletal injury*?
 - a. Hematoma
 - b. Concussion
 - c. Bone fracture
 - d. Repetitive strain injury
8. Dermatitis can be caused by exposure to chemicals at work.
 - a. True
 - b. False

Answer Key: Self-Test A-1.3 is on the other page.

Answer Key: Self-Test A-1.3

1. d. Mercury
2. d. Wood preservatives
3. a. Mercury
4. a. Dermatitis
5. b. False
6. a. True
7. d. Repetitive strain injury
8. a. True

Self-Test A-1.4: Describe General Safety Precautions and Procedures

Complete Self-Test A-1.4 and check your answers.

1. Ventilation is a major consideration when arc welding.
 - a. True
 - b. False
2. How must electrical cords always be disconnected?
 - a. Pulling on a sufficient length of cord
 - b. Quick jerking movement to avoid arcing
 - c. Pulling the plug straight out of the receptacle
 - d. Holding the cord to avoid the finger coming into contact with the plug
3. Which of these actions is an important part of safety and accident prevention?
 - a. Reporting violations
 - b. Good housekeeping skills
 - c. Staying away from all hazards
 - d. Locking up unused tools and equipment
4. What describes work that is performed close to an unrelated hazard?
 - a. Unsafe work
 - b. Shadow work
 - c. Proximity work
 - d. Unrelated hazard work
5. What should you do if you spot a hazard on the job site?
 - a. Flag the hazard
 - b. Fix the problem if possible
 - c. Inform co-workers and supervision
 - d. All of the above
6. Which of the following best describes the area surrounding every high-voltage line?
 - a. No-fun zone
 - b. High voltage area
 - c. Area of extreme caution
 - d. Absolute limit of approach
7. When a tool or piece of equipment is used in wet conditions, which of the following should be used?
 - a. Fuse box
 - b. Circuit breaker
 - c. Energized lockout box
 - d. Ground fault circuit interrupter
8. Which of the following standards ratings should all power tools have?
 - a. CSA, UPS
 - b. ULC, CSA
 - c. FM, ASME
 - d. CPA, ATME

9. If you are asked to work with a tool you are unfamiliar with, what steps should you take?
 - a. Trial and error
 - b. Ask a co-worker to perform the task for you
 - c. Leave the tool alone and proceed with another task
 - d. Read the user's manual and inform your foreman that you need instruction
10. What is the purpose of the U-ground prong found on a power cord?
 - a. Connected to the ground to protect the user
 - b. Safety feature important only for wet conditions
 - c. Redundant safety feature that is more often than not removed
 - d. Used only for identifying which way the plug is inserted into the outlet
11. What must you do if you discover a faulty or damaged tool?
 - a. Stash it in the van
 - b. Return it to the manufacturer for a refund
 - c. Tag it as broken and return it to the tool crib
 - d. Fix the tool as soon as possible to get it back in use
12. What is the rule of thumb regarding power tool guards and safety covers?
 - a. Always use them, with no exceptions
 - b. Guards are to be used when the safety officer is around
 - c. All guards must be used unless it is easier to work without them
 - d. Watch a seasoned worker to determine when a guard can be removed
13. Housekeeping is a part of your job, is your responsibility, and is one of your important daily tasks.
 - a. True
 - b. False
14. Always maintain four points of contact when climbing ladders.
 - a. True
 - b. False
15. When do temporary work platforms require a guardrail?
 - a. Potential drop is 2 m (6.5 ft.) or more
 - b. Potential drop is 1 m (3.3 ft.) or more
 - c. Potential drop is 10 m (33 ft.) or more
 - d. Potential drop is 3 m (10 ft.) or more
16. Which of the following is not an elevated work platform?
 - a. Boom lift
 - b. Scissor lift
 - c. Scaffolding
 - d. The mezzanine level in the shop
17. What is the occupational limit for carbon monoxide for an average over eight hours?
 - a. 15 ppm
 - b. 25 ppm
 - c. 50 ppm
 - d. 100 ppm
18. What type of material shall be used on a welding screen?
 - a. Asbestos
 - b. Silica coated
 - c. Reflective

- d. Non-reflective
- 19. Where is the best place to take shelter from lightning?
 - a. Under a tall tree
 - b. Inside, next to metallic material
 - c. In a low-laying ditch
 - d. Inside, away from metallic material

Answer Key: Self-Test A-1.4 is on the other page.

Answer Key: Self-Test A-1.4

1. a. True
2. c. Pulling the plug straight out of the receptacle
3. b. Good housekeeping skills
4. c. Proximity work
5. c. All of the above
6. d. Absolute limit of approach
7. d. Ground fault circuit interrupter
8. b. ULC, CSA
9. d. Read the user's manual and inform your foreman that you need instruction.
10. a. Connected to the ground to protect the user
11. c. Tag it as broken and return it to the tool crib
12. a. Always use them, with no exceptions
13. a. True
14. b. False
15. d. Potential drop is 3 m (10 ft.) or more
16. d. Mezzanine level in the shop
17. b. 25 ppm
18. d. Non-reflective
19. d. Inside, away from metallic material

Self-Test A-1.5: Describe Emergency Equipment and Facilities

Complete Self-Test A-1.5 and check your answers.

1. Panic buttons are installed so that equipment can be shut down in an emergency.
 - a. True
 - b. False
2. Besides fire alarm pull stations and fire extinguishers, what other fire control systems should you know the location of when working in a shop?
 - a. Fire exits
 - b. Direct phone lines
 - c. Computer equipment
 - d. Emergency shutdown locators
3. Why are emergency showers available at some work sites?
 - a. For use after work
 - b. In case you didn't have time to shower at home
 - c. To clean tools that have been splashed with corrosives
 - d. To wash off accidental spills or splashes of hazardous materials
4. What is one of the first things a worker should do when starting work on a new job site?
 - a. Locate the clock.
 - b. Locate your buddy.
 - c. Locate the lunchroom.
 - d. Locate all emergency shut-offs.
5. When working in a shop, which of the following should you familiarize yourself with?
 - a. Location of fire alarm pull-station
 - b. Location and class of fire extinguishers
 - c. Fire drill procedures and muster points
 - d. All of the above
6. Where are the minimum standards of job site first-aid facilities described?
 - a. WorkSafe OHS Regulation
 - b. National Building Code
 - c. Workers Compensation Act
 - d. National Fire Protection Code
7. Permanent electrical services must be authorized for use by the regulating authority.
 - a. True
 - b. False
8. The area in front of an emergency exit may be an ideal place to store materials until the exit is required for use.
 - a. True
 - b. False
9. First aid phones should require the user to dial 911 to prevent accidental calls and false alarms.
 - a. True

- b. False
- 10. If there is an accident with the gas utilities, the proper procedure is shut off the gas and then report to your supervisor as soon as safely possible.
 - a. True
 - b. False
- 11. You are required by law to use a fire extinguisher to fight a fire regardless of the fire's development.
 - a. True
 - b. False

Answer Key: Self-Test A-1.5 is on the other page.

Answer Key: Self-Test A-1.5

1. a. True
2. a. Fire exits
3. d. To wash off accidental spills or splashes of hazardous materials
4. d. Locate all emergency shut-offs.
5. d. All of the above
6. a. WorkSafe OHS Regulation
7. b. False
8. b. False
9. b. False
10. a. True
11. b. False

Self-Test A-1.6: Describe How a Workplace Safety Policy Is Established

Complete Self-Test A-1.6 and check your answers.

1. When does a work site typically require a joint health and safety committee?
 - a. The company is a roofing company
 - b. The company has a clean safety record
 - c. There are 20 or more regularly employed workers
 - d. It is proven the work site is clear of any workplace hazards
2. Which of the following is a joint health and safety committee responsibility?
 - a. Report poor-quality work
 - b. Get workers to start on time
 - c. Identify and remedy unsafe conditions
 - d. Recommend ways to improve worker morale
3. What should an occupational health and safety program be designed to do?
 - a. Reduce insurance premiums
 - b. Hold employees accountable for WCB claims
 - c. Write WorkSafeBC regulations regarding worksite safety
 - d. Prevent workplace injuries and occupational diseases
4. Which of the following groups is a job safety analysis meant to educate about potential job site hazards?
 - a. Workers
 - b. WCB investigators
 - c. Guests to the worksite
 - d. Owners and contractors
5. What are the three parts typically found in a job safety analysis?
 - a. Introduction, body, and conclusion
 - b. Lists of tasks, hazards, and controls
 - c. Lists of hazards, first aid measures, and toxic materials
 - d. Minutes of safety meetings, accident reports, investigations
6. What is the primary objective of toolbox safety talks?
 - a. Report accidents
 - b. Ensure that workers retrieve the proper tools from their toolbox
 - c. Give every worker an opportunity to lead a group discussion
 - d. Remind workers regularly of common hazards they will encounter
7. Every new worker must be given the opportunity to refuse a site orientation session.
 - a. True
 - b. False
8. Job safety analyses should be reviewed by all workers after coffee break or if conditions change.
 - a. True
 - b. False
9. Hot work permits are required if the job site ambient temperature is higher than 30°C.

- a. True
 - b. False
10. Which of the following information would not be found on a confined space permit?
- a. Any quality tests done on atmosphere
 - b. Timeline of work, including length of exposure
 - c. The name of the worker, spotter and supervisor with contact info
 - d. Material Safety Data Sheet regarding hazardous material used for the task

Answer Key: Self-Test A-1.6 is on the other page.

Answer Key: Self-Test A-1.6

1. c. If there are 20 or more regularly employed workers
2. c. Identify and remedy unsafe conditions
3. d. Prevent workplace injuries and occupational diseases
4. a. Workers
5. b. Lists of tasks, hazards and controls
6. d. Remind workers regularly of common hazards they will encounter
7. b. False
8. a. True
9. b. False
10. d. Material safety data sheet regarding hazardous material used for the task

Self-Test A-1.7: Describe Lockout and Tagout Procedures

Complete Self-Test A-1.7 and check your answers.

1. What rules apply when working on equipment requiring lockout procedures?
 - a. Apply and tag only your own lock
 - b. Remove all tags other than your own, then apply your own tag
 - c. Remove all locks other than your own, then apply your own lock
 - d. Remove locks and tags other than your own, then apply yours
2. What does it mean to “lock out” machinery or equipment?
 - a. Turn all switches off
 - b. Shut off the electrical supply
 - c. Disconnect all energy sources
 - d. Disconnect the compressed air
3. Work is to be performed on a live process piping line. What precautions must be initiated before work can begin?
 - a. Upstream valve must be shut and flagged
 - b. New personal protective equipment is distributed
 - c. Lockout and tagout procedures must be initiated and performed
 - d. General work site safety meeting must take place to discuss work
4. In a lockout, who is authorized to remove your lock?
 - a. You
 - b. Safety officer
 - c. Site supervisor
 - d. The next shift worker
5. You are to begin lockout procedures on a pump. What is one of your tasks?
 - a. Ensure that the pump cannot operate
 - b. Remove locks from the night shift
 - c. Ensure that flow is unrestricted to the pump
 - d. Ensure that all workers have a copy of your key
6. Which of the following situations would not require lockout/tagout?
 - a. Repairing a sump pump
 - b. Replacing a hydraulic valve
 - c. Removing and repairing a steam trap
 - d. Flying a bundle of pipe over a walkway
7. Lockout devices require a visual verification that states: name of worker, date of work, equipment to be worked on. What else must be stated?
 - a. “Danger Do Not Operate”
 - b. “Replacement part to be removed”
 - c. “Grade and quality of scissor hasp”
 - d. “The department the worker is from”
8. Which of the following is the safest way to lock out a piece of equipment that plugs into a receptacle?
 - a. Tell co-workers face-to-face

- b. Yellow flag the on/off switch
 - c. Post a memo in the lunchroom
 - d. Use a power cord plug lock box
9. In an emergency, management may remove someone else's lock, but only if the worker cannot be located.
- a. True
 - b. False
10. At shift end, your co-worker must leave the site early. He can give you permission to remove his lock for him.
- a. True
 - b. False
11. A blind is used to lock out a section of pipe only if there is not a valve readily accessible.
- a. True
 - b. False
12. A spade, also known as a frying pan, is a blind placed between two flanges.
- a. True
 - b. False
13. What term describes equipment after it has been locked out/tagged out and is ready to be serviced or maintained?
- a. Neutrally balanced
 - b. Zero energy state
 - c. Kinetic energy
 - d. Potential energy

Answer Key: Self-Test A-1.7 is on the other page.

Answer Key: Self-Test A-1.7

1. a. Apply and tag only your own lock
2. c. Disconnect all energy sources
3. c. Lockout and tagout procedures must be initiated and performed
4. a. You
5. a. Ensure the pump cannot operate
6. d. Flying a bundle of pipe over a walkway
7. a. Danger Do Not Operate
8. d. Use a power cord plug lock box
9. a. True
10. b. False
11. b. False
12. a. True
13. b. Zero energy state

Sample Safety Data Sheet for Chromium Acetate Hydroxide

Printable PDF: Cr-Ac-OH-MSDS_SigmaAldrich (http://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/wp-content/uploads/sites/241/2025/01/Cr-Ac-OH-MSDS_SigmaAldrich.pdf)

Material Safety Data Sheet

Version 4.1
Revision Date 10/23/2010
Print Date 02/08/2011

1. PRODUCT AND COMPANY IDENTIFICATION

Product name	: Chromium(III) acetate hydroxide	
Product Number	: 318108	
Brand	: Aldrich	
Product Use	: For laboratory research purposes.	
Supplier	: Sigma-Aldrich Canada, Ltd 2149 Winston Park Drive OAKVILLE ON L6H 6J8 CANADA	Manufacturer : Sigma-Aldrich Corporation 3050 Spruce St. St. Louis, Missouri 63103 USA
Telephone	: +19058299500	
Fax	: +19058299292	
Emergency Phone # (For both supplier and manufacturer)	: 1-800-424-9300	
Preparation Information	: Sigma-Aldrich Corporation Product Safety - Americas Region 1-800-521-8956	

2. HAZARDS IDENTIFICATION

Emergency Overview

WHMIS Classification

Not WHMIS controlled.

Not WHMIS controlled.

GHS Classification

Acute toxicity, Inhalation (Category 4)
Acute toxicity, Dermal (Category 4)
Acute toxicity, Oral (Category 4)
Skin irritation (Category 2)
Eye irritation (Category 2A)
Specific target organ toxicity - single exposure (Category 3)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Warning

Hazard statement(s)

H302 + H312	Harmful if swallowed or in contact with skin.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H332	Harmful if inhaled.
H335	May cause respiratory irritation.

Precautionary statement(s)

P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves/ eye protection/ face protection.
P301 + P312	IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell.

P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P312 Call a POISON CENTER or doctor/ physician if you feel unwell.
P322 Specific measures (see supplemental first aid instructions on this label).
P330 Rinse mouth.
P332 + P313 If skin irritation occurs: Get medical advice/ attention.
P337 + P313 If eye irritation persists: Get medical advice/ attention.
P362 Take off contaminated clothing and wash before reuse.
P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P405 Store locked up.
P501 Dispose of contents/ container to an approved waste disposal plant.

HMIS Classification

Health hazard: 0
Flammability: 0
Physical hazards: 0

Potential Health Effects

Inhalation May be harmful if inhaled. May cause respiratory tract irritation.
Skin May be harmful if absorbed through skin. May cause skin irritation.
Eyes May cause eye irritation.
Ingestion May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Formula : $C_{14}H_{23}Cr_3O_{16}$
Molecular Weight : 603.31 g/mol

CAS-No.	EC-No.	Index-No.	Concentration
Chromium(III) acetate hydroxide			
39430-51-8	254-447-3	-	-

4. FIRST AID MEASURES

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIRE-FIGHTING MEASURES

Conditions of flammability

Not flammable or combustible.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for fire-fighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Chromium oxides

Explosion data - sensitivity to mechanical impact

no data available

Explosion data - sensitivity to static discharge

no data available

6. ACCIDENTAL RELEASE MEASURES**Personal precautions**

Use personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

Environmental precautions

Do not let product enter drains.

Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE**Precautions for safe handling**

Avoid contact with skin and eyes. Avoid formation of dust and aerosols.

Provide appropriate exhaust ventilation at places where dust is formed. Normal measures for preventive fire protection.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place.

Keep in a dry place.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Contains no substances with occupational exposure limit values.

Personal protective equipment**Respiratory protection**

For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Complete suit protecting against chemicals. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Specific engineering controls

Use mechanical exhaust or laboratory fumehood to avoid exposure.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	powder
Colour	green

Safety data

pH	no data available
Melting/freezing point	no data available
Boiling point	no data available
Flash point	no data available
Ignition temperature	no data available
Autoignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	no data available
Water solubility	no data available
Partition coefficient: n-octanol/water	no data available
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

no data available

Conditions to avoid

no data available

Materials to avoid

Strong oxidizing agents

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Chromium oxides

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50

no data available

Inhalation LC50

Dermal LD50

Other information on acute toxicity

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitization

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

Inhalation - May cause respiratory irritation.

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

no data available

Aspiration hazard

no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects

no data available

Additional Information

RTECS: Not available

12. ECOLOGICAL INFORMATION**Toxicity**

no data available

Persistence and degradability

no data available

Bioaccumulative potential

no data available

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

no data available

13. DISPOSAL CONSIDERATIONS

Product

Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

Not dangerous goods

IMDG

Not dangerous goods

IATA

Not dangerous goods

15. REGULATORY INFORMATION

DSL Status

This product contains the following components listed on the Canadian NDSL list. All other components are on the Canadian DSL list.

Chromium(III) acetate hydroxide

CAS-No.

39430-51-8

WHMIS Classification

Not WHMIS controlled.

Not WHMIS controlled.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

16. OTHER INFORMATION

Further information

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Referred to in A-3.4 Describe Information to be Disclosed on a Safety Data Sheet (SDS)

Media Attribution

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Version History

This page provides a record of changes made to this learning resource, Plumbing Apprenticeship Level 1, Block A (<https://a-safetyfunctions-bcplumbingappr1.pressbooks.tru.ca/>). Each update increases the version number by 0.1. The most recent version is reflected in the exported files for this resource.

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If you identify an error in this resource, please report it using the TRU Open Education Resource Error Form.

Version	Date	Change	Details
1.0	May, 2026	Plumbing Apprenticeship Level 1 Block A learning resource from STBC content converted to open and freely accessible digital platform and published at TRU.	

Plumbing Apprenticeship & Trade Resources in BC

A successful career in plumbing requires a strong foundation of skills, knowledge, and workplace safety awareness. Below are key resources to support plumbing apprentices in BC, including educational pathways, trade certifications, workplace safety guidelines, and mental health and wellness support.

Plumbing Apprenticeship & Certification Resources

- **SkilledTradesBC – Plumbing Apprenticeship** (<https://skilledtradesbc.ca/plumber>) – Overview of plumbing training, certification requirements, and apprenticeship pathways in British Columbia.
- **Red Seal Program – Plumber** (<https://www.red-seal.ca/eng/trades/plumbers/overview.shtml>) – National certification program with exam prep guides and trade mobility information.
- **BC Building Codes & Standards** (<https://www.bccodes.ca/>) – Official building and plumbing codes for British Columbia.

Workplace Safety & Regulations

- **WorkSafeBC** (<https://www.worksafebc.com/en>) – Essential safety resources for plumbers, including:
 - Health & Safety – WorkSafeBC (<https://www.worksafebc.com/en/health-safety>)
 - Report Unsafe Working Conditions (<https://www.worksafebc.com/en/contact-us/departments-and-services/health-safety-prevention>)
 - Report a Workplace Injury or Disease (<https://www.worksafebc.com/en/claims/report-workplace-injury-illness>)
 - Submit a Notice of Project Form (<https://www.worksafebc.com/en/for-employers/just-for-you/submit-notice-project>)
 - Get Health and Safety Resources (Videos, Posters, Publications, and More) (<https://www.worksafebc.com/en/resources-health-safety>)
 - Search the OHS Regulations (and Related Materials) (<https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation>)
 - Conduct an Incident Investigation (<https://www.worksafebc.com/en/health-safety/create-manage/incident-investigations/conducting-employer-investigation>)
- **CCOHS: OHS Answers Fact Sheets – Plumber** (https://www.ccohs.ca/oshanswers/occup_workplace/plumber.html) – Safety guidelines and best practices for plumbers in various work environments.

Financial Supports

- **Financial Support (SkilledTradesBC)** (<https://skilledtradesbc.ca/financial-support>) – Information about grants, tax credits, Canada apprentice loans, employment insurance, and the Indigenous Skills and Employment Training

(ISET) program.

- **StudentAidBC** (<https://studentaidbc.ca/>) – Complete post-secondary education through student loans, grants, and scholarships. There is also programs that help with loan repayment.
- **WorkBC (Government of BC)** (<https://www.workbc.ca/find-loans-and-grants/students-and-adult-learners/services-apprentices-and-employers>) – Services for apprentices and employers.

Mental Health & Wellness Support

- **HealthLink BC – Mental Health and Substance Use** (<https://www.healthlinkbc.ca/mental-health-and-substance-use>) – HealthLink BC resources for mental health and wellness support.
- **Here2Talk** (<https://here2talk.ca/>) – Free and confidential counseling services available to all post-secondary students registered at a BC school.
- **Help Starts Here** (<https://helpstartshere.gov.bc.ca/>) – A database with over 2,500 listings of services related to mental health and substance use supports.
- **Hope for Wellness Helpline** (<https://www.hopeforwellness.ca/>) – 24/7 online chat and phone line with experienced and culturally competent counselors available to all Indigenous people in Canada.
 - First Nations Health Authority Mental Health Supports Info Sheet [PDF] (<https://www.fnha.ca/Documents/FNHA-mental-health-and-wellness-supports-for-indigenous-people.pdf>) by First Nations health Authority – List of culturally safe services for Indigenous people.
- **HeretoHelp – BC** (<https://www.heretohelp.bc.ca/>) – Mental health resources, including videos, articles, and support services in BC.
- **BC Construction Industry Rehabilitation Plan** (<https://www.constructionrehabplan.com/>) – Mental health and substance use services for CLRA and BCBT members and their families.
- **Virtual Mental Health Supports (Government of BC)** (<https://www2.gov.bc.ca/gov/content/health/managing-your-health/mental-health-substance-use/virtual-mental-health-supports>) – Virtual services are available for British Columbians who are experiencing anxiety, depression, or other mental health challenges.

Crisis Support

- **Interior Crisis Line Network** – Call 1-888-353-2273 (tel:+1-888-353-2273) for 24/7 emotional support, crisis intervention, and community resource information.
- **Talk Suicide Chat Service** (<https://talksuicide.ca/>) – An alternative if calling is difficult; available for crisis intervention.
- **310Mental Health Support** – Call 250-310-6789 (tel:+1-250-310-6789) for emotional support, information, and resources specific to mental health.
- **1-800-SUICIDE** – Call 1-800-784-2433 (tel:+1-800-784-2433) if you are experiencing feelings of distress or despair, including thoughts of suicide.
- **Opioid Treatment Access Line** – Call 1-833-804-8111 (tel:+1-833-804-8111) between 9 am and 4 pm to connect with a doctor, nurse, or healthcare worker who can prescribe opioid treatment medication that same day.
- **KUU-US Crisis Response Service** – Call 1-800-588-8717 (tel:+1-800-588-8717) for culturally-aware crisis support for Indigenous peoples in BC.
- **Alcohol and Drug Information and Referral Service** – Call 1-800-663-1441 (tel:+1-800-663-1441) to find resources and support.



Emergency Services — For life-threatening situations, call 911 or visit your nearest emergency department.