Block A: Safety Related Functions

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Plumbing Apprenticeship Program Level 1 Series

Block A: Safety Related Functions

BC Plumbing Apprenticeship, Level 1

SKILLEDTRADESBC

BC PIPING ARTICULATION AND CURRICULUM SUBCOMMITTEE; AUDREY CURRAN; MARK OVERGAARD; AND PAUL SIMPSON

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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-bcplumbingapprl1.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-bcplumbingapprl1.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-bcplumbingapprl1.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-bcplumbingapprl1.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.
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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.

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- 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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The Open Press

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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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AI Use Statement

ChatGPT and other (AI) tools may have been used to assist with the development of glossary definitions, support copy editing for grammar, clarity, and readability, and revise some image content. All content was reviewed, revised, and verified by the authors to ensure accuracy and alignment with course and industry standards.

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Accessibility

The web version of *Block A: Safety Related Functions (https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/)* has been designed to meet Web Content Accessibility Guidelines 2.0 (https://www.w3.org/TR/WCAG20/), level AA. In addition, it follows all guidelines in Appendix A: Checklist for Accessibility (https://opentextbc.ca/accessibilitytoolkit/back-matter/appendix-checklist-for-accessibility-toolkit/) of the Accessibility Toolkit – 2nd Edition (https://opentextbc.ca/accessibilitytoolkit/).

Includes:

- **Easy navigation.** This resource has a linked table of contents and uses headings in each chapter to make navigation easy.
- **Accessible videos.** All videos in this resource have captions.
- **Accessible images.** All images in this resource that convey information have alternative text. Images that are decorative have empty alternative text.
- **Accessible links.** All links use descriptive link text.

Accessibility Checklist

Element	Requirements	Pass
Headings	Content is organized under headings and subheadings that are used sequentially.	Yes
Images	Images that convey information include alternative text descriptions. These descriptions are provided in the alt text field, in the surrounding text, or linked to as a long description.	Yes
Images	Images and text do not rely on colour to convey information.	Yes
Images	Images that are purely decorative or are already described in the surrounding text contain empty alternative text descriptions. (Descriptive text is unnecessary if the image doesn't convey contextual content information.)	Yes
Tables	Tables include row and/or column headers with the correct scope assigned.	Yes
Tables	Tables include a title or caption.	Yes
Tables	Tables do not have merged or split cells.	Yes
Tables	Tables have adequate cell padding.	Yes
Links	The link text describes the destination of the link.	Yes
Links	Links do not open new windows or tabs. If they do, a textual reference is included in the link text.	Yes
Links	Links to files include the file type in the link text.	Yes
Video	All videos include high-quality (i.e., not machine generated) captions of all speech content and relevant non-speech content.	Yes
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H5P	All H5P activities have been tested for accessibility by the H5P team and have passed their testing.	Yes
H5P	All H5P activities that include images, videos, and/or audio content meet the accessibility requirements for those media types.	Yes
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- Images in H5P self-tests lack alt text, attributions, and licenses to avoid revealing answers.
- Some tables may use merged cells, but they have been structured to work properly with screen readers and there may be long descriptions included in each section if readers prefer to see the table data in a bulleted list.
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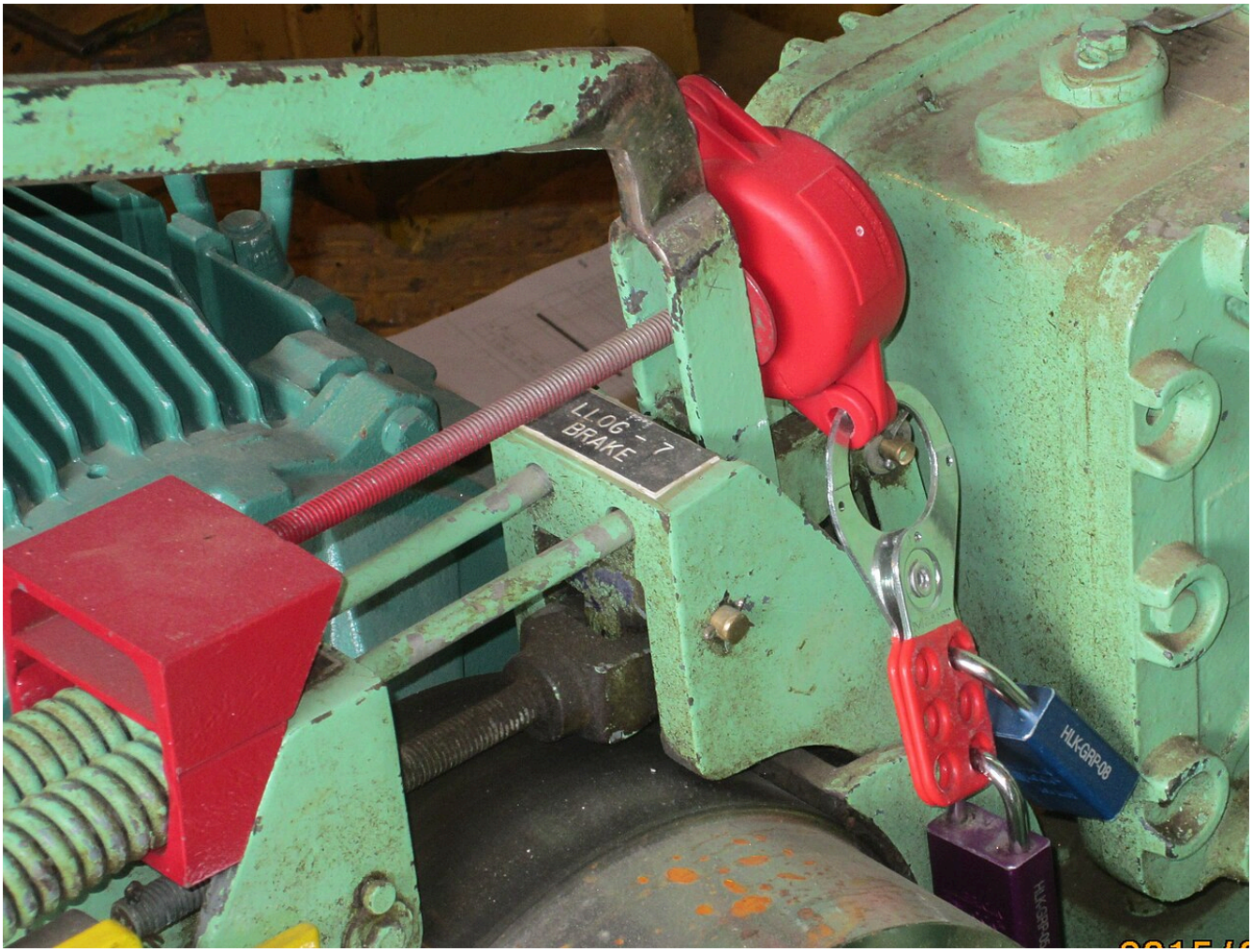
Other Formats Available

- In addition to the web version, this book is available in a number of file formats, including PDF. The Print PDF has passed our Accessibility Check.

A-1 WORKPLACE HAZARDS

Plumber Apprenticeship Program – Level 1



A lockout device applied to a hoist brake. (Wtshymanski/Wikimedia Commons) CC BY-SA 4.0 (https://creativecommons.org/licenses/by-sa/4.0/deed.en)

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].

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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: 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) 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 (Sbhrus/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.

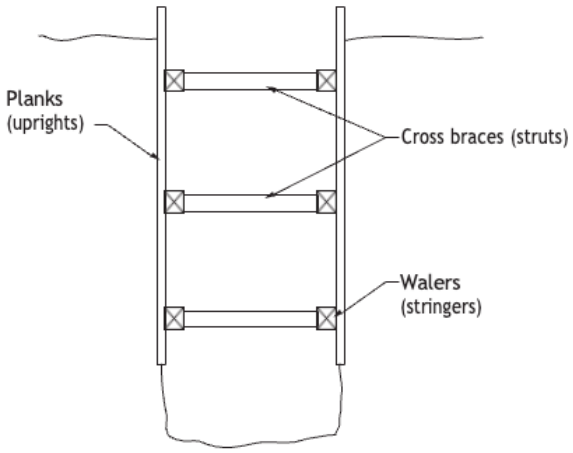

Figure 2 *Parts of a timber and plank shoring system (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

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.

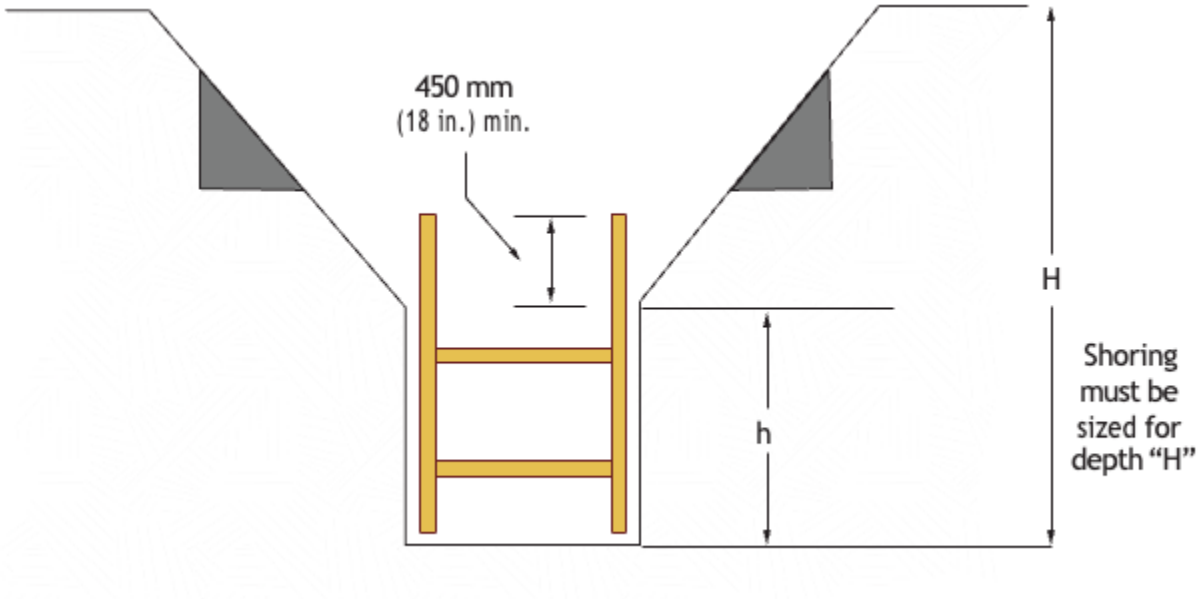

Figure 5 *Combined sloping and shoring (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

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.).

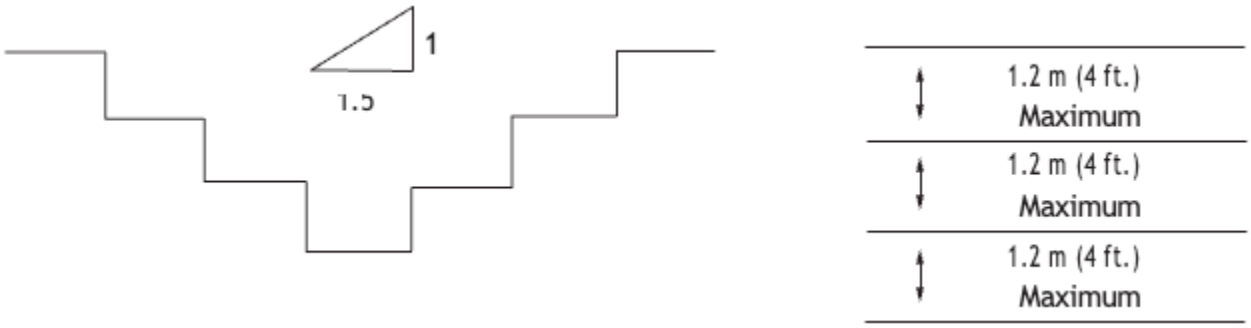

Figure 6 *Benched excavation (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

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

(Confine[d] space/pxhere) CC0 Public Domain (https://creativecommons.org/publicdomain/zero/1.0/).

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.

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=1203#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: Confined Spaces: Safe Yesterday, Deadly Today (https://youtu.be/rUM7tnYcOjQ?si=gsUmt4sn6e3xJvhD)

Electrical Hazards

Arc-fault effects (Clemenspool /Wikimedia Commons) CC0 1.0 (https://creativecommons.org/publicdomain/zero/1.0/deed.en)

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:

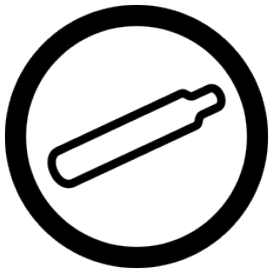
- It is not enough to simply throw a switch and start work.
- It is not enough to hang a “do not use” sign on a machine.
- It is not enough to tell everyone not to turn on the power.
- It is not enough to have everyone assure you that no one will activate the power.

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/ Wikimedia Commons) CC0 1.0 (https://creativecommons.org/publicdomain/zero/1.0/deed.en)

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.

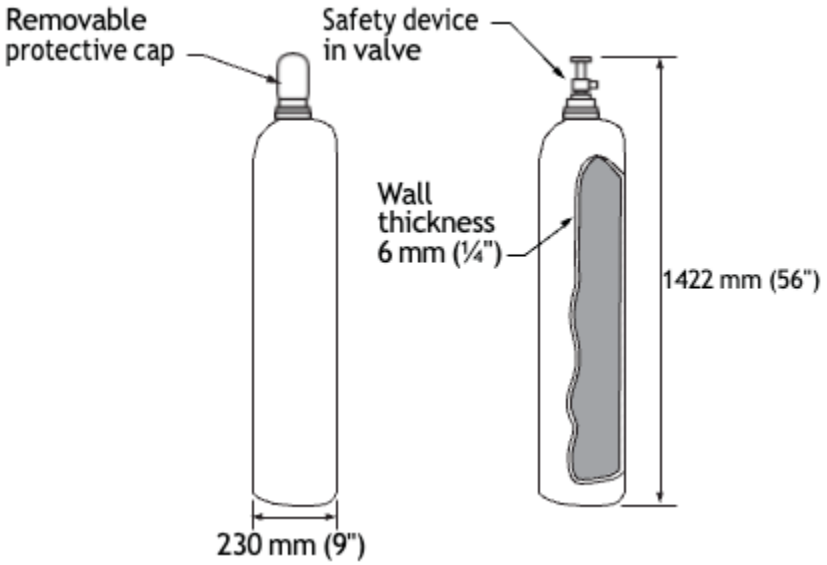


Figure 9 *Pressurized cylinder (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

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.

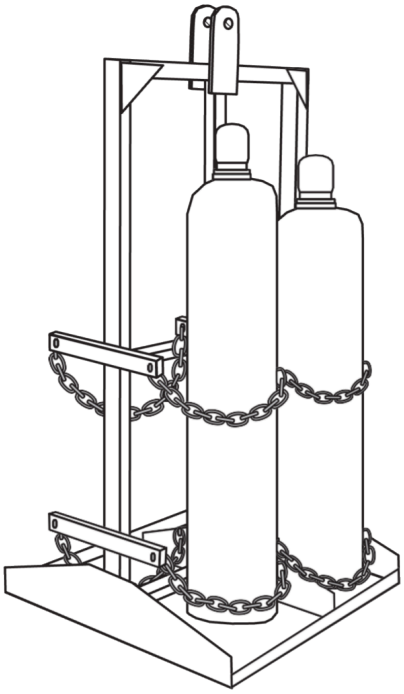


Figure 10 *Oxyacetylene cart with lifting eye (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

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.

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=1203#h5p-5 (https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/?p=1203#h5p-5)

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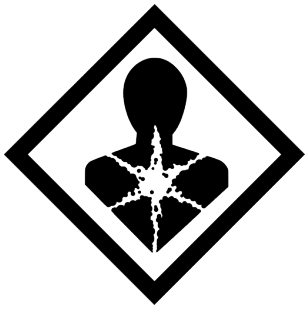
A-1.3 Describe Long-term Hazards in the Trades

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 (https://unsplash.com/license)

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 Content License (https://www.freeimages.com/license)

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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If you are using a printed copy, you can scan the QR code with your digital device to go directly to the video: Mould Exposure. (http://youtu.be/Kj5InS35N24)

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

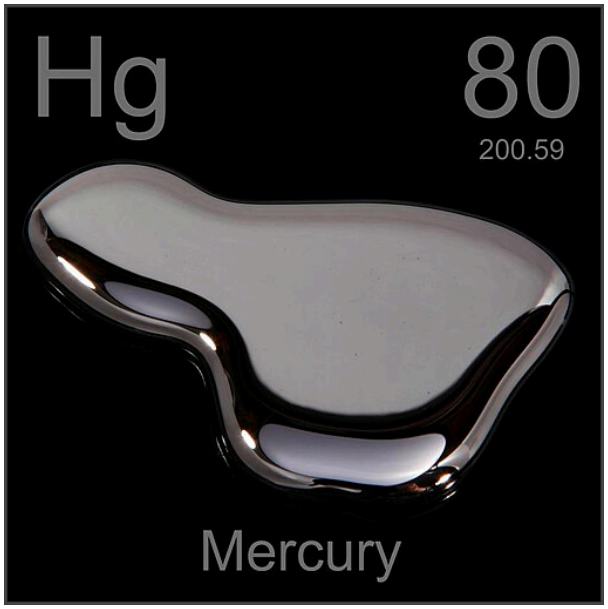
Lead (Chemical Elements – A Virtual Museum/Wikimedia Commons) CC BY 3.0 (https://creativecommons.org/licenses/by/3.0/)

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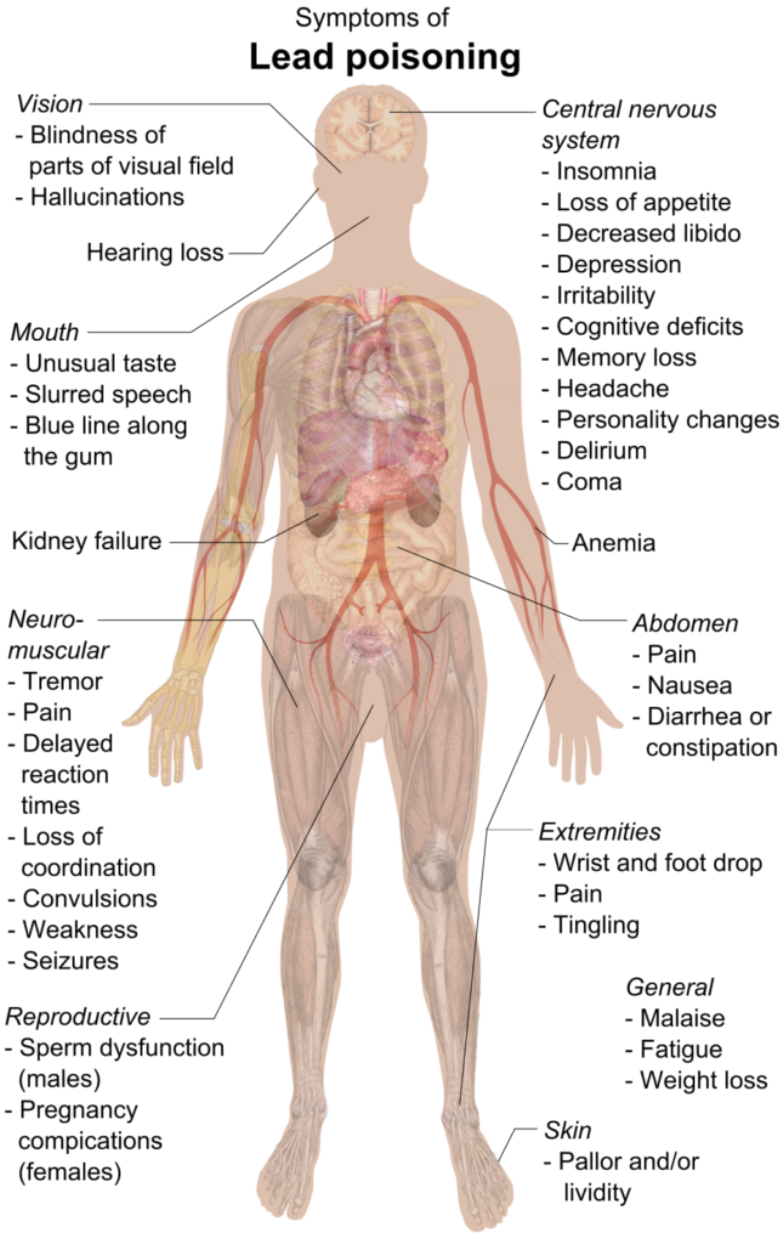
Mercury is a heavy metal that was previously used in switches, fluorescent light bulbs, and many other applications. In 1990, elevated levels of mercury were found in persons exposed to interior latex (water-based) paint containing phenyl mercuric acetate, a preservative used to prolong the paint's shelf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

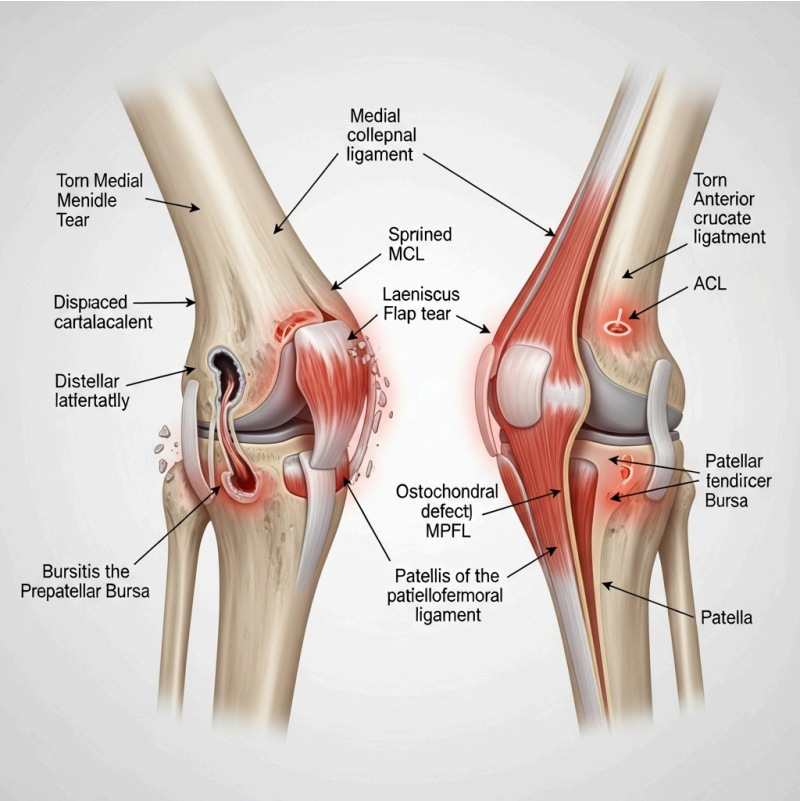
A ***gas*** is a low-density chemical compound that normally fills the space in which it is released. It has no physical shape or form. ***Vapour*** is a gas produced by evaporation. Workplace tasks can produce several hazardous vapours and gases. Ultraviolet radiation, surface coatings, shielding gases, 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 (https://creativecommons.org/licenses/by/4.0/deed.en)

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).

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=1205#oembed-3 (#oembed-3)

If you are using a printed copy, you can scan the QR code with your digital device to go directly to the video: carpal tunnel syndrome. (https://www.youtube.com/watch?v=J11EIfiHMYw&amp)

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.

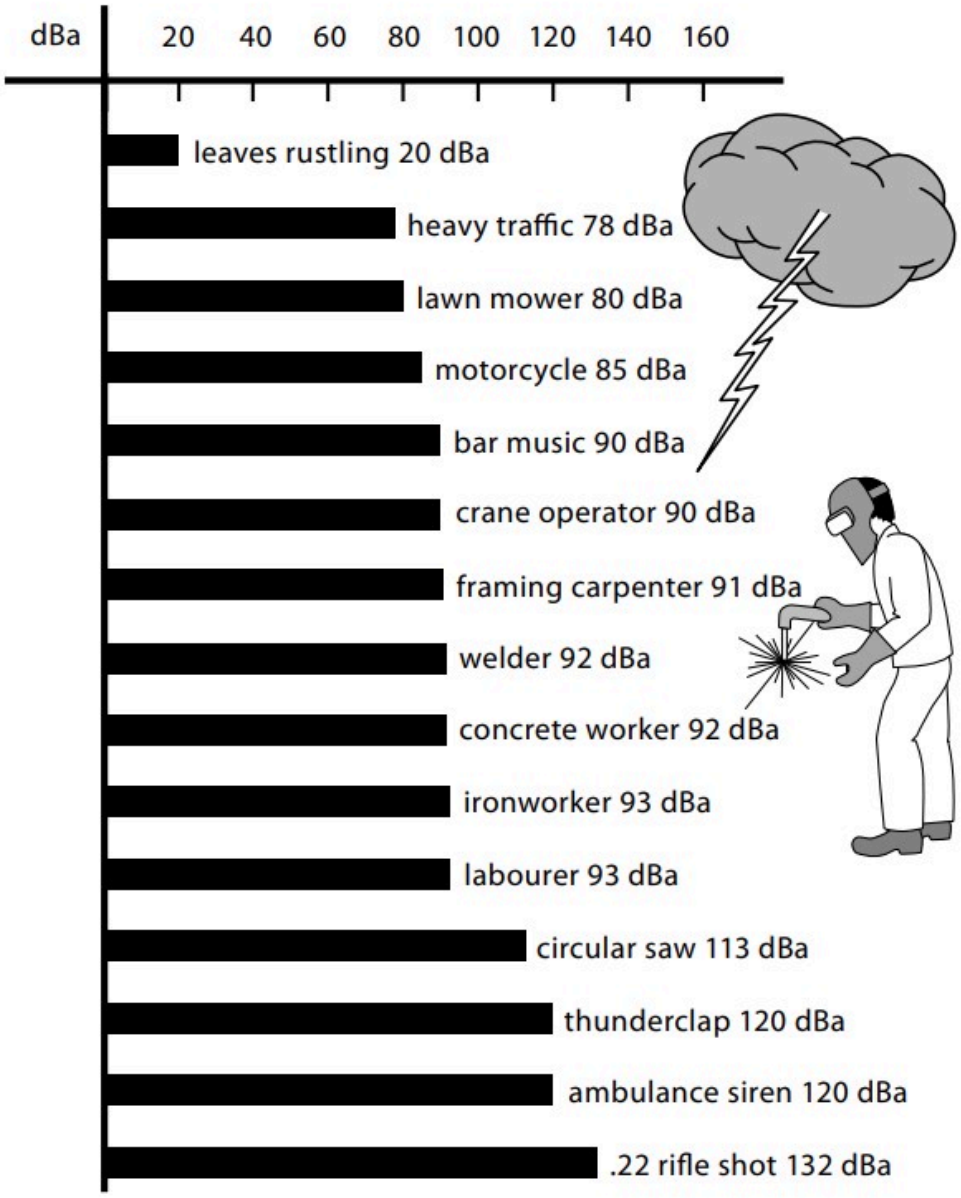


Figure 1 *Noise levels (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

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.

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=1205#h5p-6 (https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/?p=1205#h5p-6)

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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.

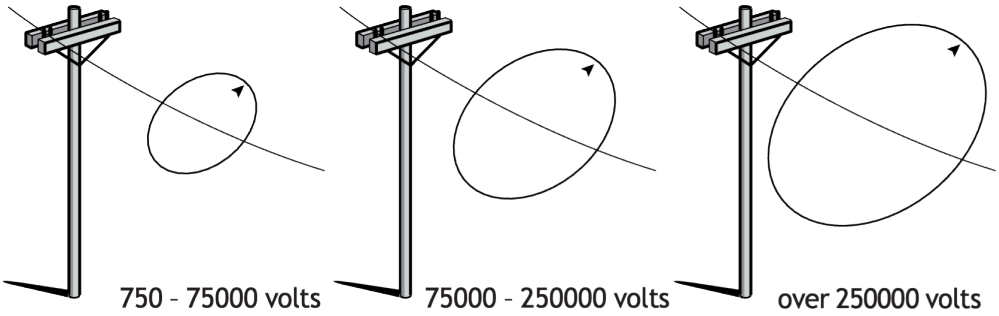


Figure 1 *Limits of approach to power lines, according to voltage (BC Industry Training Authority, 2019).* *CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

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).

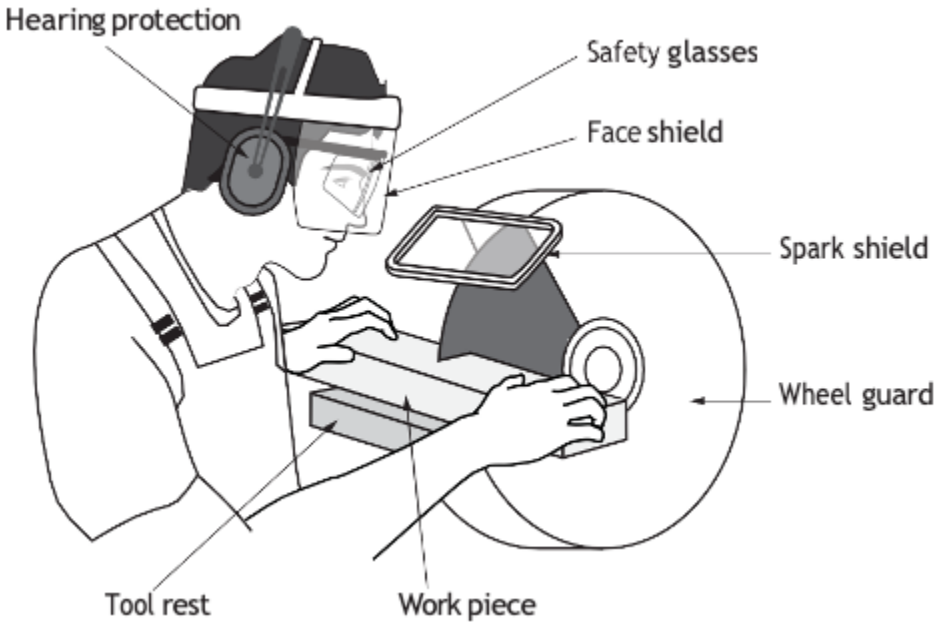


Figure 4 *Use all safety devices* (BC *Industry Training Authority*, 2019). *CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

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 (https://pixabay.com/service/license-summary/)*

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

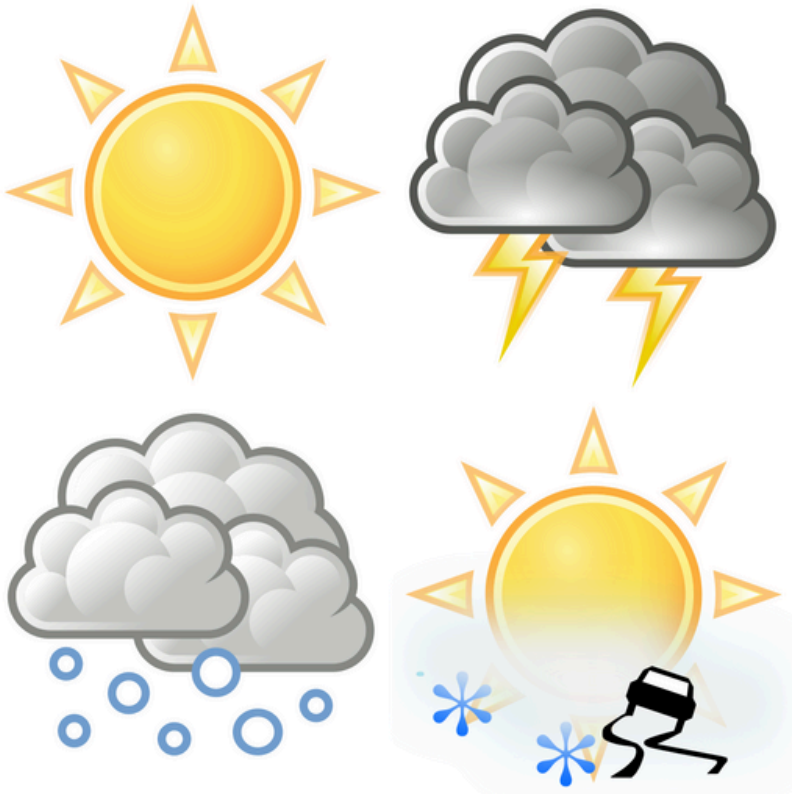


Figure 8 *Weather symbols ([modified by Przykuta (https://commons.wikimedia.org/wiki/User:Przykuta)] The people from the Tango! project/Wikimedia Commons) CC BY-SA 3.0 (https://creativecommons.org/licenses/by-sa/3.0/deed.en)*

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 if reflect off surfaces can be reduced by wearing darkened or tinted safety glasses.

Wall and Floor Openings

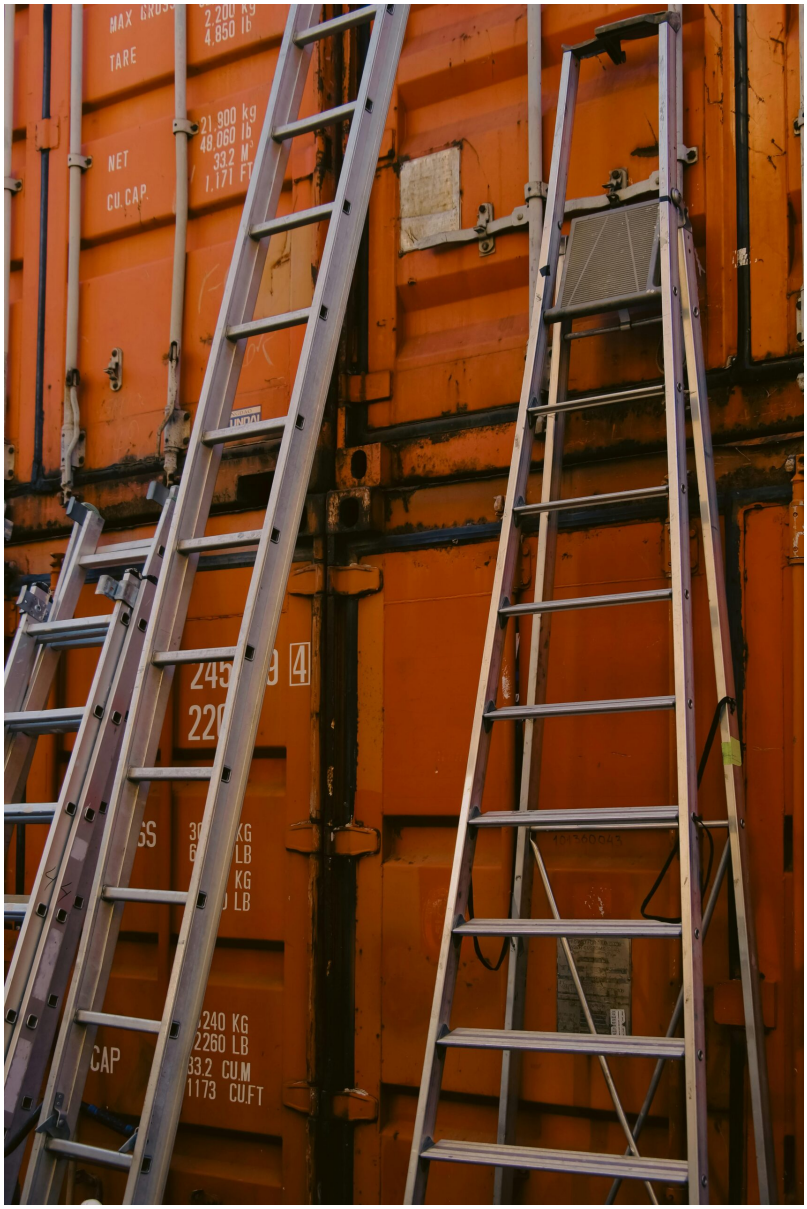
Any opening in a wall or floor is a safety hazard. For protection, openings can be either covered or guarded. Cover any hole whenever possible. When it is not practical to cover a hole, use barricades or guards. The types of guards and barricades used will vary from job to job.

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-bcplumbingapprl1.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.

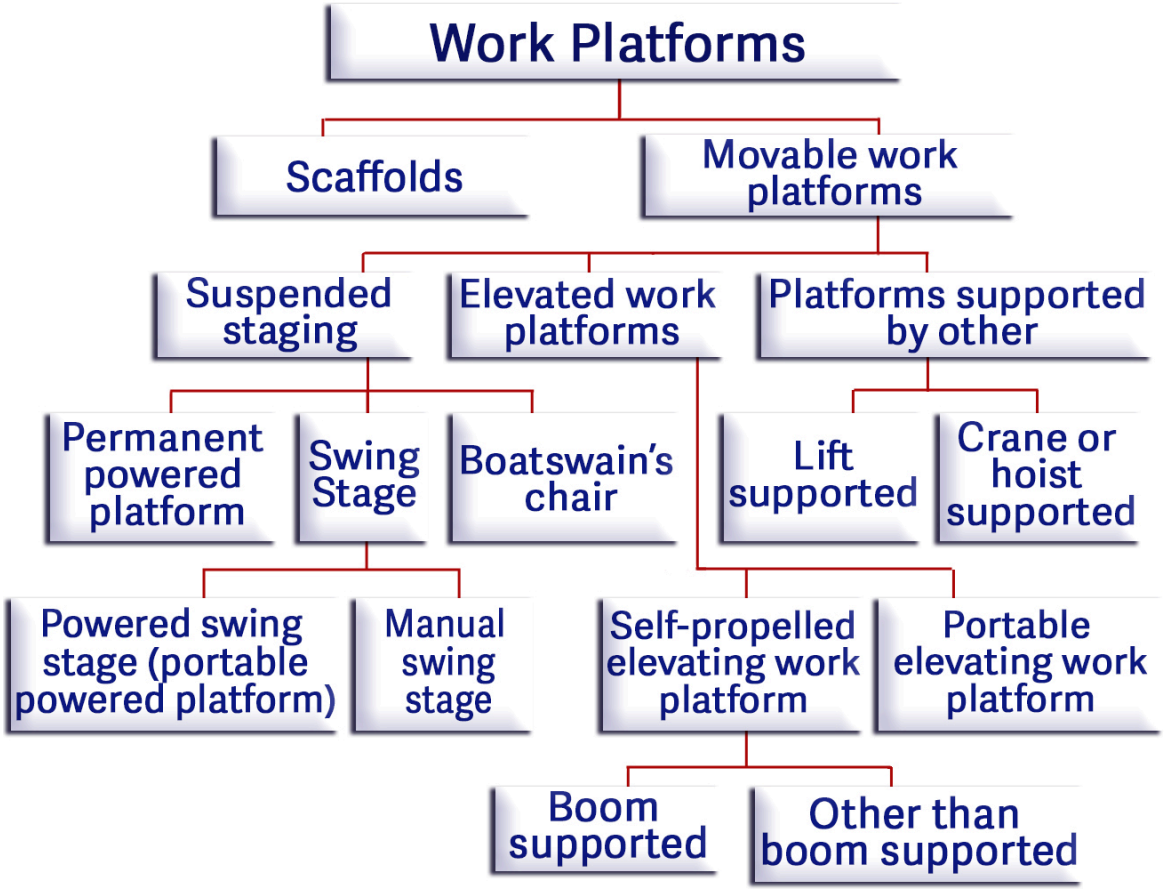


Figure 10 *Work Platforms (Open Press; adapted from BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/) [Long Description (#fig5_longdesc)]*

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-bcplumbingapprl1.pressbooks.tru.ca/?p=1207#h5p-7 (https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/?p=1207#h5p-7)

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Camosun College. (2015). Trades Access Common Core Competency A-1: Control Workplace Hazards. Victoria, B.C.: Crown Publications. Download for free from the B.C. Open Textbook Collection (https://open.bccampus.ca/browse-ourcollection/find-open-textbooks/).

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Long Description

Figure 5 Work Platforms [hierarchal 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 (#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) Content License (https://pixabay.com/service/license-summary/)*

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.

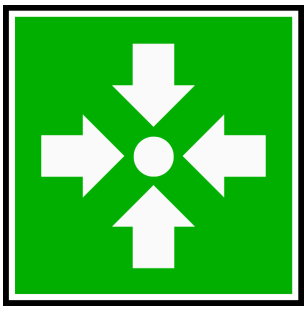

Figure 6 *Assembly point/ muster point Sign (freesvg) CC0 Public Domain (https://creativecommons.org /publicdomain/zero/1.0/)*

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.

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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.

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=1211#h5p-9 (https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/?p=1211#h5p-9)

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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 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/)*

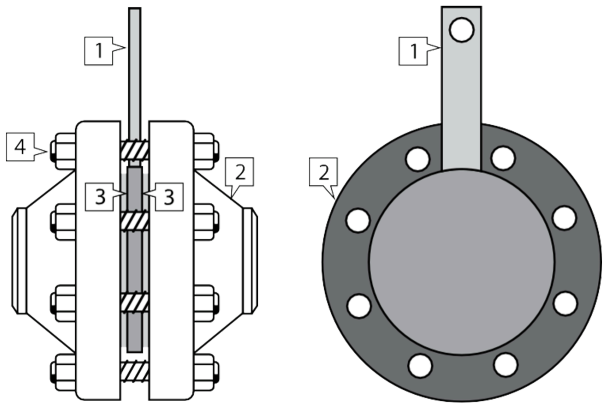

Figure 12 *Spade parts (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

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.

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=1213#h5p-10 (https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/?p=1213#h5p-10)

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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-1.2: 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.) 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 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

A-2 WORKSAFEBC REGULATIONS

Plumber Apprenticeship Program – Level 1

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A-2 WorksafeBC Regulations Introduction

In most provinces, one or more agencies are responsible for ensuring safe and healthy working environments at job sites. These organizations are often known as the Workers' Compensation Board (WCB) or an Occupational Health and Safety department. In British Columbia, **WorkSafeBC** is the provincial organization responsible for promoting workplace health and safety for workers and employers. When a work-related injury, disease, or death occurs, WorkSafeBC works with affected parties to provide return-to-work rehabilitation, health care benefits, compensation, and other services. WorkSafeBC also consults with and educates employers and workers on safe work practices, including monitoring workplaces within its jurisdiction.

This section covers a number of key documents, listed below. Compliance with all of these documents is required to help ensure a safe work environment.

- The **Workers Compensation Act (WCA)** is provincial legislation that authorizes and guides WorkSafeBC (the Workers' Compensation Board of British Columbia). The WCA also sets out the rights and responsibilities of employers and workers related to health and safety.
- The **Hazardous Products Act** is federal legislation that defines which materials are included in the Workplace Hazardous Materials Information System (WHMIS).
- The **Occupational Health and Safety (OHS) Regulation** contains the legal requirements that all workplaces within WorkSafeBC's inspection jurisdiction must meet. WorkSafeBC regularly reviews and updates the OHS Regulation based on experience and changes in knowledge, technology, and work practices.
- The **OHS Guidelines** are intended to help explain how to comply with legislation, not to provide exclusive interpretations. They provide guidance on technical matters needed to apply the Act and Regulations effectively and consistently. Because the OHS Guidelines are dynamic documents that are regularly updated, they are best accessed and maintained online.

Learning Objectives

You must be familiar with the Workers Compensation Act and Workers' Compensation Board of BC (WorkSafeBC).

When you have completed this section, you should be able to:

- Define terms used in the Workers Compensation Act.
- Describe the conditions under which compensation will be paid and the benefits available.
- Describe the workplace responsibilities of WorkSafeBC (the Worker's Compensation Board), the employer, and the worker.
- Describe the WCA requirements for reporting accidents.
- Use the Occupational Health and Safety Regulation.

Resources

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

The following five documents on the WorkSafeBC website (https://www.worksafebc.com/en/law-policy/occupational-health-safety) are **essential to understanding and meeting the minimum requirements for occupational health and safety in British Columbia**:

- *Workers Compensation Act* (B.C.) (https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/workers-compensation-act) (Act)
- *Hazardous Products Act* (Canada) summaries (https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/other-ohs-legislation/hazardous-products-act-canada--summary-of-key-sections) (HPA)
- Occupational Health and Safety Regulation (https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation) (OHS Regulation)
- *Prevention Manual* (https://www.worksafebc.com/en/resources/law-policy/prevention-manual/prevention-manual?lang=en) (policies)
- OHS Guidelines (https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-guidelines), to help interpret and apply the OHS Regulation and the Act

Terminology

The following terms will be used throughout this section. A complete list of terms for this section can be found in the **Glossary or in** Part 1 of the Workers Compensation Act (https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/workers-compensation-act/part-1-scope-of-act).

- **accident:** An unexpected event at work that causes injury or harm, such as slipping on a wet floor or getting hurt while using tools. (Section A-2.1)
- **board:** (Workers' Compensation Board) The group that runs workers' compensation. It decides rules, helps injured workers, and makes sure workplaces follow safety laws. (Section A-2.1)
- **claim:** An official request made to WorkSafeBC for compensation after a worker is injured or becomes ill because of work. (Section A-2.4)
- **compensation:** Money or support given to a worker who is hurt at work, to help pay for things like medical care or time off work. (Section A-2.1)
- **compliance:** Following the rules and laws that are in place, such as workplace safety rules set by

WorkSafeBC. (Section A-2.5)

- **construction:** Work that involves building, fixing, or repairing things like houses, buildings, pipes, or plumbing systems. (Section A-2.1)
- **dependant:** A person who relies on a worker for money or care, such as a child or a spouse. (Section A-2.1)
- **employer:** A person or company that hires workers and pays them to do a job, such as a plumbing business owner. (Section A-2.1)
- **employment:** Having a job where a person works for an employer and gets paid. (Section A-2.1)
- **hazard:** Anything at work that could cause injury, illness, or harm, such as unsafe tools, chemicals, or dangerous conditions. (Section A-2.1)
- **industry:** A group of businesses that do the same type of work, such as plumbing, construction, or trades. (Section A-2.1)
- **member of family:** A close relative, such as a parent, child, sibling, or spouse. (Section A-2.1)
- **OHS Regulation:** A set of safety rules that explain how workplaces must protect workers' health and safety. (Section A-2.5)
- **person:** Any human being, including a worker, employer, or family member. (Section A-2.1)
- **procedure for refusal:** The process a worker follows when they have reasonable cause to believe that doing a task or using equipment would create an undue hazard and could put them in danger. (Section A-2.5)
- **reconsider:** To look at a decision again to see if it should be changed. (Section A-2.1)
- **regulation:** A rule made to explain how a law should be followed, such as safety rules for plumbing work. (Section A-2.1)
- **retirement benefit:** Money paid to a worker after they stop working, often because they are older or injured. (Section A-2.1)
- **undue hazard:** A serious or unnecessary danger that could cause harm to a worker. (Section A-2.5)
- **worker:** A person who does a job for an employer, such as a plumber or construction worker. (Section A-2.1)
- **Workers Compensation Act:** A law that explains how workers are protected if they are injured or become ill because of their job, and how employers must help pay for this protection. (Section A-2.2)

References

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WorkSafeBC. (n.d.-d). OHS Guidelines. https://www.worksafebc.com/en/law-policy/occupational-health-safety/ohs-guidelines

WorkSafeBC. (n.d.-e). Workers Compensation Act (British Columbia). https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/workers-compensation-act

A-2.1 Define Terms Used in the Workers Compensation Act

The Workers Compensation Act (https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/workers-compensation-act) (WCA) is the foundation of workplace health and safety in British Columbia. It outlines the responsibilities of employers, workers, and WorkSafeBC to prevent injuries and provide compensation when accidents occur. Understanding the key terms and structure of the Act helps workers know their rights, recognize their duties, and understand how health and safety laws are applied on the job site.

The Workers Compensation Act (WCA) is divided into eight parts. These parts explain who the law applies to, how workplace safety is managed, and how injured workers are supported in British Columbia.

- **Part 1 – Scope of Act:** Explains who the Act applies to, including workers, employers, and workplaces.
- **Part 2 – Occupational Health and Safety:** Sets the rules for keeping workplaces safe and explains the duties of employers, supervisors, and workers.
- **Part 3 – Workers' Compensation System:** Describes how the workers' compensation system works and how claims are handled.
- **Part 4 – Compensation to Injured Workers and Their Dependants:** Explains the benefits and support available to workers who are injured at work and to their families.
- **Part 5 – Accident Fund and Employer Assessment:** Explains how the system is paid for and how employers contribute to the fund.
- **Part 6 – Review of Board Decisions:** Explains how some WorkSafeBC decisions can be reviewed.
- **Part 7 – Appeals to Appeal Tribunal:** Explains how decisions can be appealed to an independent appeal tribunal.
- **Part 8 – Workers' Compensation Board and General Matters:** Describes WorkSafeBC's role, powers, and general responsibilities.

Definitions in the Act

At the start of the WCA, there is a section dedicated to definitions; this ensures that the reader has a reference to the context of specific terms used within the document. If a word is not defined in this section, then the regular dictionary definition applies.

Go to the WorkSafeBC website (https://www.worksafebc.com/en) and use the search tool to find the full electronic version of the WCA.

Review the definitions of the following words in the Act:

- accident
- board
- compensation
- construction
- dependant
- employer
- employment

- industry
- member of family
- person
- reconsider
- regulation
- retirement benefit
- worker

Self-Test A-2.1: Define Terms Used in the Workers Compensation Act

Complete Self-Test A-2.1 and check your answers.

If you are using a printed copy, please find Self-Test A-2.1 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.

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=1215#h5p-11 (https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/?p=1215#h5p-11)

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A-2.2 Describe WCA Conditions of Compensation

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The ***Workers Compensation Act*** provides benefits to workers who are injured or become ill as a result of their job. To receive these benefits, certain conditions must be met. Understanding how compensation is funded and who qualifies for benefits helps both workers and employers ensure that claims are handled fairly and that injured workers receive appropriate support.

All employers in British Columbia pay an ***assessment fee***, which together cover all of WorkSafeBC's operating costs. These assessments help fund worksite inspections, training workers, and all the direct costs of jobsite or workplace injuries.

WorkSafeBC also collects ***insurance premiums*** from employers to cover the cost of workplace insurance. Employers are required to pay these premiums, just as anyone would for any other forms of insurance. Premiums are based on workers' assessable earnings, industry classification, and the employer's claims history. The premiums collected cover costs related to work-related injuries and diseases, including health care, wage-loss benefits, rehabilitation, and administration.

Workers Who Are Covered

In most provinces, all workers, whether permanent or casual, are covered by legislation in the industries listed below. Casual workers are those who are not on the regular payroll or in steady employment with a particular industry.

Industries covered include:

- Communications
- Lumbering
- Fishing
- Mining or quarrying
- Manufacturing

- Retail sales
- Public utilities
- Wholesale supply
- Transportation
- Government agencies
- Construction

Always check the current provincial legislation to confirm which occupations are covered, as requirements can change over time.

Compensated Injuries and Job-Related Illness

Workers' compensation is a ***"no-fault" insurance*** policy. This means that in most cases, a worker who is injured during work will be eligible for compensation, regardless of who was at fault. The Workers Compensation Act outlines compensation for personal injury claims in Part 4, Division 1. Workers normally receive compensation if they are covered under the legislation and "if, ***in the course of employment***", they:

- Suffer a personal injury or death
- Experience a mental disorder
- Contract an occupational disease such as mercury or lead poisoning, silicosis, asbestosis and other lung ailments, heart attack, radiation sickness, certain cancers, asthma, tendonitis, and heat stress
- Experience a loss of hearing

Circumstances for Compensation

If a worker is injured or becomes ill "in the course of employment," that worker will normally receive compensation. The phrase "in the course of employment" does not mean the person has to be at work or on a jobsite: it means the worker must be doing something that is connected with the employment.

In deciding if an injured worker is eligible to receive compensation for injury or illness, WorkSafeBC considers the following questions:

- Did it occur on the employer's premises?
- Did it occur in the process of the worker doing something for the employer?
- Did it occur during an activity done in response to instructions from the employer?
- Did it occur while using equipment or materials supplied by the employer?
- Did it occur while receiving payment or other consideration from the employer?
- Was the risk that the worker was exposed to the same as the risk a worker is normally exposed to?
- Did it occur during a time period for which the worker was being paid?
- Was it caused by some activity of the employer or a co-worker?

After considering the questions listed above, the Board allows claims that are not directly related to "work" but are related to "employment."

The examples below describe the types of decisions WorkSafeBC has made:

- A truck driver was hit by a car while crossing the street to return to her truck. She had been cashing her paycheque on company time. She was compensated for her injury.
- A mine worker in a remote mining camp fell down the bunkhouse steps in the leisure hours after his shift. He received compensation.
- A carpenter hired in Vernon was travelling to Vancouver to a new job. He was killed in an automobile accident. His widow received compensation.
- A worker was staying in a hotel while on company business. She fell in the hotel bathroom and fractured an ankle. She received compensation.
- A worker contracted a lung disease many years after working with asbestos fibres. He was compensated.

Worker Benefits

When a worker's claim is accepted, he or she will begin receiving benefits from WorkSafeBC.

The type and duration of the benefits depend on the nature of the injury and the work:

- Wage-loss benefits (https://www.worksafebc.com/en/claims/benefits-services/wage-loss-benefits) (WorkSafeBC, n.d.-d)
- Health-care benefits (https://www.worksafebc.com/en/claims/benefits-services/health-care-benefits) (WorkSafeBC, n.d.-a)
- Permanent disability benefits (https://www.worksafebc.com/en/claims/benefits-services/permanent-disability-benefits) (WorkSafeBC, n.d.-b)
- Services for families coping with a work-related death (https://www.worksafebc.com/en/claims/benefits-services/death-benefits) (WorkSafeBC, n.d.-c)

WorkSafeBC benefits begin immediately. Note that:

- The employer is responsible for a worker's wages on the day of injury.
- Wage-loss benefits from WorkSafeBC start the first scheduled shift lost after the day of a work-related injury or disease.
- Healthcare costs are covered on the day of injury.

A worker receives wage-loss benefits until the case manager concludes the worker is able to return to work or has recovered from the injury. If an employer can provide light or modified duties, and it's safe for the worker to do them, he or she can return to work to conduct those duties.

WorkSafeBC benefits can be suspended if:

- The worker does not attend or does not co-operate in a medical examination or program arranged by WorkSafeBC.
- The worker participates in any activity that might delay recovery.
- The worker refuses treatment recommended by WorkSafeBC.
- The claim is fraudulent.

Compensation benefits, also known as ***wage-loss benefits***, are based on 90% of a worker's average net earnings.

Therefore, WorkSafeBC must determine both the average earnings of a worker as well as the worker's net earnings. There are also rules for short-term average net earnings (compensation up to 10 weeks) and special rules for long-term average net earnings (when the worker is disabled beyond 10 weeks).

Self-Test A-2.2: Describe WCA Conditions of Compensation

Complete Self-Test A-2.2 and check your answers.

If you are using a printed copy, please find Self-Test A-2.2 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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A-2.3 State the Responsibilities of Employers, Workers and Others at the Workplace

A safe workplace is one that has a variety of people working together to ensure proper workplace safety is followed. Each person has a certain responsibility, and if each does her or his part, a safe workplace should result. The *Workers Compensation Act* (WCA) (https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/19001_00) identifies the responsibilities of three main groups, as shown in Figure 1. In some cases, an individual may have responsibilities in more than one group.

- Employer
- Worker
- Other:
  - Owner
  - Supervisor
  - Supplier

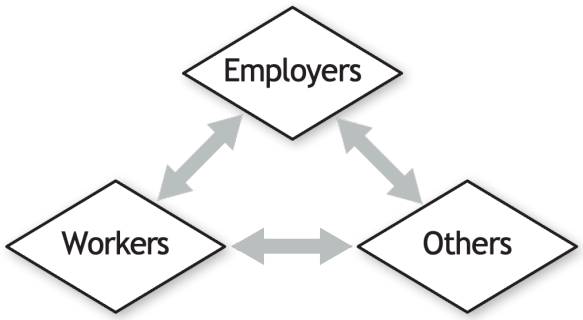

Figure 1 *Workplace safety responsibility (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Division 4 — General Duties of Employers, Workers and Others (https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/19001_02#division_d1e2782) in Part 2 — Occupational Health and Safety (https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/19001_02#part2) of the WCA identify the general duties of employers, workers and others in the workplace.

Employers' Workplace Responsibilities

The WCA identifies responsibilities that are common to all places of employment. To ensure health and safety, the employer must:

- Remedy workplace hazardous conditions
- Ensure that workers:
  - Are aware of known or foreseeable hazards of their work

    - Comply with the *Act* and Regulation
    - Are made aware of their rights and duties
- Establish occupational health and safety policies
- Provide and maintain protective equipment, devices, and clothing as required
- Provide information, instruction, training, and supervision to workers carrying out their work
- Make a copy of the *Act* and Regulation available for review by workers
- Co-operate with workplace safety representatives and WorkSafeBC

Workers' Workplace Responsibilities

According to the WCA, the worker is responsible for his or her own safety on the job as well as the safety of others. The *Act* states that every worker must:

- Carry out work in accordance with established safe work procedures
- Use and wear protective equipment, devices and clothing as required
- Not engage in horseplay or similar conduct that endangers the worker or others
- Ensure that the worker's ability to work is not impaired by alcohol, drugs, or other causes
- Report to the supervisor or employer:
    - ***Issues contravening the Act or Regulation***
    - Defects in or absence of protective equipment, devices and clothing
    - Existence of any hazards that the worker considers potentially dangerous
- Co-operate with workplace safety representatives and WorkSafeBC

Others' Workplace Responsibilities

Supervisors' Workplace Responsibilities

To ensure the health and safety of the workers under their direct supervision, a supervisor must:

- Be knowledgeable about the *Act* and any regulations that apply to their workplace
- Ensure workers are made aware of all known or reasonably foreseeable health or safety hazards in the area where they work
- Consult and co-operate with workplace safety representatives and WorkSafeBC

Owners' Workplace Responsibilities

Every owner of a workplace must:

- Provide and maintain the owner's land and premises that are being used as a workplace in a manner that ensures the health and safety of persons at or near the workplace

- Give to the employer or prime contractor at the workplace the information known to the owner that is necessary to identify and eliminate or control hazards to the health or safety of persons at the workplace

Suppliers' Workplace Responsibilities

Every supplier must:

- Ensure that any tool, equipment, machine or device or any biological, chemical or physical agent that they supply is safe when used according to the directions provided by the supplier
- Ensure that any biological, chemical or physical agent that they supply is labelled according to the applicable federal and provincial legislation
- Maintain any tool, equipment, machine or device in safe condition if the supplier has responsibility under a leasing agreement to maintain it

Self-Test A-2.3: State the Responsibilities of Employers, Workers and Others at the Workplace

Complete Self-Test A-2.3 and check your answers.

If you are using a printed copy, please find Self-Test A-2.3 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-2.4 Describe the WCA Requirements for Reporting Workplace Accidents

Whenever an injury occurs, both the worker and employer have an ***obligation*** to report the ***incident*** and injury. The worker is obliged to let the employer know, and the employer must report to WorkSafeBC. If either one fails to provide the required information, a compensation ***claim*** will be affected.

Worker Report

The worker must inform the employer of the incident as soon as reasonably possible after it occurs. The report must include the name of the worker, the time and place the injury occurred, and the nature of the injury. Informing the supervisor, first aid attendant, or superintendent will comply with the requirement to report to the employer. If requested by the employer, the worker must also provide the details of the injury by filling out a WorkSafeBC form. This information will also assist the employer in filling out the Form 7 injury and incident report.

Look at an example of Form 6A on the WorkSafeBC website: Worker's report of injury or occupational disease to employer: WorkSafeBC – Form 6A (https://www.worksafebc.com/en/resources/claims/forms/workers-report-of-injury-or-occupational-disease-to-employer-form-6a)

When applying for compensation and reporting a work-related injury or ***occupational disease***, the worker can go to the WorkSafeBC website to find a number of reporting options under the Claims (https://www.worksafebc.com/en/claims) tab:

A worker will need details of the incident that caused the injury, the earnings information for any missed work, and health-care provider information for any medical treatment.

Option 1: Call Teleclaim

If a worker has missed work because of an injury, the first step is to start a claim by calling ***Teleclaim*** at 1-888-WORKERS (1-888-967-5377), Monday to Friday from 8 am to 6 pm.

The claims representative will provide the worker with a user ID and password to check claim details.

Option 2: Submit the Form Online

If a worker has missed work because of an injury and has a user ID and password, he or she can submit a Form 6 online. The advantage of having this type of online account is that the worker can log on later to see more details about the claim, including correspondence, claim decisions, and payment information.

Option 3: Report Injuries Not Resulting in Loss of Time from Work

If a worker has not missed work because of an injury, all that is required is to report the details about the incident to the employer as soon as possible.

You can see an example of an application for compensation at WorkSafeBC Application for Compensation and Report of Injury or Occupational Disease (Form 6). (https://www.worksafebc.com/en/resources/claims/forms/application-for-compensation-and-report-of-injury-or-occupational-disease-form-6?lang=en)

Employer Report

An employer must report to WorkSafeBC within three days of every injury or disabling occupational disease occurring to a worker that is—or is claimed to be—one arising out of and in the course of employment.

An employer must immediately report to WorkSafeBC the death of a worker whether the cause of death is claimed to have arisen from the work or outside the workplace.

The employer's report must be on the proper form supplied by WorkSafeBC. Failure to report an injury is an offence and could result in penalties.

You can see a sample of the employer's report of injury or occupational disease, Form 7, on the WorkSafeBC website: Employer's Report of Injury or Occupational Disease (Form 7) (https://www.worksafebc.com/en/resources/claims/forms/employers-report-of-injury-or-occupational-disease-form-7)

For employers, the quickest and easiest way to report a worker's injury or illness is online. The employer's incident and injury report is located here: How employers report a workplace injury or disease (http://www.worksafebc.com/claims/report_injury/incident_and_injury_report/default.asp)

Self-Test A-2.4: Describe the WCA Requirements for Reporting Workplace Accidents

Complete Self-Test A-2.4 and check your answers.

If you are using a printed copy, please find Self-Test A-2.4 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.

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A-2.5 Use the Occupational Health and Safety Regulation

The purpose of the OHS Regulation is to promote occupational health and safety and to protect workers and others present at workplaces from work-related risks to their health, safety, and well-being. ***Compliance*** with the requirements provides the basis on which workers and employers, in co-operation, can solve workplace health and safety problems. The requirements are not an end in themselves but are a foundation on which to build an effective health and safety program.

OHS Regulation Organization

The ***OHS Regulation*** has 34 parts. Note: Part 33, Occupational First Aid, was repealed by B.C. Reg. 348/2003, effective March 30, 2004. Each Part covers a particular topic related to safety in the workplace (see Table 1).

Table 1. *OHS Regulation Parts*

1. Definitions	18. Traffic Control
2. Application	19. Electrical Safety
3. Rights and Responsibilities	20. Construction, Excavation and Demolition
4. General Conditions	21. Blasting Operations
5. Chemical Agents and Biological Agents	22. Underground Workings
6. Substance Specific Requirements	23. Oil and Gas
7. Noise, Vibration, Radiation and Temperature	24. Diving, Fishing and Other Marine Operations
8. Personal Protective Clothing and Equipment	25. Camps
9. Confined Spaces	26. Forestry Operations and Similar Activities
10. De-energization and Lockout	27. Wood Products Manufacturing
11. Fall Protection	28. Agriculture
12. Tools, Machinery and Equipment	29. Aircraft Operations
13. Ladders, Scaffolds and Temporary Work Platforms	30. Laboratories
14. Cranes and Hoists	31. Firefighting
15. Rigging	32. Evacuation and Rescue
16. Mobile Equipment	33. Not in effect
17. Transportation of Workers	34. Rope access

The titles of the Parts are grouped as follows:

- Parts 1–4: Core Requirements apply to all workplaces
- Parts 5–19: General Hazard Requirements deal with general hazards found in a number of workplaces, usually

higher-hazard operations
- Parts 20–32 and 34: Industry/Activity-Specific Requirements deal with specific industries or specific hazardous activities

Rights and Responsibilities

In Part 3 of the Regulation, "Rights and Responsibilities" Section 3.12 Procedure for refusal (https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-03-rights-and-responsibilities#SectionNumber:3.12) explains that you have the right to refuse to do any act or operate any tool, appliance or equipment when you have reasonable cause to believe that to do so would put you in danger.

OHS Guidelines

When you read the language in the Regulation, you may sometimes encounter wording that can be interpreted in different ways.

For example, the "***Procedure for refusal***" section uses the wording "***reasonable cause to believe***" and "***undue hazard***." In many situations, these terms are straightforward to apply. However, in some situations, it may be more difficult to determine whether a worker has reasonable cause to believe there is an undue hazard. For this reason, many parts of the OHS Regulation have associated OHS Guidelines, which are used to help interpret and apply the Regulation.

If you are looking at a section of the Regulation on the WorkSafeBC website or app, you can consult the related guidelines, which explain how to determine whether a worker has "reasonable cause to believe" that an undue hazard exists or would be created, and what qualifies as an "undue hazard." The guidelines also describe the investigation process for a work refusal, including situations where the procedure under section 3.12(3) of the Regulation has not resolved the work stoppage.

Using the OHS Regulation

It is important that a worker be able to locate and interpet regulations that deal with situations that commonly arise in the trades. The *Occupational Health & Safety (OHS) Regulation* is an important resource, and familiarity with its contents is essential for all tradespeople. Using the online search tool is a helpful aid for identifying or confirming regulations that apply to specific situations you may encounter on your job site.

Self-Test A-2.5: Use the Occupational Health and Safety Regulation

Complete Self-Test A-2.5 and check your answers.

If you are using a printed copy, please find Self-Test A-2.5 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.

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Self-Test A-2.1: Define Terms Used in the Workers Compensation Act

Complete Self-Test A-2.1 and check your answers.

1. What is the definition of "regulation" according to the *Workers Compensation Act*?
    a. Time allotted to report an incident
    b. Rules to determine who is eligible for compensation
    c. Description of who is responsible for a worker's claim
    d. Rules of law to guide safe work procedures and policy
2. Under what jurisdiction is the *Hazardous Products Act* found?
    a. Local
    b. Federal
    c. Provincial
    d. Municipal
3. Under what jurisdiction is the *Workers Compensation Act* found?
    a. Local
    b. Federal
    c. Provincial
    d. Municipal
4. It is the worker's responsibility to be familiar with the *Workers Compensation Act*.
    a. True
    b. False

Answer Key: Self-Test A-2.1 is on the other page.

Answer Key: Self-Test A-2.1

1. d. Rules of law to guide safe work procedures and policy
2. b. Federal
3. c. Provincial
4. a. True

Self-Test A-2.2: Describe WCA Conditions of Compensation

Complete Self-Test A-2.2 and check your answers.

1. What factors can be used to assess a company's insurance premiums?
    a. Company earnings
    b. Inspections, training of workers, and operating costs
    c. Industry classification, a company's history, and employee's earnings
    d. Number of vehicles in a company's fleet and number of older workers
2. When would a worker expect to be denied compensation?
    a. Worker suffers hearing loss
    b. Worker injures themselves as a result of clumsiness
    c. Worker contracts an occupational disease such as silicosis
    d. None of the above
3. A worker who receives an injury while living in a remote camp should not expect to be compensated.
    a. True
    b. False
4. There is often a two-week waiting period before benefits are paid out.
    a. True
    b. False
5. Which of the following activities could result in the suspension of benefits?
    a. Receiving acupuncture treatment for an injury
    b. Visiting your family doctor to discuss recovery
    c. Refusing to co-operate in a WorkSafeBC medical examination
    d. Claiming you are suffering from an occupational disease, not an injury
6. WorkSafeBC benefits cover all medical expenses except for costs from the day of the injury because the claim was not active yet.
    a. True
    b. False
7. The phrase "in the course of employment" means a worker is only performing tasks at work, on the clock.
    a. True
    b. False
8. When can a worker return to work?
    a. When the case manager deems the worker ready for work
    b. If the employer can provide modified or light duty deemed safe
    c. When the worker has recovered from the injury and it is safe to work again
    d. All of the above

Answer Key: Self-Test A-2.2 is on the other page.

Answer Key: Self-Test A-2.2

1. c. Industry classification, a company's history, and employee's earnings
2. d. None of the above
3. b. False
4. b. False
5. c. Refusing to co-operate in a WorkSafeBC medical examination
6. b. False
7. b. False
8. d. All of the above

Self-Test A-2.3: State the Responsibilities of Employers, Workers and Others at the Workplace

Complete Self-Test A-2.3 and check your answers.

1. Who is responsible for a worker's safe behaviour?
    a. Owner
    b. Worker
    c. Employer
    d. Supervisor
2. Who is responsible for making workers aware of hazards on the job?
    a. Owner
    b. Worker
    c. Supplier
    d. Supervisor
3. Who is responsible for removing any known workplace hazards?
    a. Owner
    b. Worker
    c. Supplier
    d. Employer
4. Who is responsible for ensuring any biological, chemical or physical agent is properly identified and labelled according to local regulations?
    a. Owner
    b. Worker
    c. Supplier
    d. Employer
5. Where can you find the description of the responsibilities of employers, workers and others to create a safe workplace?
    a. WHMIS
    b. Right to Work Act
    c. Hazardous Products Act
    d. Workers Compensation Act

Answer Key: Self-Test A-2.3 is on the other page.

Answer Key: Self-Test A-2.3

1. b. Worker
2. d. Supervisor
3. d. Employer
4. c. Supplier
5. d. Workers Compensation Act

Self-Test A-2.4: Describe the WCA Requirements for Reporting Workplace Accidents

Complete Self-Test A-2.4 and check your answers.

1. How soon must an employer report a worker's injury to WorkSafeBC?
    a. Within 24 hours
    b. Within 48 hours
    c. Within 72 hours
    d. Before the end of the day
2. How soon must a worker report an injury or occupational disease to the employer?
    a. Within 24 hours
    b. Within 48 hours
    c. Within 72 hours
    d. As soon as reasonably possible
3. Once a worker has reported an injury to the employer, the reporting process is complete.
    a. True
    b. False
4. When the worker reports an injury-causing incident that required medical treatment, what information will he or she will need?
    a. Earnings information
    b. Details of the incident
    c. Name of healthcare provider
    d. All of the above

Answer Key: Self-Test A-2.4 is on the other page.

Answer Key: Self-Test A-2.4

1. c. Within 72 hours
2. d. As soon as reasonably possible
3. b. False
4. d. All of the above

Self-Test A-2.5: Use the Occupational Health and Safety Regulation

Complete Self-Test A-2.5 and check your answers.

1. What do the letters OHS stand for?
    a. Operational Health Standards
    b. Organized Health Stipulations
    c. Organized Health Specifications
    d. Occupational Health and Safety
2. Where in the OHS Regulation would you find information on fall protection?
    a. Part 33: Fall Arrest
    b. Parts 1–4: Core Requirements
    c. Parts 5–19: General Hazard Requirements
    d. Parts 20–32: Industry/Activity Specific Requirements
3. If a worker needs information to help interpret OHS regulations associated with common safety situations that can arise in the trades, what resources can he or she find in the OHS Regulation?
    a. Policies
    b. Guidelines
    c. Shop Rules
    d. IPT Handbook
4. The OHS Regulation is written specifically for employers, not workers.
    a. True
    b. False
5. It is important that a worker can locate and interpret the OHS Regulation.
    a. True
    b. False
6. The OHS Regulation can provide helpful information and safety guidelines to be used on the job site.
    a. True
    b. False

Answer Key: Self-Test A-2.5 is on the other page.

Answer Key: Self-Test A-2.5

1. d. Occupational Health and Safety
2. c. Parts 5–19: General Hazard Requirements
3. b. Guidelines
4. b. False
5. a. True
6. a. True

A-3 SAFE HANDLING OF HAZARDOUS MATERIALS

Plumber Apprenticeship Program – Level 1

Person Wearing White Suit Holding White Container (Pixabay/Pexels) CC0 (https://creativecommons.org/public-domain/cc0/)

A-3 Safe Handling of Hazardous Materials Introduction

Workers exposed to hazardous materials may face serious health risks, such as kidney or lung damage, sterility, cancer, allergic reactions or burns. Some hazardous materials can also cause fires or explosions.

Legislation and regulations are in place to reduce injuries and diseases caused by exposure to hazardous materials used in the workplace.

Everyone who works with or near hazardous products has the right to know what the hazards are and how to use these products safely.

Learning Objectives

When you have completed this section, you should be able to:

- Describe Workplace Hazardous Materials Information System (WHMIS) regulations and the handling of hazardous goods.
- Identify the hazards associated with hazardous products.
- Select the appropriate personal protective clothing and equipment to protect yourself when working with hazardous materials.

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.**

- **corrosive**: Something that can **burn, eat away, or damage** materials like skin, eyes, or metal. Corrosive substances can cause serious injuries if they touch your body, so they must be handled very carefully. (Section A-3.5)
- **excluded** (from both federal and provincial WHMIS legislation): In WHMIS, a product or situation that is not covered by certain federal or provincial WHMIS rules. Even when a product is excluded, workers must still be told about any health or safety risks and how to use the product safely. (Section A-3.3)
- **Globally Harmonized System of Classification and Labelling of Chemicals (GHS):** An international system that uses the same symbols, labels, and safety information to explain the dangers of chemicals and how to use them safely. (Section A-3.1)
- **[hazard] categories (also called types):** A classification that shows how dangerous a hazard is. Lower numbers or earlier letters usually mean more danger. (Section A-3.1)
- **hazard classes:** A group that shows the type of danger a product has, such as fire or health risks. (Section A-3.1)
- **hazardous product:** A substance that can harm people or cause damage if it is not used safely. (Section A-3.1)
- **health hazard:** Examples include: overexposure to harmful dusts, chemicals, or radiation. (Section A-1.1 and Section A-3.1)
- **label**: A safety tag or sticker on a product container that shows hazards, symbols, and basic safety information.(Section A-3.2)
- **physical hazard:** Examples: moving objects, fluctuating temperatures, high-intensity lighting, rolling or pinching hazards, electrical connections, and sharp edges (Section A-1.1 and Section A-3.1).
- **pictogram:** A symbol that quickly shows what kind of hazard a product has; used on safety labels in WHMIS. (Section A-3.1)
- **safety data sheet (SDS)**: Documents that explain the hazards of a product and give important information on how to use, store, and handle it safely, and what to do in an emergency. (Section A-3.1 and Section A-3.2)
- **supplier label:** The label placed on a product by the supplier that shows hazards and safe handling information. (Section A-3.1)
- **Transportation of Dangerous Goods (Regulations):** A Canadian system that uses special labels and colours to warn people about dangerous materials being moved from one place to another. Some colours, like orange, are already used by TDG to show specific dangers (such as explosives), so those colours cannot be used for other safety labels because they could confuse. (Section A-3.3)
- **Workplace Hazardous Materials Information System (WHMIS):** A safety system that helps workers understand the dangers of hazardous products and how to use them safely at work. (Section A-3.2)
- **workplace label:** A safety label added by the employer at the workplace. They are used when a product is transferred to another container or when the original supplier label is missing, and they explain the hazards and safe handling of the product. (Section A-3.3)

A-3.1 Explain the Hazardous Products Legislation

Working with chemicals and other hazardous materials is a normal part of many jobs in the piping trades. To keep workers safe, the Government of Canada and WorkSafeBC have established laws that control how hazardous products are classified, labelled, and used in the workplace. These laws make sure that everyone—from suppliers and employers to workers—has the information needed to handle materials safely and prevent exposure or injury.

The most important concept to remember about handling hazardous material is that you are responsible for your own safety and the safety of others.

Purpose of WHMIS

The Workplace Hazardous Materials Information System (WHMIS) (https://www.canada.ca/en/health-canada/services/environmental-workplace-health/occupational-health-safety/workplace-hazardous-materials-information-system.html) is Canada's national hazard communication standard. The overall purpose of WHMIS is to help ensure a safer, healthier workplace. WHMIS is also known as the *Right to Know* requirement. Your knowledge about the workplace is your biggest asset in successfully understanding and benefiting from WHMIS.

Legislation

WHMIS is implemented through a combination of federal and provincial legislation. The main purpose of the **federal** WHMIS legislation is to require the suppliers of hazardous materials used in the workplace to provide health and safety information about their products as a condition of sale. The main purpose of the **provincial** WHMIS legislation is to require employers to obtain health and safety information about hazardous materials in the workplace and to pass this information on to workers.

There are a number of pieces of federal legislation that implement WHMIS:

- The **Hazardous Products Act** (https://laws-lois.justice.gc.ca/eng/acts/h-3/) places duties on suppliers to provide up-to-date labels and ***safety data sheets (SDSs)*** to their customers.
- The **Hazardous Products Regulation** (https://laws-lois.justice.gc.ca/eng/regulations/sor-2015-17/index.html), established January 30, 2015, under the amended Hazardous Products Act, defines what a hazardous product is and sets the classifications, labelling, and required information to be found on SDSs. This regulation has replaced the previous Controlled Products Regulations (CPR) and the Ingredient Disclosure List.
- The **Hazardous Materials Information Review Act** (https://laws-lois.justice.gc.ca/eng/acts/h-2.7/index.html)establishes the Hazardous Materials Information Review Commission, which is the federal agency that rules on claims for exemption from disclosing confidential business information. This Act also defines the type of information a supplier or employer may withhold from a label or SDS.
- The **Hazardous Materials Information Review Regulations** (https://laws-lois.justice.gc.ca/eng/regulations/sor-88-456/)set out the criteria that the commission uses when assessing the validity of a claim for exemption. They also set out the fees for filing a claim for exemption or appealing a decision of the commission.

Globally Harmonized System

The Globally Harmonized System of Classification and Labelling of Chemicals (GHS) (https://www.canada.ca/en/health-canada/services/environmental-workplace-health/occupational-health-safety/workplace-hazardous-materials-information-system/globally-harmonized-classification-labelling-chemicals.html) is an internationally agreed-upon system, created by the United Nations. It was designed to replace the various chemical classification and labelling standards used in different countries by using consistent criteria for hazard classification and labelling at a global level. Its development began at the United Nations Rio Conference in 1992.

Before GHS, countries—and even regions within the same country—used different systems for classifying and labelling chemical products. This situation created confusion for workers who needed to understand chemical hazards in order to work safely. It was also costly for companies required to comply with multiple systems and challenging and expensive for governments to regulate and enforce. The goal of GHS is to establish one common set of rules for classifying hazards and a consistent format and content for labels and safety data sheets (SDSs) will be adopted worldwide.

In December 2011, the Joint Action Plan for the Canada-U.S. Regulatory Cooperation Council (RCC) was announced. It included a key commitment to "align and synchronize implementation of common classification and labelling requirements for workplace hazardous chemicals" within the mandates of the U.S. Occupational Safety and Health Administration (US-OSHA) and Health Canada.

In Canada, on June 19, 2014, legislative amendments to the Hazardous Products Act (HPA), along with related amendments to other federal acts, including the Hazardous Materials Information Review Act, received Royal Assent. As a result, Health Canada repealed and replaced the Controlled Products Regulations (CPR) with the Hazardous Products Regulations (HPR) to implement GHS. These federal changes also led to updates to provincial and territorial occupational health and safety legislation and regulations.

WHMIS was first introduced in 1988 through a coordinated set of federal, provincial, and territorial laws and regulations. Adopting GHS did not change the basic roles and responsibilities of suppliers, employers, and workers under WHMIS. Instead, GHS elements were incorporated into the existing system, introducing standardized hazard classifications, label requirements, and SDS formats, and aligning WHMIS with the Joint Action Plan commitments.

For the sake of clarity, the original WHMIS is now referred to as *WHMIS 1988*, and the updated version is called *WHMIS 2015*. The transition from WHMIS 1988 to WHMIS 2015 was completed in December 2018. During the transition period, workers may have encountered both systems. For more detailed information, refer to the Canadian Center for Occupational Health and Safety (CCOHS): WHMIS (https://www.ccohs.ca/oshanswers/chemicals/whmis_ghs/general.html) website.

Hazardous Products

WHMIS defines a ***hazardous product*** as a product that poses a ***physical hazard*** or ***health hazard*** and meets the criteria for inclusion in one or more of the 31 ***hazard classes***. Some hazard classes are further divided into ***categories*** (also called *types*), which show how severe the hazard is. Product suppliers classify hazardous products and assign one or more appropriate ***pictograms*** (symbols) that must appear on the ***supplier label***.

WHMIS provides information about many hazardous materials used in the workplace, known as hazardous products. Under WHMIS, workers have the right to receive information about each hazardous product they use, including its

identity, hazards, and safety precautions. This information helps reduce exposure to hazardous materials and supports safe work practices.

Products Not Covered by WHMIS

Some hazardous products are covered by other legislation and therefore are either exempt or excluded from WHMIS requirements. They will have labelling and hazard information meeting their legislative requirements. The products excluded from WHMIS are:

- Explosives (as defined in the Explosives Act (https://laws-lois.justice.gc.ca/eng/acts/e-17/))
- Cosmetics, devices, drugs, or foods (as defined in the Food and Drugs Act (https://laws-lois.justice.gc.ca/eng/acts/f-27/))
- Pest control products (as defined in the Pest Control Products Act (https://laws-lois.justice.gc.ca/eng/acts/p-9.01/))
- Consumer products (as defined in the Canada Consumer Product Safety Act (https://laws-lois.justice.gc.ca/eng/acts/c-1.68/))
- Wood or products made of wood
- Nuclear substances, within the meaning of the Nuclear Safety and Control Act (https://laws-lois.justice.gc.ca/eng/acts/n-28.3/), that are radioactive
- Hazardous waste (being a hazardous product that is sold for recycling or recovery and is intended for disposal)
- Tobacco and tobacco products (as defined in the Tobacco and Vaping Products Act (https://laws-lois.justice.gc.ca/eng/acts/t-11.5/))
- Manufactured articles

Recognition of Rights and Responsibilities

WHMIS specifies the duties for suppliers, employers and workers (Table 1):

Table 1: WHMIS Rights and Responsibilities

Group	Responsibilities	Key Duties
Suppliers	Suppliers of hazardous products must ensure products are properly classified and provide up-to-date SDSs for all hazardous products they sell or produce. If new significant data becomes available about a product, the supplier must provide an updated SDS within 90 days of becoming aware of the changes. Suppliers must also provide supplier labels on all containers of hazardous products they sell or produce.	• Ensure hazardous products are properly classified • Provide up-to-date Safety Data Sheets (SDSs) for all hazardous products sold or produced • Update SDSs within 90 days if new important information becomes available • Provide supplier labels on all containers of hazardous products
Workers	Workers must know and understand the information on all labels and SDSs. They must use the information they receive through education and training to handle hazardous products safely.	• Understand the information on labels and SDSs • Use training and SDS information to handle hazardous products safely
Employers	Employers must ensure that there is an up-to-date SDS for each hazardous product supplied to the workplace. Copies of supplier and employer SDSs must be accessible to employees. The sheets must be placed close to work areas and made available during each work shift. Workers must be taught what to look for in a data sheet, and they must be given an opportunity to become familiar with the information the sheets carry. Employers are responsible for workplace labels when required. While some products, covered by other legislation, may be exempt from all of the WHMIS requirements, employers must still provide education and training on the health effects, safe use, and storage of these products.	• Ensure an up-to-date SDS is available for each hazardous product in the workplace • Make SDSs accessible to workers during every work shift and near work areas • Train workers on how to read and use SDSs • Provide workplace labels when required • Provide education and training for products exempt from WHMIS but still hazardous
Regulators (WorkSafeBC)	WorkSafeBC staff administer WHMIS legislation. This includes providing general information about WHMIS to employers and workers as well as ensuring compliance with both federal and provincial WHMIS legislation.	• Administer and enforce WHMIS legislation • Provide information and guidance to employers and workers • Ensure compliance with federal and provincial WHMIS requirements

Hazardous Product Classifications

There are two groups of hazardous products: those posing physical hazards and those posing health hazards. The products within these two hazard groups are further divided into hazard classes. A hazardous product may fall into more than one hazard class.

Physical Hazards

The physical hazards group includes the following hazard classes:

- Combustible dusts
- Corrosive to metals
- Flammable aerosols
- Flammable gases
- Flammable liquids
- Flammable solids
- Gases under pressure
- Organic peroxides
- Oxidizing gases
- Oxidizing liquids
- Oxidizing solids
- Pyrophoric gases
- Pyrophoric liquids
- Pyrophoric solids
- Self-heating substances and mixtures
- Self-reactive substances and mixtures
- Simple asphyxiants
- Substances and mixtures which, in contact with water, emit flammable gases
- Physical hazards not otherwise classified

Note: Explosives are not included in WHMIS 2015 because they are covered by other legislation.

Health Hazards

The health hazards group includes the following hazard classes:

- Acute toxicity
- Aspiration hazard
- Biohazardous infectious materials
- Carcinogenicity
- Germ cell mutagenicity
- Reproductive toxicity
- Respiratory or skin sensitization
- Serious eye damage/eye irritation
- Skin corrosion/irritation
- Specific target organ toxicity—single exposure
- Specific target organ toxicity—repeated exposure
- Health hazards not otherwise classified

Note: An environmental hazards group exists in GHS. This group (and its classes) was not adopted in WHMIS 2015 since it is beyond the direct scope of WHMIS legislation (i.e., workplaces). However, you may see the environmental classes listed on labels and SDSs.

Hazard Categories

Each hazard class is divided into categories or types that show how dangerous the hazard is. Categories are identified by numbers (1, 2, 3, etc.), and types are identified by letters (A, B, C, etc.). In general, lower numbers and earlier letters mean a greater hazard or danger. For example, a Category 1 oxidizing liquid is more dangerous than a Category 2 oxidizing liquid. If a category is further divided into subcategories, such as 1A and 1B, then 1A represents the higher level of hazard.

Note: There are some exceptions to this system. For the "gases under pressure" hazard class, categories such as "compressed gas," "liquefied gas," "refrigerated liquefied gas," and "dissolved gas" describe the physical form of the gas when packaged, not how severe the hazard is.

Self-Test A-3.1: Explain the Hazardous Products Legislation

Complete Self-Test A-3.1 and check your answers.

If you are using a printed copy, please find Self-Test A-3.1 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.

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=1225#h5p-17 (https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/?p=1225#h5p-17)

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A-3.2 Describe the Key Elements of WHMIS

The ***Workplace Hazardous Materials Information System (WHMIS)*** is designed to ensure that everyone in the workplace has the information they need to work safely with hazardous products. It provides a consistent system for classifying hazards and sharing safety information with workers through labels, safety data sheets (SDS), and education.

After a hazardous product has been classified, three WHMIS elements are used to communicate health and safety information:

1. Labelling
2. Safety data sheets (SDS)
3. Education and training

Labelling

When a supplier produces or imports a hazardous product for distribution and sale in Canada, the supplier must prepare a ***label*** that is clearly and prominently displayed on the container. These labels are often the first warning to users about the major hazards of the product. They also outline basic safety precautions that should be followed. The label shown in Figure 1 is an example of an acceptable supplier label from CCOHS (n.d).

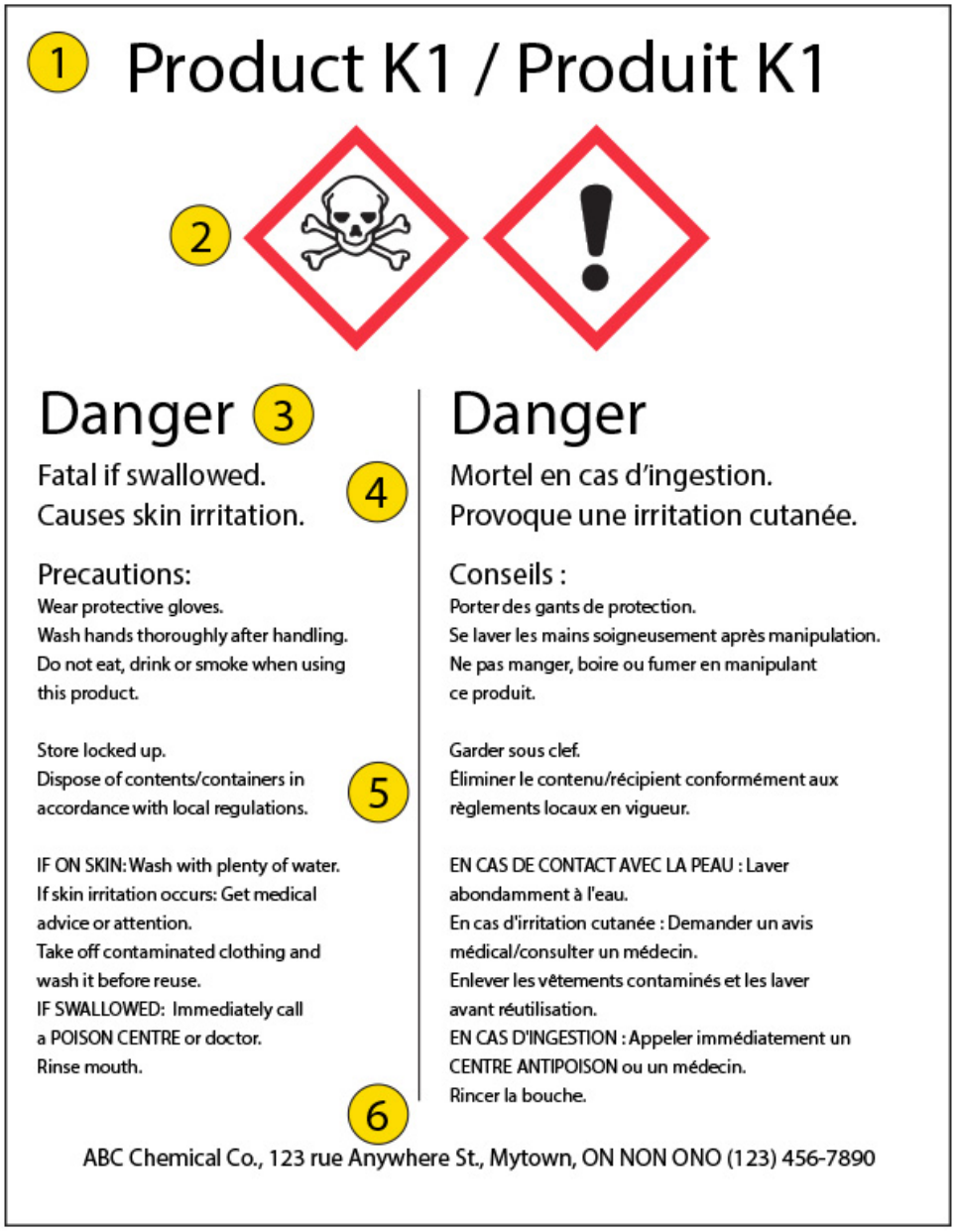

Figure 1 *Supplier label sample from CCOHS (n.d.). 1) Product Identifier, 2) Hazard Pictograms, 3) Signal Word, 4) Hazard Statements, 5) Precautionary Statements, and 6) Supplier Identifier. (Used with permission of CCOHS (https://www.ccohs.ca/products/posters/WHMIS-labels))*

Safety Data Sheets

MATERIAL SAFETY DATA SHEET

ADDRESS: Heat and Light Resources d/b/a HeatCell PO Box 1033 Jane Lew, WV 26378 (304) 326-2624	DATE: 01/02/00 PREPARED BY: Dr. Charles Simon EMERGENCY TELEPHONE NUMBER: CHEMTREC 800-424-9300

NFPA HAZARD CLASSIFICATIONS
H = HEALTH
F = FLAMMABILITY
R = REACTIVITY
NF = NOT FOUND

H = 1
F = 1
R = 1

I. IDENTIFICATION

LABEL NAME: FOOD WARMER	
TRADE OR PRODUCT NAME: EcoFuel™ XB/HeatCell	
FDA NO.:	CAS NO.: Diethylene Glycol CAS 00111-46-6

II. FIRE, EXPLOSION AND REACTIVITY DATA

FLASH POINT (METHOD): 246°F (104°C) Cleveland Open Cup	0 = LEAST 1 = SLIGHT 2 = MODERATE 3 = HIGH 4 = EXTREME
EXTINGUISHING MEDIA: DRY CHEMICAL, FOAM OR CO_2	DOT HAZARD CLASSIFICATION: NOT REQUIRED
SPECIAL FIRE FIGHTING PROCEDURES: NONE UNUSUAL FIRE AND EXPLOSION HAZARDS: UNKNOWN, Believed to be relatively safe.	
HAZARDOUS COMBUSTIBLE OR DECOMPOSITION PRODUCTS: Product consists of hydrocarbon component stabilized by tightly packed fiber wool to give an essentially non-spillable mass. The components are contained in a metal can with a metal lid. The mass is not ignitable at room temperature. To ignite, apply flame directly to glass fiber(s). Can produce carbon monoxide and some irritants under some burning conditions. Glass fibers caused cancer in animals through unnatural routes of exposure (surgical implantation), but it is not associated with cancer by inhalation. Use of glass fibers has not been shown to cause cancer in humans. If ingestion of glass fibers occur, observe individual for several days to ensure that intestinal blockage does not occur. It is not recommended to induce vomiting if ingested.	
STABILITY: Stable CONDITIONS TO AVOID: Excessive Heat. MATERIALS TO AVOID: Strong Oxidizers.	
HAZARDOUS POLYMERIZATION PRODUCTS: NA Will not occur.	

III. PHYSICAL DATA

ODOR, APPEARANCE AND PHYSICAL STATE: Slightly opaque colorless liquid with subtle petroleum solvent odor.	
BOILING POINT: 433°F 223°C MELTING POINT: NA	SPECIFIC GRAVITY (H$_2$0 = 1.0): 1.117 @ 68°F (20°C) EVAPORATION RATE: < 1 (Butyl Acetate = 1)
VAPOR PRESSURE (mmHg): < 1@20°C, DEG = 0.01 VAPOR DENSITY (AIR = 1): > 1	SOLUBILITY IN WATER: Partially Miscible

IV. PROTECTION INFORMATION

RESPIRATORY: Use MSHA or NIOXH respirator for handling vapor or mist.	VENTILATION: Always use with Good ventilation.
EYE: Safety glasses for working with vapors or mists.	SKIN: Protective gloves or clothing generally not needed.
OTHER PROTECTIVE DEVICES AND PROCEDURES: Generally not required. Avoid prolonged breathing of mist. Wash hands after handling. Wash soiled work clothing frequently.	

V. OCCUPATIONAL EXPOSURE LIMIT

THRESHOLD LIMIT VALUE (TLV): NF OSHA PERMISSIBLE EXPOSURE LIMIT (PEL): NF
HAS THE SUBSTANCE BEEN LISTED AS A CARCINOGEN OR POTENTIAL CARCINOGEN IN THE ANNUAL REPORT ON CARCINOGENS, PUBLISHED BY NTP, BY THE INTERNATIONAL AGENCY FOR RESEARCH ON CANCER, OR BY OSHA? YES ☐ NO ☒

Figure 2 *Safety Data Sheet (Sid/Flickr)* CC BY-NC-ND 2.0 (*https://creativecommons.org/licenses/by-nc-nd/2.0/deed.en*)

A ***safety data sheet (SDS)*** is a technical bulletin that provides specific, detailed information about a product, including its hazards, safe handling instructions, and emergency procedures. Since SDSs contain specific health and safety information for each hazardous product, they should be used as a key source of information for developing training programs and safe work procedures. SDSs are also valuable reference tools for workers, health and safety committees, and emergency service responders and personnel.

For more information, see WHMIS – Safety Data Sheet (SDS) (https://www.ccohs.ca/oshanswers/chemicals/whmis_ghs/sds.html) on the CCOHS website.

Education and Training

Employers must provide education and training for workers so that they can work safely with, or near, hazardous

products. Workers need to know how WHMIS works, the dangers of hazardous products in their workplace, and the procedures they must follow to work safely with the products.

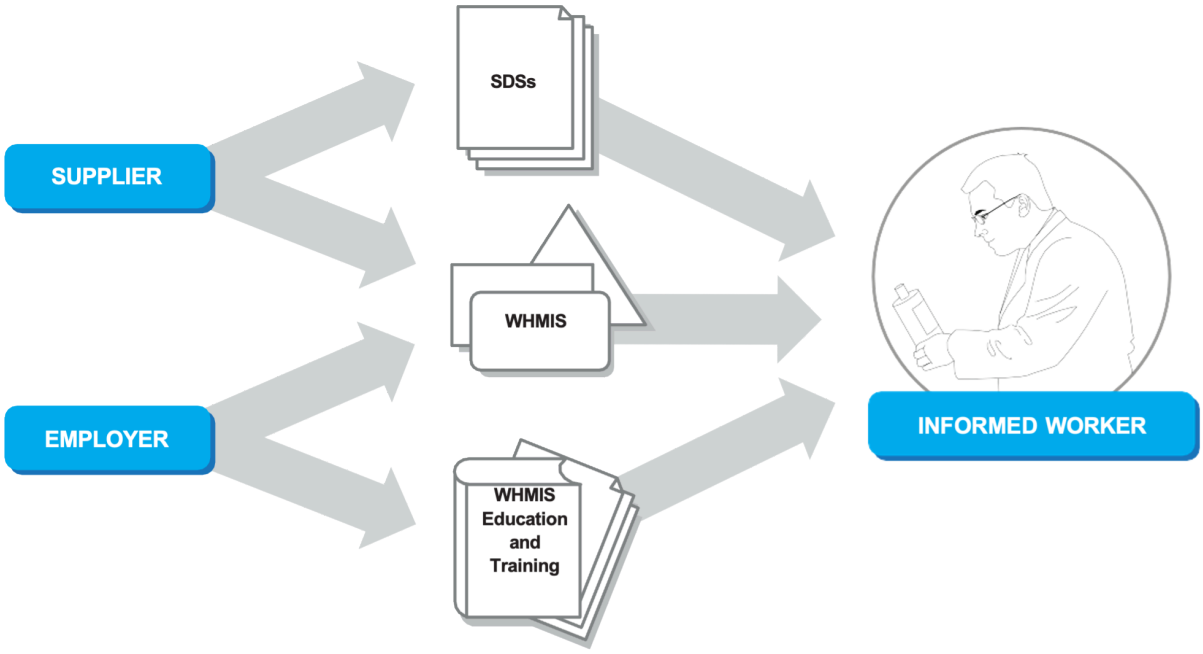

Figure 3 *WHMIS information flow (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Workers should be able to answer these questions for every hazardous product they use:

- What are the hazards of the product?
- How do I protect myself from those hazards?
- What do I do in case of an emergency?
- Where can I find more information?

Self-Test A-3.2: Describe the Key Elements of WHMIS

Complete Self-Test A-3.2 and check your answers.

If you are using a printed copy, please find Self-Test A-3.2 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.

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=1227#h5p-18 (https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/?p=1227#h5p-18)

References

BC Industry Training Authority. (2019). *Piping trades apprenticeship program: Perform safety related functions—Level 1 harmonized* [Binder]. Crown Publications, Queen's Printer for British Columbia. https://www.crownpub.bc.ca/Product/Details/7960000260_S

Camosun College. (2015). Line A: Safe Work Practices — Competency A-3: Handle Hazardous Materials Safely (BCcampus). https://collection.bccampus.ca/textbook/PMfB6kHM/

Camosun College. (2015). Trades Access Common Core Competency A-3: Handle Hazardous Materials Safely. Victoria, B.C.: Crown Publications. Download for free from the B.C. Open Textbook Collection (https://open.bccampus.ca/browse-ourcollection/find-open-textbooks/).

Canadian Centre for Occupational Health and Safety. (n.d.). *Safety data sheets (SDSs) in WHMIS and GHS*. https://www.ccohs.ca/oshanswers/chemicals/whmis_ghs/sds.html

Canadian Centre for Occupational Health and Safety. (n.d.). WHMIS – labels. Government of Canada. https://www.ccohs.ca/oshanswers/chemicals/whmis_ghs/labels.html

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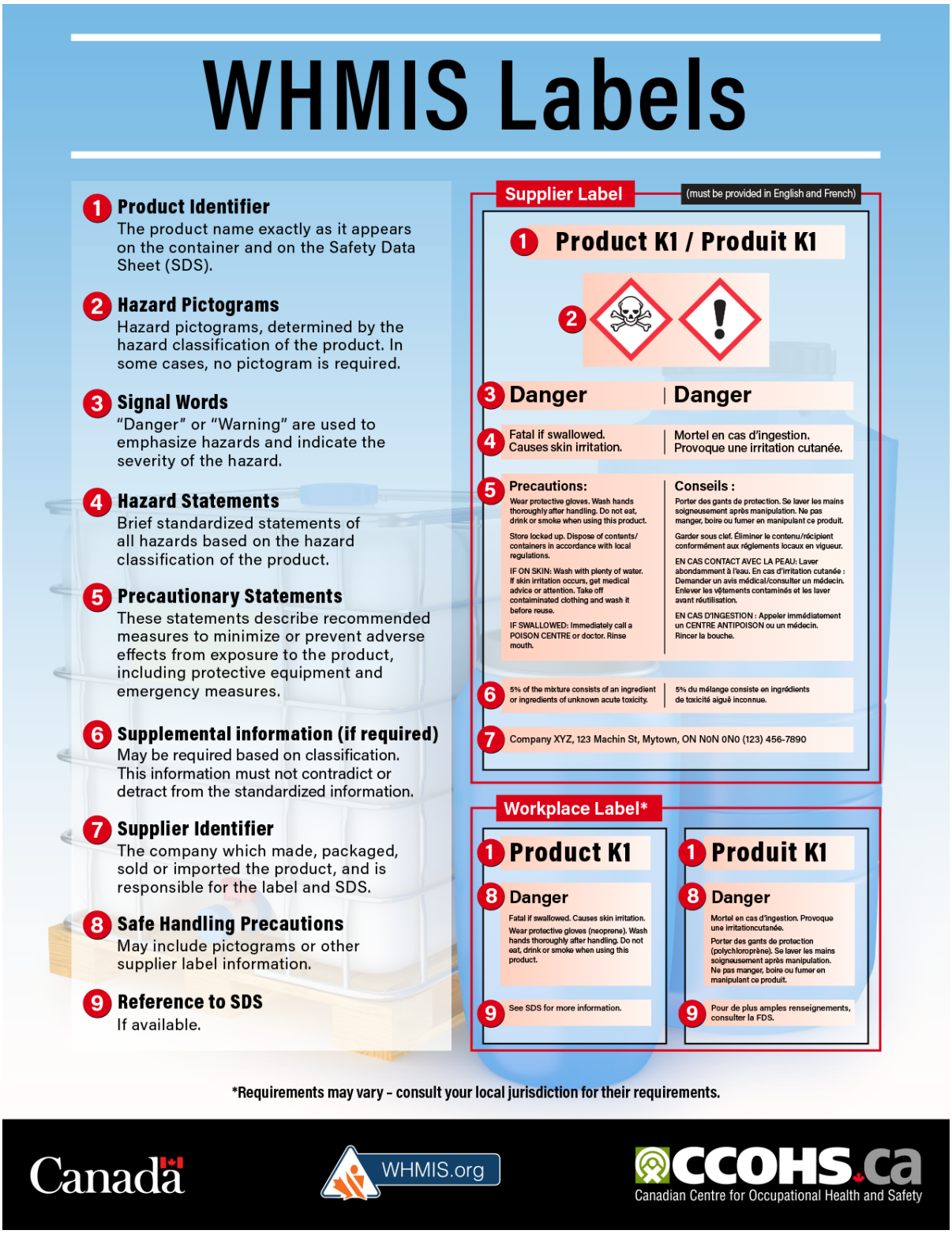
- **Figure 1** Supplier label from CCOHS: WHMIS – Labels (https://www.ccohs.ca/oshanswers/chemicals/whmis_ghs/labels.html) is used with permission.
- **Figure 2** Safety Data Sheet (https://www.flickr.com/photos/sidknee23/3279840851/) by sid [sidknee23] on Flickr is used under a CC BY-NC-ND 2.0 (https://creativecommons.org/licenses/by-nc-nd/2.0/deed.en) license.

A-3.3 Describe the Labelling of Controlled Products



WHMIS 2015 labels (Used with permission of CCOHS (https://www.ccohs.ca/products/posters/WHMIS-labels))

Two types of labels are required by WHMIS: ***supplier labels*** and ***workplace labels***. In general, suppliers are responsible for providing supplier labels and employers are responsible for providing workplace labels or other means of on-site identification. Employers must also ensure that all labels at their workplace are legible and that they are replaced if damaged.

Supplier Labels

When a supplier produces or imports a product for distribution and sale in Canada, that supplier must prepare a supplier label. Seven items of information must be included within the label border:

1. **Product identification:** Often the brand name, chemical name, trade name, common name, or generic name of the hazardous product.
2. **Initial supplier identifier:** The name, address, and phone number of the supplier (manufacturer, distributor, or importer).
3. **Hazard pictogram(s):** One or more of the nine graphic images indicating the type of hazard(s) the product presents.
4. **Signal words:** "Danger" is used for high-risk hazards: "Warning" is used for less-severe hazards. If a signal word is assigned to a hazard class and category, only the one signal word corresponding to the class of the most severe hazard should be used on a label. Some hazard classes or categories do not have a signal word assigned to them.
5. **Hazard statement(s):** Standardized phrases assigned to each hazard class and category that alert workers to the specific hazard(s) of the product. These are short statements, but they describe the most significant hazards of the product.
   Some examples of hazard statements are:

   - Extremely flammable gas.
   - Contains gas under pressure; may explode if heated.
   - Fatal if inhaled.
   - Causes eye irritation.
   - May cause cancer.

6. **Precautionary statement(s):** Standardized phrases that describe measures to be taken to minimize or prevent adverse effects resulting from exposure to the product or improper handling or storage. These statements can include instructions about storage, handling, first aid, personal protective equipment, and emergency measures. Examples of precautionary statements are:

   - Keep container tightly closed.
   - Wear protective gloves/protective clothing/eye protection/face protection.
   - If exposed or concerned: Get medical advice/attention.
   - Fight fire remotely due to the risk of explosion.
   - Protect from sunlight.

7. **Supplemental label information:** May include supplemental information about precautionary actions, physical state, or routes of exposure. Also, if the product is a mixture that contains any ingredients with unknown toxicity in amounts higher than 1 percent, the label must include a statement indicating the percentage of unknown ingredient.

See the example of a supplier label in Figure 1.

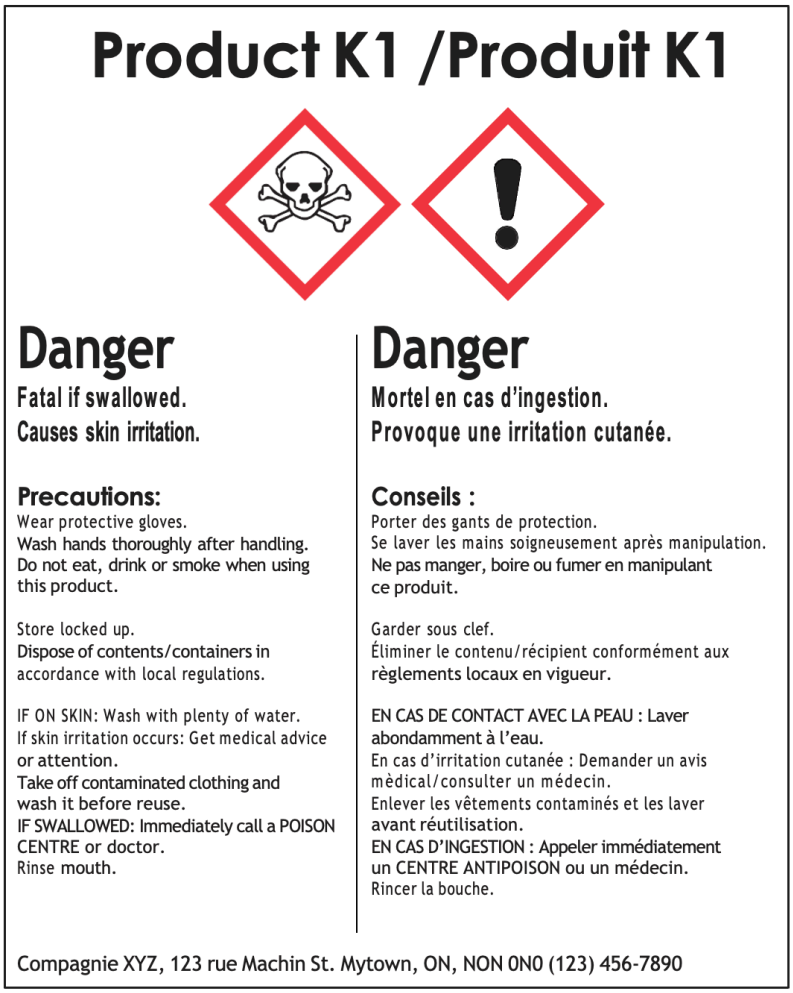


Figure 1 *Example of a supplier label (Health Canada, n.d.). Government of Canada Terms (https://www.canada.ca/en/transparency/terms.html).*

Additional requirements for supplier labels include:

- Only the above seven information items can be printed within the WHMIS label. Other information, such as directions for use, must be placed outside the WHMIS label.
- The written information must be shown in both English and French.
- The information must be correct and current. Labels need to be updated within 180 days of the supplier being aware of any significant new data. If an employer purchases a product within this 180-day time period, the supplier must inform the employer in writing, of the changes and the date they became available. Employers need to update the existing labels or the information on the containers as soon as the supplier provides the significant new information.
- Colours that conflict with ***transportation of dangerous goods (TDG)*** labelling cannot be used. For example, the colour orange cannot be used because it is used by TDG to identify explosives.
- The label must stand out from the container itself and other markings on the container. For example, the size of the label should be appropriate for the size of the container.

As long as a hazardous product remains in its supplier-provided container, the supplier label must remain attached to the container and must be legible.

Other Supplier Labels

Some supplier labels may look different from the example shown in Figure 1 because less information is required for controlled products that are:

- In small containers (less than 100 mL)
- Chemicals from laboratory chemical suppliers
- Laboratory samples
- Contained or transferred in a piping system, vessel, or tank

The Transportation of Dangerous Goods Act may require additional labels during transport. For multi-container shipments, a supplier label is not required on the outer container if a TDG label is present. Only the inner containers require supplier labels.

Workplace labels

Workplace labels are required on containers of hazardous products for any of the following situations:

- A hazardous product is produced and used on-site
- On secondary containers after a product has been transferred from the original container
- On containers where the supplier label is missing or not readable.

Workplace labels provide three types of information:

1. Product identifier
2. Specific safe handling information and personal protective clothing and equipment required
3. Reference to the SDS, if an SDS has been produced by the supplier

The format for workplace labels is fairly flexible. For example:

- The information can be written directly onto the container using a permanent marker.
- The languages used can be chosen to fit the specific workplace.
- The hazard pictograms are optional.

Figure 2 shows an example of a workplace label.

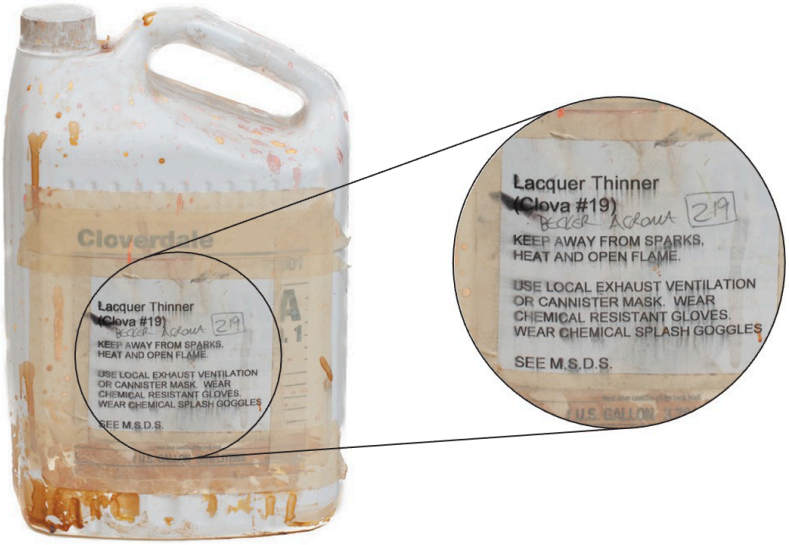


Figure 2 *Workplace label (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Other Means of Identification

In some circumstances where workplace labels are impractical, employers may use other means of identification such as warning signs, symbols, placards, and coding systems (for example, using colours, numbers or letters). These can be used as long as the identification system is communicated effectively and understood by workers.

These other means of identification can be used when the product is:

- Used in a laboratory (for example, in transfer containers such as beakers and flasks)
- Transferred by a worker into a container for use during the same shift if that worker maintains control of the new container and finishes use in that shift
- Contained in a transfer or reaction system such as a pipe, reaction vessel, tank car or conveyor belt
- Identified as a hazardous waste produced in the workplace

Partially Exempt Products

Products covered by other federal legislation are exempt from federal WHMIS requirements for supplier labels and SDSs. However, provincial WHMIS legislation still applies, and employers must:

- Provide workers with hazard information about the product
- Educate workers about the hazards of the product
- Educate and train workers in the safe use, handling, storage, and disposal of the product

These partially exempt products are:

- Some consumer products, such as chemicals and pressurized containers
- Cosmetics, medical devices, drugs and foods (Food and Drugs Act)
- Explosives (Explosives Act)
- Pesticides (Pest Control Products Act)
- Radioactive substances (Nuclear Safety and Control Act)

Completely Exempt Products

Products that are completely exempt (sometimes called ***excluded***) from both federal and provincial WHMIS legislation are still covered by general provincial occupational health and safety regulations. Workers must still be trained and supervised in the safe handling of these products.

These completely exempt products are:

- Wood and products made of wood
- Manufactured articles (such as appliances and car batteries)
- Tobacco and products made of tobacco
- Goods handled, offered for transport, or transported under the Transportation of Dangerous Goods Act
- Hazardous wastes (they must be identified at workplaces where they are produced)

Self-Test A-3.3: Describe the Labelling of Controlled Products

Complete Self-Test A-3.3 and check your answers.

If you are using a printed copy, please find Self-Test A-3.3 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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References

BC Industry Training Authority. (2019). *Piping trades apprenticeship program: Perform safety related functions—Level 1 harmonized* [Binder]. Crown Publications, Queen's Printer for British Columbia. https://www.crownpub.bc.ca/Product/Details/7960000260_S

Camosun College. (2015). Line A: Safe Work Practices — Competency A-3: Handle Hazardous Materials Safely (BCcampus). https://collection.bccampus.ca/textbook/PMfB6kHM/

Camosun College. (2015). Trades Access Common Core Competency A-3: Handle Hazardous Materials Safely. Victoria, B.C.: Crown Publications. Download for free from the B.C. Open Textbook Collection (https://open.bccampus.ca/browse-ourcollection/find-open-textbooks/).

Health Canada. (n.d.). *Guidance on the WHMIS supplier requirements* [Figure 7]. Government of Canada. https://www.canada.ca/en/health-canada/services/environmental-workplace-health/occupational-health-safety/workplace-hazardous-materials-information-system/supplier-hazard-communication-requirements-whmis/guidance.html#a6

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- Figure 7. Example of a label which meets the HPR requirements (https://www.canada.ca/en/health-canada/services/environmental-workplace-health/occupational-health-safety/workplace-hazardous-materials-information-system/supplier-hazard-communication-requirements-whmis/guidance.html#a6:~:text=Figure%207.%20Example%20of%20a%20label%20which%20meets%20the%20HPR%20requirements) in Guidance on the WHMIS supplier requirements (Health Canada, n.d.) is used in compliance with the terms (https://www.canada.ca/en/transparency/terms.html) on the Government of Canada website.
- **WHMIS labels (https://www.ccohs.ca/products/posters/WHMIS-labels)** posters downloaded from the CCOHS (2024) *WHMIS Pictograms Kit* (https://www.ccohs.ca/WHMISpictograms.html) (downloads) page is used with permission and under the CCOHS terms for educational purposes.

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

A safety data sheet (SDS) is a technical bulletin created by the producer of a hazardous product. An SDS provides specific hazard information, safe handling information, and emergency procedures for a single hazardous product. The SDS is a key part of the WHMIS program as it provides informational support to workers when working with or around a hazardous product.

Since the SDS contains detailed health and safety information specific to each hazardous product, it should be used as a key source of information for developing training programs and safe work procedures. Workers must be trained to understand the basic requirements of an SDS as well as the applicable information in it.

In addition to providing adequate education, employers are responsible for making SDSs available, accurate and up-to-date for all workers at all times. Employers must ensure that up-to-date SDSs are received for all hazardous products purchased. No SDS on site can be more than three years old unless the employer has written confirmation from the supplier that the SDS hasn't changed.

If the employer produces a hazardous product for use at the workplace, the employer must develop an SDS for that product and make it available to workers. Copies of supplier and employer SDSs must be readily accessible to employees during each work shift.

SDS Sections

Taking notes (Designed by Freepik) Freepik Terms of Use (https://www.freepik.com/legal/terms-of-use)

The following are the 16 section headings within an SDS and the types of information to be provided in each section. **Note:** Example images are excerpts from an SDS for chromium (III) acetate hydroxide, from EHSADMIN on Wikimedia Commons (CC BY-SA 3.0 (https://creativecommons.org/licenses/by-sa/3.0/)). See Appendix A for the full SDS.

Note: Sections 12 to 15 require the headings to be present, but under Canadian regulations, the supplier has the option to not provide information in these sections.

Section 1: Identification

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		

This section identifies the product, the manufacturer and the supplier, and it describes the intended product use. It also provides information about where to contact the manufacturer and supplier for information and/or in case of emergency.

Section 2: Hazard Identification

Hazard (Clker-Free-Vector-Images/ Pixabay) Content License (https://pixabay.com/service/ license-summary/)

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.

This section lists the classification of the hazardous product, hazard pictogram, signal word, hazard statement and precautionary statements for each category or subcategory applicable, as well as other hazards known to the supplier with respect to the product.

Section 3: Composition/Information on Ingredients

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	-	-

This section contains general information on physical and chemical properties such as the chemical name, common name and synonyms, CAS registry number, and any unique identifiers, mixture concentrations, or stabilizing additives.

Section 4: First-Aid Measures

First Aid (Clker-Free-Vector-Images/ Pixabay) Content License (https://pixabay.com/service/ license-summary/)

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.

This section lists specific instructions for the immediate treatment of a worker who has inhaled or swallowed the product or who has had skin or eye contact with the product.

Section 5: Firefighting Measures

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

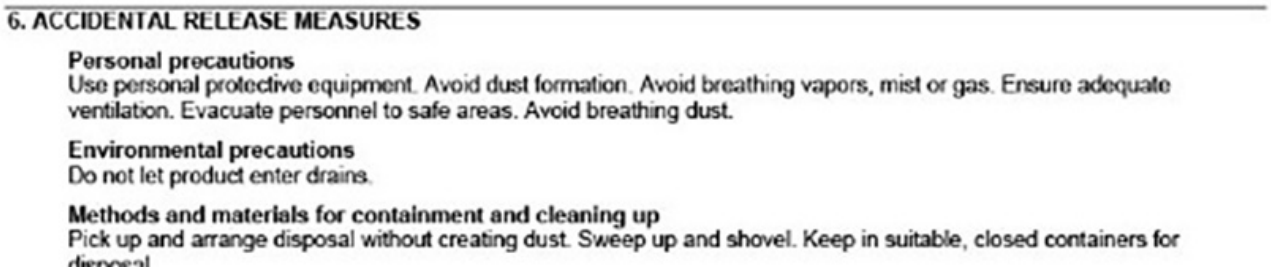
Explosion data - sensitivity to mechanical impact
no data available

Explosion data - sensitivity to static discharge
no data available

This section lists the information for developing strategies and procedures to deal with fire hazards.

Section 6: Accidental Release Measures

Protective equipment (*David/Pixabay*) *Content License* (*https://pixabay.com/service/license-summary/*)



6. ACCIDENTAL RELEASE MEASURES

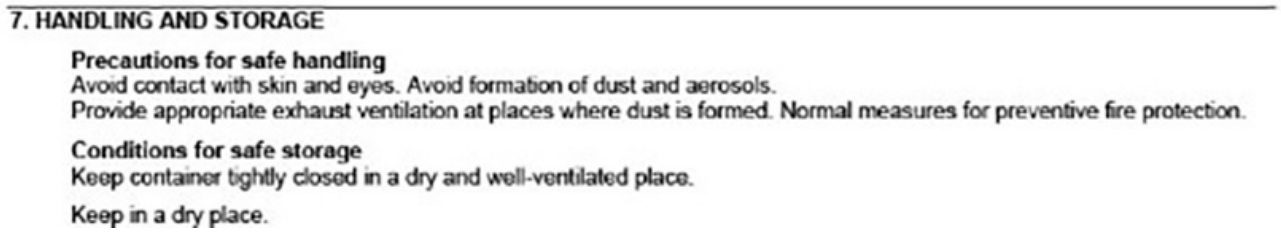
Personal precautions
Use personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

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.

This section includes information on required protective equipment, as well as on how to safely clean up and contain spills.

Section 7: Handling and Storage



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.

This section includes information on how to safely handle and store the product.

Section 8: Exposure Controls/Personal Protection

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).

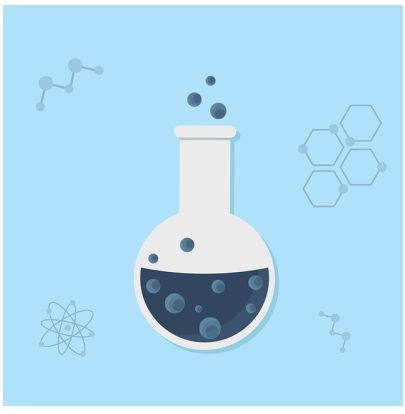
Skin and body protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

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.

This section includes information on how to control exposure as well as exposure limit values.

Section 9: Physical and Chemical Properties



Chemicals (Satheesh Sankaran/Pixabay) Content License (https://pixabay.com/service/license-summary/)

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

This section includes information on all of the physical and chemical properties of the hazardous product.

Section 10: Stability and Reactivity Data

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

This section lists conditions and other substances that should be avoided to prevent dangerous reactions.

Section 11: Toxicological Information

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

This section identifies how the substance enters the body and the possible health effects from single or repeated

exposure. It also identifies if the product has any known long-term health effects such as liver or kidney damage, sensitization, cancer, or reproductive effects.

Section 12: Ecological Information

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

This section identifies what short- or long-term effects the substance could have on the environment.

Section 13: Disposal Considerations

Disposal (OpenIcons/Pixabay) Content License (https://pixabay.com/service/license-summary/)

13. DISPOSAL CONSIDERATIONS

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

Contaminated packaging
Dispose of as unused product.

This section includes information on the safe handling and disposal methods, including any containment packaging required.

Section 14: Transport Information

14. TRANSPORT INFORMATION

DOT (US)
Not dangerous goods

IMDG
Not dangerous goods

IATA
Not dangerous goods

This section includes all of the necessary international shipping information.

Section 15: Regulatory Information

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.

	CAS-No.
Chromium(III) acetate hydroxide	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.

This section includes any safety, health and environmental regulations that have been made specific to this product.

Section 16: Other Information

More information (mcmurryjulie/ Pixabay) Content License (https://pixabay.com/service/ license-summary/)

16. OTHER INFORMATION

Further information

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Appendix A shows the complete sample SDS for chromium acetate hydroxide.

Self-Test A-3.4: Describe Information to be Disclosed on an SDS

Complete Self-Test A-3.4 and check your answers.

If you are using a printed copy, please find Self-Test A-3.4 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-bcplumbingapprl1.pressbooks.tru.ca/?p=1231#h5p-20 (https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/?p=1231#h5p-20)

References

BC Industry Training Authority. (2019). *Piping trades apprenticeship program: Perform safety related functions—Level 1 harmonized* [Binder]. Crown Publications, Queen's Printer for British Columbia. https://www.crownpub.bc.ca/Product/Details/7960000260_S

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Camosun College. (2015). Trades Access Common Core Competency A-3: Handle Hazardous Materials Safely. Victoria, B.C.: Crown Publications. Download for free from the B.C. Open Textbook Collection (https://open.bccampus.ca/browse-ourcollection/find-open-textbooks/).

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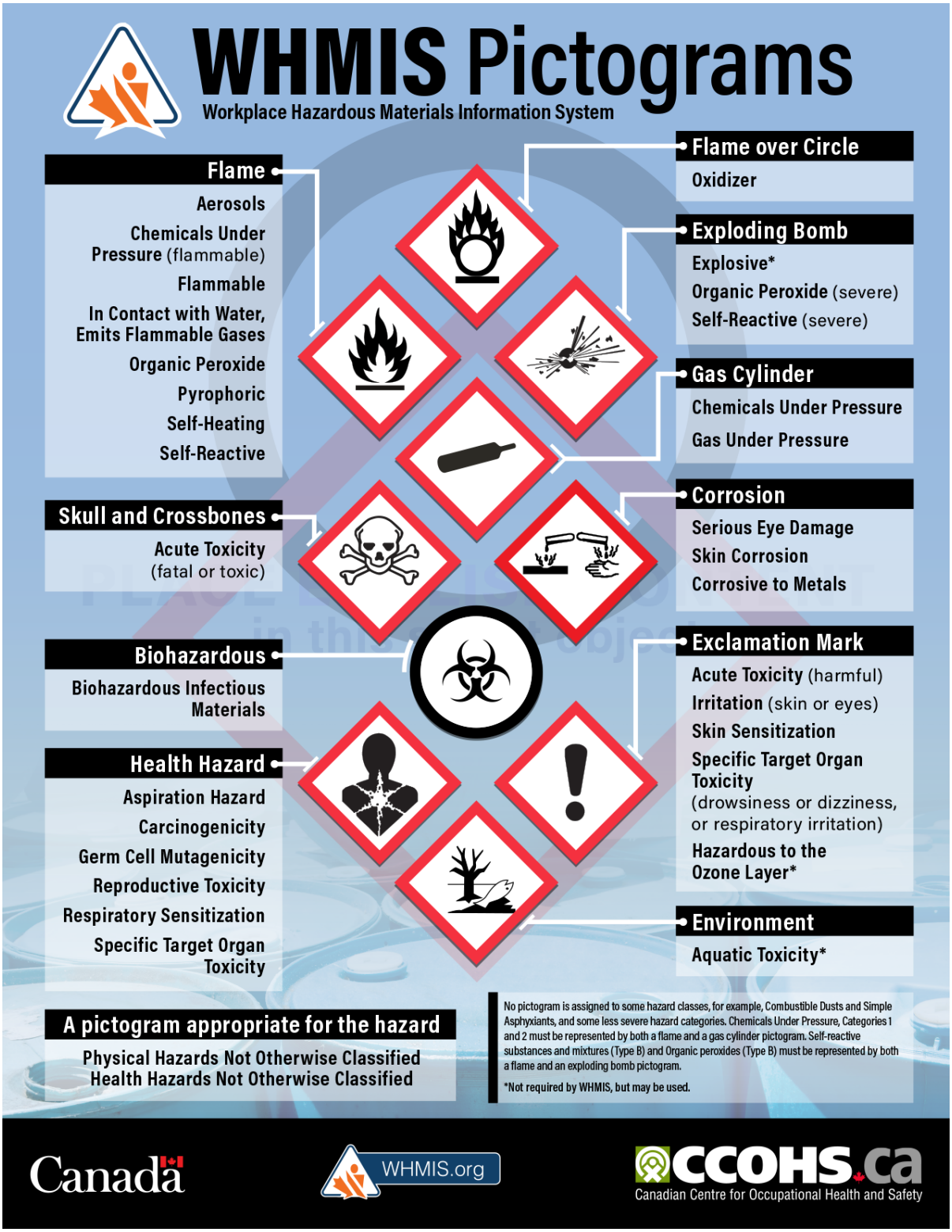
A-3.5 Identify Pictograms Found on WHMIS Labels



WHMIS 2015 classes and symbols (Used with permission of CCOHS (https://www.ccohs.ca/products/posters/WHMIS-labels))

Pictograms are graphic images that immediately show you what type of hazard a hazardous product presents.

Manufacturers and suppliers classify the products into one or more of the hazard classes and assign one or more of the appropriate pictograms. Pictograms will be on the product supplier labels of the hazardous products as well as on the SDSs.

Workers must recognize the ten hazard pictograms and know what they mean. Most pictograms have a distinctive red border in the shape of a square set on one of its corners. Inside this border is a symbol that represents the potential hazard (e.g., fire hazard, health hazard, ***corrosive***, etc.). With a quick glance, a worker can see, for example, that the product is flammable or if it might be a health hazard.

Hazard Classes, Categories and Pictograms

Table 1 shows each hazard pictogram, its name, hazard description, and the associated hazard classes and categories.

Table 1. *Hazard symbols*

Name/ Description	Pictogram	Classes and categories
Flame (for fire hazards)		• Flammable gases (Category 1) • Flammable aerosols (Category 1 and 2) • Flammable liquids (Category 1, 2, and 3) • Flammable solids (Category 1 and 2) • Pyrophoric liquids (Category 1) • Pyrophoric solids (Category 1) • Pyrophoric gases (Category 1) • Self-heating substances and mixtures (Category 1 and 2) • Substances and mixtures which, in contact with water, emit flammable gases (Category 1, 2, and 3) • Self-reactive substances and mixtures (Types B*, C, D, E, and F) • Organic peroxides (Types B*, C, D, E, and F)
Flame over circle (for oxidizing hazards)		• Oxidizing gases (Category 1) • Oxidizing liquids (Category 1, 2, and 3) • Oxidizing solids (Category 1, 2, and 3)
Exploding bomb (for explosion or reactivity hazards)		• Self-reactive substances and mixtures (Types A and B*) • Organic peroxides (Types A and B*)
Corrosion (for corrosive damage to metals, as well as skin, eyes)		• Corrosive to metals (Category 1) • Skin corrosion/irritation —Skin corrosion (Category 1, 1A, 1B, and 1C) • Serious eye damage/eye irritation—Serious eye damage (Category 1)
Gas cylinder (for gases under pressure)		• Gases under pressure (compressed gas, liquefied gas, refrigerated liquefied gas, and dissolved gas)

Skull and crossbones
 	
(can cause death or toxicity with short exposure to small amounts)
		• Acute toxicity
		  ◦ Oral (Category 1, 2 and 3)
		  ◦ Dermal (Category 1, 2, and 3)
		  ◦ Inhalation (Category 1, 2, and 3)

Exclamation mark (may cause less serious health effects or damage the ozone layer)		• Acute toxicity—Oral, dermal, inhalation (Category 4) • Skin corrosion/irritation—Skin irritation (Category 2) • Serious eye damage/eye irritation—Eye irritation (Category 2 and 2A) • Respiratory or skin sensitization—Skin sensitizer (Category 1, 1A and 1B) • Specific target organ toxicity—Single exposure (Category 3)
Health hazard (may cause or suspected of causing serious health effects)		• Respiratory or skin sensitization—Respiratory sensitizer (Category 1, 1A, and 1B) • Germ cell mutagenicity (Category 1, 1A, 1B, and 2) • Carcinogenicity (Category 1, 1A, 1B, and 2) • Reproductive toxicity (Category 1, 1A, 1B, and 2) • Specific target organ toxicity—Single exposure (Category 1 and 2) • Specific target organ toxicity—Repeated exposure (Category 1 and 2) • Aspiration hazard (Category 1)
Biohazardous infectious materials (for organisms or toxins that can cause diseases in people or animals)		• Biohazardous infectious materials (Category 1)

Note: *Both the flame and explosive pictograms are used for self-reactive substances and mixtures (Type B) and organic peroxides (Type B).

An environmental hazards group exists in the GHS for products that may cause damage to the aquatic environment. This group (and its classes) were not adopted in WHMIS 2015. However, you may see the environmental pictogram (Figure 1) listed on labels and SDSs.

Figure 1 *Environmental hazard pictogram*

Hazard Classes and Categories Without Pictograms

There are hazardous products that meet the criteria for a hazard class or category but whose classes and categories do not require a pictogram. The product label and Section 2 (Hazards Identification) of the SDS still require the signal word, hazard statement(s), and other required label elements.

WHMIS 2015 classes and categories that do not require a pictogram are:

- Flammable gases—Category 2
- Flammable liquids—Category 4
- Self-reactive substances and mixtures—Type G
- Organic peroxides—Type G
- Combustible dusts—Category 1
- Simple asphyxiants—Category 1
- Serious eye damage/eye irritation—Eye irritation—Category 2B
- Reproductive toxicity—Effects on or via lactation

Self-Test A-3.5: Identify Pictograms Found on WHMIS Labels

Complete Self-Test A-3.5 and check your answers.

If you are using a printed copy, please find Self-Test A-3.5 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=1233#h5p-21 (https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/?p=1233#h5p-21)

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BC Industry Training Authority. (2019). *Piping trades apprenticeship program: Perform safety related functions—Level 1 harmonized* [Binder]. Crown Publications, Queen's Printer for British Columbia. https://www.crownpub.bc.ca/Product/Details/7960000260_S

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Camosun College. (2015). Trades Access Common Core Competency A-3: Handle Hazardous Materials Safely. Victoria, B.C.: Crown Publications. Download for free from the B.C. Open Textbook Collection (https://open.bccampus.ca/browse-ourcollection/find-open-textbooks/).

Canadian Centre for Occupational Health and Safety (CCOHS). (2024). *WHMIS pictograms*. Free, downloadable WHMIS pictograms as regulated by the Hazardous Products Regulations. Retrieved from https://www.ccohs.ca/WHMISpictograms.html

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- **WHMIS pictograms (https://www.ccohs.ca/WHMISpictograms.html), pictogram poster (https://www.ccohs.ca/products/posters/WHMIS-pictograms) and WHMIS labels (https://www.ccohs.ca/products/posters/WHMIS-labels)** posters downloaded from the CCOHS (2024) *WHMIS Pictograms Kit* (https://www.ccohs.ca/WHMISpictograms.html) (downloads) page are used with permission and under the CCOHS terms for educational purposes.

A-3.6 Explain WHMIS Education and Training

The third component of WHMIS is worker education and training. The information provided by labels and SDSs will be of little use unless workers can understand it and apply it through training.

Employer Responsibilities

Employers are required to provide a training program that ensures workers understand WHMIS and the hazards associated with the hazardous products they use or may be exposed to in their workplace.

Education programs about WHMIS must be followed up with job-specific training in safe work procedures for handling, storing, and disposing of hazardous products. Worker representatives or the health and safety committee must be consulted in developing, implementing, and reviewing education and training programs.

Difference Between Education and Training

WHMIS education explains how WHMIS works, what an SDS is, what information is on a WHMIS label, and other information about WHMIS. WHMIS training refers to hands-on, job-specific training. Training shows individuals how to work safely with the hazardous products in a particular workplace.

Education

Worker education must include instruction in the content, purpose, and significance of workplace and supplier labels and SDSs. Workers can be educated through classroom instruction or by using videos or computer programs. Education courses can be offered on-site by employers, through contracted specialized companies, or through continuing studies at a local training facility. WHMIS education can also be completed and tested online.

Certification

Some industries, such as construction, offer WHMIS “cards” or “certificates” to participants who complete their WHMIS education program. Such cards and certificates are useful for workers who move regularly from site to site, enabling them to prove to new employers that they have attended WHMIS education sessions. However, job-specific training at each work site is still required for all workers who work with or near hazardous products.

Job-Specific Training

Employees must be trained in the procedures specific to their workplace. These include:

- Which hazardous products workers could be exposed to in their workplace
- How to store, handle, use, or dispose of hazardous products
- Emergency procedures in the event of an accident or spill

Implementing WHMIS in the Workplace

To implement the WHMIS program and develop written safe work procedures, employers make use of supplier labels and SDSs, as well as their own knowledge of the hazardous properties of products and their use in the workplace. The following sections outline the main hazards associated with products in the two hazard groups.

Hazardous Properties for the Physical Hazard Classes

This list shows the main concerns for the 18 hazard classes found in the **physical** hazard grouping.

Table 1. ***Hazardous Properties for the Physical Hazard Classes***

Hazard Class	Hazardous Properties
Flammable gases Flammable aerosols Flammable liquids Flammable solids	These classes of products have the ability to ignite (catch fire) easily. The main hazards are fire or explosion.
Oxidizing gases Oxidizing liquids Oxidizing solids	These classes of products are oxidizers, which may cause or intensify a fire or cause an explosion.
Gases under pressure	• This class includes compressed gases, liquefied gases, dissolved gases, and refrigerated liquefied gases. • Compressed gases, liquefied gases, and dissolved gases are hazardous because of the high pressure inside the cylinder or container. The cylinder or container may explode if heated. Refrigerated liquefied gases are very cold and can cause severe cold (cryogenic) burns or injury.
Self-reactive substances and mixtures	These products may react on their own to cause a fire or explosion, or may cause a fire or explosion if heated.
Pyrophoric liquids Pyrophoric solids Pyrophoric gases	These products can catch fire very quickly (spontaneously) if exposed to air.
Self-heating substances and mixtures	These products may catch fire if exposed to air. These products differ from pyrophoric liquids or solids in that they ignite only after a longer period of time or when present in large amounts.
Organic peroxides	These products may cause a fire or explosion if heated.
Corrosive to metals	These products may chemically damage or destroy metals.
Combustible dust	This class is used to warn of products that are finely divided solid particles. If dispersed in air, the particles may catch fire or explode if ignited.
Simple asphyxiants	These products are gases that may displace oxygen in air and cause rapid suffocation.
Physical hazards not otherwise classified	This class covers physical hazards that are not included in any other physical hazard class. These hazards occur as a result of a chemical reaction and may result in serious injury or death at the time the reaction occurs. If a product is classified in this class, the hazard statement on the label and SDS will describe the nature of the hazard.

Hazardous Properties for the Health Hazard Classes

This list shows the main concerns for the 12 hazard classes found in the **health** hazard grouping.

Table 2. ***Hazardous Properties for the Health Hazard Classes***

Hazard Class	Hazardous Properties
Acute toxicity	• These products are fatal, toxic, or harmful if inhaled, following skin contact, or if swallowed. • Acute toxicity refers to effects occurring following skin contact or ingestion from a single dose, or multiple doses given within 24 hours, or an inhalation exposure of up to four hours. • Acute toxicity may result from exposure to the product itself or from a product that releases a toxic gas when it comes into contact with water.
Skin corrosion/irritation	Products in this class cause severe skin burns (corrosion) and/or skin irritation.
Serious eye damage/eye irritation	Products in this class cause serious eye damage (i.e., corrosion) and/or eye irritation.
Respiratory or skin sensitization	A respiratory sensitizer is a product that may cause allergy or asthma symptoms or breathing difficulties if inhaled. A skin sensitizer is a product that may cause an allergic skin reaction.
Germ cell mutagenicity	This class includes products that may cause or are suspected of causing genetic defects (permanent changes (mutations) to body cells that can be passed on to future generations.
Carcinogenicity	This class includes products that may cause or are suspected of causing cancer.
Reproductive toxicity	This class includes products that may damage or are suspected of damaging fertility or the unborn child (baby). Note: There is an additional category that includes products that may cause harm to breast-fed children.
Specific target organ toxicity— single exposure	• This class covers products that cause or may cause damage to organs (e.g., liver, kidneys, or blood) following a single exposure. • This class also includes a category for products that cause respiratory irritation, drowsiness, or dizziness.
Specific target organ toxicity— repeated exposure	This class covers products that cause or may cause damage to organs (e.g., liver, kidneys, or blood) following prolonged or repeated exposure.
Aspiration hazard	This class is for products that may be fatal if they are swallowed and enter the airways.
Biohazardous infectious materials	These materials are microorganisms, nucleic acids or proteins that cause or are probable cause of infection, with or without toxicity, in humans or animals.
Health hazards not otherwise classified	This class covers products that are not included in any other health hazard class. These hazards have the characteristic of occurring following acute or repeated exposure and have an adverse effect on the health of a person exposed to it—including an injury or resulting in the death of that person. If a product is classified in this class, the hazard statement will describe the nature of the hazard.

Written Safe Work Procedures

Employers are required to write safe work procedures as safety guidelines for workers who will handle hazardous products. Safe work procedures address the specific hazards of the hazardous product and how it is safely used in the workplace. The written procedure must contain enough detail to provide clear direction to authorized workers.

The following steps outline the written safe work procedure to be used by authorized workers for clean-up of small spills of acetone (about one litre) for a particular work site.

Safe Work Procedure for Clean-Up of Acetone Spills

1. Extinguish and control all ignition sources, including electrical services, open flames, and electrostatic discharge.
2. Evacuate workers to the designated safe location.
3. Report the spill to your supervisor.
4. Get the waste containers and spill cart.
5. Put on the respirator, butyl rubber gloves, and safety goggles.
6. Clean up the acetone using chemical absorbent pillows from the spill cart according to the manufacturer's instructions.
7. Do not flush or rinse the spilled acetone into the sewer system.
8. Place used absorbent pillows (containing acetone) in designated waste containers.
9. Dispose of used chemical absorbent pillows according to local waste disposal procedures.

General Precautions When Using Common Hazardous Materials

Employers should take note of the following general precautions:

- Some common materials are considered safe to use under normal operation but may change to hazardous materials under certain conditions. These include fresh concrete, pressure-treated wood, contact cement, paints, and cleaners.
- Some substances are flammable as well as toxic. Use products such as contact cement and certain paints that are highly flammable in well-ventilated work areas that contain no open flame.
- Many substances are harmless by themselves, but when combined, they release toxic fumes. Two common household cleaning agents, ammonia and bleach, when mixed together will produce toxic chlorine gas. It is best not to mix any chemicals found on the job site unless you are absolutely certain that the combined mixture will not be harmful.
- Sometimes chemical changes are triggered by heat or radiation. The ultraviolet radiation from a welding operation can transform the vapours of many common solvents into the deadly gas phosgene. Many plastics and vinyl resins are harmless in their normal state but give off a highly toxic smoke when burned.
- Many paints and cleaners come in aerosol cans that use pressure to release their contents. These cans should not be kept near heat or exposed to flames. Empty cans should be disposed of properly, never burned. The containers are explosive and the residual contents are often highly flammable.
- Charges for powder-actuated tools are often used in shops and on construction sites, and are potentially dangerous. These products are supplied in plastic strips or plastic boxes. Live charges that are dropped on the floor or strips discarded with live charges in them can be dangerous. If sweepings and garbage are burned on the

site, the charges will explode when heated, which could injure anyone near the fire.

Read WHMIS 2015: At Work (https://www.worksafebc.com/en/resources/health-safety/whmis/whmis-work-2015) from WorkSafeBC, which provides an overview of WHMIS 2015, explains the key changes from the original WHMIS, outlines its four main elements, and describes the roles of suppliers, employers, and workers in safely managing hazardous products.

You may also watch the videos *WHMIS 2015 for Workers (WHMIS video series)* [4:11] and *WHMIS 2015 for Employers* [5:37] by WorkSafeBC (2015-a,b) on YouTube.

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=1235#oembed-1 (#oembed-1)

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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: WHMIS video series. (http://youtube.com/watch?v=NRKFc4DMFH0)

Self-Test A-3.6: Explain WHMIS Education and Training

Complete Self-Test A-3.6 and check your answers.

If you are using a printed copy, please find Self-Test A-3.6 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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Self-Test A-3.1: Explain the Hazardous Products Legislation

Complete Self-Test A-3.1 and check your answers.

1. What level of government is responsible for creating WHMIS?
    a. Federal
    b. Provincial
    c. Municipal
    d. Federal and provincial
2. What do the letters in WHMIS stand for?
    a. Workplace Help Make It Safe
    b. Worksite Hazard Made Isolated Standards
    c. Workplace Hazardous Material Information System
    d. None of the above
3. What is WHMIS also known as?
    a. SDS
    b. Shop rules
    c. Hazard labels
    d. The Right to Know requirement
4. Which federal legislation places responsibilities on suppliers to provide up-to-date SDSs with their products?
    a. Federal Labelling Law
    b. Hazardous Products Act
    c. Controlled Substance Act
    d. The Name It Right requirement
5. What does WHMIS call a pure substance or mixture that meets or exceeds criteria for inclusion in one or more of the WHMIS hazard classes?
    a. Hazardous product
    b. Dangerous mixture
    c. Hazardous compound
    d. Pure problematic substance
6. Who is responsible for providing up-to-date SDSs on hazardous products they sell or produce?
    a. Owner
    b. Worker
    c. Supplier
    d. Employer
7. Who is responsible for ensuring SDSs are available in the work area for all known hazardous products used?
    a. Owner
    b. Worker
    c. Supplier
    d. Employer
8. Who is responsible for the worker understanding the safe use of hazardous materials?
    a. Owner

b. Worker
c. Supplier
d. Employer

9. Where are SDSs supposed to be found?

a. Supervisor's truck
b. WorkSafeBC officer's truck
c. Close to the work area and made available at all times
d. In worker's information booklet handed out at orientation

10. What do the letters SDS stand for?

a. Safe dos and don'ts
b. Safety data sheet
c. Safer data specifications
d. Substance descriptor and safety

11. What are the two groups of hazardous products?

a. Dusts and metals
b. Gases and liquids
c. Health and physical hazards
d. Oxidizing and respiratory hazards

Answer Key: Self-Test A-3.1 is on the other page.

Answer Key: Self-Test A-3.1

1. d. Federal and provincial
2. c. Workplace Hazardous Material Information System
3. d. The Right to Know requirement
4. b. Hazardous Products Act
5. a. Hazardous product
6. c. Supplier
7. d. Employer
8. b. Worker
9. c. Close to the work area and made available at all times
10. b. Safety data sheet
11. c. Health and physical hazards

Self-Test A-3.2: Describe the Key Elements of WHMIS

Complete Self-Test A-3.2 and check your answers.

1. How do suppliers make known the risks and hazards associated with a hazardous product?
    a. Online courses
    b. Over-the-counter instructions
    c. Product labels and technical bulletins
    d. Suppliers are not required to provide this information.
2. What responsibilities do employers have in the WHMIS program?
    a. Provide education and training
    b. Create product labels and technical bulletins
    c. Employers are exempt from responsibility in the WHMIS program.
    d. Provide first aid treatment in the case of exposure to hazardous products
3. Which WHMIS element is to be found on a hazardous product received from the supplier?
    a. SDS
    b. Product label
    c. Toll-free helpline number
    d. Occupational health and safety committee notes
4. When working with a hazardous product, what information should a worker know about the product?
    a. Where to get further information
    b. What hazards are associated with the product
    c. What to do in case of an emergency
    d. How to protect yourself from the hazards
    e. All of the above

Answer Key: Self-Test A-3.2 is on the other page.

Answer Key: Self-Test A-3.2

1. c. Product labels and technical bulletins
2. a. Provide education and training
3. b. Product label
4. e. All of the above

Self-Test A-3.3: Describe the Labelling of Controlled Products

Complete Self-Test A-3.3 and check your answers.

1. What two types of labels are required by WHMIS when handling hazardous products?
    a. Risk and first-aid labels
    b. SDS and WHMIS labels
    c. Storage and disposal labels
    d. Supplier and workplace labels
2. What element of a supplier label provides the chemical or trade name of a hazardous product?
    a. SDS reference
    b. Hazard pictogram
    c. Supplier identification
    d. Product identification
3. Which part of the supplier label alerts a worker to specific risks or hazards of a hazardous product?
    a. Hazard statements
    b. Hazard pictograms
    c. Product identification
    d. Precautionary statement
4. Which part of the supplier label advises the worker on immediate treatment for an injury or accident with a hazardous product?
    a. Hazard statements
    b. Hazard pictogram
    c. Product identification
    d. Precautionary statements
5. Which part of the supplier label advises a worker on personal protective equipment when handling a hazardous product?
    a. Hazard statements
    b. Hazard pictograms
    c. Product identification
    d. Precautionary statements
6. Which part of the supplier label advises the worker, using a series of symbols, of the type of hazards associated with a hazardous product?
    a. Hazard statements
    b. Hazard pictograms
    c. “Be careful” symbols
    d. Product identification
7. A supplier label should be large enough and striking enough to jump out at the reader.
    a. True
    b. False
8. On the job, if a supplier label is accidentally ripped off a barrel containing a hazardous product, provided all workers are told what’s in the barrel, no further action is necessary.

a. True
b. False

9. To make her job easier, if a worker chooses to handle a hazardous product in an approved smaller container, what is that worker required to affix to that new container?

a. SDS
b. Supplier label
c. Hazard pictogram
d. Workplace label

10. Creating a workplace label can be as easy as recording the three types of information with a sharpie on the side of the container.

a. True
b. False

11. What information must a workplace label provide?

a. Producer's address and phone number
b. Chemical symbol of hazardous product
c. Transportation of dangerous goods reference number
d. Safe-handling information, including protective-wear guidelines

12. Workplace labels are intended to be informative and relevant to the job and workers.

a. True
b. False

13. Workplace labels must include pictograms and the supplier identifier.

a. True
b. False

14. Which of the following products are covered by provincial health and safety regulations but are completely exempt from WHMIS legislation?

a. Car batteries
b. Wood products
c. Tobacco products
d. All of the above
e. None of the above

15. Hazardous waste created on a job site is a major safety concern requiring special training of workers but is exempt from WHMIS.

a. True
b. False

Answer Key: Self-Test A-3.3 is on the other page.

Answer Key: Self-Test A-3.3

1. d. Supplier and workplace labels
2. d. Product identification
3. a. Hazard statements
4. d. Precautionary statements
5. d. Precautionary statements
6. b. Hazard pictograms
7. a. True
8. b. False
9. d. Workplace label
10. a. True
11. d. Safe-handling information, including protective-wear guidelines
12. a. True
13. b. False
14. d. All of the above
15. a. True

Self-Test A-3.4: Describe Information to Be Disclosed on an SDS

Complete Self-Test A-3.4 and check your answers.

1. What information is provided in a material safety data sheet (SDS)?
    a. Handling guidelines for a group of hazardous products
    b. Employer responsibilities for handling a hazardous product
    c. Detailed safety and health information about a single hazardous product
    d. General safety and health guidelines about a group of hazardous products
2. Which section of an SDS identifies how the hazardous product enters the body and the possible health effects from single or repeated exposures?
    a. First-aid measures
    b. Hazard identification
    c. Handling and storage
    d. Toxicological information
3. Which section of an SDS identifies the hazardous product, the manufacturer, and the supplier, and describes the product's intended use?
    a. Ingredients
    b. Identification
    c. Toxicological information
    d. Stability and reactivity data
4. Which section of the SDS lists the specific chemical name and mixture concentrations for the components of the hazardous product?
    a. Ingredients
    b. Identification
    c. Toxicological information
    d. Stability and reactivity data
5. Which section of the SDS describes the flammability and conditions under which a hazardous product might explode?
    a. Hazard identification
    b. Composition/information
    c. Toxicological information
    d. Stability and reactivity data
6. Which section of an SDS would describe chemical properties such as specific gravity or the boiling point of a hazardous product?
    a. Hazard identification
    b. Firefighting measures
    c. Accidental release measures
    d. Physical and chemical properties
7. Which section of an SDS would describe either how to clean up a spill or the personal protective clothing and equipment that are required when handling the hazardous product?
    a. Hazard identification

b. Firefighting measures
c. Accidental release measures
d. Physical and chemical properties

8. Which section of an SDS would you refer to if a co-worker got splashed by a hazardous product?

a. First-aid measures
b. Hazard identification
c. Handling and storage
d. Toxicological information

9. Which section of an SDS would you reference to check if the SDS is out of date?

a. Identification
b. First-aid measures
c. Other information
d. Toxicological information

10. Which section of an SDS would you refer for the hazard classification of a hazardous product?

a. First-aid measures
b. Hazard identification
c. Handling and storage
d. Toxicological information

Answer Key: Self-Test A-3.4 is on the other page.

Answer Key: Self-Test A-3.4

1. c. Detailed safety and health information about a single hazardous product
2. d. Toxicological information
3. b. Identification
4. a. Ingredients
5. d. Stability and reactivity data
6. d. Physical and chemical properties
7. c. Accidental release measures
8. a. First aid measures
9. c. Other information
10. b. Hazard identification

Self-Test A-3.5: Identify Pictograms Found on WHMIS Labels

Complete Self-Test A-3.5 and check your answers.

1. What is the purpose of the hazard pictograms found on WHMIS labels?
    1. Visually highlight that a hazard exists
    2. Classify a hazard in one of 31 hazard classes
    3. Provide personal protective equipment at a glance
    4. Provide physical and chemical properties at a glance
2. What section of the SDS must include the pictogram?
    1. First-aid measures
    2. Hazard identification
    3. Handling and storage
    4. Toxicological information
3. Which two pictograms are used for the hazard class of organic peroxides (Type B)?
    1. Flame and corrosion
    2. Flame and exploding bomb
    3. Flame and flame over circle
    4. Exploding bomb and corrosion
4. All hazard classes require a pictogram.
    1. True
    2. False

Description			Pictogram
I.	_____	Gases under pressure	a.
II.	_____	Fire hazards	b.
III.	_____	Oxidizing hazards	c.
IV.	_____	Can cause death or immediate and serious toxic effects	d.
V.	_____	May cause less serious health effects or damage the ozone layer	e.
VI.	_____	Organisms or toxins that can cause diseases in people or animals	f.
VII.	_____	Can cause corrosive damage to metals, as well as skin, eyes	g.
VIII.	_____	Explosion or reactivity hazards	h.
IX.	_____	Serious health effects	j.

5.

Answer Key: Self-Test A-3.5 is on the other page.

Answer Key: Self-Test A-3.5

1. a. Visually highlight that a hazard exists
2. b. Hazard identification
3. b. Flame and exploding bomb
4. a. False

	Description	Pictogram
I. e	Gases under pressure	a.
II. a	Fire hazards	b.
III. g	Oxidizing hazards	c.
IV. d	Can cause death or immediate and serious toxic effects	d.
V. ~~f~~	May cause less serious health effects or damage the ozone layer	e.
VI. b	Organisms or toxins that can cause diseases in people or animals	f.
VII. f	Can cause corrosive damage to metals, as well as skin, eyes	g.
VIII. c	Explosion or reactivity hazards	h.
IX. h	Serious health effects	j.

5.

Self-Test A-3.6: Explain WHMIS Education and Training

Complete Self-Test A-3.6 and check your answers.

1. Who is responsible, under WHMIS legislation, for the education and training of workers who will handle hazardous products?
    a. Worker
    b. Supplier
    c. WorkSafeBC
    d. Employer
2. What key resources are used to create on-site WHMIS education and training?
    a. WorkSafeBC guidelines and policies
    b. supplier labels and SDSs found on site
    c. WHMIS education the workers missed at their last job
    d. Occupation Health and Safety regulations and guidelines relating to all work sites
3. Which of the following best describes the need for job specific WHMIS training?
    a. Workers need a break and a WHMIS training day is just that.
    b. WHMIS is to be taught again and again or the workers never learn.
    c. Companies aren't required by law to provide training, so it is optional.
    d. Specific awareness of hazardous products workers may handle on site.
4. What are the common main hazards for flammable gases, aerosols, liquids, and solids?
    a. Oxidizers that may cause or intensify a fire or cause a fire or explosion.
    b. Ability to ignite (catch fire) easily, and the main hazards are fire or explosion
    c. May react on their own to cause a fire or explosion, or may cause a fire or explosion if heated
    d. These products can catch fire very quickly (spontaneously) if exposed to air
5. Under certain conditions such as combustion, the hazard potential of many commonly found materials can change, posing a new threat to the health and safety of workers.
    a. True
    b. False
6. Safe work procedures written by the employer should be very general in scope and avoid overly detailed information.
    a. True
    b. False

Answer Key: Self-Test A-3.6 is on the other page.

Answer Key: Self-Test A-3.6

1. d. Employer
2. b. Supplier labels and SDSs found on site
3. d. Specific awareness of hazardous products workers may handle on site.
4. b. Ability to ignite (catch fire) easily, and the main hazards are fire or explosion
5. a. True
6. b. False

A-4 PERSONAL SAFETY PRACTICES

Plumber Apprenticeship Program – Level 1

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A-4 Personal Safety Practices Introduction

This section describes the clothing and protective equipment workers must wear on the job site and the safety precautions they must take to protect themselves and others from injury.

Special personal protective equipment (PPE) is required on the job site. The equipment used will depend on the hazards anticipated.

When working at elevations, significant hazards are present, and fall protection is normally required. Knowing the hazards allows workers to select methods to reduce the hazard and prevent injury.

Workers often lift and move heavy and awkward objects. Failure to follow proper lifting procedures can cause serious and permanent back damage.

Learning Objectives

When you have completed this section, you should be able to:

- Describe safety precautions and procedures relating to personal apparel and personal protection equipment (PPE).
- Describe fall protection systems and the equipment.
- Describe the proper methods of lifting and moving objects.

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.**

- **anchorage / anchor point:** A secure point where fall protection equipment is attached. (Section A-4.2)
- **air-purifying respirator:** A respirator that filters harmful particles or gases from the air. (Section A-4.1)
- **carabiner:** An oblong-shaped metal connecting device with a locking gate used to attach different components of a personal fall protection system. (Section A-4.2)
- **control zone**: A marked area within a minimum of 2 metres of the edge of a structure or building that has a flat or low-sloped roof where special safety rules apply. (Section A-4.2)
- **CSA approved:** Certified by the Canadian Standards Association to meet safety standards. (Section A-4.1)
- **deceleration device:** A safety device used in fall protection that slows down a person during a fall to reduce the force of impact and help prevent serious injury. (Section A-4.2)
- **dermatitis:** A skin problem that causes redness, dryness, or irritation. (Section A-4.1)
- **ergonomics:** How your body fits and works with your tools and workspace. (Section A-4.3)
- **high-visibility apparel:** Clothing that is bright and easy to see, especially around vehicles or machinery. (Section A-4.1)
- **hoist:** A device used to lift heavy objects using a rope or chain. (Section A-4.3)
- **mechanical assistance:** Machines or equipment used to help lift or move heavy objects. (Section A-4.3)
- **noise reduction ratings (NRR):** A number that shows how much noise hearing protection can block. (Section A-4.1)
- **personal protective equipment (PPE):** Safety gear such as gloves, goggles, or boots worn to protect the body. (Section A-4.1)
- **pivot**: To turn your whole body using your feet instead of twisting your back. (Section A-4.3)
- **positive pressure respirator:** A respirator that pushes clean air into the mask to keep harmful air out. (Section A-4.1)
- **rope-and-pulley system:** A lifting system that uses a rope and wheel to raise heavy items. (Section A-4.3)
- **rope grab:** A device used to connect the lanyard to a vertical lifeline; it moves along the lifeline and locks in place if a fall occurs. (Section A-4.2)
- **scaffold:** A temporary platform used to work at heights. (Section A-4.3)
- **self-contained breathing apparatus (SCBA):** A breathing device with its own air tank worn on the back. (Section A-4.1)
- **snap hook:** A self-locking metal hook used to connect lanyards to rope grabs, harnesses, and horizontal lifelines on fall protection equipment. (Section A-4.2)
- **suspension system:** The adjustable strap system inside a hard hat that helps absorb impact. (Section A-4.1)

A-4.1 Describe Safety Gear and Work Clothing

Before starting any task, every worker must consider how to protect themselves from potential hazards on the job. The first line of defence is always to eliminate or control hazards. When that isn't possible, ***personal protective equipment (PPE)*** becomes essential. PPE includes everything from safety boots and eye protection to gloves, hard hats, and hearing protection. Knowing when and how to use PPE equipment—and how to maintain it properly—helps keep workers safe and ensures work meets WorkSafeBC and industry standards.

One of the most important concepts to remember is that you are responsible for your own safety and the safety of others. Personal protective equipment (PPE) is the last line of defence against personal injury, so using it correctly and taking proper care of it are critical to protecting yourself on the job.

The best protective equipment is of no use to you unless you do the following four things:

1. Inspect it regularly.
2. Care for and maintain it properly.
3. Use it correctly and receive training when needed.
4. Never alter or modify it in any way.

The general areas that require your attention include:

- Personal apparel
- Personal protection equipment
- WorkSafeBC regulations

WorkSafeBC Regulations

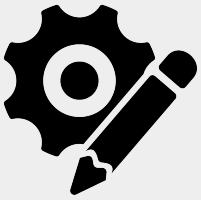
WorkSafeBC regulations state that a worker is responsible for providing:

- Clothing needed for protection against the natural elements
- General-purpose work gloves
- Appropriate footwear, including safety footwear
- Safety headgear

WorkSafeBC regulations state that the employer is responsible for providing, at no cost to the worker, all other items of personal protective equipment required by the regulations.

WorkSafeBC PPE Information Sheets

WorkSafeBC personal protective equipment (PPE) information sheets can be used to inform employers, supervisors and workers about PPE in general. These sheets are ideal for worker orientation and crew talks and for posting on bulletin boards. The sheets explain the PPE required by the regulations for specific industries and hazards as well as describing when and how different types of PPE must be worn.



Go to Personal protective equipment (PPE) (https://www.worksafebc.com/en/health-safety/tools-machinery-equipment/personal-protective-equipment-ppe) on the WorkSafeBC website to see examples of PPE information sheets.

Personal Apparel

Workers are required to supply the appropriate safety footwear and suitable clothing before being permitted to work in a shop or on a work site. There are a number of important safety considerations to be aware of for clothing, hair, and jewellery that are common to all job sites.

Clothing

Workers must wear close-fitting clothing (that is, not ragged or frayed) if they are working near moving machinery. Scarves, ties, shirts, pant cuffs, and gloves may become workplace hazards. For example, if your shirt cuff is loose, you risk getting it caught in a machine and injuring or breaking your arm if it is pulled around the shaft.

Oily, greasy, and/or synthetic clothes (e.g., rayon, nylon, polyester) are of concern when working near sparks or open flames. As well as being fire hazards, oily or greasy clothes may cause skin irritation.

Workers must use clothing to protect the body from as much dirt and as many chips and sparks as possible. Short pants, short-sleeved shirts, and sandals are not considered adequate on most job sites. Choose clothing that is appropriate for the task you are attempting.

Pant legs should not be tucked inside boots when working with or near a torch, grinder, or chipper. Hot pieces of metal may fall inside a boot and cause a bad burn before the boot can be removed. Workers may also require flame-resistant/retardant clothing if they are working where they may be exposed to flash fires or similar hot work hazards.

High-Visibility Apparel

Wear ***high-visibility*** clothing in a colour that contrasts with the environment so you can be seen at a distance. Make sure your high-visibility clothing is not covered by other garments. You must wear this clothing when:

- Working around any moving vehicles, equipment, or lines
- Working alone or in isolation

- Harvesting trees at night
- Performing traffic control in work areas where there is vehicle traffic moving through a work zone, or for falling operations
- Directing helicopter movements

Figure 1 *High-visibility garments (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Loose-fitting high-visibility outer clothing must be "tear-away" if worn where it could get caught on moving equipment or on objects such as branches or limbs.

Hair and Beards

Workers with long hair should wear a cap or a hairnet. In addition, beards should be trimmed. Both hair and beards can get caught in machinery or catch fire from sparks or an open flame. Beards may also prevent respirators from fitting properly, which could result in the inhalation of hazardous materials.

Jewellery

Workers must not wear rings, metal watchbands, bracelets, neck chains, or necklaces on a job site. Wearing these items can cause:

- A bad burn, if a metal object (for example, a watchband) touches a hot battery terminal and some other grounding object
- A shock, if working on electrical equipment that has electrical power applied
- Loss of a finger, if a ring gets caught in a piece of machinery

Special Clothing and Gear for Various Weather Conditions

Since many tradespeople work in poor weather, workers must wear appropriate rain gear and warm clothing. Keeping dry is very important for staying warm because wet clothing causes the body to lose heat more quickly.

Some raincoats are designed with vents to help release and draw off perspiration. A raincoat should be large enough to allow arms to move freely and the collar should have a cloth cover or lining to protect the neck from the coat's cold, wet material.

Rain pants help keep the lower body dry. Wearing only a raincoat allows water to drip onto your legs, making them wet and uncomfortable. It's also important to keep your feet dry so they stay warm. Rubber boots with steel toe protection and steel sole plates are available for this purpose.

Protective clothing should also be considered to guard against sun exposure. The ***ultraviolet protection factor (UPF)*** measures how well clothing blocks ***ultraviolet (UV) rays***. These ultraviolet rays are long wave (UVA) or shortwave (UVB). UVA rays penetrate deep into the skin's thicker layer of skin called the dermis, while UVB rays cause sunburn. Both UVA and UVB rays can lead to skin cancer.

Sunscreen has a ***sun protection factor (SPF)***, which can be deceiving as it merely estimates how much longer you could be out in the sun before burning compared to unprotected skin without sunscreen. Not all sunscreens protect against both UVA and UVB rays. Read the labels on sunscreens carefully to help choose one that suits your needs. Clothing is often a more reliable form of sun protection. For example, clothing with a UPF rating of 20 allows only $\frac{1}{20^\text{th}}$ (5%) of UV radiation to pass through, meaning 95% of UV radiation is blocked. A typical white cotton T-shirt has a UPF rating of about 5, and fabrics with a UPF rating below 15 are generally not considered effective UV protection.

To work safely in cold weather, it is important to wear properly insulated headgear, footwear, and gloves. Wear layered clothing, as layers allow warm air to stay trapped but do not trap perspiration next to the skin. The first layer of clothing should be a moisture-wicking fabric like polypropylene or knitted silk, which will allow the skin to breathe and keep sweat away from skin. The second layer should provide insulation while absorbing perspiration without allowing heat to escape. Wool is ideal because it keeps you warm even when wet. The final outer layer should protect against wind and water.

Personal Protection

On the job site, workers need to wear special personal protective equipment. The equipment you wear will depend on the specific hazards you may expect to encounter. You may be supplied with all or some of the following equipment:

- Goggles
- Face shield
- Gloves
- Safety lock
- Hard hat
- Welder's apron
- Coveralls
- Respirator

- Hearing protection
- High-visibility vest
- Body harness

Protective equipment can be divided into the following categories:

- Head protection
- Eye protection
- Hearing protection
- Respiratory protection
- Hand and skin protection
- Foot protection
- Fall protection

Selecting PPE

All PPE clothing and equipment should feature a safe design and construction and should be well maintained. Workers should consider the fit and comfort of PPE when selecting appropriate items for their workplace. Most protective devices are available in multiple sizes, and care should be taken to select the proper size. If several different types of PPE are worn together, make sure they are compatible. PPE that does not fit properly can make the difference between being safely covered or dangerously exposed. It may not provide the level of protection desired and may discourage use.

Head Protection

Hard hats protect workers where there is a hazard of head injury from falling, flying or thrown objects, or other harmful contacts. The headband made of webbing inside the hat (also known as a hard hat's ***suspension system***) provides a space between the shell and your head, which lessens the impact of anything falling on your head. The headband is adjustable.

Most job sites require that hard hats be worn at all times while on the site. The shells of most hard hats are now almost always made from high-impact plastic, but a few are still made from metal alloys. **Do not** wear a metal alloy hard hat when working on electrical equipment.

Hard Hat Types

The proper type or class of hard hat required will vary for specific areas or for specific jobs. Different hard hats protect against different types of hazards, such as:

- Banging your head on a sharp or hard object
- Being hit by a falling object
- Receiving a shock when working near electrical apparatus

Figure 2 *Three styles of protective headgear (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Hard hats must have either CSA or **ANSI *approval***. These standards are similar but not exactly the same. Many manufacturers have their head protection tested to meet both standards. These standards are divided into two types:

- Type 1 for top protection only
- Type 2 for top and lateral protection

Hard hats are also divided into three industrial classes:

- **Class E (electrical)** – provides head protection against high voltage conductors (20 000 V electrical rating).
- **Class G (general)** – provides head protection against low voltage conductors (2200 V electrical rating).
- **Class C (conductive)** – provides lightweight comfort and impact protection but offer no protection from electrical hazards (no electrical rating).

See*Personal Protective Equipment: Headwear — Selecting Protective Headwear* (https://www.ccohs.ca/oshanswers/prevention/ppe/protective-headwear.html) by CCOHS (n.d.)

Another class of protective headgear on the market is called a "bump hat," designed for use in areas with low head clearance. Bump hats are recommended for areas where protection is needed from head bumps and lacerations. They are not designed to protect against falling or flying objects.

Periodic cleaning and inspection will extend the useful life of protective headgear. A daily inspection of the hard hat shell, suspension system, and other accessories for holes, cracks, tears, or other damage that might compromise the protective value of the hat is essential. Paints, paint thinners, and some cleaning agents can weaken the shells of hard hats and may eliminate electrical resistance. Consult the helmet manufacturer for information on the effects of paint and cleaning materials on their hard hats. Never drill holes, paint, or apply labels to protective headgear, as doing so may reduce the integrity of the headgear's materials. Do not store protective headgear in direct sunlight, such as on the rear window shelf of a car, since it can be damaged by sunlight and extreme heat.

Hard hats with any of the following defects should not be used and should be replaced:

- Perforation, cracking, or deformity of the brim or shell
- Any indication of exposure of the brim or shell to heat, chemicals, or ultraviolet light and other radiation (in addition to a loss of surface gloss, such signs include chalking or flaking)

Always replace a hard hat if it sustains an impact, even if damage is not noticeable. It is not necessary to replace the entire hard hat if just the suspension system is damaged. Suspension systems are available as replacement parts if they are damaged or show excessive wear.

Some workers are more comfortable wearing their hard hats backwards. This still meets WorkSafeBC requirements if the hat's suspension is also reversed, but if you can't reverse the suspension, you must not reverse the hard hat.

Eye Protection

Your eyes are among the most vulnerable parts of your body, and even a small particle or splash can cause permanent injury. On a busy job site, hazards can come from almost any direction — grinding sparks, flying debris, pressurized fluids, or bright welding arcs. Understanding the risks and choosing the right protective equipment is essential for working safely and confidently.

Eye protection is one of the most important safety concerns of people on the job site. Eye hazards include:

- Splashes from liquids, such as acids and caustics
- Sparks flying off of a grinder
- Dust kicked up by compressed air
- "Flash" from a welder working nearby
- Exposure to laser pointer light

There are many types and styles of eye protection available. Some of the most common types include:

- Safety glasses
- Goggles
- Face shields
- Welding helmets
- Laser safety goggles

Safety Glasses

These protective eyeglasses have safety frames constructed of metal or plastic and impact-resistant lenses. Side shields are available on some models.

Wear specially designed and manufactured safety glasses to protect your eyes in activities such as:

- Working on any live electrical equipment
- Using cutting pliers to cut material
- Soldering or de-soldering
- Using an electric hand drill
- Hammering
- Working with tool steel

Figure 3 *Safety glasses (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Goggles

Goggles are a type of tight-fitting eye protection that completely cover the eyes, eye sockets and facial area immediately surrounding the eyes. They provide protection from impact, dust and splashes. Some goggles will fit over corrective lenses.

Wear goggles to protect your eyes when doing activities such as:

- Drilling or chipping, hammering and working with steel
- Using a powder-actuated tool

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

Face Shields

Face shields are transparent sheets of plastic that extend from the eyebrows to below the chin and across the entire width of the head. Some are polarized for glare protection. Face shields protect against nuisance dusts and potential splashes or sprays of hazardous liquids, but they will not provide adequate protection against impact hazards. Face shields used in combination with goggles or safety glasses will provide additional protection against impact hazards.

Wear a face shield to protect your face in activities such as:

- Using a grinder
- Using a drill press
- Using compressed air for cleaning

Figure 5 *Face shield (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Welding Helmets

Constructed of vulcanized fibre or fibreglass and fitted with a filtered lens, welding helmets protect eyes from burns caused by infrared or intense radiant light. They also protect both the eyes and face from flying sparks, metal spatter, and slag chips produced during welding, brazing, soldering, and cutting operations. Filter lenses have a shade number appropriate to protect against the specific hazards of the work being performed and against harmful light radiation.

Figure 6 *Welding helmets (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Laser Safety Goggles

These specialty goggles protect against intense concentrations of light produced by lasers. The type of laser safety goggles a worker chooses will depend on the equipment and operating conditions in the workplace.

Figure 7 *Laser safety goggles (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Never assume that regular prescription glasses, sunglasses, or contact lenses can provide adequate eye protection. Dust particles, wood chips, sparks or welding flash may still cause eye damage if eyes are not properly protected.

Regardless of the job, whether grinding, chipping, drilling or welding, always use adequate eye protection (welding goggles or helmets are not acceptable for grinding). Choose a type or style of eye protection that will protect you in the job that you are doing (e.g., goggles when chipping concrete, a welder's helmet when welding). Also, always use safety-approved eye protection. Improper or faulty protection devices can also be hazardous.

Hearing Protection

Noise on the job site can affect you in different ways. Being exposed to high noise levels and moderate noise levels over a long period of time can impair your ability to hear specific types of sounds. For example, the noise from diesel-powered vehicles such as trucks can permanently damage your hearing. High noise levels can affect your state of mind, making you easily annoyed, irritable, and mentally fatigued, and can decrease your ability to concentrate and stay alert.

Hearing protection ***noise reduction ratings* (NRR)** are given in decibels (dB). If the noise level is 90 dB and a worker is wearing expandable foam plugs rated at 29 dB, the actual noise exposure will be 90 – 29 = 61 dB. When choosing hearing protection devices, you should choose a device that will reduce the noise exposure to a maximum of 85 decibels.

There are four main points to remember when choosing hearing protection:

- Choose a type or style of protection suitable to the job you are doing.
- Ear plugs should be pliable, fit each ear tightly, and be kept clean and free from damage.
- Earmuffs make it easier to hear certain signals in noisy environments.
- Headphones designed for listening to music do not offer suitable protection.

Single-Use Earplugs

These earplugs are made from material like expandable PVC or urethane foam. They are self-forming and, when properly inserted, they work as well as most moulded earplugs.

Figure 8 *Single-use earplugs (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Pre-Moulded Reusable Earplugs

Pre-moulded earplugs are made from biocompatible silicon, plastic, or rubber and are manufactured as either "one-size-fits-most" or in several sizes to fit small, medium, or large ear canals. Advantages of pre-moulded plugs are that they are relatively inexpensive, reusable, washable, convenient to carry, and come in a variety of sizes.

Figure 9 *Pre-moulded earplugs (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Custom-Fitted Hearing Earplugs

Made from impressions taken of an individual's ear, custom-fitted earplugs completely fill the ear canal and match the ear shape of the wearer. Some custom-fitted plugs are designed to let the wearer hear conversations in noisy environments. Others have a communication speaker installed into them.

Figure 10 *Custom-fitted earplugs* (BC *Industry Training Authority*, 2019). CC BY-NC-SA 4.0 (*https://creativecommons.org/licenses/by-nc-sa/4.0/*)

Canal Caps

Canal caps resemble earplugs on a flexible plastic or metal band. The earplug tips of a canal cap may be made of a formable or pre-moulded material. These have the convenience of being easily removed and replaced as needed.

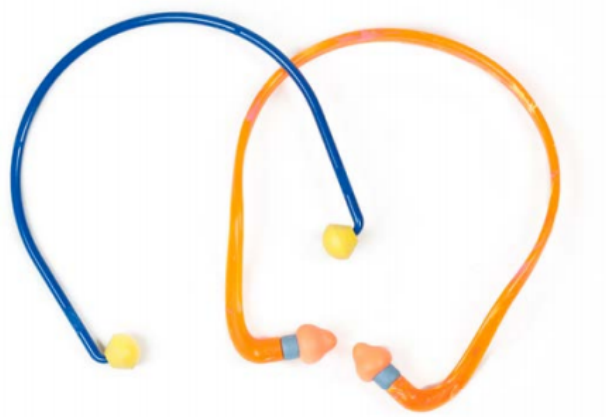


Figure 11 *Canal caps* (BC *Industry Training Authority*, 2019). CC BY-NC-SA 4.0 (*https://creativecommons.org/licenses/by-nc-sa/4.0/*)

Earmuffs

Earmuffs come in many models designed to fit most people, and some styles can be connected to a hard hat. They work by blocking out noise by completely covering the outer ear.

To work properly, earmuffs must be perfectly sealed around the ears. Their effect may be reduced if glasses, facial hair, or long hair compromise the seal. Facial movements such as chewing may also affect the seal.

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

Respiratory Protection

Airborne contaminants are among the most dangerous—and least visible—hazards in the workplace. Dust, fumes, mists, and vapours can damage the lungs or lead to long-term health problems even when they can't be seen or smelled. Understanding when respiratory protection is needed, how to select the right type, and how to maintain it properly is essential for every worker on the job site.

Workers must be aware of any airborne hazards present on the job and must take the necessary precautions to protect the respiratory system. Examples of hazards include airborne particles such as body filler, asbestos, or dust, as well as toxic gases or fumes. All of these are harmful if inhaled, but workers can protect themselves by wearing an approved ***respirator***.

If you are required to use a respirator, you will need the appropriate training to select, test, wear, and maintain this equipment. Always use the appropriate respirator for the hazard involved and the extent and nature of the work to be performed, which includes choosing the correct type of cartridge and filter. Respirators must be kept clean and sterilized according to the manufacturer's instructions. It is very important to check a respirator carefully for damage and proper fit. All respirators must be properly fitted to your face, and the seal must be checked each time the respirator is used.

Before selecting your respirator, you should consider the environment and conditions that you are going to be working in. A ***positive pressure respirator*** will supply air to the inside of a face mask that will exceed the ambient air pressure on the outside of the respirator. ***Self-contained breathing apparatus (SCBA)*** and air respirators are examples of positive pressure respirators. A ***negative-pressure respirator*** will be under negative pressure when compared to the ambient air while the user inhales. ***Air-purifying respirators*** are negative-pressure respirators.

There are three types of respirators commonly used for various atmosphere conditions in the workplace. These are:

- Air-line or supplied air respirators

- Self-contained breathing apparatus (SCBA)
- Air-purifying respirators

Air-line Respirators

Figure 13 *(OpenClipart-Vectors/Pixabay) Content License (https://pixabay.com/service/license-summary/)*

Air-line or supplied-air respirators have a mask or hood with a remote air supply available through a connected hose. This type of respirator is used where there is not enough oxygen or there are toxic gases or fumes in the air.

Self-Contained Breathing Apparatus (SCBA)

An SCBA draws air from a compressed-air cylinder, which is strapped to the worker's back.

This style of respirator is used when there is not enough oxygen on the work site or there are toxic gases or fumes in the air. An SCBA has the added advantage of an independent air supply without the need for hose, which is why this type of respirator is more commonly used in rescue and emergency situations.

Figure 14 SCBA (*BC Industry Training Authority*, 2019). CC BY-NC-SA 4.0 (*https://creativecommons.org/licenses/by-nc-sa/4.0/*)

Air-Purifying Respirators

There are two common types of air-purifying respirators:

- Dust/mist masks
- Cartridge respirators

These types of respirators cannot be used in an oxygen-deficient environment. The full face mask with a chemical canister can be used to protect against short exposure to dangerous gases or fumes, such as an emergency escape situation, as the cartridge in the respirator is able to neutralize the gases for a very short time only.

Dust/Mist Masks

Dust masks are made of paper or soft non-woven fibre and simply fit over the mouth and nose. These generally offer protection against nuisance dusts and fine mists only. Some models have a built-in exhaust valve for more comfort.

Figure 15 *Dust mask (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Cartridge Respirators

Cartridge respirators are commonly used in conditions where there are low concentrations of organic gases, pesticides, and paint vapours. These come in half-mask or full-face piece designs. Both of these designs are also made in one- or two-cartridge styles. Do not use these types of respirators to protect against highly toxic gases.

Figure 16 *Cartridge respirator (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Hand and Skin Protection

WorkSafeBC accident statistics indicate that over 30 percent of work injuries involve fingers, hands, and arms, and many of these accidents could be avoided by using appropriate hand protection. As a trades worker, you are ultimately responsible for ensuring that you use the correct hand protection for each hazardous situation.

Gloves

Gloves are manufactured from materials such as cotton, leather, rubber, metal and other synthetics and are tailored to meet every need for hand protection in every trade area:

- Leather or vinyl-coated gloves should be used when handling lumber or steel.
- Gauntlet-type welder's gloves should be used when welding or flame cutting.
- Special heat-resistant gloves should be used when handling hot metal.
- Rubber or approved plastic-treated gloves should be used when handling acids and cleaning solutions.

See*Personal Protective Equipment: Chemical Protective Clothing – Glove Selection* (https://www.ccohs.ca/oshanswers/prevention/ppe/gloves.html) by CCOHS (n.d.).

Figure 17 *Types of work gloves* (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (*https://creativecommons.org/licenses/by-nc-sa/4.0/*)

Barrier Creams

If you are exposed to chemicals that can strip oils from your skin, you are susceptible to developing ***dermatitis***. Avoid this condition by using proper gloves, along with a barrier cream, if you notice your skin drying out.

Foot Protection

Your feet deserve as much consideration as your eyes, ears, or hands.

Potential hazards to your feet include:

- Heavy objects falling on them
- Stepping on sharp objects
- Having hot sparks or slag fall inside your shoes

You must wear safety footwear appropriate to the job you are doing. For example, leather boots are required in the welding shop, where there are specific hazards from sparks and molten slag.

Leather is not impervious to all chemicals and, therefore, is not a good choice when walking in wet concrete. In that case, rubber boots with steel toe and sole protectors would be better. Footwear should be inspected regularly and replaced if worn out.

CSA Standards

Due to the dangers listed above, you must wear safety footwear that is **CSA *approved***. Look for the green triangle with the CSA logo.

Figure 18 *CSA footwear logo (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Fall Protection

Working at heights is one of the most common causes of serious injuries and fatalities in the construction and piping trades. Falls can happen quickly—from ladders, scaffolds, platforms, or even ground-level slips—which is why planning, training, and the right protective equipment are essential. Fall protection systems are designed to prevent falls or reduce the impact if one occurs, keeping workers safe while working above ground. This category is covered in detail in section A-4.2 Describe Fall Protection Systems.

General Care of PPE

Remember that PPE is the last line of defence against personal injury, so using it properly and taking care of it are very important. Be sure to do all of the following:

- Regularly inspect it.
- Properly store and care for it.
- Use it properly when it is needed.
- Never alter or modify it in any way.
- Maintain it.
- Refer to the manufacturer's documentation for further information.

Self-Test A-4.1: Describe Safety Gear and Work Clothing

Complete Self-Test A-4.1 and check your answers.

If you are using a printed copy, please find Self-Test A-4.1 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.

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=1237#h5p-23 (https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/?p=1237#h5p-23)

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- **Figure 13** Breather defense firefighter (https://pixabay.com/vectors/breather-defense-firefighter-152093/) by OpenClipart-Vectors on Pixabay is used under the Pixabay Content License (https://pixabay.com/service/license-summary/)

A-4.2 Describe Fall Protection Systems

There are different methods of providing fall protection. A fall protection system is defined in the OHS Regulation (Part 11) as:

- A fall restraint system
- A fall arrest system
- Work procedures that minimize the risk of injury, such as using a safety net, that are acceptable to WorkSafeBC

Fall Restraint System

Fall restraint systems prevent a worker from falling from a work position, or travelling to an unguarded edge from which the worker could fall. Examples are guardrails or a personal fall protection system. This may include the use of a ***control zone*** with a safety monitor when fall protection is not practical. A control zone is the area within a minimum of 2 metres of the edge of a structure or building that has a flat or low-sloped roof. The control zone and work area are separated with a raised warning line, limiting access to this unsafe area. The safety monitor supervises work in the control zone according to the fall protection plan. One safety monitor can supervise no more than eight workers. If workers will not enter the control zone and the pitch of the roof is less than $\frac{4}{12}$, a safety monitor or other fall protection is not required.

Figure 1 *Fall restraint (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Watch the following video by WorkSafeBC (2009) titled “Fall Protection: Fall Restraint (3 of 6)” [2:15] on YouTube.

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=1239#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: Fall restraint (https://youtu.be/yCcBlhkGhTE)

Fall Arrest System

Fall arrest systems stop a worker's fall before the worker hits the surface below.

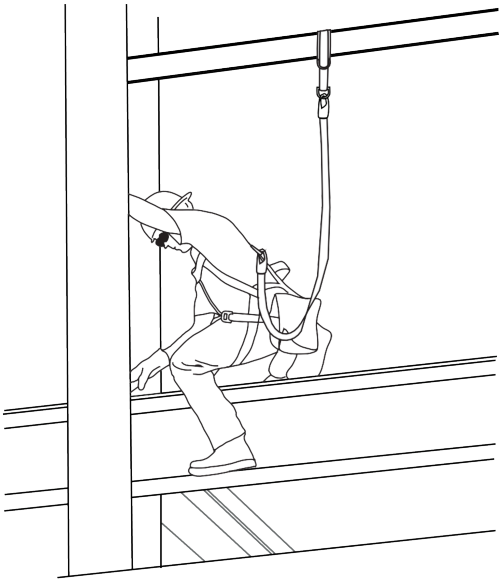

Figure 2 *Fall arrest (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Watch “Fall Protection: Fall Arrest (4 of 6)” [3:13] 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: Fall arrest (https://youtu.be/_dhlEovMkcw)

Fall Protection Equipment

A worker’s personal fall protection system will have different equipment depending on whether it is a fall arrest or a fall restraint system. It will include:

- A safety belt or full body harness
- A lanyard, lifeline, and any other connecting equipment that is used to secure the worker to an individual point of ***anchorage*** or to a horizontal lifeline system

Figure 3 *Fall protection equipment* (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (*https://creativecommons.org/licenses/by-nc-sa/4.0/*)

Review OHS Regulation part 11 "Fall Protection (https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-guidelines/guidelines-part-11)" on the WorkSafeBC website.

Harness and Belts

When using personal fall protection equipment, wear a full body harness if you are at risk of falling. A full body harness consists of straps passed over the shoulders, across the chest, and around the legs. It also has a D-ring or support point at the rear between the shoulder blades.

In a fall, a full body harness will protect you more than a safety belt because the harness distributes the force of impact

over a greater area of your body. A belt should be used only as part of a fall restraint system. It is important to adjust the harness to fit your body. A poorly fitting harness is uncomfortable and may not protect you properly.

Figure 4 *Full body harness (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Connecting Equipment

There are various types of equipment that can be used to connect the harness to the anchor point.

Lanyard

A ***lanyard*** is a flexible line of webbing, or a synthetic or wire rope used to secure a safety belt or full body harness to a lifeline or anchor.

Figure 5 *Lanyard (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Deceleration Device or Shock Absorber

A common method of reducing the impact strain on the body and the anchorage system is to use a ***deceleration device***. These devices are designed to slowly release energy and absorb the initial shock. The device may use a spring or tear-webbing design. It is important to know that this shock absorber may increase the length of the lanyard during a fall by as much as 1.2 m (4 ft), which must be allowed for in the design of your personal fall protection system.

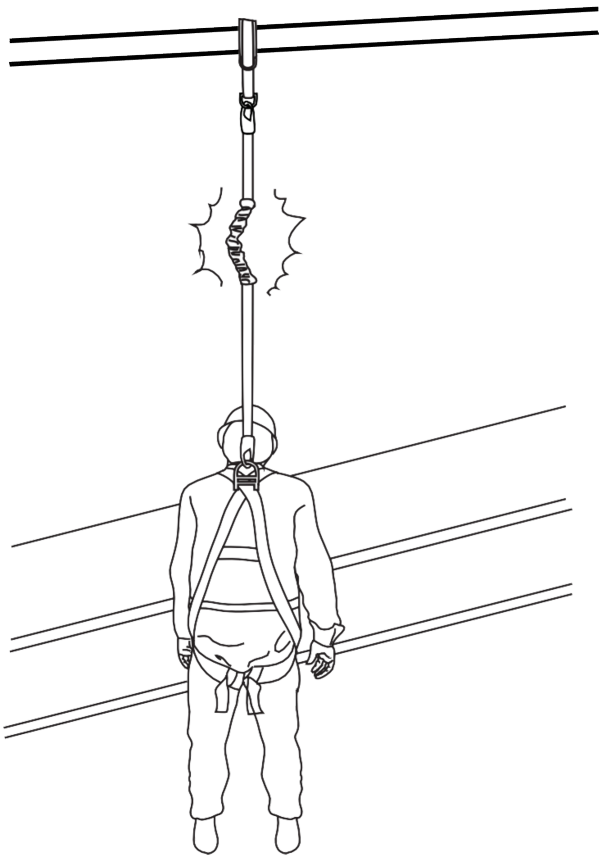

Figure 6 *Deployed shock absorber (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Lifeline

Lifelines can be vertical or horizontal and made of synthetic fibre or steel wire rope. A retractable lifeline is a special type of vertical lifeline. It is fastened to a horizontal lifeline unless the manufacturer allows alternate use.

Vertical lifelines have a breaking strength of 26.7 kN (6,000 lb). Horizontal lifelines can be permanent or temporary and are installed between two secure anchor points. Permanent horizontal lifelines must be certified by a professional engineer.

Temporary horizontal lifelines are permitted with certain restrictions. They can be manufactured for commercial use,

provided the use and installation are in accordance with the manufacturer's written instructions. They can also be engineered and installed according to written instructions from a professional engineer.

Alternatively, they can be installed with many restrictions.

WorkSafeBC lists the following requirements:

- The horizontal lifeline is a minimum 12 mm ($\frac{1}{2}$ in.) diameter wire rope having a breaking strength specified by the manufacturer of at least 89 kN (20,000 lb.)
- The horizontal lifeline is free of splices except at the terminations
- Connecting hardware, such as shackles and turnbuckles, has an ultimate load capacity of at least 71 kN (16,000 lb.)
- The span is at least 6 m (20 ft) and not more than 18 m (60 ft)
- End anchors have an ultimate load capacity of at least 71 kN (16,000 lb.)
- The horizontal lifeline has an unloaded sag of approximately the span length divided by 60
- The elevation of the line at any point is at least 1 m (39 in.) above the working surface
- The free fall distance is limited to 1.2 m (4 ft)
- A minimum of 3.5 m (12 ft) of unobstructed clearance is available below the working surface
- No more than three (3) workers are secured to the horizontal lifeline
- The horizontal lifeline is positioned so it does not impede the safe movement of workers.

Refer to An Introduction to Personal Fall Protection Equipment (https://www.worksafebc.com/en/resources/health-safety/books-guides/an-introduction-to-personal-fall-protection-equipment) from WorkSafeBC (2014) for more information.

Retractable lifelines work like the seat belt in a car. These are under constant tension, and the moment you fall, the lifeline locks.

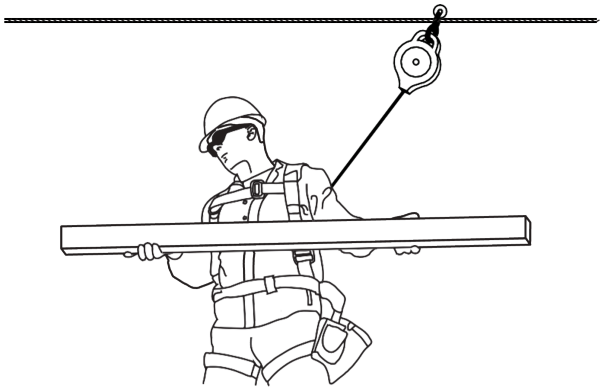

Figure 7 *Retractable lifeline fastened to a horizontal lifeline (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Rope Grab

A ***rope grab*** is used to connect the lanyard to a vertical lifeline. The rope grab travels along the lifeline with you and will lock onto it if you fall.

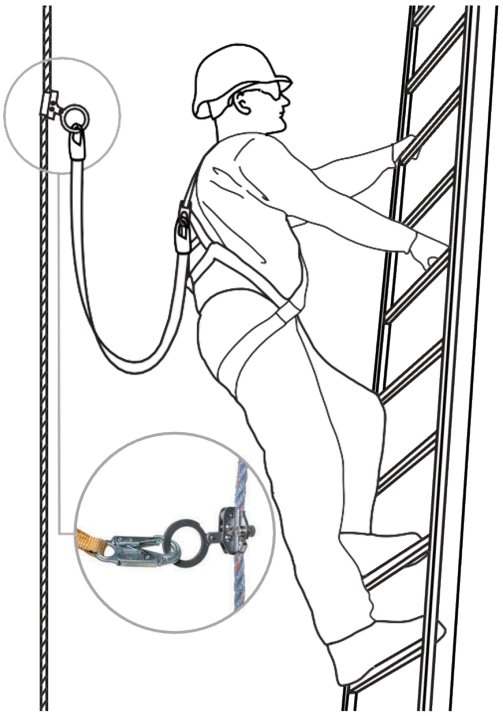

Figure 8 *Rope grab fastened to a vertical lifeline (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Snap Hook or Carabiner

Snap hooks are used to connect lanyards to rope grabs, harnesses, and horizontal lifelines. Snap hooks must be self-locking, so that the hook can't be open unless you depress a separate locking mechanism before opening the keeper.

Figure 9 *Locking snap hook (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

A ***carabiner*** is an oblong-shaped connecting device also used to attach different components of a personal fall protection system. A carabiner should have gates that are both self-closing and self-locking, with a breaking strength of at least 22 kN (5,000 lb.). It should also have the manufacturer's identity and load capacity clearly marked on it.

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

Inspection, Storage, and Maintenance

To maintain service life and performance, all fall protection equipment should be inspected frequently. Damage can include burns, hardening due to chemical contact, and excessive wear. Fall protection equipment must be inspected by a qualified person and replaced or recertified if any damage is found. Always store fall protection equipment in a dry location away from any substances that could cause deterioration.

Self-Test A-4.2: Describe Fall Protection Systems

Complete Self-Test A-4.2 and check your answers.

If you are using a printed copy, please find Self-Test A-4.2 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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A-4.3 Lift and Move Objects Safely

In the piping trades, moving tools, pipe, and equipment is part of everyday work. Knowing how to lift and carry objects safely helps prevent injuries and ensures you can work efficiently over the long term. This section explains how to protect your back and body through proper lifting techniques and ergonomic awareness.

Preventing lower back injury on the job is particularly important. You can keep your back healthy by paying attention to ***ergonomics*** (the relationship between you and your work environment) and the rules for safe lifting and carrying.

The design of the human body is such that the back is especially susceptible to injury if it is not treated with respect. Know your own strengths and limitations. A high percentage of all workplace injuries involve the back. Basic precautions and lifting techniques are easy to learn and apply and can greatly reduce the chances of serious back injury.

General Rules for Lifting and Moving Objects

Always follow these rules, even for lifting light objects:

- Place your feet apart for good balance.
- Bend your knees.
- Hold the object as close to your body as possible.
- Lift smoothly and slowly.
- ***Pivot*** with your feet; don't twist your back.
- Push, rather than pull, the load.
- Share the load; work with a partner.
- Get ***mechanical assistance*** for heavy loads.

Many of the objects you may have to lift and move can be heavy and awkward, including beams, planks, plywood, panel products, ladders, and wheelbarrows. The following safe lifting procedures are recommended for most tasks.

Table 1. ***Proper Body Positioning for Safe Lifting***

Body Position	Recommended Safe Lifting Practice	Why It Matters
Feet	Stand with your feet spaced apart, with one foot slightly in front of the other.	Provides stability and balance when lifting heavy or awkward objects.
Back	Keep your back straight; do not bend, arch, or twist.	Reduces the risk of back strain or serious injury.
Chin	Keep your chin tucked toward your chest.	Helps keep your back straight and properly aligned.
Palms (Grip)	Use a full palm grip with fingers close together.	The palm is stronger than the fingers alone, allowing for safer lifting.
Body Weight	Keep your balance and distribute your weight evenly on both feet.	Improves control and reduces strain during the lift.
Arms	Keep your arms tucked close to your sides.	Allows you to carry more weight safely and reduces injury risk.

Procedures for Lifting Specific Objects

Before moving anything, make sure your path is clear of obstacles and that there is space to put the object or material down. Depending on how you have to move the object, your vision may be blocked on one side. Be sure you can see where you're going.

Watch out for overhead power lines when lifting and carrying ladders, pipes, and other long objects.

Plywood

To pick up and carry a sheet of plywood, wear leather gloves and use this procedure:

1. Stand the plywood on its narrow edge in a vertical position. If the plywood is lying flat on the ground, go to one end and pick up the narrow edge. Then lift and walk toward the plywood until it is standing vertically on its narrow edge. This method requires you to lift only half the weight of the plywood from the ground.
2. Place your hands at the midpoints of the long edges of the plywood. Roll the sheet onto your right or left hand. The sheet should be balanced in the carrying hand. This avoids straining your back when trying to keep the sheet from dropping at one end.
3. If your grip feels uncomfortable, put the sheet down on its narrow edge and take a new grip. If you lean the sheet of plywood into your shoulder, some of the weight will transfer from your hand. Figure 1 shows the correct way to hold and carry a large, lightweight panel product.

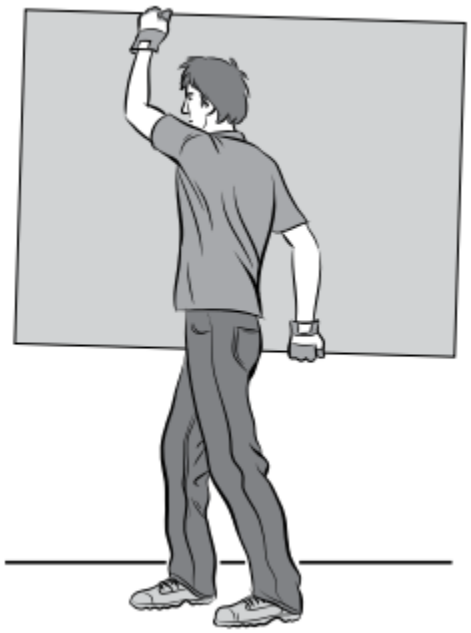


Figure 1 *Carrying a large sheet of a panel product (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Always ask for help if you need it. For example, if there are obstacles to move around, get someone to help you carry the sheet. In this situation, there should be one person at each end. If it is windy, you may have difficulty carrying large sheets, so again, ask for help.

Planks and Beams

If they are not too heavy, planks and beams can be carried on your hip or shoulder. If the plank or beam is too heavy, get help or use mechanical assistance such as a ***hoist*** or ***forklift***. The plank or beam should be off the floor on ***blocking*** so that you can easily get your hands under it. To place blocking under the plank or beam, you may have to turn it on its edge or use a crowbar to lift it up.

The following is the procedure for carrying a beam:

1. Bend down, keeping your back straight and your feet slightly apart, pointed in the direction that you want to move.
2. Place one hand on each side of the beam near the middle, one hand slightly forward and the other slightly behind.
3. Lift slightly to check the weight and the balance, then relocate your hands until you have the proper balance.
4. Stand up slowly, keeping your back straight and using your leg muscles.
5. Hold the plank or beam close to your body and let your hip carry some of the weight.

If you want to carry the plank or beam on your shoulder, pick it up from one end and walk and lift it toward the other end until it is on your shoulder. With the beam on your shoulder, adjust the balance so that slightly more of the weight is behind than in front. This way you can pull the plank or beam down in front of you to keep your balance.

Before you move a plank or beam, make sure that the way is clear and that there is a space to place it. Both planks and beams should be put down on blocking if they are not put directly into place in the building structure.

Do not twist your back when moving heavy weights. Use your feet to change direction of travel. Do not carry any more than you can comfortably handle and control at all times. If you are forced to drop your load or if you lose control of it, you risk injuring yourself or a co-worker.

Steel Pipe and Rebar

Steel pipe can be carried in the same manner as the beams or planks. If there is more than one pipe to carry at the same time, bundle and tie them together at each end and in the middle. If you try to carry more than one pipe at a time, you can easily lose control of them as they will want to go in different directions.

Ladders

Extension ladders come in various lengths, and the longer the ladder, the heavier it is. Most trades workers should be able to handle a 5 m (16 ft.) ladder by themselves. Longer ladders should be handled by two people.

A ladder is usually carried on the shoulder, with one arm placed between the rails and the other hand used to balance it. The ladder should be picked up in the same manner as beams or planks.

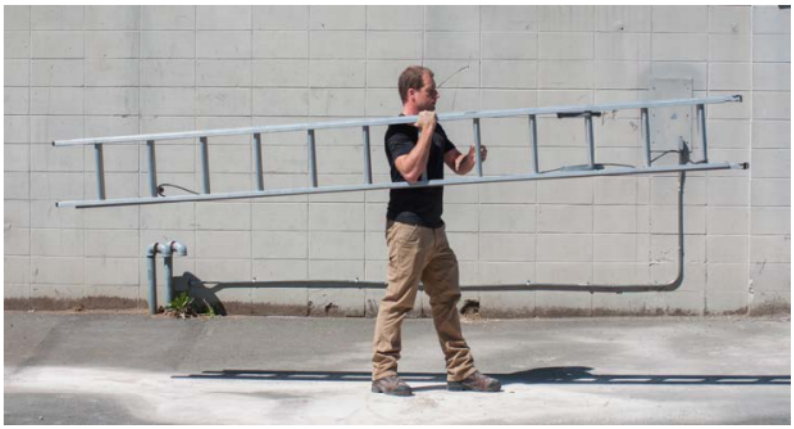


Figure 2 *Lifting a ladder* (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (*https://creativecommons.org/licenses/by-nc-sa/4.0/*)

Do not drop a ladder or let it hit anything. You could crack the side rails and make the ladder unsafe.

Wheelbarrows

One worker can carry a very heavy load (up to 300 kg) in a wheelbarrow. Before using a wheelbarrow, check that the wheel is properly inflated and centred on its ***axle***.

When you use a wheelbarrow, always maintain your balance. Keep the bulk of the weight in a wheelbarrow toward its front for greater control, and make sure it's not overfilled. When turning a corner, tilt the barrow slightly in the direction of the turn, just as you would tilt a bicycle — not too sharply, or you may tip the load. When you go downhill, hold back the barrow to prevent losing control.

In the construction industry, wheelbarrows are primarily used to place concrete and gravel. They have a narrow spout to direct the concrete into the forms, and there is an extension of the handrails past the front wheel. This allows the barrow to be tipped and the contents dumped. Be sure to protect any surfaces that may break or chip from coming into direct contact with the handrail extensions when pouring.

When you move a wheelbarrow, use the following technique:

1. Bend your knees, keeping your back straight, your chin in, and your feet slightly apart.
2. Lift in a smooth motion and push the barrow in the direction you want to go, tilting the barrow to make the turns.
3. When you take a wheelbarrow up a ramp and you need help to move the barrow, only one person should do the pushing. The other should use a long hook on the front of the barrow and pull it up the ramp. If two people try to push the barrow, balance will be lost and the contents will spill.

Figure 3 *Wheelbarrow (Sergei Starostin/Pexels) Pexels License (https://www.pexels.com/license/)*

Shovelling

Shovelling may seem like a simple task, but if done incorrectly, it can cause injury. There are basic rules for using a shovel comfortably and safely:

1. Keep your back as straight as possible.

2. Bend at the hips and keep your feet slightly apart, with one ahead of the other.
3. Place yourself in a comfortable position and have a cleared area to work in. You will find that a long-handled shovel is easiest to work with. Not only will it provide more leverage, but it will not require you to bend very far.
4. If you are right-handed, your left hand should grip the shovel just above the metal ferrule, and the right hand should be nearer the top of the shovel handle.
5. Slide or push the shovel into the material.
6. Drop the end of the shovel slightly to catch the material. Then draw the shovel toward you, allowing it to slide on the ground.
7. When the shovel is near you, you can then lift with your left hand and steady your right hand to move the material by tossing it off to the side or behind you.

You can also use your knee for leverage to help lift up a shovel. The motion of using the shovel should feel comfortable, without any strain. If the load on the shovel is too heavy, take smaller loads.

Learn to pace yourself. If you start too vigorously, you will quickly tire and be unable to maintain a steady pace.

The best shovelling method depends on the material to be moved. Drain rock or gravel should be picked up from the bottom edge of the pile, rather than from the middle or top. Sand can be picked up from any part of the pile.

Soil that has been dumped by truck can be taken near the bottom of the pile. Soil that has to be dug out of the ground may have to be loosened with a pick or maddock before it can be easily picked up.

Barrels and Drums

Large barrels or drums are moved by rolling them on their rims. If a barrel is lying on its side, it must be placed in the upright position by using the following procedure:

1. Stand at the top end of the barrel and bend your legs (but keep your back straight) so that you can get a good grip on each side of the rim near the bottom.
2. Lift the barrel toward the upright position and, as it reaches the balance point, be ready to change your grip so that you can prevent the barrel from dropping on its end.

If the barrel is full, you will need the help of a second person or the use of a barrel dolly, which is designed to pick up and move barrels.

Small Pails

Small pails (20 to 25 L, or 5 to 6 gal.) used for paints, adhesives, coatings, and the like are quite heavy, so you need to be careful when moving them.

Check that the handles are properly secured, inserted into the holders at the sides of the containers. If the handle slips, the container could fall and injure your foot.

To pick up a heavy container, bend your legs, keeping your back straight. Reach down and grip the handle and then stand erect and carry the container to the desired location. To keep your balance, you may find it easier to carry two pails at the same time.

Containers to be moved up to a ***scaffold*** platform should be raised with a ***rope-and-pulley system***. They are usually too heavy to be pulled up by a rope only.

Boxes

Many items come in heavy boxes or sacks. To pick up boxes from the floor or ground safely:

1. Bend your legs, keeping your back straight and your feet apart, one foot slightly ahead and the other slightly behind.
2. Move close to the box. Place your left hand on the top left corner away from you and place your right hand on the lower right corner next to you.
3. Tilt the box away from you, keeping the weight of the box on the floor. Then tilt the box to judge its weight.
4. Using the palm grip, grasp the bottom edges of the box (Figure 4) and use your leg muscles to stand up. Turn your feet in the direction you want to move.
5. When carrying a heavy object, do not twist your back to change direction.

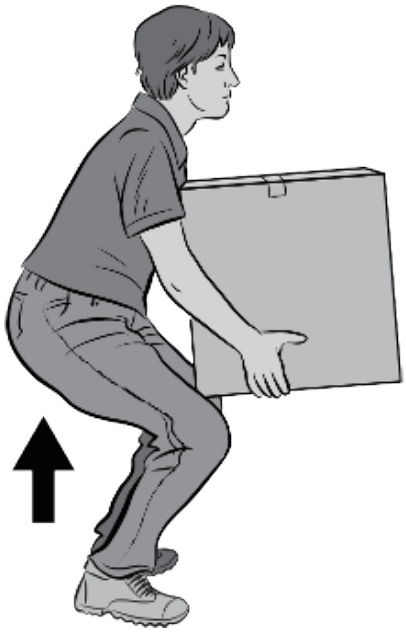


Figure 4 *Lifting a box (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

The instructions for lowering the box are the reverse of the directions for lifting. If the box is too heavy, get someone to help you. If it is too heavy for two people to lift, use mechanical equipment such as a forklift.

Back Maintenance

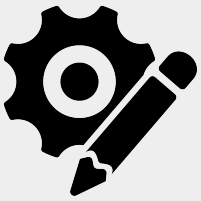
Strong, flexible muscles are essential for a healthy back. They support the ***spinal column*** and determine ***posture***, which is key to preventing injury. If your muscles are weak or tight, back injuries are more likely and recovery is more difficult.

Exercise and Your Back

Stay fit by exercising regularly to maintain flexibility, strength, and endurance. If you are receiving professional back care, do only those exercises you have been instructed to perform.

Stretching

Athletes warm up and do stretching exercises before practices and events to limber up the joints and get blood flowing to muscles. The same principles apply to lifting. By stretching and warming up, along with taking basic precautions and following proper lifting techniques, you can greatly reduce your chances of serious injury.



Go to the WorkSafeBC (2014) website to review Back Talk: An Owner's Manual for Backs (http://www.worksafebc.com/en/resources/health-safety/books-guides/back-talk-an-owners-manual-for-backs) and additional information on back care and maintenance.

Self-Test A-4.3: Lift and Move Objects Safely

Complete Self-Test A-4.3 and check your answers.

If you are using a printed copy, please find Self-Test A-4.3 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.

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=1241#h5p-25 (https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/?p=1241#h5p-25)

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- **Figure 3** Wheelbarrow (https://www.pexels.com/photo/construction-workers-collaborating-outdoors-29181481/) by Sergei Starostin from Pexels is used under the Pexels License (https://www.pexels.com/license/)

Self-Test A-4.1: Describe Safety Gear and Work Clothing

Complete Self-Test A-4.1 and check your answers.

1. It is the worker's responsibility to wear proper safety equipment on the job site.
    a. True
    b. False
2. What makes loose or sloppy clothing dangerous in mechanical shops?
    a. May catch fire
    b. May get caught in moving machinery
    c. May cover your hands, interfering with your grip
    d. Sleeves may get into the solvent when washing parts
3. You should tuck your pant legs inside your boots when working near a torch or grinder.
    a. True
    b. False
4. Rings and metal watchbands constitute a hazard on the job and can contribute to a shock or a burn.
    a. True
    b. False
5. What PPE are workers responsible for supplying?
    a. Headgear, eye protection, and ear protection
    b. Gloves, safety headgear, and safety footwear
    c. Safety boots, gloves, and eye and ear protection
    d. Fall-arresting, buoyancy, eye and ear protection devices
6. Bump hats are designed to be used in areas with low head clearance. They are used to protect against head bumps and lacerations, but can also be used to protect against falling or flying objects.
    a. True
    b. False
7. What type of footwear must be worn when working in the welding shop?
    a. Rubber boots
    b. Caulked boots
    c. Steel-toed work boots
    d. Running shoes with safety toes
8. Never paint on or apply labels to a hard hat.
    a. True
    b. False
9. When must hard hats be worn?
    a. Whenever working outdoors
    b. If requested by your supervisor
    c. If it is necessary to be identified as an employee
    d. Whenever a hazard of flying or falling objects exists
10. When a hard hat has sustained an impact, it doesn't need to be replaced unless it has noticeable damage.

a. True
b. False

11. What PPE must be worn when performing an operation that could create flying particles or chips?

a. Gloves
b. Coveralls
c. Ear protection
d. Eye and face protection

12. Which of the following is required for face protection when grinding?

a. Safety glasses
b. Plastic goggles
c. Full face shield
d. Laser safety goggles

13. When handling chemicals, what are rubber gloves and a face shield worn to protect against?

a. Explosions
b. Toxic vapours
c. Spills and splashes
d. Contaminating the product

14. What type of hearing protection can have a communication speaker installed into it?

a. Canal caps
b. Single-use earplugs
c. Pre-moulded earplugs
d. Custom-fitted earplugs

15. When wearing a respirator for lung protection, it is necessary to use the correct cartridge for the type of hazards to which you are exposed.

a. True
b. False

16. Cartridge respirators are commonly used when performing work in an environment contaminated with highly toxic gases.

a. True
b. False

17. Leather gloves should be used for handling acids, caustics, or solvents.

a. True
b. False

18. What type of solar radiation will contribute to a sunburn?

a. UVA
b. UVB
c. SPF
d. UPF

19. What type of respirator would be considered to be a negative-pressure respirator?

a. SCBA
b. SCUBA
c. Cartridge respirator
d. Air/line respirators

Answer Key: Self-Test A-4.1 is on the other page.

Answer Key: Self-Test A-4.1

1. a. True
2. b. May get caught in moving machinery.
3. b. False
4. a. True
5. b. Gloves, safety headgear, and safety footwear
6. b. False
7. c. Steel-toed work boots
8. a. True
9. d. Whenever a hazard of flying or falling objects exists
10. b. False
11. d. Eye and face protection
12. c. Full face shield
13. c. Spills and splashes
14. d. Custom-fitted earplugs
15. a. True
16. b. False
17. b. False
18. b. UVB
19. c. Cartridge respirator

Self-Test A-4.2: Describe Fall Protection Systems

Complete Self-Test A-4.2 and check your answers.

1. What term best describes the combination of PPE that is used to protect workers who fall?
    a. Full body harness
    b. Fall arrest system
    c. Fall restraint system
    d. Fall protection system
2. What is the fall protection component that connects a safety belt or harness to an anchor point?
    a. Lanyard
    b. Lifeline
    c. Rope grab
    d. Carabiner
3. A safety belt could be used as a component of what type of fall protection system?
    a. Fall arrest system
    b. Fall restraint system
    c. Confined space system
    d. A safety belt is not approved for any fall protection system
4. What piece of fall protection equipment reduces the impact on the body when a fall happens?
    a. Safety net
    b. Rope grabs
    c. Carabiners
    d. Deceleration device
5. What piece of fall protection equipment must be self-locking?
    a. Lifeline
    b. Snag hook
    c. Snap hook
    d. Rope grab
6. When using a shock absorber lanyard, what must be accounted for in the fall protection system design?
    a. Harness should be adjusted to fit loosely
    b. Lanyard length may increase by up to 1.2 m (4 ft.) during a fall
    c. Lanyard length may decrease by up to 1.2 m (4 ft.) during a fall
    d. Lanyard must be connected to the front of your body harness
7. What is the maximum number of workers that a safety monitor is allowed to supervise?
    a. 4
    b. 6
    c. 8
    d. 10
8. What breaking point shall a vertical life be rated for?
    a. 2.67 (600 lb)
    b. 26.7 kN (6000 lb)
    c. 71 kN (16,000 lb)
    d. 89 kN (20,000 lb)

Answer Key: Self-Test A-4.2 is on the other page.

Answer Key: Self-Test A-4.2

1. b. Fall arrest system
2. a. Lanyard
3. b. Fall restraint system
4. d. Deceleration device
5. c. Snap hook
6. b. The lanyard length may increase by up to 1.2 m (4 ft.) during a fall.
7. c. 8
8. b. 26.7kN (6000 lb)

Self-Test A-4.3: Lift and Move Objects Safely

Complete Self-Test A-4.3 and check your answers.

1. How far should the arms be from the body when lifting?
    a. Fully extended
    b. As close as possible
    c. Does not make any difference
    d. About 30 cm (1 ft.) out from the shoulder
2. When preparing to lift an object, how should you position your feet?
    a. Wider than shoulder width
    b. Foot position is not important
    c. One slightly ahead of the other
    d. Close together so the heels touch
3. When setting down an object, after having lifted it, what must be done?
    a. Drop the load
    b. Shift the back
    c. Bend the back
    d. Bend the knees
4. What should you do to turn or move an object in another direction?
    a. Just lift and twist
    b. Lift the object then turn your feet
    c. Twist your back and turn your feet
    d. Clear area and twist your back to move object
5. Where should the weight be positioned when lifting?
    a. At your elbows
    b. Below the knees
    c. Close to the body
    d. Far from the body
6. Lifting should be done primarily with the:
    a. Legs
    b. Arms
    c. Back
    d. Shoulders
7. When lifting, the back should be:
    a. Straight
    b. Immobile
    c. Slightly bent
    d. Perfectly horizontal
8. How far apart should the feet be when lifting?
    a. Very close
    b. Arm's length apart
    c. Shoulder width apart
    d. 1½ shoulder width apart

9. Most back injuries are the result of:
    a. Incorrect posture
    b. Sitting on very soft chairs
    c. Failure to use a good back support
    d. Improper bending and lifting techniques
10. When standing for long periods of time at a working position, back strain can be reduced by:
    a. Leaning forward
    b. Leaning backward
    c. Resting one foot on a block about 20 cm (8 in.) high
    d. Resting one foot on a block about 50 cm (20 in.) high

Answer Key: Self-Test A-4.3 is on the other page.

Answer Key: Self-Test A-4.3

1. b. As close as possible
2. c. One slightly ahead of the other
3. d. Bend the knees
4. b. Lift the object then turn your feet
5. c. Close to the body
6. a. Legs
7. a. Straight
8. c. Shoulder width apart
9. d. Improper bending and lifting techniques
10. c. Resting one foot on a block about 20 cm (8 in.) high

A-5 FIRE SAFETY

Plumber Apprenticeship Program – Level 1

Firefighter Holding Fire Extinguisher (Anna Shvets/Pexels) Pexels License (https://www.pexels.com/license/)

A-5 Fire Safety Introduction

As a trades worker, you have a responsibility to work safely, and fire prevention is a primary concern. Many of the work tasks you carry out include the application of heat and flame. You should be able to apply fire prevention practices, identify fire causes, and identify and apply fire-extinguishing agents to control or extinguish a fire. You are not expected to be an expert firefighter, but you may have to deal with a fire to protect your safety and the safety of others.

Learning Objectives

Once you have completed this section, you will be able to:

- Describe how fires start.
- Identify the fire triangle.
- Name the components of a fire triangle and explain how the fire triangle works.
- Identify and name the classes of fire.
- Identify and name the types of fire extinguishers.
- State the letters used to identify fire extinguishers.
- Select the correct type of extinguisher for each type of fire.
- Describe the procedures for extinguishing small fires.
- Describe proper methods for preventing fires.

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.**

- **autoignition temperature:** The temperature at which a substance ignites on its own without a spark or

flame. (Section A-5.1)

- **chemical chain reaction**: A continuing chemical process that keeps a fire burning once it has started. (Section A-5.1)
- **class of fire:** A category that describes the type of material that is burning. (Section A-5.2)
- **combustible material:** A substance that can catch fire and burn. (Section A-5.1)
- **combustion:** Burning; a chemical reaction that produces heat and often light. (Section A-5.1)
- **construction heater:** A portable heater used at building sites to keep the air warm while workers are constructing or repairing a building; helps to dry materials like paint or concrete; keeps workers safe and comfortable in cold weather; can run on electricity, propane, natural gas, or diesel fuel. (Section A-5.3)
- **cooling:** In fire safety, means lowering the temperature of a fire, usually by adding water, so it no longer has enough heat to keep burning. (Section A-5.1)
- **dry chemical extinguisher:** A fire extinguisher that uses powder to put out a fire. (Section A-5.2)
- **energized electrical equipment:** Electrical equipment that is connected to power. (Section A-5.2)
- **extinguishing agent:** A substance used to put out a fire. (Section A-5.1)
- **flammable**: Able to catch fire easily. (Section A-5.2)
- **flashpoint:** The lowest temperature at which a liquid gives off vapour that can ignite with a spark or flame. (Section A-5.1)
- **fuel:** In fire safety, any material that can burn. (Section A-5.1)
- **fire tetrahedron**: A model that adds a chemical chain reaction as the fourth part needed to sustain a fire. (Section A-5.1)
- **fire triangle:** A model showing that fuel, oxygen, and heat are needed for a fire to start. (Section A-5.1)
- **fire watch:** A trained person who watches for fires during and after hot work. (Section A-5.3)
- **fume inhalation:** Breathing in harmful smoke or gases. (Section A-5.4)
- **hot work permit:** A written safety approval required before doing work that creates heat or sparks. (Section A-5.3)
- **hydrocarbons:** Chemical substances made of hydrogen and carbon that can burn, such as gasoline. (Section A-5.3)
- **ignition temperature:** The temperature at which a substance starts to burn. (Section A-5.1)
- **incipient-stage fire:** A very small fire that has just started. (Section A-5.4)
- **means of egress:** A safe way to exit a building during an emergency. (Section A-5.4)
- **multipurpose extinguisher:** An extinguisher that can be used on more than one class of fire. (Section A-5.2)
- **oxidation:** A chemical reaction where a substance combines with oxygen. (Section A-5.1)
- **oxidation agent:** A substance that helps something burn by providing oxygen or a similar effect. (Section A-5.1)
- **ozone layer:** A protective layer in the atmosphere that shields Earth from harmful sun rays. (Section A-5.2)
- **portable fire extinguisher:** A small device you can carry that sprays chemicals or water to put out a fire. (Section A-5.4)
- **pressurized cylinder:** Strong containers that hold gases under high pressure. (Section A-5.3)
- **purged:** Cleaned out to remove gases or dangerous substances. (Section A-5.3)
- **reignite**: To start burning again after being put out (Section A-5.4)
- **residue:** Material left behind after something is used. (Section A-5.2)
- **short circuit:** An electrical problem where electricity flows the wrong way and can cause sparks or fire. (Section A-5.3)

- **smothering:** In fire safety, means putting out a fire by cutting off its oxygen supply, so the fire cannot continue to burn. (Section A-5.1)
- **space heater:** A portable heaters used to warm a room or work area. (Section A-5.3)
- **starvation:** In fire safety, putting out a fire by removing its fuel source so it no longer has anything to burn. (Section A-5.1)
- **static grounding system:** A safety system that removes built-up electricity to prevent sparks. (Section A-5.3)
- **ventilation:** The movement of fresh air into a space to remove harmful gases or fumes. (Section A-5.3)

A-5.1 Describe the Conditions Necessary to Support a Fire

Fire or ***combustion*** is a form of ***oxidation*** (the union of a substance with ***oxygen***). During the oxidation process, energy is released in the form of heat, sometimes accompanied by light. Oxidation takes place at varying rates of speed. Here are some examples of oxidation occurring at different rates:

Figure 1 *Oxidation (meineresterampe/Pixabay) Content License (https://pixabay.com/service/license-summary/)*

- Very slow — the rusting of iron
- Slow — the spontaneous heating of materials such as oil-soaked rags
- Fast — the burning of paper or wood
- Extremely fast — the exploding of gunpowder upon ignition

Before a fire can occur, three elements must be present:

Figure 2 *Burning (Jon Sullivan/Pixnio) CC0 (https://creativecommons.org/publicdomain/zero/1.0/)*

- Fuel
- Oxygen

- Heat (sufficient to raise the fuel to its ***ignition temperature***)

Fuel

Fuel is any ***combustible material*** in solid, liquid, or gas form that will combine with oxygen and heat to burn. Combustible material can include common materials such as wood, wood waste products, liquid chemicals, gasoline, paper, or cloth.

Oxygen

Oxygen supports combustion and is always present in the air we breathe at approximately 21 percent concentration. A typical fire requires an atmosphere with only approximately 16 percent oxygen. If pure oxygen were present, some materials that would not normally be considered combustible, including some metals, would burn.

The term ***oxidizing agent*** is now often used instead of ***oxygen***, as it helps explain why some materials can burn in an atmosphere free of any other sources of oxygen.

Heat

Heat is anything that will raise the temperature of the fuel to a point where enough gases are given off to burn.

Flashpoint and Autoignition

Flashpoint and ***autoignition temperature*** both describe how easily a fuel can ignite, but they refer to different stages of combustion.

The flashpoint is the lowest temperature at which a liquid gives off enough vapour to ignite in the presence of an external ignition source (such as a spark or flame). The autoignition temperature is the lowest temperature at which a substance will spontaneously ignite without any external ignition source. For example, gasoline has a flashpoint of approximately −42.8 °C (−45 °F) and an autoignition temperature of about 246 °C (475 °F).

Fire Triangle

The ***fire triangle*** is a simple model for understanding the necessary ingredients for most fires: oxygen, heat, and fuel. When they combine in proper amounts, as shown in the fire triangle diagram (Figure 3), a fire is created. Keeping these three components separated will prevent a fire from occurring. An existing fire can be extinguished by removing any one of the three components.

Figure 3 *Fire triangle (TRU Open Press) CC BY-NC-SA (https://creativecommons.org/licenses/by-nc-sa/4.0/deed.en)*

Fire safety, at its most basic level, is based on the principle of keeping fuel sources and ignition sources separate:

1. Remove the fuel (combustible material) from the vicinity of the fire. For example, if you shut off the valve of a gas main, the result will be ***starvation***.
2. Remove the heat. For example, by applying water, the result will be ***cooling***.
3. Remove the oxygen. For example, if you cover the fire with a lid, a wet blanket, or sand, or use a carbon dioxide, foam, or dry chemical extinguisher, the result is ***smothering***.

Fire Tetrahedron

Today there are many newly developed chemicals, resins, materials and metals that burn differently and have varying types of ***chemical chain reaction***s that do not fit the traditional theories of the fire triangle. A fourth component of a fire triangle may be a chemical reaction, creating a ***fire tetrahedron***.

The fire tetrahedron represents the addition of a chemical chain reaction to the fire triangle. Once a fire has started, the resulting chain reaction sustains the fire and allows it to continue. Just as removing one of the elements of the fire triangle will extinguish a fire, so will using an extinguishing agent that breaks the chain reaction.

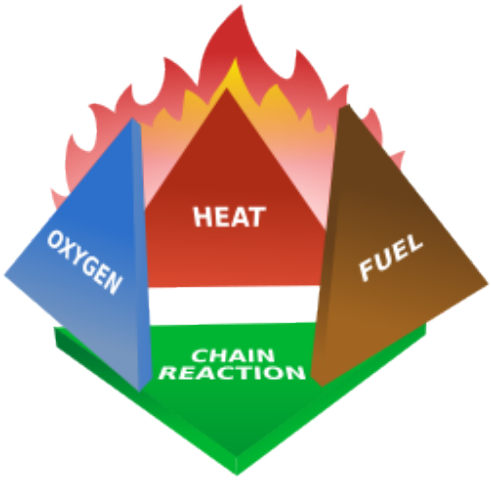

Figure 4 *Fire tetrahedron (adapted) (Gustavb/ Wikimedia Commons) Public Domain (https://en.wikipedia.org/wiki/en:public_domain).*

Self-Test A-5.1: Describe the Conditions Necessary to Support a Fire

Complete Self-Test A-5.1 and check your answers.

If you are using a printed copy, please find Self-Test A-5.1 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.

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=1243#h5p-26 (https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/?p=1243#h5p-26)

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Camosun College. (2015). Trades access common core competency A-5: Describe Fire Safety. Victoria, B.C.: Crown Publications. Download for free from the B.C. Open Textbook Collection (https://open.bccampus.ca/browse-ourcollection/find-open-textbooks/).

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- **Figure 1** Oxidation (https://pixabay.com/photos/rust-iron-metal-iron-oxide-oxide-962464/) by meineresterampe from Pixabay is used under the Pixabay Content License (https://pixabay.com/service/license-summary/).
- **Figure 2** Burning (https://pixnio.com/miscellaneous/fire-flames-pictures/campfires-burning-wood-pits) by Jon Sullivan from Pixnio is used under the Pixnio CC0 (https://creativecommons.org/publicdomain/zero/1.0/) license.
- **Figure 3** Fire triangle (TRU Open Press) has been adapted from Fire triangle (https://commons.wikimedia.org/wiki/File:Fire_triangle.svg) by Gustavb on Wikimedia, and is subject to the CC BY-SA 3.0 (https://creativecommons.org/licenses/by-sa/3.0/deed.en) license.
- **Figure 4** Fire tetrahedron (https://commons.wikimedia.org/wiki/File:Fire_tetrahedron.svg) (adapted) by Gustavb (https://en.wikipedia.org/wiki/User:Gustavb), via Wikimedia Commons, is in the public domain (https://en.wikipedia.org/wiki/en:public_domain).

A-5.2 Identify Class of Fires and Extinguishers

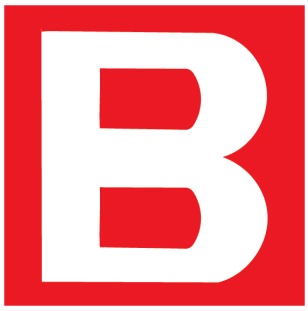
During combustion, enough heat is produced to raise the fuel's temperature and release vapours that can ignite. The fire will continue burning as long as fuel, heat, and oxygen are present. To stop the process, an ***extinguishing agent*** — such as a fire extinguisher — must be used to break this cycle.

When sufficient heat is generated during combustion to raise the temperature of the fuel, vapours that can ignite are produced, and the burning process will continue as long as there is enough fuel, heat, and oxygen to sustain it. The process must be interrupted by means of an extinguishing agent, such as a fire extinguisher.

Classes of Fires

Fires are divided into five main classes: A, B, C, D, and K. The ***class of fire*** is important to know when selecting a fire extinguisher because it determines the type of extinguisher required. The symbols shown in Table 1 may be the only indication you have of the best use for a fire extinguisher.

Table 1: ***Fire Classes and Appropriate Extinguishers***

Fire Class	Type of Fire	Common Materials Involved	Recommended Extinguishers	Important Safety Notes
Class A, Green				
	Ordinary combustibles	Wood, paper, cloth, rubber, many plastics	Water, foam, multipurpose dry chemical	Works by cooling the fire below ignition temperature
Class B, Red				
	Flammable liquids and gases	Gasoline, oil, grease, paint, solvents	Foam, CO_2, dry chemical	**Never use water** — it can spread the fire

Fire Class	Type of Fire	Common Materials Involved	Recommended Extinguishers	Important Safety Notes
Class C, Blue	Energized electrical equipment	Electrical panels, wiring, appliances	CO_2, dry chemical	Must use non-conductive agents; de-energize equipment before using water
Class D, Yellow	Combustible metals	Magnesium, sodium, titanium, potassium	Special dry powder agents	**Never use water** — may cause explosion or violent reaction

Fire Class	Type of Fire	Common Materials Involved	Recommended Extinguishers	Important Safety Notes
Class K, Black 	Cooking oils and fats	Commercial kitchen oils and grease	Wet chemical (Class K extinguisher)	Designed for high-temperature cooking fires

Some materials, when burning, may produce toxic gases.

Types of Fire Extinguishers

All work sites must have portable fire extinguishers. These come in many sizes and colours and have several markings on them. Although most extinguishers can be used on more than one class of fire, none can be successfully used for all types of fire situations.

It is important that you know the location of and how to operate each extinguisher in your workplace. Because each manufacturer uses a slightly different operating procedure, you should carefully read the markings and instructions on the extinguisher. They explain how to use it and where it is most effective.

If you use the wrong type of fire extinguisher on the wrong class of fire, you can make the situation worse. It is therefore very important to understand the five fire classifications and recognize the identification symbols used on fire extinguishers!

Class A Fire Extinguishers

Class A extinguishers work by cooling the fire below its ***ignition temperature***. They may use pressurized water, foaming agents, or multipurpose dry chemical agents. Water-based extinguishers may be pressurized, gravity-fed, or manually pumped.

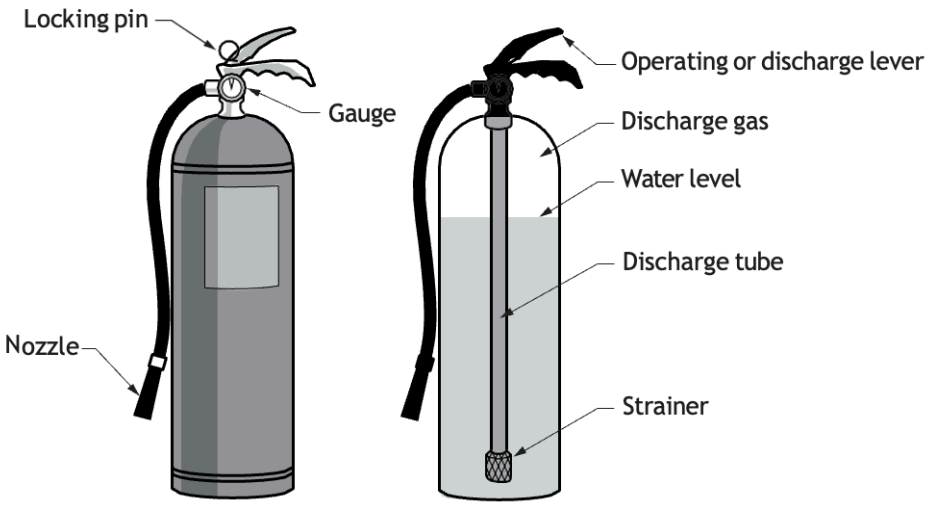


Figure 1 *Pressurized water extinguisher for burning wood, paper, textiles, and other types of Class A fires. (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Class B Fire Extinguishers

Class B extinguishers should be used on ***flammable*** liquids or gases such as oils, paints, gasoline, and grease. These extinguishers may come in several types, including foam, carbon dioxide (CO_2), ordinary dry chemical, and multipurpose dry chemical.

Never use water to extinguish flammable liquid fires. Water is extremely ineffective at extinguishing this type of fire, and you may, in fact, spread the fire if you try to use water on it.

Class C Fire Extinguishers

Class C extinguishers are used on ***energized electrical equipment***. These extinguishers may contain carbon dioxide (CO_2), ordinary dry chemicals, or multi-purpose dry chemicals. Carbon dioxide extinguishers are preferred for sensitive electrical equipment and computer components because they don't leave any harmful ***residue***.

Never use water or any other agent that conducts electricity to extinguish a Class C fire. Electrical equipment must be unplugged or de-energized before using a water extinguisher.

Class D Fire Extinguishers

Class D fires involve combustible metals. The type of extinguisher required depends on the metal that is burning. medium may include dry graphite, dry cast iron turnings, or other approved compounds with a graphite base, or a dry substance with a chloride base. When trying to suppress a Class D fire in its initial stage, localize the fire by scraping away any adjacent metal chips. The smothering material should then be applied gently to avoid scattering the fire. The material forms an air-excluding crust over the burning metal.

Figure 2 *Extinguishing powder applied by shovel or scoop (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Under no circumstances should water or any standard fire extinguisher (of the pressurized or liquid type) be used to combat a magnesium fire.

Class K Fire Extinguishers

Class K fires involve combustible cooking oils and fats. These fires can spread rapidly and must be treated differently than Class B fires. Class K extinguishers may be portable or installed in commercial or industrial kitchens within ventilation hoods.

Figure 3 *Class K fire extinguisher (Daniel Abdulai/TRU Open Press). CC BY-NC-SA (https://creativecommons.org/licenses/by-nc-sa/4.0/deed.en)*

Multipurpose Fire Extinguishers

Manufacturers produce and supply single fire extinguishers designed for multiple classes of fire. ***Multipurpose extinguisher***s may contain dry powders that suppress more than one type of fire, such as Class A, B, or C fires. Carbon dioxide (CO_2) extinguishers are often labelled to fight both Class B and C fires.

Dry Chemical Extinguishers

Dry chemical extinguishers are filled with either foam or powder, usually sodium bicarbonate (baking soda) or potassium bicarbonate, and pressurized with nitrogen. Baking soda is effective because it decomposes at 700° C (1,580° F) and releases carbon dioxide (which smothers oxygen) once it decomposes.

Dry chemical extinguishers interrupt the ***chemical chain reaction*** of the fire by coating the fuel with a thin layer of powder or foam, separating the fuel from the surrounding oxygen. When used indoors, dry powder chemical extinguishers can reduce visibility and damage goods and machinery.

Dry chemical extinguishers are designed for Class B and C fires or Class A, B, and C fires, depending on the type of agent contained in the cylinder.

Three of the most commonly used dry chemicals are:

- **Triplex dry chemical:** a multipurpose dry chemical agent effective in extinguishing Class, A, B and C fires, generally considered the best all-round fire extinguisher
- **Quick-Aid dry chemical:** a specially treated sodium bicarbonate dry chemical agent that is moisture resistant and free-flowing; it is effective, approved for use on Class B and C fires, and offers the lowest cost per kilo of the three dry chemical agents
- **Purple K dry chemical:** a specially treated potassium bicarbonate dry chemical agent that provides effective protection against Class B and C fires and is approximately twice as effective as the standard sodium bicarbonate dry chemical

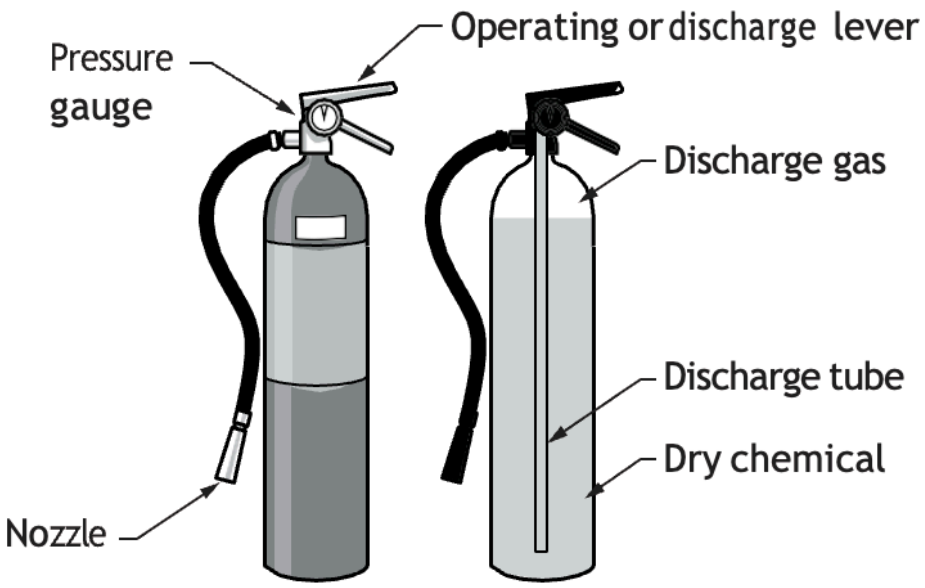


Figure 4 *Dry chemical extinguisher (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Carbon Dioxide (CO_2) Extinguishers

A CO_2 extinguisher is recognized by its fibre discharge horn. It is less effective than dry chemical extinguishers but has the advantage of not leaving a residue that must be cleaned up.

CO_2 cylinders are red and range in size from 2.26 kg (5 lb.) to 45 kg (100 lb.) or larger. In the larger sizes, the hard horn is located on the end of a long, flexible hose.

These extinguishers contain pressurized carbon dioxide gas. CO_2 is heavier than oxygen, so these extinguishers work by displacing or taking away oxygen from the surrounding area. Additionally, CO_2 is very cold and works by cooling the fuel.

Carbon dioxide is ideal for fires involving electrical apparatuses and will also extinguish Class B liquid fires. However, the fire could reignite if the cooling effect has not reached the ignition temperature of the fuel.

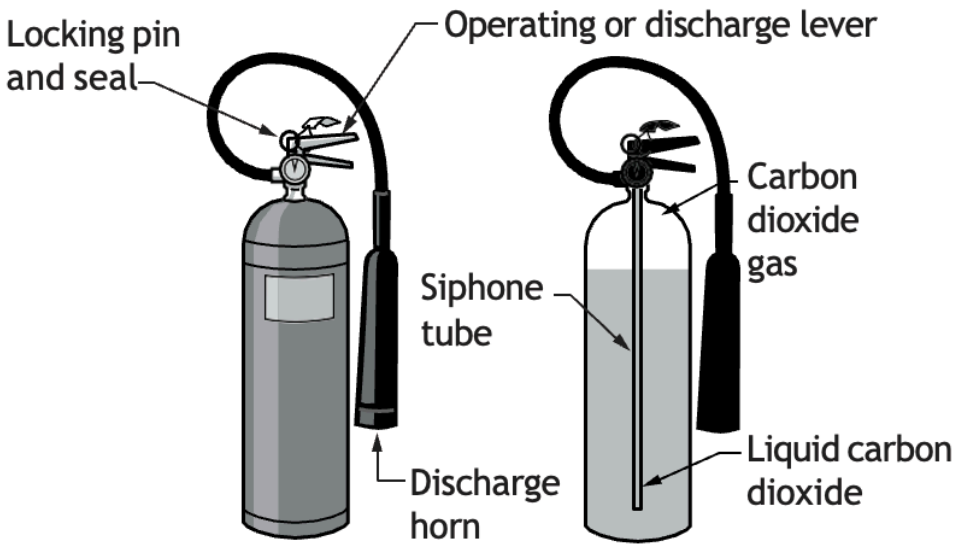


Figure 5 *CO_2 extinguisher (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Halon Extinguishers

Halon extinguishers were designed for Class A, B, and C fires.

Halon is effective but has been banned because it damages the **ozone layer**. Existing units may still be found in some locations but cannot be refilled once discharged.

Emergency Fire Blanket

Emergency fire blankets are designed to smother flames if clothing catches fire. The blankets are about 2 m × 2 m (6 ft × 6 ft) in size.

Fire Extinguisher General Requirements

The following are general guidelines for maintaining and storing fire extinguishers:

- Portable fire extinguishers must be mounted in clearly visible and accessible locations.
- The size of an extinguisher is often based on the weight of the extinguishing agent. For example, 1 kg (2.5 lb.) is a small extinguisher.
- Class A and B extinguishers may have a number before the letter. These numbers allow you to compare the relative effectiveness of various fire extinguishers. For example, a multi-class extinguisher may be labelled as Class ABC—2.25 kg (5 lb.), 3A:10B:C. The A rating is a water equivalency rating. The number preceding the A multiplied by 1.25 gives the equivalent extinguishing capability in gallons of water. The number preceding the B indicates the size of fire in square feet that an ordinary user should be able to cover. The C does not have a number assigned.
- Portable fire extinguishers must be kept fully charged and operational.
- Fire extinguishers must have an annual maintenance inspection, at minimum.
- Records must be kept that identify the inspection, testing and maintenance/expiry dates and who completed the work.
- When an extinguisher is removed for maintenance or recharge, an alternate must be provided.
- Extinguishers should be located near exits. The location of the extinguisher should be clearly marked.
- All employees must be trained in the general principles of fire extinguisher use and the application hazards involved with first response firefighting.

Figure 6 *ABC fire extinguisher with inspection tag* (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (*https://creativecommons.org/licenses/by-nc-sa/4.0/*)

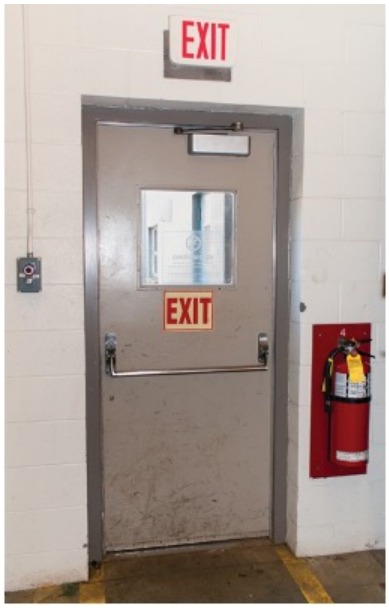


Figure 7 *Fire extinguisher near exit (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Self-Test A-5.2: Identify Class of Fires and Extinguishers

Complete Self-Test A-5.2 and check your answers.

If you are using a printed copy, please find Self-Test A-5.2 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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- **Figure 3** Class K fire extinguisher (photos) are by Daniel Abdulai, esteemed team member of the TRU Open Press. This image is subject to the CC BY-NC-SA (https://creativecommons.org/licenses/by-nc-sa/4.0/deed.en) license.

A-5.3 Apply Preventive Fire Safety Precautions

Figure 1 *Fire Prevention Infographic (TRU Open Press/ChatGPT) CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

As you already know, fire is only possible where there is a supply of combustible materials, oxygen, and heat. However, lack of caution, equipment failure, or simple human error can cause ignition.

Any fire in the workplace can cause serious injury or property damage. Workers are often required to work in various hazardous environments. Corrosive and explosive substances may be used or stored in these locations. Workers must be aware of the presence of these hazardous substances and take appropriate precautions.

Preparation

Preparation is key to controlling any fires that may start. Take the following precautions to protect your workplace from fire:

- Keep the work area clean and clutter-free.
- Know what chemicals you work with.
- Know how to store and handle the chemicals on your work site.
- Make sure you are familiar with your company's emergency action plan for fires.
- Know what you are expected to do in a fire emergency.
- Know how to report fires.
- Use caution when using power tools near flammable substances.

Hot Work Permit

Ideally, all welding, cutting, or other torch work would be done in areas free of combustible materials; however, this is not always possible. In those cases, you may be required to get a ***hot work permit*** so that all fire hazards in your area can be assessed and the necessary precautions can be listed. Usually, this will involve posting ***fire watch*** personnel.

The person on fire watch should have access to fire extinguishers and alarms and know how to use them. The area where the hot work was done must also be monitored afterwards until there is no longer a risk of fire.

Storage of Flammable Materials

The nature of flammable materials makes them vulnerable to ignition. Consequently, storage precautions are necessary. Both WorkSafeBC and the BC Fire Code (https://www2.gov.bc.ca/gov/content/industry/construction-industry/building-codes-standards/bc-codes/fire) have regulations regarding maximum quantities of flammable materials that can be stored and how they are stored. The permitted quantities are affected by their flashpoint temperatures.

Flammable Liquids and Related Equipment

The nature of flammable liquids makes them very vulnerable to ignition, and the following storage precautions are therefore necessary:

- All containers of flammable liquids must be of an approved type (CSA or ULC in Canada) and clearly marked.
- All containers must have secure capping devices.

- Open flames or lit cigarettes must be prohibited within or near any liquid-gas storage area.
- Where drums are used as containers, they must have taps and a drip tray.
- Transportation must only take place while containers are sealed.
- All empty containers must be stored upright.
- Spills must be cleaned up or covered with sand.

Any equipment that requires a flammable liquid needs the same basic precautionary measures as stored liquids. All tank or equipment leaks must be reported and then repaired immediately.

Drivers and operators must be warned of ignition hazards while refuelling such equipment. They must not smoke, and the engines must be stopped.

Flammable Gases

Flammable gases used on work sites often include acetylene, hydrogen, ethane, and propane. These gases are ***hydrocarbons***. Natural gas, acetylene, ethane, and propane are compounds, while diesel and gasoline are mixtures made up of mostly hydrocarbon compounds. Some of these gases are stored in ***pressurized cylinders***, which must be handled with care.

Read OHS Regulation Part 5: Chemical Agents and Biological Agents (https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-05-chemical-and-biological-substances) from the WorkSafeBC website.

Aerosol products can contain flammable gases and present a fire hazard. You should be familiar with how to handle and dispose of such products safely.

Ventilation

Flammable gases or vapours may accumulate in a room as part of the workplace process. It is important to properly ***ventilate*** the space to reduce the risk of fire and health hazards.

Do not cut or weld any container that you suspect may have contained a combustible substance. Even a gasoline tank that contains no liquid gasoline can have enough vapours present to cause an explosion. You must have the container thoroughly ***purged*** and inspected.

Combustible Materials

Rubbish is a severe problem in fire prevention, but it can always be avoided through good management. Any buildup of packing materials, sawdust, wood shavings, oil waste, or other combustible material constitutes a potential fire hazard. The following precautions must always be taken:

- All waste liquids that are flammable must be placed in approved containers for disposal according to waste disposal regulations.
- Open fires require a permit, and they must be constantly supervised.

- Extinguishers must be available at or near any fire lit for the disposal of rubbish.
- All oily rags must be retained in metal bins with sealed lids.
- Don't allow fine dust to build up, as it can be highly flammable and often explosive.

Shop Electrical Wiring and Equipment

All wiring, whether permanent or temporary, must be made safe so that it does not cause a fire. The following precautions are necessary:

- Any temporary or permanent wiring at ground level must be buried or protected from foot or vehicular traffic damage by use of ramps.
- All portable electric-powered hand tools must be connected with flexible rubber or sheathed PVC cables.
- Adequate breaker protection against excess current must be included.

A ***static grounding system*** must be used on fuel storage equipment to ensure there isn't a buildup of static electricity that could arc spark to ground and cause an explosion.

Vehicle Electrical Systems

You should observe extreme caution when servicing electrical systems. Serious fires could result from ***short circuit***s in the wiring. Batteries being charged or exposed to heavy discharge (such as during a cold or no-start situation) give off explosive gases (hydrogen), which can ignite if a spark is present.

When removing batteries, always disconnect the ground wire first. All wiring leading to the starter motor and switch must be protected from sharp edges and mechanical or heat damage. If installing a new cable, always route it to avoid damage.

Safe Use of Temporary Heating

Temporary heating is often required on the job site. This heating may be powered by electricity or fuelled by propane, kerosene, or diesel. These heaters are usually non-ducted and are therefore considered ***space heaters*** — although they are commonly known as ***construction heaters***. It is important to follow the manufacturer's instructions and take extra precautions against burns and fire when using these heaters.

Self-Test A-5.3: Apply Preventive Fire Safety Precautions

Complete Self-Test A-5.3 and check your answers.

If you are using a printed copy, please find Self-Test A-5.3 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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- **Figure 1** Fire Prevention Infographic was created by TRU Open Press with help from ChatGPT (OpenAI), 2026. Licensed under CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/).

A-5.4 Describe First-Response Firefighting

First-response firefighting can best be described as extinguishing a fire in its initial stages by using whatever is readily at available, before it becomes too large. First-response extinguishers are designed to deal with fires in their infancy. They are necessary even when an area is protected by a ***fire sprinkler system***.

Small fires can often be put out quickly by a well-trained individual using a ***portable fire extinguisher***. However, to do this safely, the person must understand the proper use and limitations of a portable fire extinguisher and the hazards associated with fighting fires.

Attempting to extinguish even a small fire carries some risk. Fires can increase in size and intensity in seconds, blocking the exit path and creating a ***hazardous atmosphere***. Employees are not expected to fight fires. Your responsibility in a fire situation is to alert others and to evacuate.

Steps to Take Prior to Fighting a Fire

Fires can be very dangerous, and you should always ensure that you will not endanger yourself or others when attempting to put out a fire. For this reason, you must take the following steps when a fire is discovered:

1. Assist any person in immediate danger to safety, while keeping your own safety in mind.
2. Activate the building fire alarm system or notify the fire department by dialling 911 (or designating someone else to notify the department for you).
3. Position yourself with a clear ***means of egress*** at your back before attempting to use an extinguisher.

Only after completing these three steps—and only if the fire is small, contained, and not spreading—should you attempt to use an extinguisher.

Do not fight a fire when:

- You don't know what is burning. If you don't know what is burning, you don't know what type of extinguisher to use. Even if you have an ABC extinguisher, there may be something in the fire that could explode or produce highly toxic smoke. Chances are you will know what's burning, or at least have a pretty good idea, but if you don't, let the fire department handle it.
- The fire is spreading rapidly beyond the spot where it started. Exit the area immediately to a safe location.
- You don't have appropriate ***firefighting equipment*** (correct type and size).
- You are unable to protect yourself from excessive smoke or ***fume inhalation*** (plastics and synthetics gases can be fatal in very small amounts).
- Your instincts tell you not to. If you are uncomfortable for any reason, just allow the fire department to handle the situation.

In these situations, trained firefighters should deal with the fire.

Training

All workers required to use fire extinguishers must receive training that includes:

- Extinguisher locations
- Classes of fire most likely to occur and the appropriate extinguisher to use
- When and how to use extinguishers
- The importance of sounding the alarm
- Health and safety hazards
- ***Personal protective equipment***

Using a Portable Fire Extinguisher

To extinguish a fire with a portable extinguisher, a person must:

- Have immediate access to the extinguisher
- Know how to operate the unit
- Know how to apply the extinguishing agent effectively

Portable fire extinguishers contain a limited amount of ***extinguishing agent*** and can discharge in seconds. Therefore, individuals should attempt to fight only very small or ***incipient-stage fire***s.

There are various models and designs of extinguishers. Some are manually operated, such as water pump types, while others are ***pressurized*** designs.

Pull, Aim, Squeeze, Sweep (PASS)

The proper use of a portable fire extinguisher can be easily remembered using the acronym PASS.

Stand a safe distance from the fire—about 2 to 3 m (6 to 10 ft)—while holding the extinguisher upright. Standing too close may cause burning materials to scatter and spread the fire.

Pull

Pull the pin from the handle, breaking the plastic seal.

Figure 1 *Pull the pin (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Aim

Aim the extinguisher nozzle at the base of the flames. This is where the burning material is located. If you aim at the flames, which is frequently the temptation, the extinguishing agent will fly right through and be ineffective. You want to hit the ***fuel source***.

Figure 2 *Aim the nozzle (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Squeeze and Sweep

Keep the extinguisher upright and squeeze the handles together to discharge the pressurized extinguishing agent.

Sweep the extinguisher nozzle from side to side, covering the fire completely with extinguishing agent. Start using the extinguisher from a safe distance and move forward carefully—watch for scattering material. The idea is to completely cover the fuel. Keep spraying until the fire is out and monitor the area in case it ***reignite***s.

Figure 3 *Squeeze and sweep (BC Industry Training Authority, 2019). CC BY-NC-SA 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/)*

Self-Test A-5.4: Describe First-Response Firefighting

Complete Self-Test A-5.4 and check your answers.

If you are using a printed copy, please find Self-Test A-5.4 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-bcplumbingapprl1.pressbooks.tru.ca/?p=1249#h5p-29 (https://a-safetyfunctions-bcplumbingapprl1.pressbooks.tru.ca/?p=1249#h5p-29)

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Self-Test A-5.1: Describe the Conditions Necessary to Support a Fire

Complete Self-Test A-5.1 and check your answers.

1. What three components must you have to support combustion?
    a. Fuel, heat, carbon dioxide
    b. Heat, oxygen, fuel
    c. Carbon monoxide, fuel, heat
    d. Fuel, oxygen, carbon dioxide
2. Keeping the components of combustion separated will prevent a fire.
    a. True
    b. False
3. Oxidation is the process of oxygen uniting with another element.
    a. True
    b. False
4. When a gas fire is being extinguished how does shutting off the main valve affect the fire?
    a. Cooling
    b. Starvation
    c. Smothering
    d. Disconnecting
5. When a wood fire is being extinguished, how does applying water affect the fire?
    a. Cooling
    b. Starvation
    c. Saturation
    d. Smothering
6. When a fire is being extinguished, how does covering the fire with a lid or wet blanket affect the fire?
    a. Cooling
    b. Starvation
    c. Pressurizing
    d. Smothering
7. What is the fourth component that creates the fire tetrahedron?
    a. Aerobic reaction
    b. Metabolic reaction
    c. Chemical destabilizers
    d. Chemical chain reaction
8. When foam is applied to a fire, what is the result?
    a. Cooling
    b. Starvation
    c. Reignition
    d. Smothering

Answer Key: Self-Test A-5.1 is on the other page.

Answer Key: Self-Test A-5.1

1. b. heat, oxygen, fuel
2. a. true
3. a. true
4. b. starvation
5. a. cooling
6. d. smothering
7. d. chemical chain reaction
8. d. smothering

Self-Test A-5.2: Identify Class of Fires and Extinguishers

Complete Self-Test A-5.2 and check your answers.

1. What is the classification of an electrical fire?
    a. Class A
    b. Class B
    c. Class C
    d. Class D
2. In a Class C fire, what is the burning material?
    a. Flammable liquids
    b. Combustible metals
    c. Ordinary combustibles
    d. Electrical conductors or components
3. What class are fires involving gasoline and other flammable liquids?
    a. Class A
    b. Class B
    c. Class C
    d. Class D
4. What is the symbol indicating that an extinguisher is suitable for Class C fires?
    a. Star
    b. Circle
    c. Square
    d. Triangle
5. What is the symbol indicating that an extinguisher is suitable for Class B fires?
    a. Star
    b. Circle
    c. Square
    d. Triangle
6. What class are fires involving ordinary combustibles such as wood?
    a. Class A
    b. Class B
    c. Class C
    d. Class D
7. How are fire extinguishers classified?
    a. Local regulations
    b. Weight when full
    c. How long they will last
    d. Type of fire they will extinguish
8. What is the symbol indicating that an extinguisher is suitable for Class A fires?
    a. Star
    b. Circle

c. Square
d. Triangle

9. What is the symbol that is used to indicate that an extinguisher is suitable to extinguish a Class D fire?

    a. Star
    b. Circle
    c. Square
    d. Triangle

10. What class of fire would be fought with an extinguisher that could be installed with the exhaust hood of a commercial kitchen, to fight grease fire?

    a. Class A
    b. Class B
    c. Class C
    d. Class K

Answer Key: Self-Test A-5.2 is on the other page.

Answer Key: Self-Test A-5.2

1. c. Class C
2. d. Electrical conductors or components
3. b. Class B
4. b. Circle
5. c. Square
6. a. Class A
7. d. Type of fire they will extinguish
8. d. Triangle
9. a. Star
10. d. Class K

Self-Test A-5.3: Apply Preventive Fire Safety Precautions

Complete Self-Test A-5.3 and check your answers.

1. When might you require a hot work permit?
    a. Working on hot materials
    b. Doing any welding or cutting
    c. Handling explosive chemicals
    d. Doing welding or cutting in areas with combustible materials
2. When the hot work is completed all personnel must exit the area immediately.
    a. True
    b. False
3. What material characteristic affects the maximum quantities of flammable materials stored?
    a. Latent heat
    b. Specific heat
    c. Lower explosive limit
    d. Flashpoint temperature
4. What precaution should be taken when removing a vehicle battery?
    a. Cut the red wire
    b. Remove supply wire first
    c. Remove ground wire first
    d. Remove both wires simultaneously
5. What is another name for temporary construction heaters?
    a. Ducted heaters
    b. Electric heaters
    c. Space heaters
    d. Radiant heaters
6. Which of the following are mixtures of hydrocarbons?
    a. Hydrocarbon and oxygen
    b. Ethanol and diesel
    c. Diesel and gasoline
    d. Propane and acetylene

Answer Key: Self-Test A-5.3 is on the other page.

Answer Key: Self-Test A-5.3

1. d. Welding or cutting in areas with combustible materials
2. b. False
3. d. Flashpoint temperature
4. c. Remove ground wire first.
5. c. Space heaters
6. c. Diesel and gasoline

Self-Test A-5.4: Describe First-Response Firefighting

Complete Self-Test A-5.4 and check your answers.

1. What is the first step to take when a fire is discovered?
    a. Use an extinguisher to put it out
    b. Activate the building fire alarm system
    c. Notify the fire department by dialing 911
    d. Assist any person in immediate danger to safety
2. If you don't know what is burning, make sure that you use an ABC fire extinguisher.
    a. True
    b. False
3. Any worker can and should use a fire extinguisher.
    a. True
    b. False
4. What should you do if the fire is spreading rapidly?
    a. Get a larger fire extinguisher
    b. Exit the area to a safe location
    c. Help the fire department extinguish the fire
    d. Get a fellow worker to help you extinguish it
5. Portable fire extinguishers contain a limited amount of extinguishing agent.
    a. True
    b. False
6. What does the acronym PASS stand for?
    a. Pin, Aim, Stand, Safe
    b. Pull, Aim, Start, Sweep
    c. Plastic, Access, Strap, Seal
    d. Pull, Aim, Squeeze, Sweep
7. You should stand as close to the fire as possible when using a fire extinguisher as long as you don't feel too much heat.
    a. True
    b. False

Answer Key: Self-Test A-5.4 is on the other page.

Answer Key: Self-Test A-5.4

1. d. Assist any person in immediate danger to safety
2. b. False
3. b. False
4. b. Exit the area to a safe location.
5. a. True
6. d. Pull, Aim, Squeeze, Sweep
7. b. False

Glossary - Block A: Safety Related Functions

“no-fault” insurance

A worker can receive compensation for a work-related injury or illness without having to prove who caused the accident. (Section A-2.2 (#chapter-a-2-2-describe-wca-conditions-of-compensation))

absolute limit of approach

The closest distance allowed between people or equipment and live power lines. (Section A-1.4 (#chapter-a-1-4-describe-general-safety-precautions-and-procedures))

accident

An unexpected event at work that causes injury or harm, such as slipping on a wet floor or getting hurt while using tools. (Section A-2.1 (#chapter-a-2-1-define-terms-used-in-the-workers-compensation-act))

air-purifying respirator

A respirator that filters harmful particles or gases from the air. (Section A-4.1 (#chapter-a-4-1-describe-safety-gear-and-work-clothing))

airborne fibres

Tiny thread-like particles in the air that can be breathed into the lungs and cause serious health problems. (Section A-1.3 (#chapter-a-1-3-describe-long-term-hazards-in-the-trades))

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 (#chapter-a-1-3-describe-long-term-hazards-in-the-trades))

anchorage/anchor point

A secure point where fall protection equipment is attached. (Section A-4.2 (#chapter-a-4-2-describe-fall-protection-systems))

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 (#chapter-a-1-2-describe-short-term-hazards-in-the-trades))

ANSI approval

A certification that shows a product meets safety standards set by the American National Standards Institute (ANSI). If equipment has ANSI approval, it has been tested to make sure it meets certain safety requirements. (Section A-4.1 (#chapter-a-4-1-describe-safety-gear-and-work-clothing))

arsenic

A poisonous metal often used in wood preservatives that can cause serious health problems. (Section A-1.3 (#chapter-a-1-3-describe-long-term-hazards-in-the-trades))

asbestos

A dangerous material once used in buildings that can release tiny fibres into the air when disturbed. (Section A-1.3 (#chapter-a-1-3-describe-long-term-hazards-in-the-trades))

asbestosis

A serious lung disease caused by breathing in asbestos fibres over a long time. (Section A-1.3 (#chapter-a-1-3-describe-long-term-hazards-in-the-trades))

assessment fee

Money that employers in British Columbia must pay to WorkSafeBC to help cover the costs of workplace safety programs, inspections, and injury claims. (Section A-2.2 (#chapter-a-2-2-describe-wca-conditions-of-compensation))

autoignition temperature

The temperature at which a substance ignites on its own without a spark or flame. (Section A-5.1 (#chapter-a-5-1-describe-the-conditions-necessary-to-support-a-fire))

axle

A rod that holds a wheel in place and allows it to turn. (Section A-4.3 (#chapter-a-4-3-lift-and-move-objects-safely))

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 (#chapter-a-1-2-describe-short-term-hazards-in-the-trades))

blind flange

A solid metal plate bolted to the end of a pipe to completely block the flow of liquid or gas, making the pipe safe to work on.

blocking

Wood or material placed under an object to lift it off the ground. (Section A-4.3 (#chapter-a-4-3-lift-and-move-objects-safely))

Board

(Workers' Compensation Board) The group that runs workers’ compensation. It decides rules, helps injured workers, and makes sure workplaces follow safety laws. (Section A-2.1 (#chapter-a-2-1-define-terms-used-in-the-workers-compensation-act))

boom lift/scissor lift

A machine used to lift people and tools to work at heights. It raises a platform or bucket off the ground so workers can safely reach high places. A boom lift can move up, down, and sideways, while a scissor lift moves straight up and down.

cadmium

A highly toxic metal found in some batteries and metals that can damage the lungs and kidneys. (Section A-1.3 (#chapter-a-1-3-describe-long-term-hazards-in-the-trades))

Canadian testing certification label (CSA, ULC)

A Canadian testing certification label is a safety mark on tools or equipment that shows they have been tested and approved to be safe for use in Canada by organizations like Canadian Standards Association (CSA) or Underwriters Laboratories of Canada (ULC). (Section A-1.4)

carabiner

An oblong-shaped metal connecting device with a locking gate used to attach different components of a personal fall protection system. (Section A-4.2 (#chapter-a-4-2-describe-fall-protection-systems))

category (type)

A classification that shows how dangerous a hazard is. Lower numbers or earlier letters usually mean more danger. (Section A-3.1) (#chapter-a-3-1-explain-the-hazardous-products-legislation)

chemical chain reaction

A continuing chemical process that keeps a fire burning once it has started. (Section A-5.1 (#chapter-a-5-1-describe-the-conditions-necessary-to-support-a-fire))

circuit breaker

A safety switch in an electrical system that automatically turns off the power if too much electricity flows through a circuit. This helps prevent wires from overheating and protects buildings and devices from electrical fires or damage. (Section A-1.2 (#chapter-a-1-2-describe-short-term-hazards-in-the-trades))

claim

An official request made to WorkSafeBC for compensation after a worker is injured or becomes ill because of work. (Section A-2.4 (#chapter-a-2-4-describe-the-wca-requirements-for-reporting-workplace-accidents))

class of fire

A category that describes the type of material that is burning. (Section A-5.2 (#chapter-a-5-2-identify-class-of-fires-and-extinguishers))

combustible material

A substance that can catch fire and burn. (Section A-5.1 (#chapter-a-5-1-describe-the-conditions-necessary-to-support-a-fire))

combustion

Burning; a chemical reaction that produces heat and often light. (Section A-5.1 (#chapter-a-5-1-describe-the-conditions-necessary-to-support-a-fire))

compensation

Money or support given to a worker who is hurt at work, to help pay for things like medical care or time off work. (Section A-2.1 (#chapter-a-2-1-define-terms-used-in-the-workers-compensation-act))

compliance

Following the rules and laws that are in place, such as workplace safety rules set by WorkSafeBC. (Section A-2.5 (#chapter-a-2-5-use-the-occupational-health-and-safety-regulation))

confined space

A small, enclosed area with limited entry and exit that is not meant for people to stay in for long periods. (Section A-1.4 (#chapter-a-1-4-describe-general-safety-precautions-and-procedures))

construction

Work that involves building, fixing, or repairing things like houses, buildings, pipes, or plumbing systems. (Section A-2.1 (#chapter-a-2-1-define-terms-used-in-the-workers-compensation-act))

construction heater

A portable heater used at building sites to keep the air warm while workers are constructing or repairing a building. It helps dry materials like paint or concrete and keeps workers safe and comfortable in cold weather. Construction heaters can run on electricity, propane, natural gas, or diesel fuel. (Section A-5.3 (#chapter-a-5-3-apply-preventive-fire-safety-precautions))

control zone

A marked area within a minimum of 2 metres of the edge of a structure or building that has a flat or low-sloped roof where special safety rules apply. (Section A-4.2 (#chapter-a-4-2-describe-fall-protection-systems))

cooling

In fire safety, means lowering the temperature of a fire, usually by adding water, so it no longer has enough heat to keep burning. (Section A-5.1 (#chapter-a-5-1-describe-the-conditions-necessary-to-support-a-fire))

corrosive

Something that can burn, eat away, or damage materials like skin, eyes, or metal. Corrosive substances can cause serious injuries if they touch your body, so they must be handled very carefully. (Section A-3.5 (#chapter-a-3-5-identify-pictograms-found-on-whmis-labels))

CSA approved

Certified by the Canadian Standards Association to meet safety standards. (Section A-4.1 (#chapter-a-4-1-describe-safety-gear-and-work-clothing))

deceleration device

A safety device used in fall protection that slows down a person during a fall to reduce the force of impact and help prevent serious injury. (Section A-4.2 (#chapter-a-4-2-describe-fall-protection-systems))

dependant

A person who relies on a worker for money or care, such as a child or a spouse. (Section A-2.1 (#chapter-a-2-1-define-terms-used-in-the-workers-compensation-act))

dermatitis

A skin problem that causes redness, dryness, or irritation. (Section A-4.1 (#chapter-a-4-1-describe-safety-gear-and-work-clothing))

direct costs (of an injury)

The easiest injury costs to see and understand; they include emergency room and doctor visits, medical bills, medicines, rehabilitation, and lost wages. Direct costs are covered by a company's insurance. (Section A-1.1 (#chapter-a-1-1-describe-the-causes-and-results-of-accidents))

dry chemical extinguisher

A fire extinguisher that uses powder to put out a fire. (Section A-5.2 (#chapter-a-5-2-identify-class-of-fires-and-extinguishers))

dusts

Very small, dry particles that float in the air and can be breathed in, sometimes causing lung damage. (Section A-1.3 (#chapter-a-1-3-describe-long-term-hazards-in-the-trades))

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 (#chapter-a-1-2-describe-short-term-hazards-in-the-trades))

emergency exit

A clearly marked way out of a building that is used during an emergency. (Section A-1.5 (#chapter-a-1-5-describe-emergency-equipment-and-facilities))

emergency shutdown system (panic button)

A switch that quickly turns off power to equipment during an emergency. (Section A-1.5 (#chapter-a-1-5-describe-emergency-equipment-and-facilities))

employer

A person or company that hires workers and pays them to do a job, such as a plumbing business owner. (Section A-2.1 (#chapter-a-2-1-define-terms-used-in-the-workers-compensation-act))

employment

Having a job where a person works for an employer and gets paid. (Section A-2.1 (#chapter-a-2-1-define-terms-used-in-the-workers-compensation-act))

energized electrical equipment

Electrical equipment that is connected to power. (Section A-5.2 (#chapter-a-5-2-identify-class-of-fires-and-extinguishers))

ergonomics

How your body fits and works with your tools and workspace. (Section A-4.3 (#chapter-a-4-3-lift-and-move-objects-safely))

excavation

The removal of ground material by digging in order to bury or access pipelines, conduits, foundations, etc. (Section A-1.2 (#chapter-a-1-2-describe-short-term-hazards-in-the-trades))

excluded

In WHMIS, a product or situation that is not covered by certain federal or provincial WHMIS rules. Even when a product is excluded, workers must still be told about any health or safety risks and how to use the product safely. (Section A-3.3 (#chapter-a-3-3-describe-the-labelling-of-controlled-products))

extinguishing agent

A substance used to put out a fire. (Section A-5.1 (#chapter-a-5-1-describe-the-conditions-necessary-to-support-a-fire))

fall restraint system

A system that prevents a worker from reaching an edge where they could fall. (Section A-4.2 (#chapter-a-4-2-describe-fall-protection-systems))

fire extinguisher

A portable device used to put out small fires when they first start. (Section A-1.5 (#chapter-a-1-5-describe-emergency-equipment-and-facilities))

fire sprinkler system

A system in a building that sprays water automatically when it detects heat from a fire. (Section A-5.4 (#chapter-a-5-4-describe-first-response-firefighting))

fire tetrahedron

A model that adds a chemical chain reaction as the fourth part needed to sustain a fire. (Section A-5.1 (#chapter-a-5-1-describe-the-conditions-necessary-to-support-a-fire))

fire triangle

A model showing that fuel, oxygen, and heat are needed for a fire to start. (Section A-5.1 (#chapter-a-5-1-describe-the-conditions-necessary-to-support-a-fire))

fire watch

A trained person who watches for fires during and after hot work. (Section A-5.3 (#chapter-a-5-3-apply-preventive-fire-safety-precautions))

firefighting equipment

tools used to control or put out fires. (Section A-5.4 (#chapter-a-5-4-describe-first-response-firefighting))

first aid station

A place where supplies and equipment are kept to treat injuries until medical help arrives. (Section A-1.5 (#chapter-a-1-5-describe-emergency-equipment-and-facilities))

first-response firefighting

Putting out a small fire right away before it grows bigger. (Section A-5.4 (#chapter-a-5-4-describe-first-response-firefighting))

flammable

Able to catch fire easily. (Section A-5.2 (#chapter-a-5-2-identify-class-of-fires-and-extinguishers))

flammable liquids

Liquids that can easily catch fire, especially when their vapours mix with air. (Section A-1.4 (#chapter-a-1-4-describe-general-safety-precautions-and-procedures))

flashpoint

The lowest temperature at which a liquid gives off vapour that can ignite with a spark or flame. (Section A-5.1 (#chapter-a-5-1-describe-the-conditions-necessary-to-support-a-fire))

forklift

A powered machine used to lift and move heavy loads. (Section A-4.3 (#chapter-a-4-3-lift-and-move-objects-safely))

fraudulent claim

A false or dishonest report about a work injury or illness, made to try to receive benefits that the worker is not entitled to. (Section A-2.2 (#chapter-a-2-2-describe-wca-conditions-of-compensation))

fuel

In fire safety, any material that can burn. (Section A-5.1 (#chapter-a-5-1-describe-the-conditions-necessary-to-support-a-fire))

fuel source

The material that is burning in a fire. (Section A-5.4 (#chapter-a-5-4-describe-first-response-firefighting))

full body harness

A safety harness worn over the shoulders and legs to protect a worker during a fall. (Section A-4.2 (#chapter-a-4-2-describe-fall-protection-systems))

fume inhalation

Breathing in harmful smoke or gases. (Section A-5.4 (#chapter-a-5-4-describe-first-response-firefighting))

gas

A low-density chemical compound that normally fills the space in which it is released. It has no physical shape or form.

Globally Harmonized System of Classification (GHS)

An international system that uses the same symbols, labels, and safety information to explain the dangers of chemicals and how to use them safely. (Section A-3.1 (#chapter-a-3-1-explain-the-hazardous-products-legislation))

ground fault circuit interrupter (GFCI)

A safety device that quickly shuts off electricity to prevent shocks. (Section A-1.4 (#chapter-a-1-4-describe-general-safety-precautions-and-procedures))

grounding

Connecting electrical tools or equipment to the ground so electricity can flow safely if there is a fault. (Section A-1.4 (#chapter-a-1-4-describe-general-safety-precautions-and-procedures))

guardrails

Safety barriers placed along edges or openings to prevent falls. (Section A-1.4 (#chapter-a-1-4-describe-general-safety-precautions-and-procedures))

hazard

Anything at work that could cause injury, illness, or harm, such as unsafe tools, chemicals, or dangerous conditions. (Section A-2.1 (#chapter-a-2-1-define-terms-used-in-the-workers-compensation-act))

hazard assessment

Identifying physical and health hazards in the workplace. (Section A-1.1 (#chapter-a-1-1-describe-the-causes-and-results-of-accidents)).

hazard classes

A group that shows the type of danger a product has, such as fire or health risks. (Section A-3.1 (#chapter-a-3-1-explain-the-hazardous-products-legislation))

hazardous atmosphere

Air that is dangerous to breathe because it contains smoke, chemicals, or toxic gases. (Section A-5.4 (#chapter-a-5-4-describe-first-response-firefighting))

hazardous product

A substance that can harm people or cause damage if it is not used safely. (Section A-3.1 (#chapter-a-3-1-explain-the-hazardous-products-legislation))

health hazard

Examples include: overexposure to harmful dusts, chemicals, or radiation. (Section A-1.1 (#chapter-a-1-1-describe-the-causes-and-results-of-accidents) and Section A-3.1 (#chapter-a-3-1-explain-the-hazardous-products-legislation))

health-care benefits

Cover the cost of medical care a worker needs after being hurt or becoming ill at work, such as doctor visits, hospital care, medicine, or therapy. (Section A-2.2 (#chapter-a-2-2-describe-wca-conditions-of-compensation))

heavy metals (toxic metals)

Metals that can build up in the body over time and cause serious health problems: lead, mercury, arsenic, and cadmium. (Section A-1.3 (#chapter-a-1-3-describe-long-term-hazards-in-the-trades))

high-visibility apparel

Clothing that is bright and easy to see, especially around vehicles or machinery. (Section A-4.1 (#chapter-a-4-1-describe-safety-gear-and-work-clothing))

hoist

A device used to lift heavy objects using a rope or chain. (Section A-4.3 (#chapter-a-4-3-lift-and-move-objects-safely))

horseplay

Rough play, joking, or fighting at work that can cause accidents or injuries. (Section A-1.4 (#chapter-a-1-4-describe-general-safety-precautions-and-procedures))

Hot work

Any process or temporary work done that could result in a fire.

hot work permit

A written safety approval required before doing work that creates heat or sparks. (Section A-5.3 (#chapter-a-5-3-apply-preventive-fire-safety-precautions))

housekeeping

Keeping the work area clean, organized, and free of clutter to prevent accidents. (Section A-1.4 (#chapter-a-1-4-describe-general-safety-precautions-and-procedures))

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 (#chapter-a-1-2-describe-short-term-hazards-in-the-trades))

hydrocarbons

Chemical substances made of hydrogen and carbon that can burn, such as gasoline. (Section A-5.3 (#chapter-a-5-3-apply-preventive-fire-safety-precautions))

hypothermia

The condition in which your body loses heat at a rate greater than you are able to produce it. (Section A-1.1)

ignition temperature

The temperature at which a substance starts to burn. (Section A-5.1 (#chapter-a-5-1-describe-the-conditions-necessary-to-support-a-fire))

in the course of employment

An injury or illness happened while a worker was doing something connected to their job, even if it did not happen directly at the worksite. (Section A-2.2 (#chapter-a-2-2-describe-wca-conditions-of-compensation))

incident

An event at work that causes, or could cause, an injury or illness, such as a fall, cut, or equipment malfunction. Section A-2.4)

incipient-stage fire

A very small fire that has just started. (Section A-5.4 (#chapter-a-5-4-describe-first-response-firefighting))

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.

industry

A group of businesses that do the same type of work, such as plumbing, construction, or trades. (Section A-2.1 (#chapter-a-2-1-define-terms-used-in-the-workers-compensation-act))

insurance premiums

Regular payments employers make to WorkSafeBC to pay for workplace insurance, which helps cover the costs of injuries, illnesses, and lost wages. (Section A-2.2 (#chapter-a-2-2-describe-wca-conditions-of-compensation))

issues contravening the Act or Regulation

Problems at work where the rules for health and safety are not being followed. For example, if safety gear is missing, training was not provided, or unsafe work is allowed. (Section A-2.3 (#chapter-a-2-3-state-the-responsibilities-of-employers-workers-and-others-at-the-workplace))

Job Safety Analysis (JSA)

Each step of a task is examined for potential hazards. (Section A-1.1 (#chapter-a-1-1-describe-the-causes-and-results-of-accidents))

label

A safety tag or sticker on a product container that shows hazards, symbols, and basic safety information. (Section A-3.2 (#chapter-a-3-2-describe-the-key-elements-of-whmis))

lanyard

A flexible line of webbing, or a synthetic or wire rope used to secure a safety belt or full body harness to a lifeline or anchor. (Section A-4.2 (#chapter-a-4-2-describe-fall-protection-systems))

lead

A toxic metal sometimes found in old paint or pipes that can cause poisoning if breathed in or swallowed. (Section A-1.3 (#chapter-a-1-3-describe-long-term-hazards-in-the-trades))

lifeline

A rope or cable that connects a worker to a secure anchor point. (Section A-4.2)

long-term average net earnings

Used to calculate compensation when a worker is unable to return to work for **more than 10 weeks**, using special rules to fairly reflect the worker's normal earnings. (Section A-2.2 (#chapter-a-2-2-describe-wca-conditions-of-compensation))

Long-term hazards

Dangers that harm your health slowly over time instead of causing an immediate injury. (Section A-1.3 (#chapter-a-1-3-describe-long-term-hazards-in-the-trades))

means of egress

A safe way to exit a building during an emergency

mechanical assistance

Machines or equipment used to help lift or move heavy objects. (Section A-4.3 (#chapter-a-4-3-lift-and-move-objects-safely))

member of family

A close relative, such as a parent, child, sibling, or spouse. (Section A-2.1 (#chapter-a-2-1-define-terms-used-in-the-workers-compensation-act))

mercury

A toxic metal that can harm the brain and nervous system if people are exposed to it. (Section A-1.3 (#chapter-a-1-3-describe-long-term-hazards-in-the-trades))

mould

A type of fungus that grows on damp materials and releases spores that can make people sick. (Section A-1.3 (#chapter-a-1-3-describe-long-term-hazards-in-the-trades))

multipurpose extinguisher

An extinguisher that can be used on more than one class of fire. (Section A-5.2 (#chapter-a-5-2-identify-class-of-fires-and-extinguishers))

Musculoskeletal Injuries (MSI) / Repetitive Strain Injuries (RSI):

Injuries that affect muscles, joints, tendons, ligaments, or nerves and often happen from repeated movements, heavy lifting, or working in awkward positions over time. These injuries can cause pain, stiffness, or swelling and usually develop slowly rather than all at once.

muster point

A muster point is a safe meeting place where everyone goes during an emergency so workers can be counted and kept safe. (Section A-1.5)

negative-pressure respirator

A respirator that pulls air through a filter when you breathe in. (Section A-4.1 (#chapter-a-4-1-describe-safety-gear-and-work-clothing))

noise reduction ratings (NRR)

A number that shows how much noise hearing protection can block. (Section A-4.1 (#chapter-a-4-1-describe-safety-gear-and-work-clothing))

obligation

Something a person is required to do by law or rules, such as reporting a workplace injury.

occupational disease

An illness caused by a worker's job or work environment, such as lung disease from dust or hearing loss from loud noise. (Section A-2.4)

off-gassing

The release of chemicals from non-metallic substances; anytime there's an odour from a substance, that's off-gassing; some off-gassing is odourless, which makes detection difficult.

OHS Regulation

(Occupational Health and Safety regulation) a set of safety rules that explain how workplaces must protect workers' health and safety. (Section A-2.5 (#chapter-a-2-5-use-the-occupational-health-and-safety-regulation))

open flange

The end of a pipe where the flange is not covered or sealed, allowing liquid or gas to flow through the pipe.

oxidation

A chemical reaction where a substance combines with oxygen. (Section A-5.1 (#chapter-a-5-1-describe-the-conditions-necessary-to-support-a-fire))

oxidizing agent

A substance that helps something burn by providing oxygen or a similar effect. (Section A-5.1 (#chapter-a-5-1-describe-the-conditions-necessary-to-support-a-fire))

oxygen

A gas in the air that supports burning. (Section A-5.1 (#chapter-a-5-1-describe-the-conditions-necessary-to-support-a-fire))

ozone layer

A protective layer in the atmosphere that shields Earth from harmful sun rays. (Section A-5.2 (#chapter-a-5-2-identify-class-of-fires-and-extinguishers))

permanent disability benefits

Payments given to a worker who has a lasting injury that affects their ability to work, even after medical treatment is finished. (Section A-2.2 (#chapter-a-2-2-describe-wca-conditions-of-compensation))

person

Any human being, including a worker, employer, or family member. (Section A-2.1 (#chapter-a-2-1-define-terms-used-in-the-workers-compensation-act))

personal protective equipment (PPE)

Safety gear such as gloves, goggles, or boots worn to protect the body. (Section A-1.4 (#chapter-a-1-4-describe-general-safety-precautions-and-procedures); Section A-4.1 (#chapter-a-4-1-describe-safety-gear-and-work-clothing))

physical hazard

Examples: moving objects, fluctuating temperatures, high-intensity lighting, rolling or pinching hazards, electrical connections, and sharp edges (Section A-1.1 (#chapter-a-1-1-describe-the-causes-and-results-of-accidents) and Section A-3. (#chapter-a-3-1-explain-the-hazardous-products-legislation)1).

pictogram

A symbol that quickly shows what kind of hazard a product has; used on safety labels in WHMIS. (Section A-3.1 (#chapter-a-3-1-explain-the-hazardous-products-legislation))

pivot

To turn your whole body using your feet instead of twisting your back. (Section A-4.3 (#chapter-a-4-3-lift-and-move-objects-safely))

portable fire extinguisher

A small device you can carry that sprays chemicals or water to put out a fire. (Section A-5.4 (#chapter-a-5-4-describe-first-response-firefighting))

positive pressure respirator

A respirator that pushes clean air into the mask to keep harmful air out. (Section A-4.1 (#chapter-a-4-1-describe-safety-gear-and-work-clothing))

posture

The way you hold your body when standing, sitting, or lifting. (Section A-4.3 (#chapter-a-4-3-lift-and-move-objects-safely))

pressurized

Containing air or gas that is tightly packed inside to push something out. (Section A-5.4 (#chapter-a-5-4-describe-first-response-firefighting))

pressurized cylinders

Strong containers that hold gases under high pressure. (Section A-5.3 (#chapter-a-5-3-apply-preventive-fire-safety-precautions))

Procedure for refusal

The process a worker follows when they have reasonable cause to believe that doing a task or using equipment would create an undue hazard and could put them in danger. (Section A-2.5 (#chapter-a-2-5-use-the-occupational-health-and-safety-regulation))

proximity work

Work done close to a hazard without touching it, which requires extra caution. (Section A-1.4 (#chapter-a-1-4-describe-general-safety-precautions-and-procedures))

purged

Cleaned out to remove gases or dangerous substances. (Section A-5.3 (#chapter-a-5-3-apply-preventive-fire-safety-precautions))

reasonable cause to believe

Having a good and sensible reason to think something is unsafe, based on what a typical worker would notice or understand. (Section A-2.5 (#chapter-a-2-5-use-the-occupational-health-and-safety-regulation))

reconsider

To look at a decision again to see if it should be changed. (Section A-2.1 (#chapter-a-2-1-define-terms-used-in-the-workers-compensation-act))

regulation

A rule made to explain how a law should be followed, such as safety rules for plumbing work. (Section A-2.1 (#chapter-a-2-1-define-terms-used-in-the-workers-compensation-act))

reignite

To start burning again after being put out (Section A-5.4 (#chapter-a-5-4-describe-first-response-firefighting))

residue

Material left behind after something is used. (Section A-5.2 (#chapter-a-5-2-identify-class-of-fires-and-extinguishers))

respirator

A mask or device worn to protect your lungs from dust, fumes, or harmful gases. (Section A-4.1 (#chapter-a-4-1-describe-safety-gear-and-work-clothing))

retirement benefit

Money paid to a worker after they stop working, often because they are older or injured. (Section A-2.1 (#chapter-a-2-1-define-terms-used-in-the-workers-compensation-act))

retractable lifeline

A safety line that automatically extends and retracts as a worker moves. If the worker falls, the lifeline quickly locks to stop the fall and help prevent injury. (Section A-4.2 (#chapter-a-4-2-describe-fall-protection-systems))

rope grab

A device used to connect the lanyard to a vertical lifeline; it moves along the lifeline and locks in place if a fall occurs. (Section A-4.2 (#chapter-a-4-2-describe-fall-protection-systems))

rope-and-pulley system

A lifting system that uses a rope and wheel to raise heavy items. (Section A-4.3 (#chapter-a-4-3-lift-and-move-objects-safely))

safety awareness

Being alert and paying attention to your surroundings to avoid danger at work. (Section A-1.4 (#chapter-a-1-4-describe-general-safety-precautions-and-procedures))

safety data sheets (SDSs)

Documents that explain the hazards of a product and give important information on how to use, store, and handle it safely, and what to do in an emergency. (Section A-3.1 (#chapter-a-3-1-explain-the-hazardous-products-legislation) and Section A-3.2 (#chapter-a-3-2-describe-the-key-elements-of-whmis))

safety monitor

A trained person who watches workers in a control zone to help prevent falls. (Section A-4.2 (#chapter-a-4-2-describe-fall-protection-systems))

safety orientation

A meeting or training that explains job site rules, hazards, and emergency procedures before work begins. (Section A-1.4 (#chapter-a-1-4-describe-general-safety-precautions-and-procedures))

scaffold

A temporary platform used to work at heights. (Section A-4.3 (#chapter-a-4-3-lift-and-move-objects-safely))

Self-contained breathing apparatus (SCBA)

A breathing device with its own air tank worn on the back. (Section A-4.1 (#chapter-a-4-1-describe-safety-gear-and-work-clothing))

services for families coping with a work-related death

Services that provide financial support and help to the family of a worker who dies because of a work-related injury or illness. (Section A-2.2 (#chapter-a-2-2-describe-wca-conditions-of-compensation))

short circuit

An electrical problem where electricity flows the wrong way and can cause sparks or fire. (Section A-5.3 (#chapter-a-5-3-apply-preventive-fire-safety-precautions))

short-term average net earnings

Used to calculate a worker's compensation for the first 10 weeks after a work-related injury or illness, based on the worker's usual take-home pay. (Section A-2.2 (#chapter-a-2-2-describe-wca-conditions-of-compensation))

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 (#chapter-a-1-2-describe-short-term-hazards-in-the-trades))

smothering

In fire safety, means putting out a fire by cutting off its oxygen supply, so the fire cannot continue to burn. (Section A-5.1 (#chapter-a-5-1-describe-the-conditions-necessary-to-support-a-fire))

snap hook

A self-locking metal hook used to connect lanyards to rope grabs, harnesses, and horizontal lifelines on fall protection equipment. (Section A-4.2 (#chapter-a-4-2-describe-fall-protection-systems))

space heaters

A portable heater used to warm a room or work area. (Section A-5.3 (#chapter-a-5-3-apply-preventive-fire-safety-precautions))

spade (or "frying pan")

A round plate with a small tab that is placed between two pipe flanges in order to lock out certain piping sections.

spectacle blind (or spectacle flange)

A metal safety device placed between pipe flanges to stop liquid or gas from flowing through a pipe. It has one solid side that blocks the pipe and one open side that allows flow. Turning it to the solid side makes the pipe safe to work on by fully blocking the flow.

spinal column

The backbone that supports your body and protects your spinal cord. (Section A-4.3 (#chapter-a-4-3-lift-and-move-objects-safely))

starvation

In fire safety, putting out a fire by removing its fuel source so it no longer has anything to burn. (Section A-5.1 (#chapter-a-5-1-describe-the-conditions-necessary-to-support-a-fire))

static grounding system

A safety system that removes built-up electricity to prevent sparks. (Section A-5.3 (#chapter-a-5-3-apply-preventive-fire-safety-precautions))

sun protection factor (SPF)

A number that shows how well sunscreen protects your skin from sunburn. (Section A-4.1 (#chapter-a-4-1-describe-safety-gear-and-work-clothing))

supplier label

The label placed on a product by the supplier that shows hazards and safe handling information. (Section A-3.1 (#chapter-a-3-1-explain-the-hazardous-products-legislation))

supplier labels

Safety labels put on hazardous products by the supplier. They show important information such as hazards, symbols, and safety warnings to help workers use the product safely. (Section A-3.2)

suspension system

The adjustable strap system inside a hard hat that helps absorb impact. (Section A-4.1 (#chapter-a-4-1-describe-safety-gear-and-work-clothing))

Task Safety Analysis (TSA)

Often used for routine or recurring tasks, which involves completing a pre-printed checklist. (Section A-1.1 (#chapter-a-1-1-describe-the-causes-and-results-of-accidents))

Teleclaim

A phone-based reporting service offered by WorkSafeBC that lets workers or employers report a workplace injury or occupational disease by telephone rather than submitting a form online or on paper.

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 (#chapter-a-1-2-describe-short-term-hazards-in-the-trades))

Transportation of Dangerous Goods Regulations (TDG)

A Canadian system that uses special labels and colours to warn people about dangerous materials being moved from one place to another. Some colours, like orange, are already used by TDG to show specific dangers (such as explosives), so those colours cannot be used for other safety labels because it could cause confusion.

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 (#chapter-a-1-2-describe-short-term-hazards-in-the-trades))

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 (#chapter-a-1-2-describe-short-term-hazards-in-the-trades))

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 (#chapter-a-1-2-describe-short-term-hazards-in-the-trades))

trenches

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: trenches are narrow and workers can easily become trapped. (Section A-1.2 (#chapter-a-1-2-describe-short-term-hazards-in-the-trades))

ultraviolet (UV) rays

Invisible rays from the sun that can damage your skin. (Section A-4.1 (#chapter-a-4-1-describe-safety-gear-and-work-clothing))

ultraviolet protection factor (UPF)

A number that shows how well clothing blocks harmful UV rays. (Section A-4.1 (#chapter-a-4-1-describe-safety-gear-and-work-clothing))

undue hazard

A serious or unnecessary danger that could cause harm to a worker. (Section A-2.5 (#chapter-a-2-5-use-the-occupational-health-and-safety-regulation))

utilities (shutoffs)

Services like electricity, water, and gas, and the switches or valves used to turn them off in an emergency. (Section A-1.5 (#chapter-a-1-5-describe-emergency-equipment-and-facilities))

vapour

A gas produced by evaporation.

ventilation

Moving fresh air into a work area to remove harmful fumes, gases, or dust. (Section A-1.4 (#chapter-a-1-4-describe-general-safety-precautions-and-procedures))

volatile organic compounds (VOCs)

Chemicals that often come from various household products like paints, lacquer, printers, pesticides, cleaning supplies, carpets and adhesives; known to cause nose and throat irritation, headaches, nausea, and damage to the

central nervous system. Always increase ventilation during the period of VOC off-gassing and consider using an air purifier.

wage-loss benefits

Payments given to a worker who cannot work because of a job-related injury or illness, to replace some of the wages they are missing. (Section A-2.2 (#chapter-a-2-2-describe-wca-conditions-of-compensation))

work platforms

Elevated or suspended surfaces, such as scaffolds or lifts, used to work at heights. (Section A-1.4 (#chapter-a-1-4-describe-general-safety-precautions-and-procedures))

worker

A person who does a job for an employer, such as a plumber or construction worker. (Section A-2.1 (#chapter-a-2-1-define-terms-used-in-the-workers-compensation-act))

Workers Compensation Act

A law that explains how workers are protected if they are injured or become ill because of their job, and how employers must help pay for this protection. (Section A-2.2 (#chapter-a-2-2-describe-wca-conditions-of-compensation))

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 (#chapter-a-1-1-describe-the-causes-and-results-of-accidents))

Workplace Hazardous Materials Information System (WHMIS)

A safety system that helps workers understand the dangers of hazardous products and how to use them safely at work. (Section A-3.2 (#chapter-a-3-2-describe-the-key-elements-of-whmis))

workplace label

A safety label added by the employer at the workplace. They are used when a product is transferred to another container or when the original supplier label is missing, and they explain the hazards and safe handling of the product. (Section A-3.3 (#chapter-a-3-3-describe-the-labelling-of-controlled-products))

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.

	CAS-No.
Chromium(III) acetate hydroxide	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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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Co., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.

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

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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-bcplumbingapprl1.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.