

- 4) Where can the regulations covering general construction be found (i.e., what section)?
- 5) What section of what regulation includes specific responsibilities for a gas technician/fitter when a potentially dangerous condition associated with an installed gas appliance is encountered?

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## 3. Hazardous materials

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### Overview

### Purpose

In the gas industry, technicians/fitters will be exposed to a variety of potentially toxic and explosive materials. Federal and provincial legislation provides for the gas technician's/fitter's right to know, as a Canadian worker, about the major risks they can expect and the safety protection measures required to be in place wherever hazardous materials are present.

### Objectives

At the end of this Chapter you will be able to:

- describe the Workplace Hazardous Materials Information System (WHMIS); and
- describe safe handling, storage, disposal, and transportation of hazardous materials.

## Terminology

Term	Abbreviation (symbol)	Definition
Globally Harmonized System of Classification and Labeling of Chemicals	GHS	Internationally agreed-upon system to classify and label chemicals including easy-to-understand symbols.
Liquid propane gas	LP-gas	One type of common fuel.
Material safety data sheet	MSDS	Document that provides workers and emergency personnel with procedures for handling or working with that substance in a safe manner.
Parts per million	ppm	Value that represents the part of a whole number in Units of 1/1,000,000.
Safety data sheet	SDS	Document, adopted under WHMIS 2015 that provides workers and emergency personnel with procedures for handling or working with hazardous products in a safe manner.
Sewer gas		Mixture of vapours, odours, and gases found in a sewer.
Solvents		Liquids that dissolve other substances.
Workplace Hazardous Materials Information System	WHMIS	Provides workers, employers, and suppliers of materials with vital information about hazardous materials in the workplace. WHMIS 2015 was updated in 2015.

## Workplace Hazardous Materials Information System (WHMIS 2015)

The Workplace Hazardous Materials Information System (WHMIS), established in 1988 and updated through legislation in 2015, provides workers, employers, and suppliers of materials with vital information about hazardous materials in the workplace. Gas technicians/fitters often come into contact with hazardous products. It is essential that you:

- understand your rights and responsibilities relating to WHMIS 2015; and
- good housekeeping practices you should maintain to ensure your safety and that of others working around you.

WHMIS 2015, updated in February 2015, moves to align with the Globally Harmonized System of Classification and Labelling of Chemicals (GHS), created by the United Nations (UN). It is important to note that Canada's regulations do have differences from the UN GHS.

GHS includes terminology that has specific meaning to chemicals and hazardous products:

GHS term	Description
Hazard group	Physical hazards group (based on physical or chemical property) Health hazards group (based on the health effect of the product)
Hazard class	Products that have similar hazardous properties. Examples: Flammable gases, oxidizing liquids, gases under pressure, acute toxicity, aspiration hazard, etc.
Hazard category	How hazardous the product is. Examples: Category 1, 1B, 2, 2A, etc.

While GHS does not replace WHMIS, it does enhance components of WHMIS. Under WHMIS 2015, workers have access to information on hazardous materials and products on labels and on separate data information sheets.

In WHMIS 2015, GHS includes standardized label elements:

GHS label element	Description
Symbols	<ul style="list-style-type: none"> <li>GHS hazard pictograms.</li> </ul>
Signal words	<ul style="list-style-type: none"> <li>Only two signal words used, with only one appearing on a label.               <ul style="list-style-type: none"> <li>“Danger” for more severe hazards.</li> <li>“Warning” for less severe hazards.</li> </ul> </li> </ul>
Hazard statements	<ul style="list-style-type: none"> <li>Brief, standardized statements to describe the product’s hazards.</li> <li>Includes phrases assigned to a hazard class and hazard category.</li> </ul>
Precautionary statements	<ul style="list-style-type: none"> <li>Types focus on “general”, “prevention”, “response”, “storage”, and “disposal” information on how to minimize or prevent harmful effects from the product.</li> </ul>

The previous version of WHMIS enabled the additional presentation of the hazardous products information on materials safety data sheets (MSDS). With GHS adopted in WHMIS 2015, this information is now presented on safety data sheets (SDS).

Employers are required to establish education and training programs for workers exposed to hazardous products in the workplace. Employers must also ensure that the products are labelled, that SDS are present for each product, and that these labels and SDS are readily available to workers.

Workers are required to participate in the education and training programs and use this information to help them work safely with hazardous products. They may inform employers when labels on containers have been accidentally removed or if the label is no longer readable.

## WHMIS 2015 legislation

WHMIS 2015 regulations lay out the legal steps that employers and suppliers of hazardous products must follow to ensure the protection of workers' health and safety.

WHMIS 2015 leaflets (obtainable through the provincial Workers Compensation Board, Workers Safety Insurance Board, or equivalent) explain about both:

- Federal hazardous products and controlled products legislation.
- Provincial jurisdiction(s) over hazardous products.

Federal legislation deals with the importation and sale of controlled products. This includes establishing criteria for including hazardous products and requirements for suppliers to provide appropriate labels and SDS.

At the federal level, WHMIS 2015 legislation includes the amended *Hazardous Products Act* and the new *Hazardous Products Regulation (HPR)*.

New GHS labelling includes two distinct labels:

GHS label type	Requirements
Supplier label	<ul style="list-style-type: none"> <li>• Provided or affixed (attached) by the supplier.</li> <li>• Appears on all hazardous products received at a workplace in Canada.</li> <li>• For hazardous product always used in the container with the supplier label, no other label is required.</li> </ul>
Workplace label	<p>Required when a:</p> <ul style="list-style-type: none"> <li>• hazardous product is produced (made) at the workplace and used in that workplace;</li> <li>• hazardous product is decanted (e.g., transferred or poured) into another container; or</li> <li>• supplier label becomes lost or illegible (unreadable).</li> </ul>

Provincial legislation is concerned with the storage, handling, and use of hazardous products in the workplace. Through amendments to the Occupational Safety and Health Regulations, provincial legislation ensures the employer will provide worker education and training on hazardous products.

If you handle hazardous products that the employer produced and observe that additional/ different procedures or precautions are necessary, you are responsible for notifying your supervisor so that the employer will add this updated information to the SDS.

Information on and updating of a SDS:

Updating requirement	Format	Information sections
<p>Are updated when the supplier is making significant changes to the SDS.</p> <p>Communicate significant changes as soon as possible to the consumer.</p>	<p>SDS are more detailed than a hazard product supplier label or workplace label and provide detailed hazard information.</p>	<p>Contain 16 information sections on a hazardous product, with sections 12-15 optional for the supplier of the product to include.</p>

## Data sheet information and pictograms for SDS

### SDS: Sixteen sections under WHMIS 2015

	Section/heading	Information
1	Identification	<ul style="list-style-type: none"> <li>Product identifier (e.g., product name)</li> <li>Other means of identification (e.g., product family, synonyms, etc.)</li> <li>Recommended use</li> <li>Restrictions on use</li> <li>Canadian supplier identifier*               <ul style="list-style-type: none"> <li>Name, full address, and phone number(s)</li> </ul> </li> <li>Emergency telephone number and any restrictions on the use of that number, if applicable</li> </ul>
2	Hazard identification	<ul style="list-style-type: none"> <li>Hazard classification (class, category) of substance or mixture or a description of the identified hazard for Physical or Health Hazards Not Otherwise Classified</li> <li>Label elements:               <ul style="list-style-type: none"> <li>Symbol (image) or the name of the symbol (e.g., flame, skull and crossbones)</li> <li>Signal word</li> <li>Hazard statement(s)</li> <li>Precautionary statement(s)</li> </ul> </li> <li>Other hazards which do not result in classification</li> </ul>
3	Composition/ information on ingredients	<ul style="list-style-type: none"> <li>When a hazardous product is a material or substance:               <ul style="list-style-type: none"> <li>Chemical name</li> <li>Common name and synonyms</li> </ul> </li> </ul>

	Section/heading	Information
		<ul style="list-style-type: none"> <li>• Chemical Abstract Service (CAS) registry number and any unique identifiers</li> <li>• Chemical name of impurities, stabilizing solvents and/or additives†</li> <li>• For each material or substance in a mixture that is classified in a health hazard class‡: <ul style="list-style-type: none"> <li>• Chemical name</li> <li>• Common name and synonyms</li> <li>• CAS registry number and any unique identifiers</li> <li>• Concentration</li> </ul> </li> </ul> <p><b>Note:</b> Confidential business information rules can apply.</p>
4	First-aid measures	<ul style="list-style-type: none"> <li>• First-aid measures by route of exposure: <ul style="list-style-type: none"> <li>• Inhalation</li> <li>• Skin contact</li> <li>• Eye contact</li> <li>• Ingestion</li> </ul> </li> <li>• Most important symptoms and effects (acute or delayed)</li> <li>• Immediate medical attention and special treatment, if necessary</li> </ul>
5	Fire-fighting measures	<ul style="list-style-type: none"> <li>• Suitable extinguishing media</li> <li>• Unsuitable extinguishing media</li> <li>• Specific hazards arising from the hazardous product (e.g., hazardous combustion products)</li> <li>• Special protective equipment and precautions for fire-fighters</li> </ul>
6	Accidental release measures	<ul style="list-style-type: none"> <li>• Personal precautions, protective equipment, and emergency procedures</li> <li>• Methods and materials for containment and cleaning up</li> </ul>
7	Handling and storages	<ul style="list-style-type: none"> <li>• Precautions for safe handling</li> <li>• Conditions for safe storage (including incompatible materials)</li> </ul>
8	Exposure controls/ personal protection	<ul style="list-style-type: none"> <li>• Control parameters, including occupational exposure guidelines or biological exposure limits and the source of those values</li> <li>• Appropriate engineering controls</li> <li>• Individual protection measures (e.g., personal protective equipment)</li> </ul>

	Section/heading	Information
9	Physical and chemical properties	<ul style="list-style-type: none"> <li>• Appearance (physical state, colour, etc.)</li> <li>• Odour</li> <li>• Odour threshold</li> <li>• pH</li> <li>• Melting point/freezing point</li> <li>• Initial boiling point/boiling range</li> <li>• Flash point</li> <li>• Evaporation rate</li> <li>• Flammability (solid, gas)</li> <li>• Lower flammable/explosive limit</li> <li>• Upper flammable/explosive limit</li> <li>• Vapour pressure</li> <li>• Vapour density</li> <li>• Relative density</li> <li>• Solubility</li> <li>• Partition coefficient - n-octanol/water</li> <li>• Auto-ignition temperature</li> <li>• Decomposition temperature</li> <li>• Viscosity</li> </ul>
10	Stability and reactivity	<ul style="list-style-type: none"> <li>• Reactivity</li> <li>• Chemical stability</li> <li>• Possibility of hazardous reactions</li> <li>• Conditions to avoid (e.g., static discharge, shock, or vibration)</li> <li>• Incompatible materials</li> <li>• Hazardous decomposition products</li> </ul>
11	Toxicological information	<p>Concise but complete description of the various toxic health effects and the data used to identify those effects, including:</p> <ul style="list-style-type: none"> <li>• Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact)</li> <li>• Symptoms related to the physical, chemical and toxicological characteristics</li> <li>• Delayed and immediate effects, and chronic effects from short-term and long-term exposure</li> </ul>

	Section/heading	Information
		<ul style="list-style-type: none"> <li>Numerical measures of toxicity</li> </ul>
12	Ecological information§	<ul style="list-style-type: none"> <li>Ecotoxicity</li> <li>Persistence and degradability</li> <li>Bioaccumulative potential</li> <li>Mobility in soil</li> <li>Other adverse effects</li> </ul>
13	Disposal considerations§	Information on safe handling for disposal and methods of disposal, including any contaminated packaging
14	Transport information§	<ul style="list-style-type: none"> <li>UN number</li> <li>UN proper shipping name</li> <li>Transport hazard class(es)</li> <li>Packing group</li> <li>Environmental hazards</li> <li>Transport in bulk, if applicable</li> <li>Special precautions</li> </ul>
15	Regulatory information§	Safety, health, and environmental regulations specific to the product
16	Other information	Date of the latest revision of the SDS

\* The supplier that must be identified on an SDS is the initial supplier identifier (i.e., the name, address, and telephone number of either the Canadian manufacturer or the Canadian importer). There are two exceptions to this requirement. In a situation where a distributor is selling a hazardous product, he/she may replace the name, address, and telephone number of the initial supplier with his/her own contact information. In a situation where an importer imports a hazardous product for use in their own workplace in Canada (i.e., the importer is not selling the hazardous product), he/she may retain the name, address, and telephone number of the foreign supplier on the SDS instead of replacing it with his/her own contact information.

† These impurities and stabilizing products are those that are classified in a health hazard class and contribute to the classification of the material or substance.

‡ You must list each ingredient when it is classified in a health hazard class and present above the concentration limit designated for its class or in the mixture at a concentration that results in its classification.

§ 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.

## Pictograms under WHMIS 2015





Hazard products pictograms—symbols with red borders in a diamond shape—easily and visibly identify the product by hazard group, hazard class, and hazard category.

Pictograms display on labels and SDS.



**Figure 3-1**  
**WHMIS 2015 hazard pictograms**





**Note:** Physical Hazards Not Otherwise Classified and Health Hazards Not Otherwise Classified classes are required to have a GHS pictogram that is appropriate to the hazard identified.

Hazard	Pictogram	Physical hazard group	Health hazard group
Flammable		Flammable gases, category 1 Flammable aerosols, categories 1, 2 Flammable liquids, categories 1, 2, 3 Flammable solids, categories 1, 2 Self-reactive substances and mixtures, types B, C, D, E, F Pyrophoric liquids, category 1 Pyrophoric solids, category 1 Self-heating substances and mixtures, categories 1, 2 Substances and mixtures which, in contact with water, emit flammable gases, categories 1, 2, 3 Organic peroxides, types B, C, D, E, F	
Oxidizing		Oxidizing gases, category 1 Oxidizing liquids, categories 1, 2, 3 Oxidizing solids, categories 1, 2, 3	
Compressed gas		Compressed gases Liquefied gases Refrigerated liquefied gases Dissolved gases	
Corrosive		Corrosive to metals, category 1	Skin irritation/corrosion, categories 1, 1A, 1B, 1C Serious eye damage/eye irritation, category 1

*(Continued)*

Figure 3-1 (Continued)



**Note:** Physical Hazards Not Otherwise Classified and Health Hazards Not Otherwise Classified classes are required to have a GHS pictogram that is appropriate to the hazard identified.

Hazard	Pictogram	Physical hazard group	Health hazard group
Explosive		Self-reactive substances and mixtures, types A, B  Organic peroxides, types A, B	
Toxic			Acute toxicity (oral, dermal, inhalation), categories 1, 2, 3
Health hazard			Respiratory or skin sensitization, categories 1, 1A, 1B  Germ cell mutagenicity, categories 1, 1A, 1B, 2  Carcinogenicity, categories 1, 1A, 1B, 2  Reproductive toxicity, categories 1, 1A, 1B, 2  Specific target organ toxicity following single exposure, categories 1, 2  Specific target organ toxicity following repeated exposure, categories 1, 2  Aspiration hazard, category 1
Exclamation mark			Acute toxicity (oral, dermal, inhalation), category 4  Skin corrosion/irritation, category 2  Serious eye damage/eye irritation, category 2, 2A

(Continued)

Figure 3-1 (Concluded)

**Note:** Physical Hazards Not Otherwise Classified and Health Hazards Not Otherwise Classified classes are required to have a GHS pictogram that is appropriate to the hazard identified.

Hazard	Pictogram	Physical hazard group	Health hazard group
			Respiratory or skin sensitization, categories 1, 1A, 1B  Specific target organ toxicity following single exposure, category 3
Biohazardous infectious materials			(For organisms or toxins that can cause diseases in people or animals)  Biohazardous Infectious Materials, category 1
Environment			

**Note:** The GHS Pictogram for Environment was not adopted in WHMIS 2015, but you may see this on labels and SDS in the workplace for environmental classes and need to understand its meaning.

## Good housekeeping

The responsibility of a gas technician/fitter is to follow proper handling, storage, and use requirements for hazardous materials. Consult the SDS provided by the employer and ensure that you have the most recent updates to these sheets.

Ensure that you read and follow directions on manufacturers' information sheets when handling hazardous products. If information on the proper handling of a hazardous product is not available, you should phone your area's Construction Safety Association for help.

If you cannot obtain the information you need, consult your supervisor before using any product or material to ensure that you are completely informed of the use and hazard.

## Safe handling, storage, disposal, and transportation of hazardous materials

For the purposes of this section, hazardous materials are described in three categories:

- liquid solvents, glues, and resins
- toxic materials

- common fuel gases

## Liquid solvents

Solvents are liquids that dissolve other substances. They are used as cleaning agents to dissolve oils, greases, and resins, and in the production of paints, lacquers, adhesives, and cements for plastic and fibreglass. Exposure to solvents may present a permanent threat to your health and reduce your awareness, thereby increasing the potential for mistakes and accidents.


The following are three ways in which a liquid cleaning agent or solvent may enter and affect your body.

Method of contact	Description
Inhalation	Excessive breathing of solvent vapours affects the central nervous system, causing dizziness, nausea, headaches, sleepiness, the appearance of drunkenness, unconsciousness, and possibly death. Other cases of overexposure may result in serious damage to the blood, lungs, liver, and kidneys.  Respirators are recommended as a means of short-term protection against inhalation hazards. They should be approved and be suitable for protection against organic fumes. Regularly check and properly maintain them.
Skin contact	All solvents can dry and irritate the skin with continuous contact, leaving the skin subject to disabling and possibly disfiguring dermatitis and opening the way to serious infection. Many solvents are easily absorbed through the skin, leading to similar effects as those described under inhalation.
Ingestion	Accidental swallowing of industrial solvents is rare because of the unpleasant odour that usually identifies them.

Solvents and cleaning agents should be used with care. If you are called upon to repair a piping system that carries any of these agents, find out what it is and what specific precautions you should take. Good personal hazard prevention is very important wherever you use solvents.

## General safety precautions for handling liquid solvents

Be aware of the hazards of the cleaning agent or solvent you are using. Check with your foreperson or supervisor to ensure that you know how to handle a particular solvent, and follow these general precautions:

Do...	Do not/never...
<ul style="list-style-type: none"> <li>• Use only approved containers in good condition. Keep them tightly closed when not in use.</li> <li>• Clean up liquid spills immediately. Put cleanup rags in designated containers.</li> <li>• Check the grounding of large drums containing flammable liquids. This prevents static sparks from being generated when pouring solvents.</li> <li>• Avoid skin contact and practice proper personal hygiene.</li> <li>• Always use personal protective equipment (PPE) and special protective devices and equipment.</li> </ul>	<ul style="list-style-type: none"> <li>• Use a container for any liquid other than that for which it is intended and so marked.</li> <li>• Use sawdust to absorb a spill unless you can immediately and safely dispose of the sawdust mixture.</li> <li>• Smoke or produce sparks or flame in the vicinity of a flammable or combustible liquid.</li> </ul> <p> Work with a solvent if you are “not sure” of its properties or what type of protective clothing to wear. Check with your foreperson or safety supervisor if you are in doubt.</p>

## Storage

- Solvents may be stored either in above-ground or underground tanks. Outside storage is always preferred to inside storage, but drums should always be protected from direct rays of the sun and other sources of heat. Protection from extreme cold may be necessary in severe climates.
- Do not smoke or eat in any area where solvents or any other volatile substances are stored or used. The danger of fire from a spark or contamination of food due to fumes is extreme.
- If a drum leaks or is otherwise damaged, its contents should be immediately transferred to a sound container that is clean or that previously held the same liquid.
- The contents of each drum should be clearly labelled. This prevents accidents occurring from improper use or incorrect mixtures. Where possible, the labelling should include handling precautions and emergency action.

## Toxic materials

In the gas industry, you will encounter various types of toxic material. Some of the more common types encountered by gas technicians/fitters are listed below:

- plastic venting glues, cleaners, and cement (S636), and fibreglass solvents, glues, and resins
- chlorine
- asbestos
- sewer gas
- zinc or cadmium fumes

## Chemical solvents, glues, and resins

Gas technicians/fitters use a variety of products to join the fittings for plastic pipe used in venting systems. The solvents and glues used with ABS and PVC and CPVC products are toxic. Take

caution and use special PPE in unventilated or confined spaces. These pipe materials are highly flammable and emit highly toxic fumes when burned.

## General safety precautions for handling ABS, PVC, CPVC, and fibreglass

Do...	Do not/never...
<ul style="list-style-type: none"> <li>• Apply solvent cement with a brush and avoid skin contact.</li> </ul>	<ul style="list-style-type: none"> <li>• Smoke while using primers or solvents.</li> <li>• Let solvent cement get into your eyes. If it should, flush your eyes with water and see a doctor immediately.</li> </ul>

## Storage of solvents and glues

Containers should be tightly sealed and kept away from extreme heat or cold.

## Chlorine

Chlorine, used extensively in water and sewage treatment plants, has two main forms: liquid and gas.

Form	Description
Liquid chlorine	Is a clear, amber-coloured liquid about 1.5 times as heavy as water.
Gaseous chlorine	Is greenish-yellow and is about 2.5 times as heavy as air. Thus, if the gas escapes from a container or system, it will collect at floor level.

Chlorine is non flammable, a strong oxidant, and has a disagreeable, suffocating, irritating odour. Chlorine is a strong eye and lung irritant. Exposure to low concentrations, between 15–30 ppm (parts per million), causes a burning sensation in the eyes, nose, and throat, and sometimes headaches. There may be redness of the face, sneezing, coughing, and huskiness or loss of voice.

Inhalation of chlorine in higher concentrations affects both the upper and lower respiratory tract. The most prominent symptoms are eye and throat irritation, choking sensation, restlessness, nausea, vomiting, shortness of breath, chest pain, and fluid in the lungs. Delayed onset may occur 6-12 hours after exposure.

Brief exposure to very high concentrations (800 ppm) of chlorine may cause death from suffocation. If skin or eye contacts chlorine liquid or vapour, it causes severe local irritation and burns.

While chlorine is neither explosive nor flammable, it will support combustion. Water, in certain concentrations, is explosive with chlorine gas when ignited by a spark.

Visit [www.ccohs.ca](http://www.ccohs.ca) for more information.



## Asbestos

Asbestos is one of the most dangerous substances you can encounter as a gas technician/fitter. Asbestos is a designated substance and, therefore, must be reported to your employer and supervisor. Do not engage in any activity with asbestos until you have been authorized by your supervisor.

Some asbestos fibres are so small and light that when they are breathed in, they may not be trapped by the ciliary hairs or mucous membranes of the air passages. The fibres are instead inhaled deep into the lungs and into the air sacs through which oxygen is transferred to the bloodstream. The body may not destroy the minute fibrils, and over a period of time, scar tissue forms around them. When lungs become tough and inelastic, breathing becomes difficult, insufficient oxygen reaches the blood, and the heart may become enlarged and weakened.

## Precautions for handling asbestos

Personnel working with installation or removal of asbestos are required to successfully complete a certified asbestos abatement course. They must contact the authority having jurisdiction (typically the Ministry of Labour) before they remove asbestos.

## Sewer gas

Sewer gas is a mixture of vapours, odours, and gases found in a sewer. The gases may include methane ( $\text{CH}_4$ ), gasoline vapour, illuminating gas, hydrogen sulfide ( $\text{H}_2\text{S}$ ), carbon monoxide ( $\text{CO}$ ), acetylene ( $\text{C}_2\text{H}_2$ ), hydrogen ( $\text{H}_2$ ), ammonia ( $\text{NH}_3$ ), oxygen ( $\text{O}_2$ ), and nitrogen ( $\text{N}$ ).

Some of these gases are combustible and explosive in the presence of oxygen. Hydrogen sulphide and carbon monoxide are highly poisonous, even in relatively small concentrations. All may be asphyxiating when the concentration of oxygen in the atmosphere is reduced. Hydrogen sulfide, other gases, and volatile matter may be present in low concentrations, but still be sufficient to create highly offensive odours and cause corrosion.

The possibility that sewer gas may be dangerous to your health has created controversy. People have died from asphyxiation or gas poisoning upon entering a manhole. No scientific data can be found to prove or disprove that any specific disease results from the presence of sewer gas in a building. However, in view of the uncertainties, the greatest effort should be made to confine sewer gas to sewers.

Before entering a sewer, the worker must perform tests to determine the contents of the atmosphere. Where tests indicate that the atmosphere is unsafe, he/she must vent the sewer and then check it again. If it is impractical to vent the sewer, the worker must wear respiratory equipment. Elimination or control of all sources of ignition is required.

Consult your supervisor and company policy for more details.

## Zinc or cadmium fumes

Pipes or sheet metal galvanized with zinc or cadmium present a hazard to gas technicians/fitters. When these materials are cut with an oxyacetylene torch, the fumes given off are in the form of highly toxic, dense white smoke.

When cutting pipe galvanized with zinc or cadmium (and you are using oxyacetylene equipment) take precautions to avoid breathing the fumes. It is required to perform the cutting operation in a well-ventilated area or wear breathing equipment

Cadmium may also be found in some brazing alloys. Use caution and appropriate PPE to protect yourself when using cadmium-containing products. Alternatively, use a cadmium-free product if there is a choice.

## Common fuel gases

The most common fuels in a commercial/industrial environment are:

- gasoline
- diesel
- propane (LP-gas)
- natural gas

## Gasoline and diesel fuels

Gasoline and diesel fuel are liquids designed to ignite easily. This means they vaporize easily and readily form combustible mixtures, making them extremely dangerous.

### General precautions for working with gasoline and diesel fuels

- Smoking while working with fuel gases is prohibited. The flammable limits of gasoline are 1%–16%.
- Never use gasoline and diesel as cleaning agents.
- When transferring the fuels from one container to another, avoid sparks that may cause ignition.
- Should spillage occur, place the materials used to clean up in designated, sealed containers.
- Never carry gasoline and other flammable liquids in the passenger compartment of a vehicle.
- Transport and store gasoline and other flammable liquids in approved containers bearing the CSA (CSA Group) or ULC (Underwriters' Laboratories of Canada) label.
- Ensure that gasoline and diesel fuel containers are not damaged, and that caps or fittings are properly secured after filling.
- Transport flammable liquids in an upright position, braced, or otherwise secured to prevent overturning.
- Keep an ABC fire extinguisher in the driver's compartment while transporting gasoline or other flammable liquids in a van.

## Storage

Store gasoline and diesel fuels in sealed, clearly labelled containers.

## LP-gas and natural gas

Liquid propane gas (LP-gas) and natural gas are in the gaseous state while burning at atmospheric pressure and normal temperatures. Both are non-toxic and should not harm anyone breathing low concentrations near minor leaks.



In their pure states, both fuels are tasteless, colourless, and odourless. As a safety measure, each fuel comes with an unpleasant odour so it can be detected when its atmospheric concentration reaches 1%. This concentration is well below the level at which combustion can occur.

LP-gas leaking or released into the air looks like a steam cloud that disappears as soon as the liquid absorbs enough heat to vaporize. Heat is absorbed from everything the liquid touches, which can result in cold burns to the skin.

The combination of LP-gas or natural gas and oxygen produces an extremely dangerous mixture. If a leak is suspected, immediately shut off the supply at its source and check for the leak with an approved testing agent.

Natural gas is lighter than air (relative density 0.6), causing it to rise and be dissipated by currents of air. Propane is heavier than air (relative density 1.5), which causes it to descend and collect at low points. Such pockets of gas can remain invisible; they are ready to ignite with as little as a spark from an electrical switch.

## Storage

Store LP-gas and natural gas in the same storage area as oxygen.

Store only both LP-gas and natural gas fuels, which are under pressure, in approved containers, with approved regulators and relief valves. Avoid mishandling the containers.

## Transportation

Propane is shipped and stored in a container as a liquid under pressure. Natural gas remains a gas but is compressed for shipping into smaller containers or transmitted through smaller pipes.

## Transportation of dangerous goods

Clauses from CSA B149.2, *Propane storage and handling code*, cover the requirements for transportation of propane in cylinders and tanks (refer to the sections "Transportation of cylinders" and "Movement of tanks not designed for transportation or delivery of propane"). CSA B149.2 references the Transportation of Dangerous Goods Regulations of Transport Canada.

Other relevant standards include CSA B340, *Selection and use of cylinders, spheres, tubes, and other containers for the transportation of dangerous goods, Class 2*, and CSA-B622, *Selection and use of highway tanks, TC portable tanks, and ton containers for the transportation of dangerous goods, Class 2*.

For more information on TDG go to: <http://www.tc.gc.ca/eng/tdg/safety-menu.htm>

## Assignment Questions – Chapter 3

- 1) What system was established to provide workers, employers, and suppliers of material with vital information about hazardous material in the workplace?
  - a) Workplace Hazardous Material Instructional System
  - b) Workplace Hazardous Material Identification System
  - c) Workplace Hazardous Material Information System
  - d) Workplace Hazardous Material International System
- 2) In 2015, what was WHMIS updated to align with?
  - a) Provincial Regulations
  - b) Federal Regulations
  - c) Transport of Dangerous Goods Act
  - d) Globally Harmonized System (GHS)
- 3) Which of the following is not a way by which liquid cleaning agents or solvents can enter the body?
  - a) Inhalation
  - b) Skin contact
  - c) Ingestion
  - d) Subliminally
- 4) What should be included when labelling drums of liquid solvent?
  - a) Identification, handling precautions, and emergency actions
  - b) Where it was purchased and handling precautions
  - c) Identification, supplier name, and emergency actions
  - d) Identification, size of the container, and supplier name
- 5) Which of the following is not considered a precaution for handling solvents used to connect plastic pipe?
  - a) No smoking
  - b) Avoid contact with the eyes
  - c) Avoid skin contact
  - d) Check for proper colour solvent
- 6) What are the two hazard groups under WHMIS 2015?
  - a) Health, Safety
  - b) Physical, chemical
  - c) Physical, health
  - d) Biological, physical