

# **Module 8    Safety**

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## **Unit 8.2            Hazardous Materials**

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# Introduction

## About this unit

Welcome to Unit 8.2 on hazardous materials.

The unit teaches you about what hazardous materials are and how to identify them. You will be shown where to find information about the materials that you use.

You will also be given information about how to handle and store hazardous materials correctly and safely and what to do in the case of an emergency.

## How to use this book

As well as information about hazardous materials, this book also contains activities.

These activities don't play a part in your assessment for this unit, but they are there to help you find out much you have learned.

Read the information, and then answer the questions as you work through the book.

Answers and examples are provided in this book for you to check your progress.

Your tutor will give you an assessment task to check what you have learned about hazardous materials.

This task will determine your competence in this unit.

## How you'll be assessed

To be assessed for this unit you will be given an assessment task. You will do this task when you have finished certain parts of the work in the book.

Your tutor will help you to understand what you need to do for the task – ask your tutor straightaway to explain anything you don't understand.

## Finding your way

As you work through the text you'll see symbols in the left margin of some pages. These symbols or "icons" are to guide you through the content.



Read



Important- take note!



Self-checking question/activity



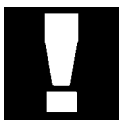
Assessment task



Things to do



Things not to do



## Competency

The content of this training programme for Technical and Vocational teachers is based on the skills that you need to develop. The skills for each unit are set out as things that you must have learned or are able to do.

The assessment by your tutor will test what you have learned and your level of skill.

Each unit sets out the skills needed. If you already think you know enough about the unit to show that you have the skills needed, you may be able to get your tutor to test you without studying the unit.

## Learning outcomes

When you have completed this unit you should be able to:

- Define hazardous materials
- State the precautions for handling and storage of hazardous materials in solid, liquid and gaseous states
- Identify and explain the meanings of signs and symbols used to identify hazardous materials and situations
- Take appropriate action in cases of emergency

## Assessment criteria

Your tutor will assess what you have learned by getting you to:

- Define, in accordance with international regulations, hazardous materials.
- Identify, in accordance with provided information, commonly used hazardous materials.
- State, without error, the precautions for handling identified hazardous materials.
- State, without error, the precautions for storage of identified hazardous materials.
- Identify, without error, international codes and symbols for hazardous materials.
- State, without error, the meaning of each identified code and symbol.
- State appropriate action to be taken in given examples of emergencies.
- Perform an analysis of the safety precautions in force in your workshop and recommend appropriate corrective action(s) (where necessary) to increase safety in that workshop.

## Assessment methods

Your tutor may test your skills by:

- Giving you an oral or written test
- Giving you an assignment

The instructor may also use the points contained in the learning activities as a guide in assessing your performance.

## Other resources you may find useful

- Information from local fire and ambulance services
- Information on health and safety from national or local government
- Information on health and safety from large industries in your local area

## References:

### ***Occupational Safety Management and Engineering 4th ed.***

Author: Willie Hammer

ISBN: 0-13-629379-4

Publisher: Prentice Hall

### ***Occupational Safety and Health: for Technologist, Engineers, and Managers***

3rd ed.

Author: David L. Goetsch

ISBN: 0-13-924085-3

Publisher: Prentice Hall

Web page address: - **[www.safetyinfo.com](http://www.safetyinfo.com)**



# Section 1



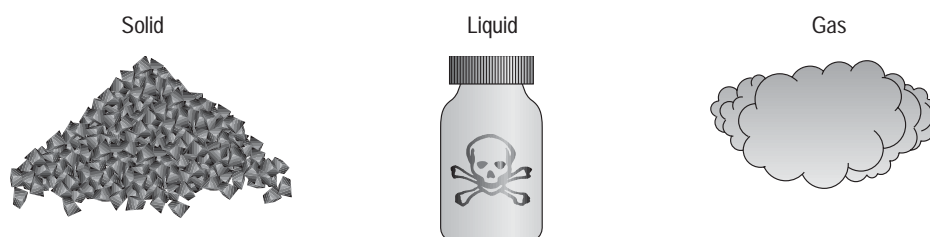
## Hazardous materials

Hazardous materials are materials that are used or produced and are hazardous to people and property. They require special handling and special precautions to be taken.

Hazardous materials can cause a harmful effect on people if they come into contact with the body, by being splashed onto the skin or into the eyes, swallowed or breathed in. Some materials cause injury through fire or explosion.

Whatever their properties and their potential for injury and damage, a lot of care is needed in their handling, storage and transport.

You will find a number of hazardous materials in the workshop. They will exist in one of the following three states:



Virtually all substances can exist in all three states under the right conditions (especially temperature).

The change from solid to liquid usually occurs at a clearly defined temperature; for example, ice turns to water at 0°C. Further rises in temperature can change a liquid to a gas. In the case of water, it turns to steam at 100°C.

Most liquids will give off a vapour (that is, change from liquid to gas) at any temperature. A few solids will also give off a vapour.

Some materials, such as solvents, oils, hydrogen sulphide, acids and so on are hazardous by themselves.

Other materials are only hazardous when you do something with them.

*For example:*

*A piece of wood by itself is fairly harmless. However, once you start doing things to it such as sanding or sawing, wood dust will be produced. Wood dust can be harmful if you breathe in too much. Some woods can also irritate the skin.*

Some processes create hazardous materials.

*For example:*

*Welding produces harmful fumes and gases. When welding stainless steel, for example, nickel and chromium metal fumes will be produced as well as ozone and carbon monoxide gas. These can all be harmful to health if breathed in.*



## Classification of hazardous materials

**Classification** is the process whereby the health hazards of a material are identified and the material is put into a hazard category. There are six basic hazard categories. Once a material has been classified, it can be allocated certain risk and safety phrases. Risk **phrases** provide quick information on the hazards of a material. Safety **phrases** provide information on safe storage, handling, disposal, personal protection and first aid.

Table 1 (on the following page) lists the six hazard categories and some of the risk phrases that may be used to describe the potential health hazards.

Table 1

Hazard category	Risk phrases
VERY TOXIC	R26 Very toxic by inhalation R27 Very toxic in contact with skin R28 Very toxic if swallowed R39 Danger of very serious irreversible effects
TOXIC	R23 Toxic by inhalation R24 Toxic in contact with skin R25 Toxic if swallowed R39 Danger of very serious irreversible effects

HARMFUL	R20 Harmful by inhalation R21 Harmful in contact with skin R22 Harmful if swallowed R40 Possible risk of irreversible effects
VERY CORROSIVE	R35 Causes severe burns
CORROSIVE	R34 Causes burns
IRRITANT	R36 Irritating to eyes R37 Irritating to respiratory system R38 Irritating to skin R41 Risk of serious damage to eyes

In addition to the above categories, some materials may also be:

- Carcinogenic (causes cancer)
- Mutagenic (affects genetic material)
- Teratogenic (causes birth defects).

In this case there are risk phrases to identify this.

*For example:*

*R45 may cause cancer*

*R46 may cause heritable genetic damage.*

A material may be classified in more than one hazard category.

***For example:***

The following risk phrases apply to the solvent carbon disulphide:

R23 toxic by inhalation

R36/38 irritation to eyes and skin

R47 may cause birth defects

R48 danger of serious damage to health by prolonged exposure.

From this example you can see that carbon disulphide is classified as toxic, irritant and teratogenic.

## Dangerous goods

In addition to the classification system discussed above, there is another system for classifying hazardous materials.

Some hazardous materials are also classified as dangerous goods, which means there are separate regulations that cover the classification, labelling and transport of these particular materials. Dangerous goods are classified from a safety point of view whereas the system discussed above is based on the potential health hazards of the material.

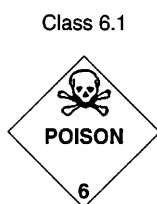
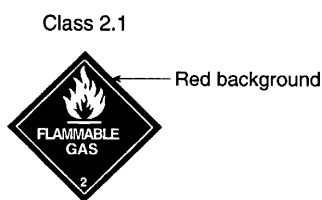
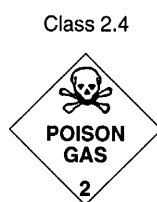
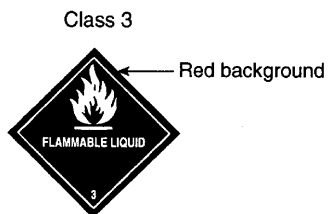
These regulations are made to prevent accidents involving the range of hazardous materials that are known internationally as **dangerous goods**. Your country should have a system of classifying and labelling hazardous materials and will probably be based on the United Nations system.

Dangerous goods are divided into nine classes based on their hazardous properties. They may be corrosive, flammable, explosive, oxidising or reactive with water as shown in Table 2.

**Table 2: Dangerous goods classes**

Class	Definition	Examples
1	Explosives	Dynamite
2	Gases: compressed, liquefied or dissolved under pressure	
2.1	Flammable gases	LP gas
2.2	Non-flammable non-toxic gases	Nitrogen
2.2	Oxidising gases	Oxygen
2.4	Poisonous gases	Chlorine, carbon monoxide
3	Flammable liquids	Petrol, solvents
4	Flammable solids, substances liable to spontaneous combustion and substances which in contact with water emit flammable gases	
4.1	Flammable solids	Phosphorous, matches
4.2	Spontaneously flammable substances	White phosphorous
4.3	Flammable substances if wetted	Calcium carbide
5	Oxidising agents and organic peroxides	
5.1	Oxidising substances	Nitrates, hydrogen peroxide
5.2	Organic peroxides	Methyl ethyl ketone peroxide
6	Poisonous (toxic) and infectious substances	
	Poisonous substances	Cyanides, arsenic compounds
	Harmful substances	Cadmium compounds
	Infectious substances	Vaccines
7	Radioactive substances	Uranium, radioisotopes
8	Corrosive substances	Sulphuric acid, sodium hydroxide
9	Miscellaneous dangerous goods	Dry ice, aerosols

Except for very small packages, all packages and containers that hold dangerous goods for transport must carry the correct class label. This label (which is a diamond shape) shows the nature of the hazard by the colour and symbol, and the class of the goods by numeral. Some examples of these labels are shown below.



Manufacturers and importers of materials are responsible for deciding whether a material is hazardous to health and for classifying it. If the material can't be classified then it can't be supplied.

They must also label the materials correctly and supply a Material Safety Data Sheet. This is where you will get information about the hazardous material.

## Labelling and Material Safety Data Sheets

A **label** is any information on a container which:

- tells you what the substance in the container is
- tells you whether the substance is hazardous
- gives you basic information about how to use and handle the material safely.


Generally manufacturers and suppliers of hazardous materials are required to make sure the materials are labelled correctly.

Sometimes materials are supplied in large containers that can be hard to handle. Therefore you may transfer some of the material into a smaller container so that it is easier to use. If you do this then it is your responsibility to label the second container so that the contents can be easily identified.

Existing labels on new containers of hazardous chemicals should never be removed or defaced, except when empty. All warning labels, tags etc. must be maintained in a legible condition.

Read the label each time you use a newly purchased chemical. It is possible the manufacturer may have added new hazard information or has reformulated the product since your last purchase, and thus altered the potential hazards you face while working with the product.

Below is an example of a typical label and the information it provides.

<b>MATERIAL X</b>		
<b>POISON</b>		
<b>FLAMMABLE LIQUID</b>		
<b>2.5L</b>		
<b>RISK</b>	Highly flammable. Irritating to respiratory system and eyes. Harmful by inhalation.	
<b>SAFETY</b>	Use only in well ventilated areas. Wear suitable protective clothing including suitable respiratory equipment. Keep away from sources of ignition – no smoking. Do not empty into drains.	
<b>FIRST AID</b>	If swallowed, contact doctor or Poisons Information Centre immediately and show this label. In case of contact with eyes, rinse immediately with plenty of water and contact a doctor or Poisons Information Centre.	
<b>SPILLS/LEAKS</b>	Restrict access to area. Remove sources of ignition. Provide adequate protective equipment and ventilation. If possible, cover liquid with earth, sand or absorbent material. Flush area with water.	
<b>FIRE</b>	Fire-fighters should wear full protective clothing and self-contained breathing apparatus with full face-piece. Use dry chemical foam or carbon dioxide to fight fire.	

**What information does the label tell you?** It tells you that Material X is harmful if you breathe it in and can irritate your eyes and throat. The diamond label means that Material X is also classed as a dangerous good — Class 3 flammable liquid. As it is flammable it should be kept away from ignition sources, such as flames and sparks.

The label tells you what precautions to take when using it (Safety) and what to do if you are exposed to it (First Aid). It also tells you what you should do in the case of a spill or fire.



A **Material Safety Data Sheet** (MSDS) is a document giving information that will allow you to use hazardous materials safely and correctly. They provide more detailed information than a label. MSDS's are recognised internationally as the best way to provide the information necessary for the safe use of materials. The layout of a MSDS may differ from country to country, depending on the national guidelines, however all will include the following basic information.

<b>Company Details</b>	<ul style="list-style-type: none"> <li>• Of the manufacturer or importer in your country</li> </ul>
<b>Identification</b>	<ul style="list-style-type: none"> <li>• Product name/s – name by which product is known and as shown on label</li> <li>• UN number – number assigned to one substance or group of substances with similar characteristics</li> <li>• Dangerous goods class</li> <li>• Hazchem code – provides information to emergency services</li> <li>• Uses – lists major recommended uses of material</li> <li>• Physical description/properties – described in terms of colour, odour and form, e.g “<i>colourless liquid with sweet odour</i>” and properties including boiling &amp; melting point, vapour pressure, solubility etc</li> <li>• Ingredients – list of what's in the material and how much (as %)</li> </ul>
<b>Health hazard information</b>	<ul style="list-style-type: none"> <li>• Health effects – information on the known health effects</li> <li>• First aid – simple instructions on what to do if you are exposed to the material</li> <li>• Advice to doctor</li> </ul>
<b>Precautions for use</b>	<ul style="list-style-type: none"> <li>• Exposure Standards – lists the Exposure Standards relevant to the material</li> <li>• Engineering controls – information on ways to reduce exposure to the material</li> <li>• Personal protection – information on personal protection that should be worn when using the material</li> <li>• Flammability – information on fire hazards</li> </ul>
<b>Safe handling information</b>	<ul style="list-style-type: none"> <li>• Storage and transport – information for the safe storage and transport of the material</li> <li>• Spills and disposal – what to do in case of a spill</li> <li>• Fire/explosion hazard – contains information for fire and emergency people</li> </ul>
<b>Contact point</b>	<ul style="list-style-type: none"> <li>• Gives the name and phone number of someone you can contact for further information about the material</li> </ul>

Possible injury and harm can result if these signs and symbols are ignored.



### Activity 1

Make a list of all the hazardous materials that you can think of in your workshop. Remember not all hazardous materials will be in a container or cylinder; some will be produced from the processes that are carried out in the workshop.



### Activity 2

1. What are hazardous materials?
2. What are the three ways in which you can be exposed to a hazardous material?
3. When classifying hazardous materials, what are the 6 categories that they can be classified as?
4. What is a risk phrase?
5. What is the purpose of a label and Material Safety Data Sheet?
6. What does this label tell you?



**Compare your answers with those on the following page.**



### Activity 1 Answers

Some hazardous materials that you may have on your list include:

- solvents such as kerosene and isopropanol
- paint
- oils
- gases such as carbon dioxide and argon used for welding
- wood dust
- metal fumes produced during soldering or welding
- ozone and carbon monoxide gas produced during welding



### Activity 2 Answers

1. A hazardous material is a material that is used or produced and is hazardous to people and property. It requires special handling and special precautions to be taken.
2. The three ways you can be exposed to a hazardous material is by:
  - breathing it in
  - swallowing it
  - getting it on your skin or in your eyes
3. The six categories that hazardous materials can be classified as are:

• very toxic	• toxic
• harmful	• very corrosive
• corrosive	• irritant.
4. Risk phrases provide quick information on the hazards of a material.
5. The purpose for labels and Material Safety Data Sheets is to give you information that will allow you to use hazardous materials safely and correctly.
6. The diamond shaped label tells you that the material is a Dangerous Good and is classified as Class 8 corrosive material.

**If you didn't answer all the questions correctly then read the section again before going to Section 2.**



## Section 2



### Handling and storage of hazardous materials

There are two main reasons why hazardous materials need to be handled and stored correctly.

1. To prevent people being exposed to the material.
2. To prevent fire and explosion.

You can find information on the correct and safe way to handle and store hazardous materials from labels and MSDSs.

### Handling

Correct handling is important in preventing exposure to hazardous materials that may cause injury or illness.

You should never handle a hazardous material until you have read and understood the precautions on the label and MSDS of the material.

The safest way should always be used to handle or transfer hazardous materials.

Before moving any container, check that the lid or bung is firmly in place and that the container is not leaking. If a container has been damaged, transfer the contents to a clean, sound container. Seal the new container correctly and label it making sure that all the information is transferred from the old container to the new.

You should always look at the handling methods you use and ask yourself whether they could be improved in some way.

#### Good handling methods

Listed (on the following page) are some general good handling techniques to reduce the risk of accidents occurring. Some of these may not apply to you in the workshop.

#### *Liquids:*

- When handling liquid materials that give off a vapour such as solvents and acids, use a fume hood if available.
- **ALWAYS** add acids to water and **NOT** the reverse.

- If possible use a suitable drum pump to transfer liquids from drums.
- Alternatively, if a drum pump is not available, ladle liquids instead of pouring.
- When chemicals have to be mixed, make the additions slowly and mix constantly.

***Solids:***

- When handling solid materials use a fumehood if available.
- Use a scoop to transfer solid materials instead of tipping.
- When splitting bags open and emptying them always do this gently and carefully, do not shake the bag vigorously. Be careful when getting rid of the empty bag. Fold the bag very carefully with the open end facing away from you. This will reduce the amount of dust forced out.

***Gases:***

- Cylinders (full or empty) must be firmly strapped to a bench and must be transported around on special cylinder trolleys.
- Don't use force to open cylinder valves. Cylinders should be opened only by using the key designed for the purpose. After the cylinder is opened, the key should remain in position.
- Cylinders should be handled with care at all times.
- Cylinder valves should be opened slowly.
- If using toxic gases the correct safety equipment must be used. The smallest cylinders should be used and these must only be used in a suitable fume hood.

**Handling containers**

When handling any materials, the weight of the container and the distance it is to be transported should be considered.

If the container is heavy and is to be moved manually, there may be a risk of back injury. In this case, use a forklift, chain hoist or trolley to move the container. The risk of spillage of any liquid chemical, and in particular, corrosives, is reduced by making sure that you are working within your physical capabilities.

If liquid corrosives are stored in drums, use a drum pump for transferring the liquid to a secondary container.

### ***Personal protective clothing and equipment (PPCE)***

Where there is a risk of being exposed to a hazardous material, Personal Protective Clothing and Equipment (PPCE) should be worn. This includes any item of clothing or equipment worn by a person to reduce their exposure to hazards. Examples of PPCE are safety glasses, respirators, gloves, overalls and hoods.

The PPCE that should be worn depends on what the material is, what you are doing with it and how it may damage or get into the body. Labels and data sheets give advice as to what PPCE to wear and when.

#### ***For example:***

*If you are pouring a solvent from one container to another, the risks are from splashes in the eyes and on the skin and from breathing in the vapour. Therefore you should probably wear eye protection, gloves and respiratory protection.*



## **Storage**

Hazardous materials need to be stored correctly to prevent fire and explosion. This means:

- having special storage areas for some materials
- not storing some materials together
- taking certain precautions when in or around storage areas.

The general rules for storing hazardous materials are:

- All hazardous materials must be stored in a cool, dry, well-ventilated place and secure from the possibility of physical damage. All containers should be stored off the floor and out of direct sunlight. Containers should be stored at a convenient height for handling.
- An inventory (list) of all the hazardous materials and the amounts held should be maintained and kept in a readily accessible location. One reason for this is so that you always know what materials are on site in case of an emergency. This list should also include details of the suppliers.
- Depending on how easy it is to get hazardous materials from your suppliers, minimum stocks of materials should be held on site.
- All containers must be clearly labelled at all times with enough information required for the safe use of the material they contain.

- There should be regular examinations of stored hazardous materials for signs of leakage, reaction and expired shelf life. Spillage kits should be provided and training given on how a spillage should be dealt with.
- Highly toxic chemicals should be locked away and in unbreakable chemically resistant containers.
- Eating, drinking, smoking and storage of food should not be allowed in areas where hazardous materials are stored or used.
- Access to the hazardous materials should be limited to as few people as practical.

For some materials, special precautions need to be taken. This section discusses the storage for various types of hazardous materials.

### **Separation of hazardous materials**

Some materials are incompatible which means they react in combination with others at ordinary temperatures. They may cause an explosion, produce large amounts of heat or produce a toxic gas. Therefore incompatible materials must be kept apart from one another so that they do not mix in the case of a spillage.

We discussed classes of dangerous goods in Section 1.2. The following table shows which of these classes may be stored together and which ones can't.

To use the table, pick two classes of dangerous goods. Find the first class on the top line of class numbers, and the second class in the column on the left-hand side of the table. Read the code at the intersection of the line and column.



Class	2.1	2.2	3.1	3.2 3.3 3.4	4.1	4.2	4.3	5.1	5.2	6.1	8	9
2.1	NA	NA	FS	FS	FS	PR	FS	PR	PR	FS	FS	SG
2.2	NA	NA	SG	SG	SG	FS	SG	SG	FA	SG	SG	SG
3.1	FS	SG	NA	NA	FS	FS	FS	PR	PR	FS	SG	SG
3.2 3.3 3.4	FS	SG	NA	NA	SG	FS	FS	PR	PR	FS	SG	SG
4.1	FS	SG	FS	SG	NA	FS	FS	PR	PR	FS	SG	SG
4.2	PR	FS	FS	FS	FS	NA	FS	PR	PR	FS	SG	SG
4.3	FS	SG	FS	FS	FS	FS	NA	PR	PR	FS	FS	SG
5.1	PR	SG	PR	PR	PR	PR	PR	NA	FS	FS	FS	FS
5.2	PR	FS	PR	PR	PR	PR	PR	FS	NA	PR	FS	FS
6.1	FS	SG	FS	FS	FS	FS	FS	FS	PR	NA	SG	SG
8	FS	SG	SG	SG	SG	SG	FS	FS	FS	SG	NA	SG
9	SG	SG	SG	SG	SG	SG	SG	FS	FS	SG	SG	NA

### ***Keys to the codes***

**NA:** the two classes may be stored in the same area.

**SG:** the two classes of chemicals must be kept apart from each other by a distance of at least three metres.

**FS:** the two classes must be fire separated (must not be stored closely together).

**PR:** the two classes must not be in the same storage area. Also, they must not be stored in adjoining areas that are attached to each other. The two classes must be stored in separate areas at least 10 m apart.

### ***For example:***

*If you wanted to store a Class 3.1 material (flammable liquid) and a Class 4.3 material (flammable substance if wetted) you can see from the table that the code is FS, which means the two classes must be fire separated.*

*Or, if you wanted to store a Class 4.1 material (flammable solid) and a Class 2.2 material (non-flammable non-toxic gas) you can see from the table that the code is SG which means the two classes of chemicals must be kept apart from each other by a distance of at least 3 m.*

## Storage of flammable materials

Most solvents such as benzene, kerosene and methylated spirit are flammable and many are **very** flammable. The fire hazard of these materials is a common hazard. The liquids and especially the vapours must be kept away from sources of ignition such as flames, sparks and hot surfaces. The build-up of vapour in small spaces can lead to an explosion.

The hazards of flammable chemicals can be reduced by safe storage and handling.

For safety reasons, only small amounts of flammable liquids (up to 50 L) should be kept in the workshop. The containers should be kept in fire-resistant metal cabinets or chests.

Large amounts of flammable liquids should be stored outside the workshop in a properly designed fire-resistant and licensed store.

- There should be no sources of ignition in the store.
- There should be no smoking in and around the store.
- Containers must be kept closed at all times to stop the vapour building up in the store.
- The store should be ventilated to allow fresh air to flow through to prevent the build-up of vapour.
- There should be a portable fire extinguisher in the store.

## Storage of unstable materials

Some materials can explode if heated or subjected to mechanical shock. Common examples are acetylene and metal acetylides, azides, azo and diazo compounds, chlorates and perchlorates, highly nitrated organic compounds, nitrogen halides, organic peroxides, and organic salts of per-acids. You probably won't come across many of these materials in the workshop; however, it is something to be aware of.

Where it is necessary to carry out work with potentially explosive substances, the quantities used should be kept to a minimum. As little as 0.1 g can do serious damage.

A lot of care must be taken with the storage of potentially explosive materials. They must be stored away from flammable materials and sources of heat and in such quantities and in such locations that if there were an explosion, the minimum structural damage and/or personal injury would be likely to occur.

## **Storage of gas cylinders**

With any gas cylinder there is a risk of explosion in the event of fire. For this reason, the size and number of gas cylinders in the workshop should be kept to a minimum at all times. All other cylinders should be kept in a store or bay away from flames, direct sunlight and sources of heat. The cylinders should be securely chained to the walls of the store or bay to prevent them from falling over.

Some of the more important guidelines for the safe storage of gas cylinders are as follows:

- Cylinders of flammable or toxic gases should be kept outside the building (but not indirect sunlight) and the gas piped to the point of use.
- Cylinders not in use or empty should be returned to the store and rechained to the wall.
- Cylinders (full or empty) must be firmly strapped to a wall or bench and must be transported around site only on special cylinder trolleys.
- Cylinders containing "permanent" gases, such as oxygen or hydrogen, can be stored or used in either the horizontal or the vertical position. They should be used only with an appropriate pressure regulator.
- Cylinders containing "liquefiable" gases, such as, ammonia or chlorine, should be stored or used only in the upright position.
- Cylinders containing dissolved gases, like acetylene in acetone, should always be stored or used in the upright position.
- Leaking cylinders should be returned to store immediately with a warning label attached.

**Now complete the activity on the next page.**



### Activity 3

1. What are the two main reasons why hazardous materials should be handled and stored correctly?
2. Where can you find information on how to handle a material safely?
3. If you are using a hazardous material and the label says “irritating to skin and eyes” what precautions would you take?
4. Why can’t some hazardous materials be stored together?
5. When storing flammable liquids, what precautions should be taken?
6. What are some basic precautions that you should take when storing gas cylinders?

***Compare your answers with those on the next page.***



### Activity 3 Answers

1. The two main reasons why hazardous materials should be handled and stored correctly is:
  - To prevent exposure to the material
  - To prevent fire and explosion.
2. Labels and Material Safety Data Sheets are where you can find information on how to handle a material safely.
3. If a material is irritating to skin and eyes, that means you don't want to get it splashed in your eyes or on your skin. Therefore you should wear eye protection and gloves.
4. Some hazardous materials can't be stored together if they are incompatible. This means they react in combination with others at ordinary temperatures.
5. Flammable liquids should be stored in a properly designed fire-resistant and licensed store.
  - There should be no sources of ignition in the store.
  - There should be no smoking in and around the store.
  - Containers must be kept closed at all times to stop the vapour building up in the store.
  - The store should be ventilated to allow fresh air to flow through to prevent the build-up of vapour.
  - There should be a portable fire extinguisher in the store.
6. Gas cylinders should be kept in a store or bay away from flames, direct sunlight and sources of heat. The cylinders should be securely chained to the walls of the store or bay to prevent them from falling over.

**If you didn't answer all the questions correctly then read the sections again before going to Section 3.**



## Section 3



### What to do in case of emergencies

The purpose of this section is to tell you the basic things to do if an accident or emergency happens. This will not tell you everything you will need to know.

As a teacher, your job is to keep yourself, your students and your colleagues safe until help arrives.

The most important things to do in an accident and emergency are:



#### Do

- Keep yourself safe
- Keep calm
- Remember what you have learned
- Act quickly



#### Don't

- Panic!

In nearly all cases of an accident or emergency you will need to:

- Move everybody out of the area and to the assembly points, using the evacuation procedure.
- Get professional help, such as the fire service and ambulance service.
- Do what you can to help any injured people.
- Get responsible people to wait at a safe distance outside the area to keep unauthorised people away and direct the emergency services.
- If possible, use brightly coloured notices and tape to form barriers at places where people could get into the area.

When professional help arrives, your job is to give them as much information about the accident or emergency as possible. And follow the instructions they give you.



## Fire/explosion

In the case of a fire or explosion, the emergency services will need to be called. It is important to warn the fire service what hazardous materials are involved so that they can be prepared.

Material Safety Data Sheets (MSDS) contain information about what to do in the case of an emergency when dealing with specific hazardous materials. This is one of the reasons why it is important to have MSDSs for all the hazardous substances you have on site. They contain useful information for the fire service such as the Hazchem code, type of extinguishers to use, precautions to take and protective clothing that should be worn.

## Spills

In the case of a spill it should be cleaned up immediately if possible. Special spill kits should be kept for this purpose. Again MSDSs have information on what to do in the case of a spill.

Emergency spillage procedures should be drawn up and these should be known and understood by everyone who may have to deal with a spillage.

The procedures should cover:

- clearing everyone from the area of the spill
- no smoking
- no flames
- arrangements for first aid
- appointing someone to keep all people and traffic away
- alerting someone else in charge
- alerting the emergency services in the case of large spills
- requesting advice from qualified personnel on cleaning up a spill

### General procedure for spills

- Wear correct personal protective clothing and equipment.
- Attend to any persons who may have been contaminated.
- Notify persons in the immediate area about the spill.
- Evacuate non-essential personnel from the spill area



If you are cleaning up a small spill yourself, make sure that you are aware of hazards associated with the materials spilled. Make sure to have adequate ventilation (open windows, chemical fumehood on) and proper personal protective clothing equipment. **Chemical spills should only be cleaned up by knowledgeable and experience personnel.**

If the spill material is flammable, turn off ignition and heat sources.



#### Activity 4

1. If you have a large spill what are some of the things that you should do?
2. Where can you find some information on how to handle a spill for a particular material?
3. If the spill was a flammable material – what is one of the most important precautions you should take?
4. If there was a fire and you had to call the fire service, why do you think it is important that you tell them what material/s caused the fire?

***Compare your answers with those on the following page.***



### Activity 4 Answers

1. If you had a spill, the procedures you should cover are:
  - clearing everyone from the area of the spill
  - no smoking
  - no flames
  - arrangements for first aid
  - appointing someone to keep all people and traffic away
  - alerting someone else in charge
  - alerting the emergency services in the case of large spills
  - requesting advice from qualified personnel on cleaning up a spill
2. You can find information on how to handle a spill from the Material Safety Data Sheet.
3. If the spill was a flammable material – the most important precaution you should take is to keep any sources of ignition away from the spill area. Otherwise you could have a bigger emergency on your hands with a fire.
4. It is important that you tell the fire service what material/s caused the fire so they can prepare. There are different extinguishing methods for certain materials and they may need to wear special protective clothing and equipment. They also need to know in case there is a risk of explosion.

**If you didn't answer all the questions correctly then read the sections again.**



## Assignment No. 8.2-1

### Unit 8.2 Hazardous materials

You are now required to do the Assignment 8.2 – 1 that will be found at the end of this unit or distributed by your tutor.



## Assignment No. 8.2-1

To be completed and returned to your Tutor for assessment.

This is an Open Book assignment and you may refer to whatever resources you have at your disposal.

Name: \_\_\_\_\_ Due Date: \_\_\_\_\_

### Question 1

What are hazardous materials?

*1 mark*

### Question 2

Using a tick (✓) mark, check the items listed below that are hazardous materials.

- 2.1    ☐    acid
- 2.2    ☐    electric drill
- 2.3    ☐    welding fume produced during welding
- 2.4    ☐    piece of wood
- 2.5    ☐    wood dust produced during sawing
- 2.6    ☐    solvent

*1 mark each – 6 marks*

**Question 3**

What are the 6 main hazard categories that hazardous materials can be classified under?

3.1 \_\_\_\_\_

3.2 \_\_\_\_\_

3.3 \_\_\_\_\_

3.4 \_\_\_\_\_

3.5 \_\_\_\_\_

3.6 \_\_\_\_\_

***1 mark each – 6 marks***

**Question 4**

What are the 3 pieces of information that a label tells you?

4.1 \_\_\_\_\_

4.2 \_\_\_\_\_

4.3 \_\_\_\_\_

***1 mark each – 3 marks***

**Question 5**

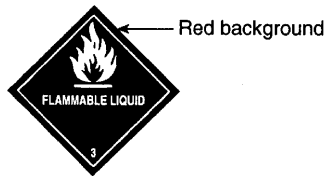
What is a Material Safety Data Sheet (MSDS)?

***1 mark - 1***

**Question 6**

What do the following signs tell you?

6.1



6.2



***2 marks each – 4***

**Question 7**

What are the 2 main reasons why hazardous materials need to be stored and handled correctly?

7.1 \_\_\_\_\_

7.2 \_\_\_\_\_

***1 mark each - 2***

**Question 8**

Attached at the end of this assignment is an example of a Material Safety Data Sheet (MSDS) for Material X.

8.1 From the MSDS, what are the health risks of using Material X?

***4 marks***

8.2 When storing Material X, what precautions are you going to take?

***5 marks***

8.3 What precautions are you going to take when you are handling Material X?

***5 marks***

8.4 In your store you have a container of hydrogen peroxide, which is classified as a Class 5 Dangerous Good. Is it safe to store Material X next to the hydrogen peroxide?

***1 mark***

8.5 If you accidentally spill Material X on yourself, what would you do?

***1 mark***

8.6 If there was a spill of Material X, what would you do?

***5 marks***

8.7 If there was a large fire involving Material X, what would you do?

***5 marks***

8.8 If it was a small fire, what type of fire extinguisher would you use?

***1 mark***

***Total: 50 marks***

**MATERIAL SAFETY DATA SHEET**

Company: ABC Ltd  
Address: 123 Practice St, PO Box 456,  
SOMEWHERE  
Telephone number: 123 4567  
Emergency telephone number: 765 4321

**PRODUCT IDENTIFICATION**

Product Name: Material X  
Other Names:  
Manufacturers Product Code: MatX  
UN Number: 2468  
Dangerous Goods Class: Class 3  
Hazchem Code: 2[Y]E  
Use: xxxxxxxxxxxxxxxxxxxx

**Physical Description/Properties**

Appearance: clear, colourless liquid with  
aromatic odour  
Boiling Point/Melting Point: xxx °C  
Vapour Pressure: xxx mm of Hg at 25°C  
Specific Gravity: xxx  
Flashpoint: xxx °C  
Flammability Limits: xxx %  
Solubility in Water: xxx g/L

**Ingredients**

Chemical Name	CAS Number	Proportion (%)
Material X	987-65-4	99%
Other	567-89-4	1%



## HEALTH HAZARD INFORMATION

### Health Effects

#### **Acute exposure**

##### Inhalation:

May cause irritation of the upper respiratory tract. Symptoms of over-exposure may include fatigue, confusion, headache, dizziness and drowsiness. Peculiar skin sensations (e.g. pins and needles) or numbness may be produced. Very high concentrations may cause unconsciousness and death.

##### Ingestion:

Swallowing may cause abdominal spasms and other symptoms that parallel over-exposure from inhalation. Aspiration of material into the lungs can cause chemical pneumonitis, which may be fatal.

##### Skin Contact:

Causes irritation. May be absorbed through skin.

##### Eye Contact:

Causes severe eye irritation with redness and pain.

#### **Chronic Exposure**

Reports of chronic poisoning describe anaemia, decreased blood cell count and bone marrow hypoplasia. Liver and kidney damage may occur. Repeated or prolonged contact has a defatting action, causing drying, redness, and dermatitis. Exposure to material X may affect the developing foetus. Harmful by inhalation; at 10 ppm may cause headaches and dizziness, 250-500 ppm difficulty in breathing, 500 pm unconsciousness leading to death after 30 minutes.

#### **First aid**

##### Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. CALL A DOCTOR IMMEDIATELY.

##### Ingestion:

Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately. If vomiting occurs, keep head below hips to prevent aspiration into lungs.

##### Skin contact:

In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a doctor immediately.

##### Eye contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

## PRECAUTIONS FOR USE

### Exposure standards:

Material X 40 ppm

### Engineering controls:

Use only in a well ventilated area.

A system of local and/or general exhaust is recommended to keep exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area.

### Personal protection:

If the exposure limit is exceeded, a half-face organic vapour respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapour respirator may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin protection: Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye protection: Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

### Flammability:

Highly flammable.

Use in a well-ventilated area.

Keep away from sources of ignition.

## SAFE HANDLING INFORMATION

### Storage and transport:

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any fire hazards. Outside or detached storage is preferred. Separate from incompatibles including heat, flame, strong oxidisers, nitric and sulphuric acids, and chlorine. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be “No Smoking areas”. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapours, liquid); observe all warnings and precautions listed for the product.

**Spills and disposal:**

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified above. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e.g., vermiculite, dry sand, earth), and place in a chemical waste container.

Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapours, to protect personnel attempting to stop leak, and to flush spills away from exposures.

**Fire/explosion hazard**Fire:

Flammable liquid and vapour!

Flammable limits in air % by volume: lel: 3.3; uel: 19

Dangerous fire hazard when exposed to heat or flame. Vapours can flow along surfaces to distant ignition source and flash back.

Explosion:

Above flash point, vapour-air mixtures are explosive within flammable limits noted above. Contact with strong oxidisers may cause fire or explosion. Sensitive to static discharge.

Fire extinguishing media:

Dry chemical, foam or carbon dioxide. Water may be used to flush spills away from exposures and to dilute spills to non-flammable mixtures.

Special information:

In the event of a fire, wear full protective clothing and approved self-contained breathing apparatus with full face piece operated in positive pressure mode. Water spray may be used to keep fire-exposed containers cool.