



Self-Teach Training Program

WHMIS

**Workplace Hazardous Materials
Information System**

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1 Introduction

I Want to Know

WHMIS is for you - the person who works around hazardous materials like compressed gases, paints, cleaning products, fuels or solvents.

It's designed to keep you safe by providing you with information. Before you work with any chemical product, you want to know:



The next chapters start with stories of Canadian workers who were injured or killed in situations where WHMIS information could have made a difference.



Jeff
Chapter 2

"It felt like a hundred years ... but I knew it was only about ten seconds."



Kellie
Chapter 3

"It absolutely limits my ability to work out the way I want to and play sports the way I want to."



Miriam
Chapter 4

"She was a great worker and she was just trying to make a good impression on everyone."



Chandra
Chapter 5

"Then he took the bottle and left, and I just wish I could tell him not to."



Barry
Chapter 6

"I went back ... and knelt down and looked into the pipe, and ... it blew up in my face."

Laws to Protect You

WHMIS protects you from the hazards of chemical products by making sure you have the information and training you need to work safely.

Workplace Hazardous Materials Information System = **WHMIS**

WHMIS requirements are set out in the federal Hazardous Products Act and Regulations, administered by Health Canada. Each province and territory also has its own WHMIS legislation.

Hazardous Products Act and Regulations = **HPA HPR**

WHMIS is based on the Globally Harmonized System, developed by the United Nations to help standardize hazard communication around the world.

Globally Harmonized System = **GHS**

Q

What is the complete name for GHS?
(Check the glossary, which starts on page 67.)

- Globally Harmonized System for Health and Safety
- Globally Harmonized System for Classification and Labelling of Chemicals
- Globally Harmonized System for Chemical Safety in the Workplace

The correct answer is at the back of the book in case you need to check.



Your Self-Teach Manual

This is your copy of the WHMIS self-teach manual, so feel free to underline or highlight important points or make notes in the margin.

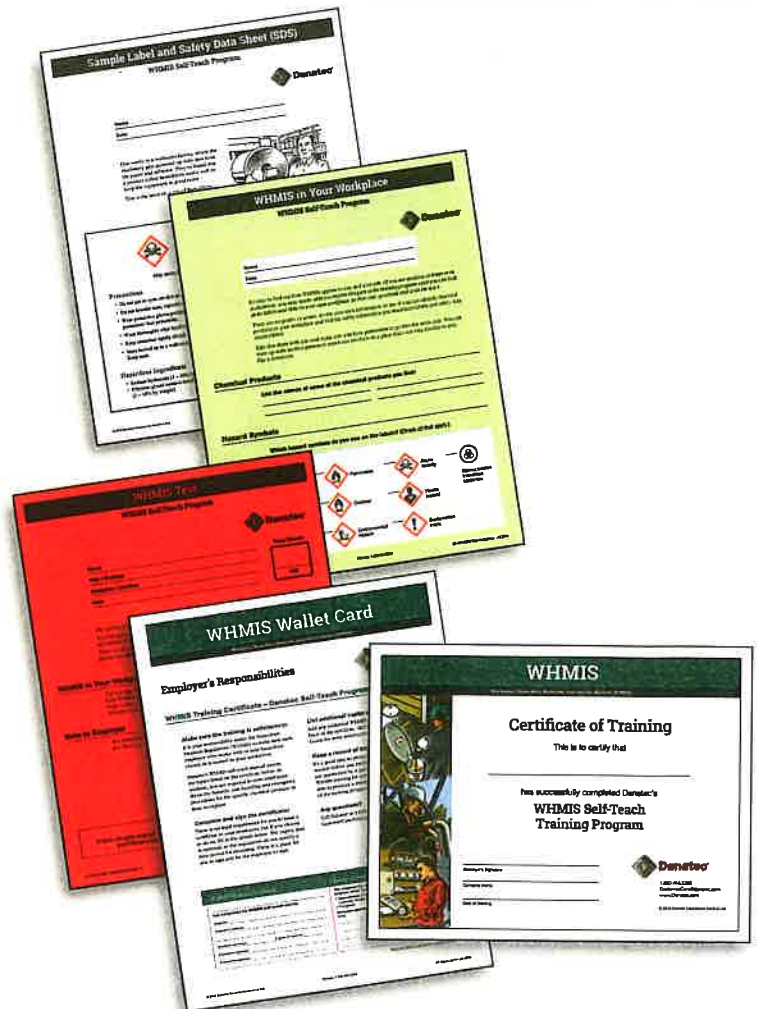
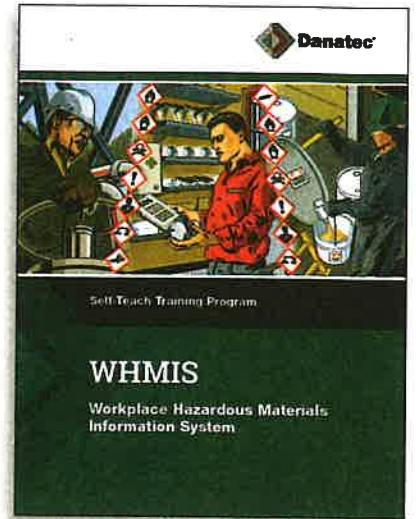
The glossary at the back will be a handy reference when you run across an unfamiliar term on a label or a safety data sheet.

Check to make sure you have these materials in the front pocket:

- a WHMIS poster
- a sample label and safety data sheet
- *WHMIS in Your Workplace*

Your employer might have removed the following items to give to you later but if not, they'll be in the front pocket:

- a test
- a wallet card
- a wall certificate



Here's how to get the most benefit from this program:

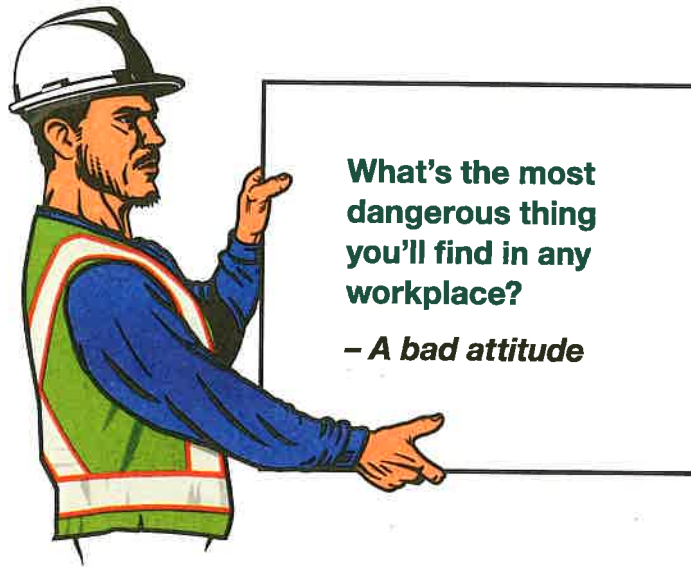
1. Read the manual, answering the questions as you go.
2. Do the practical exercise called *WHMIS in Your Workplace*.
3. Complete the test and hand it in to be marked.
4. Learn more about the chemical products in your workplace – ask questions.

If you're reading this manual by yourself, try to set aside time to work with no distractions. Or you might be using it in a small group or a classroom, where you can discuss the information with your co-workers.

Before you take the test, you'll be asked to use *WHMIS in Your Workplace* to go into your work area, identify chemical products and look for specific information on the labels and matching safety data sheets.

The **test** will not be difficult if you've answered the questions in the manual as you go. It's an "open book" test so you'll be able to refer to all your course materials.

If this is your introduction to WHMIS it might take two or three hours to complete the manual, the practical exercises and the test.



2 Where can I get information about this product?

Jeff (based on a true story)

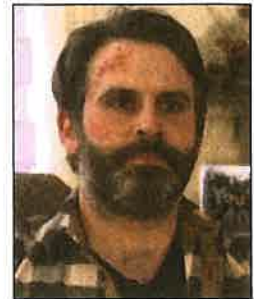
Jeff Aaronson was a machine operator who was seriously burned when he spilled sodium chlorate on his face and arm. His friend Brad still works at the plant.

Jeff: Brad and I have worked together for 20 years. We started at the plant right after high school. We played hockey, went quadding, and our families hung out together all the time. We were very close.

Brad: A year ago we got a new safety manager who was on a “green” crusade. He got rid of some of the toxic chemicals we used and brought in products that were environmentally friendly. Trouble was, some of them didn’t work so well, especially the new purging compound we had to use to clean the extruders whenever we changed colours or materials.

Jeff: Brad and I decided to keep some of the old stuff and use it to clean our machines if we could do it without getting caught.

The sodium chlorate that Jeff and Brad hid in the furnace room had become unstable after being stored for too long at a warm temperature. Some of the chemical leaked from the container and soaked into the wooden shelves.



Jeff: It was just after Christmas and we had to change the line, so I went to get our old stash of sodium chlorate out of the furnace room. I grabbed it and the container was really slippery – I guess because it had been leaking for a while. It spilled on my face, all down my arm and onto my hand. I dropped it and everything burst into flames.

Brad: I was working on my machine and I heard a crash, and when I turned around I saw Jeff running out of the furnace room and his arm was completely on fire!

Jeff: It felt like a hundred years before the other guys got the fire out, but I knew it was only about ten seconds. Then the smell bit me right in the face – it was my own burning flesh. And all I could think about was my son, and whether we'd ever be able to play hockey again.

At first, the doctors thought Jeff would recover. However, after a few days his badly burned hand became infected and they had to amputate three of his fingers. His wife Miranda and 12-year-old son Danny have had a tough time adjusting to Jeff's injuries.

Jeff: It's been 3 months since the accident and Brad only came to see me once. Guess he can't handle it. I try to put on a good show at home, but I hate that Miranda has to take care of me – bandage me up and help me clean myself. Danny pretends that everything's still okay but I know it's not. I used to be his super-hero and now I can't even button my own shirt.

– Jeff Aaronson

The fire that started in the furnace room caused extensive damage to the building. A provincial government investigation found the company partially responsible for Jeff's accident, particularly for having wooden shelves in the furnace room.

Jeff's employer was trying to make the workplace safer by using less toxic products. The new safety manager provided comprehensive WHMIS training and computerized the SDSs for all the chemicals in use at the plant. However, a WHMIS program is only effective when everyone does their part to make it work.

Sources of Information about Chemical Products

You learn about chemical safety:

- from **training programs** like this one
- by reading the **label** on a chemical product
- by looking up information on a **safety data sheet**
- by asking your **supervisor** or someone who knows about the product



WHMIS Education and Training

General WHMIS education teaches you about hazards, labels and SDSs, along with your rights and responsibilities. These topics are included in this self-teach manual.

Specific WHMIS training is directly related to your worksite, your job and the hazardous materials you work with. Your employer is responsible for teaching you to use, handle and store these chemical products safely. You'll also learn about other labelling and identification systems, the use of personal protective equipment and safe workplace practices.

You'll need further training or information when:

- you encounter a new chemical product
- you're given a new task or change the way you work with a product
- you switch jobs within the same company

Many employers offer refresher training once a year.

If you change jobs, your new employer is responsible for providing the WHMIS training you need in order to work safely.


Even if you don't work directly with chemicals, you could still be at risk during storage, handling, use or disposal, or in an emergency situation. If so, you also need WHMIS training.

Q Rose is a graphic artist in a large print shop. She spends most of her time in the office but occasionally she needs to walk through the work area to do a press check on one of her print jobs.

Does Rose need WHMIS training?

- a) Yes.
- b) No.
- c) Maybe, if there's a chance she'll be handling the chemicals.

The correct answer is at the back of the book in case you need to check.



WHMIS Pictograms

The pictograms you'll see on containers of chemical products are an immediate indication of the type of hazard. The red-bordered symbols are used around the world as part of GHS, the Globally Harmonized System for Classification and Labelling of Chemicals.

In Chapter 3 you'll learn more about the hazards represented by each symbol.



Compressed gas



Acute toxicity
(fatal or toxic)



Corrosive
*serious eye damage,
skin corrosion,
corrosive to metals*



Health hazard
*carcinogenicity, respiratory
sensitization, reproductive toxicity,
specific target organ toxicity, germ
cell mutagenicity, aspiration hazard*



Explosive
*self-reactive (severe),
organic peroxide (severe)*



Exclamation mark
*irritation (skin or eyes),
skin sensitization, acute toxicity
(harmful), specific target organ
toxicity (drowsiness or dizziness,
or respiratory irritation)*



Flammable
*flammable, self-reactive,
self-heating, pyrophoric,
organic peroxide, emits flammable
gases on contact with water*



Environmental hazard



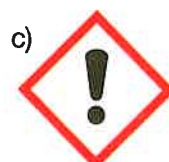
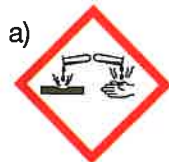
Oxidizer



Biohazardous
infectious material

Q

Which symbol indicates the product could be an irritant?



The correct answer is at the back of the book in case you need to check.



Q

Dan works in a wallpaper factory. Even though they have a good extraction system, there's still a lot of dust from the paper and adhesive. They've found that a product called RemoKleen works well to keep the equipment in good order.

After Dan finishes his WHMIS course he wants to know more about RemoKleen, so first he checks the label.

What do the symbols on the label tell Dan about the hazards of RemoKleen? (Check the RemoKleen label in the front pocket of this manual to find the answer.)

- a) It is corrosive and toxic.
- b) It is explosive and toxic.
- c) It is corrosive and flammable.

The correct answer is at the back of the book in case you need to check.

Supplier Labels


The supplier label gives you quick answers to some of the important questions you need to ask about a chemical product. For example:

- What are the hazards?
- How can I use it safely?
- What should I do if something goes wrong?



Here are the items that appear on a WHMIS label:

- **Product identifier** - the product name that appears at the top of the label and the safety data sheet
- **Pictograms** - one or more
- **Signal word** - “Danger” or “Warning”
- **Hazard statements** - standardized phrases describing the hazards
- **Precautionary statements** - standardized phrases briefly describing how to use the product safely and what to do if something goes wrong
- **Supplier identification** - name, address and phone number

The label could also include supplementary information such as a list of the hazardous ingredients or first aid instructions.

		
<p>Product identifier</p> <p>Signal word</p> <p>Hazard statements</p> <p>Precautionary statements</p> <p>Supplier identification</p>	<p>ACETONE</p> <p>DANGER Highly flammable liquid and vapour. Causes serious eye irritation. Harmful if swallowed or inhaled.</p> <p>PREVENTION Keep away from heat, sparks, open flames and hot surfaces. – No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use explosion-proof electrical, ventilating, and lighting equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Avoid breathing mist, vapours, or spray. Wash thoroughly after handling. Use only outdoors or in a well-ventilated area. Wear gloves, chemical goggles and face shield.</p>	<p>CONTAINS Acetone 100% (CASRN 67-64-1)</p> <p>FIRST AID Skin: Take off immediately all contaminated clothing. Rinse skin with water/shower. Eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists, get medical advice/attention. Ingestion: Do NOT induce vomiting. Get medical aid immediately. Inhalation: Remove person to fresh air and keep comfortable for breathing.</p> <p>FIRE Use dry chemical, CO2, water spray or alcohol-resistant foam to extinguish.</p> <p>STORAGE Store in a well-ventilated place. Keep container tightly closed. Keep cool.</p>
	<p>Sampson Scientific 165 Ascension Drive, Frenton, ON L7L 1M5 1-888-555-1000</p>	

Supplier Label Details

ACETONE			
DANGER Highly flammable liquid and vapour. Causes serious eye irritation. Harmful if swallowed or inhaled.	CONTAINS Acetone 100% (CASRN 67-64-1)	FIRST AID Skin: Take off immediately all contaminated clothing. Rinse skin with water/shower. Eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists, get medical advice/attention. Ingestion: Do NOT induce vomiting. Get medical aid immediately. Inhalation: Remove person to fresh air and keep comfortable for breathing.	
PREVENTION Keep away from heat, sparks, open flames and hot surfaces. – No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use explosion-proof electrical, ventilating, and lighting equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Avoid breathing mist, vapours, or spray. Wash thoroughly after handling. Use only outdoors or in a well-ventilated area. Wear gloves, chemical goggles, and face shield.	FIRE Use dry chemical, CO2, water spray or alcohol-resistant foam to extinguish.		

Product identifier – The product identifier on the label is always exactly the same as the product name used on the safety data sheet, so you can find the matching SDS easily.

Pictograms – The label includes the symbol (or symbols) that identify the type of hazard.

Signal word – Most labels include one of these two signal words:

- **“Danger”** – for more severe hazards
- **“Warning”** – for less severe hazards

Hazard statements – The manufacturer or supplier selects the appropriate phrases from a list in order to describe the hazards of the product. For example:

- **Highly flammable liquid and vapour.**
- **Causes serious eye irritation.**
- **Harmful if swallowed or inhaled.**

These standardized phrases describe what kind of hazards the chemical has, warn you what could happen if it comes in contact with your body, and provide other information about possible harmful effects.

Precautionary statements – The manufacturer or supplier selects the appropriate phrases from a list. For example:

- **Keep container tightly closed.**
- **Avoid breathing mist, vapours or spray.**
- **Wear gloves, chemical goggles and face shield.**
- **If inhaled: Remove person to fresh air and keep comfortable for breathing.**

These standardized phrases describe measures you can take to prevent harm to you and your co-workers. They also provide immediate instructions in case of an emergency.

Supplier identification – The supplier could be the manufacturer, importer or distributor of the product.

The label must include the supplier's:

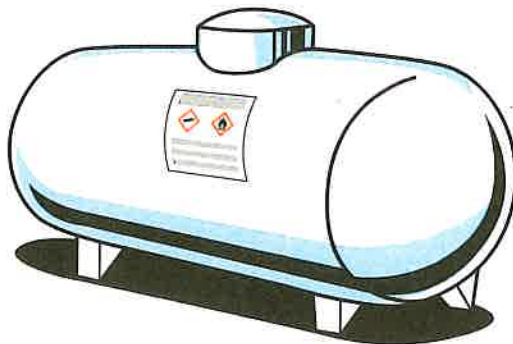
- **Company name**
- **Address**
- **Phone number**

This contact information could be important if you can't find the safety data sheet for a product. In an emergency situation, a first responder can ask the supplier for more details about health hazards, first aid, firefighting, spill cleanup, etc. If some of the chemical ingredients are protected as trade secrets, a medical professional can contact the supplier, who discloses the information in a confidential manner.

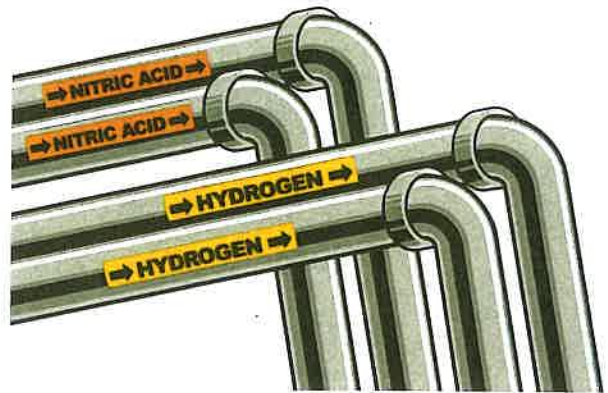
Other Types of Hazard Identification

In some situations your employer might use a different type of hazard identification.

A **sign or placard** on a large container such as a tank or storage vessel may be the best way to warn you about the hazards.



Many facilities use **colour-coding** and other markings to identify the contents of pipes.



WHMIS Labels / TDG Labels

WHMIS pictograms are similar to the Transportation of Dangerous Goods (TDG) labels you see on shipping containers.

WHMIS pictograms always have a white background, and there are no numbers or words inside the border.



WHMIS Pictogram



TDG Label

There might be a situation where the container you use in your workplace is the same one the supplier used to ship the hazardous chemical. A drum is a good example.

The container probably has a Transportation of Dangerous Goods label, along with the shipping name and UN number, as required during transport.



If the TDG label stays on the container, the WHMIS label does not need its own pictogram.

Consumer Products

Consumer products that are packaged for retail sale are covered under the Consumer Packaging and Labelling rules instead of WHMIS even when they're used in the workplace. You must still be informed about the hazards, and if a consumer product is transferred to another container, then WHMIS rules apply.



Toxic



Flammable



Corrosive

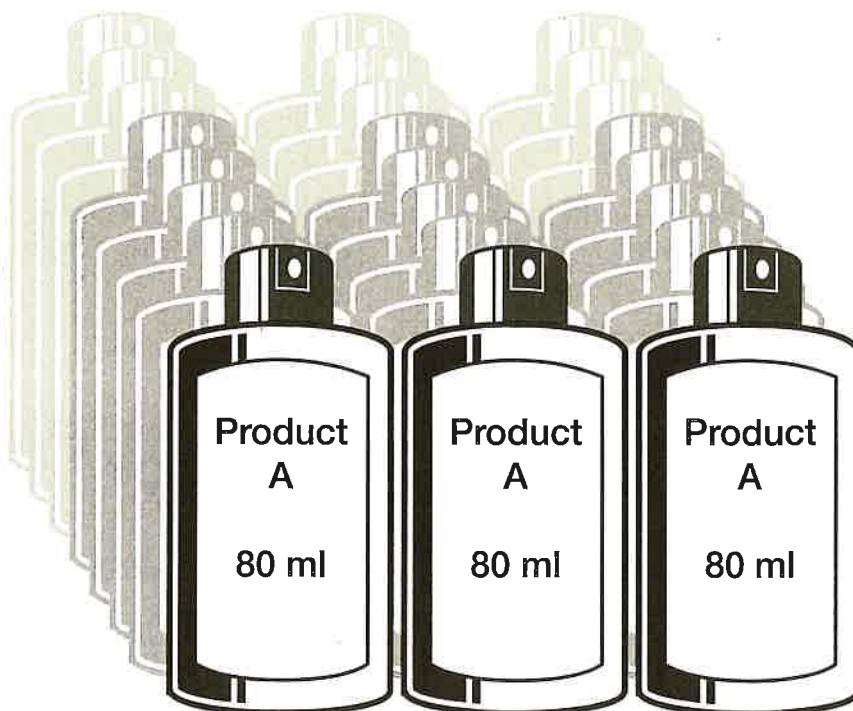


Explosive

Exemptions

In certain cases, different labelling rules apply. There's more information about these exemptions in Chapter 6.

- bulk shipments
- small containers
- laboratory samples
- hazardous waste
- tobacco
- wood
- drugs
- alcoholic beverages



Workplace Labels

Sometimes you might transfer a product from a labelled container to another container in your workplace. For example, you might fill up a 20-litre pail from a 205-litre drum, or you could pour the contents of several 20-litre pails into one drum.

In each case, the new container must have a WHMIS workplace label, which is much simpler than the supplier label.

The requirements for workplace labels vary from province to province, but in general it only requires:

- the name of the product
- safe handling information
- a reference to the SDS for more details



ACETONE	} Name of the product	
Flammable. Irritating to eyes, skin and respiratory tract. Keep away from sources of ignition. Wear gloves, chemical goggles, and face shield.		} Safe handling information (risks and precautions)
See SDS		} A reference to the SDS for more details

If you're the only person using the transferred product and if you are positive you'll finish it up completely before the end of your shift, you're allowed to label the new container with just the product name. But... a complete workplace label is better.

If you're transferring a product for immediate use (for example, to pour the entire contents into a machine), you are not legally required to label the portable container. But... it's a good idea to do it anyway.

You can make a workplace label yourself if a pre-printed one is not handy.

A workplace label can also be used:

- to replace a damaged or missing supplier label
- for a product that is produced and used in your workplace



Safety Data Sheets (SDSs)

Safety data sheets provide very detailed information about the hazardous chemicals in your workplace (a lot more information than you'll find on labels). These technical documents contain important safety instructions about new products as well as ones you've used for years.

Here are the 16 sections of an SDS:

- | | |
|---|-------------------------------------|
| 1. Identification | 9. Physical and chemical properties |
| 2. Hazard identification | 10. Stability and reactivity |
| 3. Composition/information on ingredients | 11. Toxicological information |
| 4. First-aid measures | 12. Ecological information |
| 5. Fire-fighting measures | 13. Disposal considerations |
| 6. Accidental release measures | 14. Transport information |
| 7. Handling and storage | 15. Regulatory information |
| 8. Exposure controls/personal protection | 16. Other information |

Q

Which sections of the SDS would provide you with more detail to help you answer the question,
“What are the hazards of this product?”

- a) 4, 5 and 6 b) 2, 3, 9, 10 and 11 c) 7 and 8

Which sections of the SDS would provide you with more detail to help you answer the question,
“How can I use it safely?”

- a) 4, 5 and 6 b) 2, 3, 9, 10 and 11 c) 7 and 8

Which sections of the SDS would provide you with more detail to help you answer the question,
“What should I do if something goes wrong?”

- a) 4, 5 and 6 b) 2, 3, 9, 10 and 11 c) 7 and 8

The correct answers are at the back of the book in case you need to check.

The 16 sections appear in the same order with the same names on every safety data sheet, making it easy to find the information you're looking for.

1. Identification – The product identifier on the SDS is always exactly the same as the product name used on the label.

Section 1 describes the recommended use of the product and any restrictions on its use. It includes the supplier's name and contact information, as well as an emergency phone number.

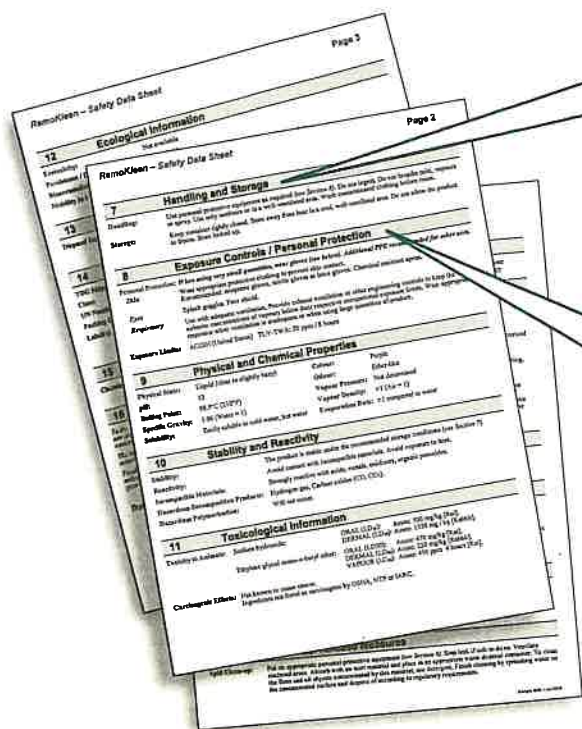
2. Hazard Identification – This is a very important section. You'll find out how the product can harm you, depending on how you are using it and how it enters your body. There's also information about the possible long-term (chronic) effects.

3. Composition / Information on Ingredients – This section tells you if the product is a pure chemical or a mixture, and identifies each ingredient by a Chemical Abstracts Service number.

4. First aid Measures – The instructions are based on the routes of exposure (inhalation, skin contact, eye contact, ingestion). The section also includes symptoms and recommendations.

5. Fire Fighting Measures – This is where you find a description of how the product could ignite or cause a fire, and instructions for the best way to extinguish a fire involving the chemical.

6. Accidental Release Measures – In some SDSs the spill cleanup procedures are separated into small spills and large spills, and they may include instructions for trained emergency responders.



7. Handling and Storage – This section provides recommendations for safe handling practices, such as not eating, drinking or smoking near the product.

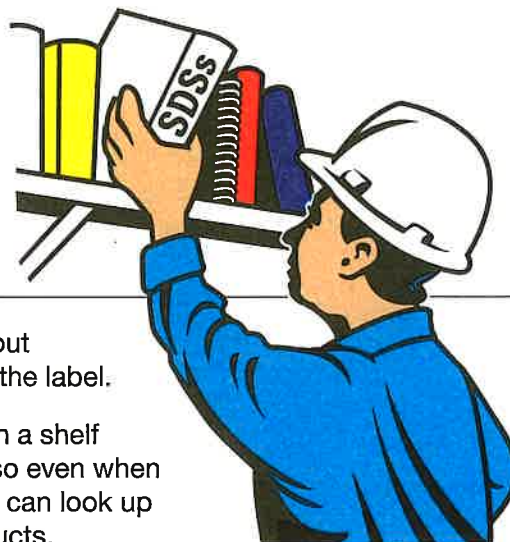
The storage guidelines suggest precautionary measures to help avoid dangers specific to the chemical, such as high temperatures, ignition sources or incompatible products.

8. Exposure Controls / Personal Protection – Here is where you'll find ways to control the hazard before it can harm you.

You can find out how much of the chemical it would take to hurt you, based on permissible exposure limits.

This section will tell you what engineering controls are recommended, such as ventilation.

It also lets you know if you need personal protective equipment. Sometimes the kind of PPE is based on how you intend to use the product.



Q

Dan wants more information about RemoKleen than he can find on the label.

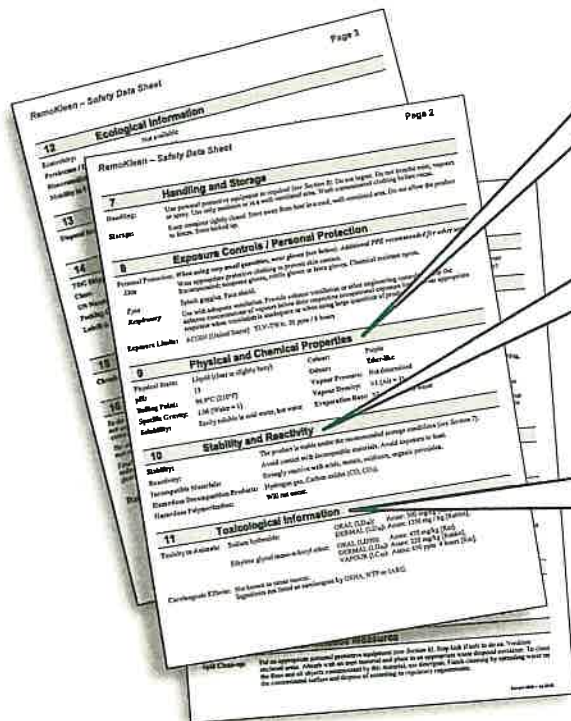
The SDSs are kept in a binder on a shelf outside the supervisor's office, so even when Dan is working the night shift he can look up details about the chemical products.

Which of these hazardous ingredients is found in RemoKleen?

(Check Section 3 of the RemoKleen SDS from the front pocket of your manual to find the answer.)

- a) sulphuric acid
- b) sodium hydroxide
- c) methyl ethyl ketone

The correct answer is at the back of the book in case you need to check.



9. Physical and Chemical Properties – This information can be used by health and safety professionals to determine the best ways to use the product safely.

10. Stability and Reactivity – This section describes conditions that could lead to harmful chemical reactions. It helps to determine the best ways to handle and store the product safely.

11. Toxicological Information – The information in this section expands on the hazards described in Section 2. Much of it is very technical and is intended for health and safety specialists. The toxicity tests are done on laboratory animals, and may not produce the same results in humans. If you have any questions or concerns about the hazards of a chemical product in your workplace, ask your supervisor or employer for more information. You have the **right** to know, and the **responsibility** to protect yourself.

Q **What does RemoKleen smell like?**
(Check Section 9 of your RemoKleen SDS to find out.)

- a) rotten eggs
- b) ether
- c) vinegar

The correct answer is at the back of the book in case you need to check.

Q **Will RemoKleen react with an oxidizer?**
(Check Section 10 of your RemoKleen SDS to find out.)

- a) Yes
- b) No

The correct answer is at the back of the book in case you need to check.

12. Ecological Information – These details are not required on the SDS, but information about the environmental impact of a spill or leak may be included.

13. Disposal Considerations – Besides guidelines for proper disposal, there's often a general statement such as, "Comply with all federal, provincial and municipal requirements."

14. Transport Information – Information in this section is related to shipping the product by road, air, rail or sea, based on the Transportation of Dangerous Goods (TDG) regulations. It will likely include the shipping name, UN number, packing group and label information.

15. Regulatory Information – There may be safety, health and environmental requirements not addressed elsewhere on the SDS.

16. Other Information – Besides the date the SDS was prepared or revised, this section might include a disclaimer, a list of reference sources used to prepare the SDS, or other details.

Q

How is RemoKleen classified under the Transportation of Dangerous Goods Regulations?
(Check Section 14 of the RemoKleen SDS to find out.)

a) Class 8
 b) Class 3
 c) Class 6

The correct answer is at the back of the book in case you need to check.

Your Right to Know

If you've read the label and checked the SDS and still aren't sure about the hazards of the product, how to use it safely, or what to do if something goes wrong – then you need more information.

WHMIS is sometimes called "Right to Know", because it's based on your right to have all the information you need in order to understand the chemical products in your workplace. So if you can't find the answers you're looking for, ask your supervisor.

How WHMIS Can Help Prevent Accidents

Jeff didn't have a copy of the safety data sheet for the sodium chlorate, because his employer thought there wasn't any of the chemical left in the facility. There was no label because it was no longer in its original container.



Sodium Chlorate LABEL – excerpt



Danger

Oxidizing liquid. Acute oral toxicity.
May intensify fire. Harmful if swallowed.
Keep away from heat. Keep away from clothing and other combustible materials.
Take any precaution to avoid mixing with combustibles.
Wear protective gloves, eye protection, face protection. Wash hands and face thoroughly after handling. Do not eat, drink or smoke when using this product.

Sodium Chlorate SDS – from Section 7 – Handling and Storage

Handling

Wear personal protective equipment. Ensure adequate ventilation. Keep away from clothing and other combustible materials. Wash hands immediately after handling the product.

Storage

Keep in a dry, cool and well-ventilated place. Keep container tightly closed. Do not store near combustible materials.

Wooden pallets should not be used for the storage of chlorates since, in addition to being a combustible material, they may, with continued use, become impregnated with chlorate and themselves become a considerable fire risk and also a potential source of ignition.

Q

What would Jeff have learned if he'd read the label?

(Read the label excerpt on the previous page.)

- a) Sodium chlorate is flammable.
- b) Sodium chlorate is corrosive.
- c) Sodium chlorate is an oxidizer.

The correct answer is at the back of the book in case you need to check.

Q

What would Jeff have learned about handling and storing sodium chlorate if he'd read the safety data sheet?

(Read the SDS excerpt on the previous page.)

- a) Sodium chlorate should be stored in a warm area.
- b) Sodium chlorate can soak into wood and become a fire hazard.
- c) Sodium chlorate should only be stored in metal containers.

The correct answer is at the back of the book in case you need to check.

Jeff: People tend to be careful with new products, but not so careful with the old products that they've been using for years.

– Jeff Aaronson

Brad: The thing that haunts me the most is that Jeff's the one who has to deal with everything. He's the one who's living in hell. I could have been in there myself, if I'd decided to go instead of him. It was a toss-up. I could be him right now.

– Brad Klein

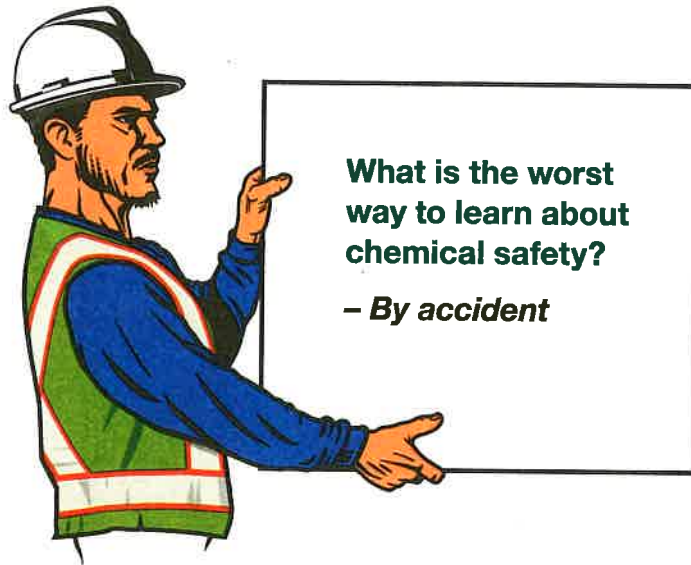


Chapter Summary

Chapter 2 described several sources of information about chemical products:

- education and training
- WHMIS pictograms
- supplier labels
- workplace labels
- safety data sheets

If you've read the label and checked the SDS and still aren't sure about the hazards of the product, how to use it safely, or what to do if something goes wrong - then you need more information. Ask your supervisor.



Notes

3 What are the hazards?

Kellie (a true story)

Kellie Renwick is a kinesiologist who specializes in treating patients with traumatic brain injuries. The chemicals she was exposed to during a summer job several years ago have left her with long-term health problems.

When I was 19 and finished my first year of university, I got a job with a re-surfacing company that did non-slip surfaces for pool decks, playgrounds, porches and so on. It was heavy physical work but I was already strong and fit from playing sports, and the money was good.



Kellie was the mixer on the surfacing crew. Her job was to measure out a portion of recycled rubber shards and dump it into the machine along with a pitcher of industrial glue from a large pail. When it was thoroughly mixed she poured it into buckets and carried it to her co-workers, who spread it onto the surface.



There was no formal safety training when I started. My boss just said to use rubber gloves. It was really hot so I wore shorts and a tank top, and when I got glue on my arms and legs my co-workers told me to put some solvent on a rag and rub it off. The smell of the hot glue and rubber was pretty nauseating.

Kellie had been working 10-hour days for a few weeks when she got sick.

I had some sort of rash, but it didn't seem too serious. I went to bed, woke up about 2 a.m. and it felt like my skin was on fire! It was incredibly itchy, like nothing I'd ever felt before. I started screaming and my mom and dad woke up and drove me to the hospital. On the way I called my boss and asked him the name of whatever chemicals we'd been working with, especially the glue, but he didn't know and couldn't find any paperwork or information.

Without a copy of the safety data sheet or any specific information about the chemicals Kellie had been exposed to, the doctors gave her an anti-inflammatory IV cocktail. Kellie quit her job and never reported the incident or tried to file a claim. Although she asked her employer several times for the safety data sheet, she never received it.

It took a while to get back to normal, and even then I still had outbreaks of the rash whenever it was really hot or when I exercised.

A couple of months after the incident I went for a run and out of nowhere, I was short of breath. I felt my esophagus tightening and it's hard to explain, but kind of like a fluttering and wheezing. I went to the sports medicine doctor at the university and she told me I had exercise-induced asthma.

I believe the exercise-induced asthma that I acquired was because of the chemicals I was working with seven years ago. It absolutely limits my ability to work out the way I want to and play sports the way I want to. If I'm doing sprints for rugby or in the middle of a game, sometimes I'll have a small attack and I have to get off the field.

If I'd read the SDS before working with these chemicals, I probably would have taken better measures to protect myself.

– Kellie Renwick

Understanding Hazards

In order to protect ourselves from both the immediate and long-term dangers of chemical products, it helps to understand how they are divided into various classes represented by the pictograms. In WHMIS, these classes are separated into two major groups - physical hazards and health hazards.

Physical hazards are dangerous because they could cause damage through fire or explosion. They include flammables, combustibles, oxidizers, and compressed gases.

Health hazards pose a wide variety of threats from minor irritation like a skin rash, to life-threatening diseases such as cancer. They include all the chemicals classified under acute toxicity, health hazards and irritants.

Physical hazards



Health hazards



In order to understand the hazards of these products, it's not enough just to know if they're flammable, poisonous, corrosive, etc. You really need to understand:

- how chemicals can enter your body
- what health effects they can produce when you are exposed to them
- how the type and length of exposure can affect your health



Routes of Entry

A product can affect you in different ways, depending on how you come into contact with it – by inhaling it, getting it on your skin, in your eyes or in your mouth. The way a chemical gets into your body is called its “route of entry”.

Inhalation

The most common way for chemicals to enter your body is by inhalation. Breathing in gases, vapours, mist, dust, fumes or smoke can be a serious workplace hazard.

Skin contact

Chemicals can also get into your body through your skin.

If it's **surface damage**, the injury might be immediate and visible, like a rash or a burn.

If the chemicals are **absorbed through your skin**, you might not see anything on the surface, but they can travel through your bloodstream and cause damage a long way from the point of contact – like your liver or kidneys.

It's also possible to get chemicals into your body if your skin is pierced by the sharp edge of a contaminated object or a piece of equipment. Health care workers are often at risk of **accidental injection** by needles.

Eye contact

Your eyes are especially sensitive and vulnerable. Some products can react with the moisture in your eyes and cause a lot of damage. Getting mineral spirits on your skin, for example, isn't very serious, but getting it in your eyes is really painful.

Ingestion

Even though you're not likely to eat or drink these chemicals on purpose, you can still swallow a hazardous substance by eating or smoking when your hands are contaminated, or by accidentally drinking a harmful product.



Health Effects

Products such as corrosive materials can cause severe **burns** or can **irritate** your eyes, skin or lungs.

Others, such as acetylene, can interfere with your **nervous system** or your **ability to think clearly**.

Gases such as carbon dioxide seem to be harmless but if they're released in a small space they can **displace oxygen** in the air and stop you from breathing.

Some chemicals may not bother you at first, but then begin to cause a reaction after you've been using them for a while. These are called **sensitizers**.

Chemicals like arsenic and mercury can **poison** your liver, brain or other organs. They can damage your blood or nervous system. Some fuels and cleaning products also do this.

There are chemicals that cause permanent and even fatal **changes to the cells** of the body, leading to diseases such as cancer. Other chemicals can cause birth defects or affect your ability to have children.

Q

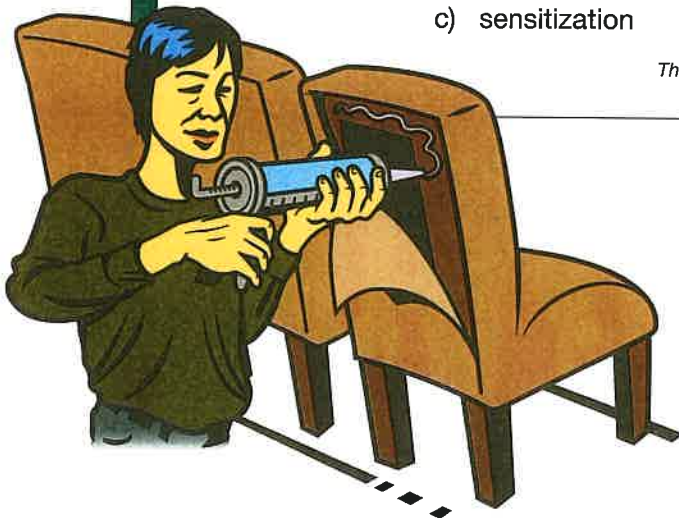
Jason's been working at Eddyville Furniture for a couple of years now, making tables and chairs.

Lately he's noticed that when he uses the upholstery adhesive, he gets a rash and he has trouble breathing. The reaction seems to be getting worse.

What type of health effect is Jason experiencing?

- a) damaged nervous system
- b) cellular changes
- c) sensitization

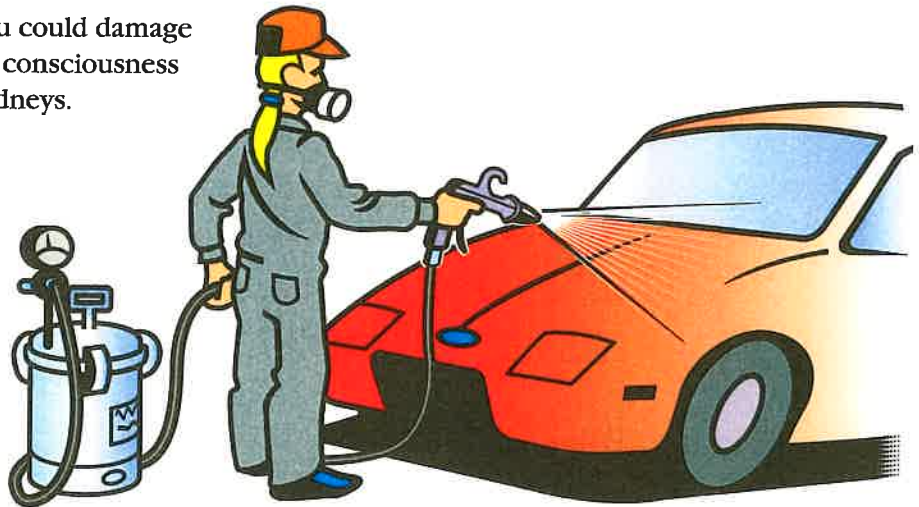
The correct answer is at the back of the book in case you need to check.



Short-term effects

Some chemical products cause immediate harm, called **acute** effects. For example:

- Sulphuric acid will burn your skin or your eyes.
- Hydrogen sulphide, or H₂S, can injure or kill you by interfering with your body's ability to use oxygen.
- If you swallow acetone, you could damage your digestive system, lose consciousness and harm your liver and kidneys.



Long-term effects

If the chemicals take longer to do their damage, the effects are **chronic**. It may be hours, days, years, or even decades before you become aware of any problems.

Multiple effects

One product can have several hazards, different routes of entry and more than one health effect.

Methanol is a good example. Besides being flammable, it's also toxic if it's inhaled or absorbed through your skin. Drinking it could kill you or make you go blind, and possible long-term effects include damage to your central nervous system.

Q

If you are over-exposed to a chemical and a while later, as a result, you experience damage to your central nervous system, what type of health effect is this?

- a) acute
- b) chronic
- c) multiple

The correct answer is at the back of the book in case you need to check.

Pictograms and Their Hazards

The WHMIS symbols are important because they can be the first sign that you're dealing with a hazardous chemical.



FLAMMABLE

Flammable materials can catch fire if they're heated or exposed to a source of ignition under normal working conditions. Some materials may burst into flames spontaneously. Others might release flammable gas as a result of water contact, friction or impact. They include:

- flammables
- pyrophorics
- substances that emit flammable gas on contact with water
- self-heating substances
- self-reactive substances
- organic peroxides



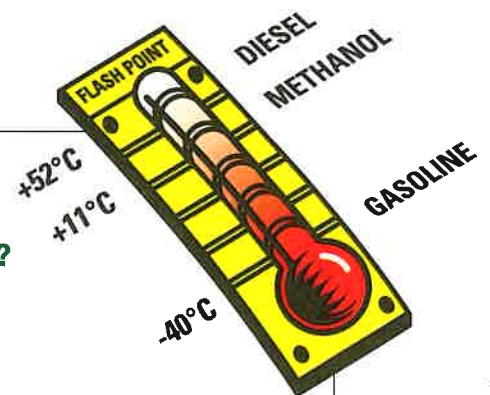
A **flash point** test identifies the lowest temperature at which the vapours given off by the material will ignite if a source of ignition is present. A lower flash point means a higher risk, because the vapours catch fire more easily.

Examples: acetone, toluene



If the flash point of methanol is 11° Celsius, does this mean it's more flammable or less flammable than gasoline?

- Methanol is more flammable than gasoline.
- Methanol is less flammable than gasoline.



The correct answer is at the back of the book in case you need to check.


COMPRESSED GAS


Compressed gas cylinders can explode if they get too hot, or if they're dropped or punctured. If they suddenly release their contents, it could injure the skin or eyes of anyone nearby. For some of these gases, the vapours can be so cold that they cause "freeze burns."



Examples: propane, acetylene, nitrogen, compressed air

Q Many products have more than one hazard. What are the hazards shown by these symbols on a propane label?

 _____

 _____

The correct answer is at the back of the book in case you need to check.

OXIDIZER

Oxidizers are dangerous because they can increase the risk or intensity of a fire by providing lots of readily available oxygen. They pose a more serious hazard when they're used or stored near flammable materials, or close to any source of ignition.





The symbol is a flame supported by an "O", for oxygen.

Examples: hydrogen peroxide, sodium chlorate

Q Terry works at Centennial Hospital and is helping to replace oxygen cylinders in an ambulance.

What hazards do these symbols warn about?

 _____

 _____

The correct answer is at the back of the book in case you need to check.

EXPLOSIVE

Although explosives are not regulated under WHMIS, the explosive pictogram appears with certain self-reactive substances and organic peroxides. These materials require careful storage and handling.

**CORROSIVE**

Materials that are either very **acidic** or very **alkaline** can burn your skin or eyes on contact, causing permanent damage. The vapours can also be harmful.



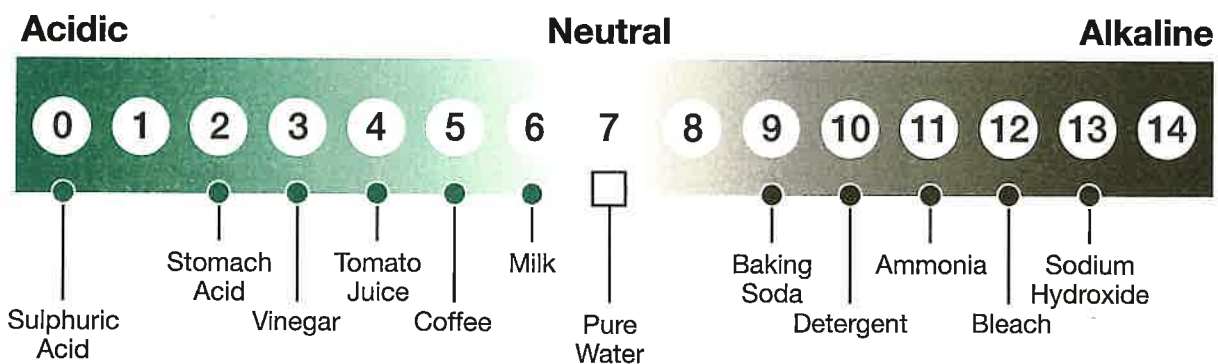
The symbol shows how corrosives can eat through metal as well as flesh.

Examples of acids: battery acid, hydrochloric acid

Examples of alkalis: lime, sodium hydroxide

The pH scale indicates how acidic or alkaline a substance is. A pH of 7 is neutral, so substances further from this central point are more corrosive.

- Substances with a pH less than 7 are acidic. Acidity increases as the pH decreases.
- Substances with a pH greater than 7 are alkaline. Alkalinity increases as the pH increases.



Q

Which substance is more corrosive?

- sulphuric acid
- ammonia

The correct answer is at the back of the book in case you need to check.

ACUTE TOXICITY

The skull and crossbones is used for products we normally think of as poisons. They can cause rapid and serious injury or death, even in small amounts.



Examples: sodium cyanide, hydrogen sulphide

HEALTH HAZARD

This “exploding chest” symbol covers a variety of health hazards, including:

- respiratory sensitizers
- carcinogens
- mutagens
- reproductive toxins
- aspiration toxins
- target organ toxins



The glossary defines all these terms, and you’ll run across several of them on safety data sheets.

You might want more information about specific health hazards. For example, if you’re concerned about your ability to have healthy children, you’ll want to learn about mutagens and reproductive toxins.

Example: benzene, asbestos

Q

If the safety data sheet describes a product in your workplace as a teratogen, what are the potential dangers?

(Look up “teratogen” in the glossary.)

- reduced fertility
- birth defects, miscarriage
- liver and kidney damage

The correct answer is at the back of the book in case you need to check.

EXCLAMATION MARK

Chemical products with this symbol can inflame your eyes or skin, cause allergic reactions such as a rash, damage your health over a long period of time, or cause other health problems. If the toxic effects become more serious with each exposure, the product is a **sensitizer**.



Examples: iodine, methyl methacrylate

BIOHAZARDOUS INFECTIOUS MATERIAL

If you work with biohazardous materials, you'll see the biohazard symbol in a black circle instead of a red diamond.



These materials are not classified under the Globally Harmonized System, but they're still regulated in Canada under WHMIS.

ENVIRONMENTAL HAZARD

Environmental toxins are not regulated under WHMIS.

However, you may see this "dead tree/dead fish" symbol on labels or SDSs, especially for products imported from other countries.



Q

At the wallpaper factory they have to put biocide in one of the machines to keep fungus and bacteria from growing. One day, Dan's co-worker messed up and put in ten times the normal amount of biocide.

Quite a few people got sick, including Dan. He had a bright red rash all over his body. It cleared up but every time he gets near that machine the rash comes back – even though the biocide level is normal.

Which symbol do you think was on the biocide?

a)

b)

c)

The correct answer is at the back of the book in case you need to check.

How WHMIS Can Help Protect Your Health

Kellie's employer didn't provide her with WHMIS training, safety data sheets or personal protective equipment.



Industrial Glue

LABEL – excerpt

Caution

Use in a well-ventilated area and avoid inhalation.

Avoid contact with skin and eyes.

Wear chemical-resistant gloves (butyl rubber, nitrile rubber). Cover as much of the exposed skin as possible with protective clothing. Wear eye protection and face protection. Do not wear contact lenses.

Industrial Glue

SDS – from Section 11 – Toxicological Information

Acute Skin Effects

Isocyanates react with skin protein and moisture and can cause irritation which may include the following symptoms: reddening, swelling, rash, scaling or blistering. Cured material is difficult to remove.

Chronic Inhalation Effects

As a result of previous repeated overexposures or a single large dose, certain individuals develop isocyanate sensitization (chemical asthma) which will cause them to react to a later exposure to isocyanate at levels well below the TLV.

These symptoms, which can include chest tightness, wheezing, coughing, shortness of breath or asthma attack, could be immediate or delayed.

Once sensitized, an individual can experience these symptoms upon exposure to dust, cold air or other irritants. This increased lung sensitivity can either be temporary or permanent.

Q

What would Kellie have learned if she'd read the label on the pail of industrial glue?

- a) If she gets any glue on her skin she should immediately remove it with solvent.
- b) She should wear leather work gloves when handling the product.
- c) She should cover her skin and eyes as much as possible to prevent contact with the product.

The correct answer is at the back of the book in case you need to check.

Q

What would Kellie have learned if she'd read the safety data sheet for the industrial glue she was working with?

- a) The product can cause permanent lung damage.
- b) The product can be easily removed from the skin with a solvent.
- c) Only people who already have asthma are in danger of developing isocyanate sensitization (chemical asthma).

The correct answer is at the back of the book in case you need to check.

*I really wish I had learned all this before I started the job.
I would have been more careful and asked more questions.*

Since this happened I've probably done WHMIS training about 10 times, and I'm a lot more careful around chemicals that I'm working with. I make sure to read the labels and safety data sheets.

If I could give advice to young people, it would be: You have the right to work in a safe work environment. You deserve to be safe and it's not worth it to stay silent.



– Kellie Renwick

Chapter Summary

Chapter 3 provided an overview of the physical and health hazards that might be presented by chemicals in your workplace.

The routes of entry include:

- inhalation
- skin contact
- eye contact
- ingestion (swallowing)

Health effects can be immediate (acute) or can take time to develop (chronic).

The WHMIS pictograms are based on the international Globally Harmonized System (GHS), and include flammables, compressed gases, oxidizers, corrosives, acute toxicity, health hazards, irritants and biohazards.



Notes

4 How can I use it safely?

Miriam (based on a true story)

Miriam Navarro works at a large hotel laundry facility with a state-of-the-art system that delivers most of the detergent, cleaning solutions and bleach directly to each machine.

When we receive the linens we sort them and put them in the washing machines. Sometimes we add extra chemicals for certain loads.

The people here – we're like a family. Everybody works hard and I love the friendly environment.

Thelma was our new employee. She was a great worker and she was just trying to make a good impression on everyone.

Thelma poured one of the chemicals into a container that was already partly full, but she didn't read the labels and didn't realize they were different chemicals. One was acid and one was bleach and combining them created a yellow chlorine gas.



Thelma couldn't help inhaling it and she collapsed on the floor and spilled the chemicals all over herself.

I saw it happen and I ran over to help her but I had trouble breathing and passed out right beside her. When I woke up I found out that eight other people were in the hospital with me and Thelma, all of us sick from inhaling the yellow gas.

The two chemicals were sodium hypochlorite and hydrofluorosilicic acid. When they were mixed together they produced a highly toxic chlorine gas.

In our WHMIS training once a year we learn about the chemicals that we use and what the dangers are. We're taught how to read the labels properly so there won't be any accidents.

When investigators looked into the accident they found that the labels on both products warned about incompatibility.

Although Thelma had some basic WHMIS training and had been told to read the labels, she hadn't attended the annual WHMIS course yet, and her employer hadn't emphasized the danger of mixing these two products.

After the accident, Thelma didn't come back to work because she'd suffered extensive damage to her lungs - I heard she's on permanent disability.

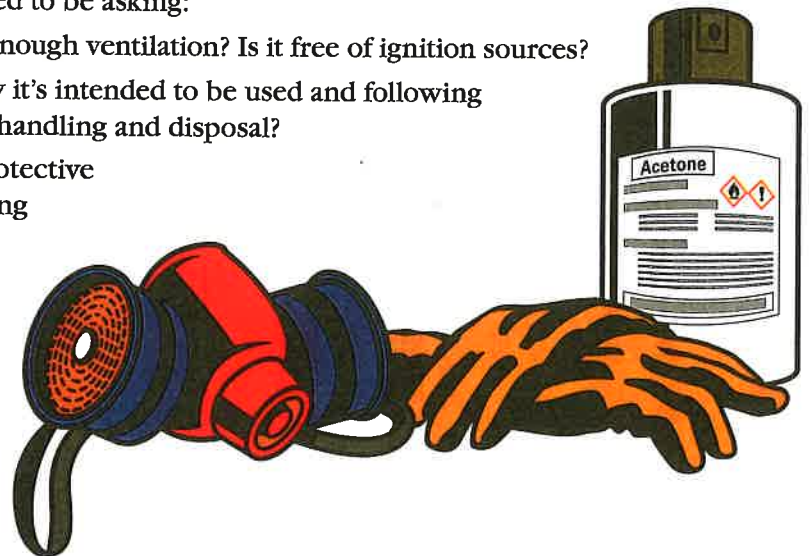
I still sometimes have trouble breathing and I'm way more tired now at the end of the day.

– Miriam Navarro

Controlling the Hazards

Here are some of the questions you need to be asking:

- Is my work area safe? Is there enough ventilation? Is it free of ignition sources?
- Am I using the product the way it's intended to be used and following the guidelines for safe storage, handling and disposal?
- Do I have the right personal protective equipment (PPE) and the training to use it correctly?



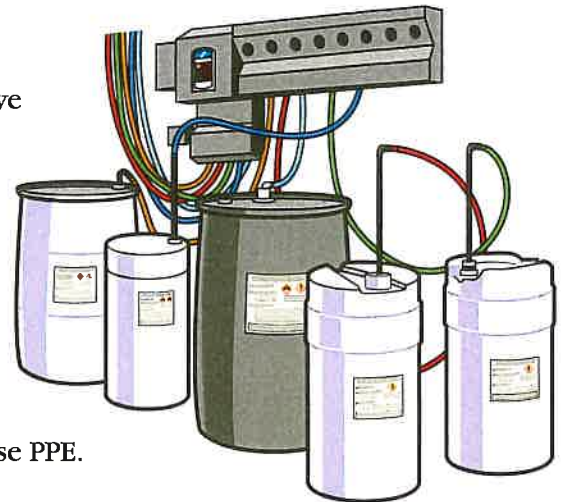
PPE is not always the best solution for protecting yourself against the hazards of chemical products. You and your employer can consider several other options first:

- **elimination** – Do we really have to use this product at all?
- **substitution** – Can we use a safer product instead?
- **engineering controls** – Can we find a safer method, such as improving the ventilation system? At Miriam's laundry facility, most of the detergent, bleach and cleaning agents are piped directly to the washing machines.
- **administration** – Managers can help in different ways, such as having employees rotate jobs to reduce exposure times.

If the product is still hazardous to work with after these solutions have been considered, then good personal protective equipment is necessary as the last line of defence.

Here's another way to look at it. Think in terms of having three opportunities to control each hazard:

1. **at the source** – For example, replace the hazardous product or redesign the work process.
2. **along the path** – For example, install ventilation or put up barriers.
3. **at the user** – For example, limit exposure time or use PPE.



Personal Protective Equipment (PPE)

The label and SDS often suggest what type of PPE you need for that product, based on the routes of entry (*page 26*). If there's not enough information, ask your supervisor.

Make sure you've been trained to use the equipment your employer provides and that it's in good condition.

The type of PPE you need often depends on how you're going to use the product.

Q

The wallpaper factory receives a shipment of new machinery from their main plant in England. Dan helps to install it, and uses RemoKleen to remove a few small spots of grease.

What personal protective equipment should he use?

(Refer to Section 8 of the RemoKleen SDS in the front pocket of this manual.)

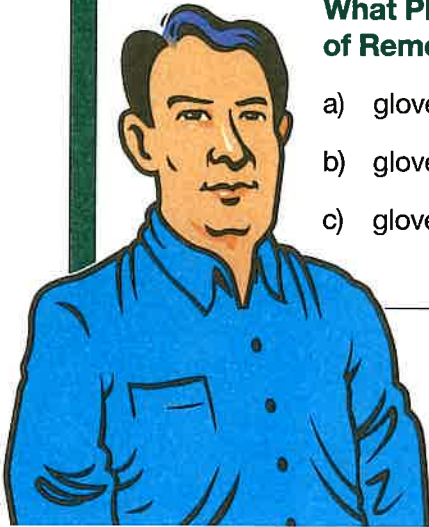
- a) gloves
- b) gloves and goggles
- c) gloves, face shield and respirator

The next day Dan is assigned to clean up the old machinery before it is shipped to a buyer. There's a lot of grease and glue residue so he needs to use large quantities of RemoKleen.

What PPE should Dan use when working with large quantities of RemoKleen? *(Check Section 8 of the RemoKleen SDS.)*

- a) gloves
- b) gloves and goggles
- c) gloves, face shield and respirator

The correct answers are at the back of the book in case you need to check.



Protective clothing

This could be a pair of gloves, an apron, boots or even a full body suit. Make sure they are made from the correct material, and keep in mind that no single material will protect your skin from all types of chemicals.

Eye protection

Depending on the chemical and the kind of work you're doing, you may need different types of eye protection, ranging from safety glasses to a full face shield (or both).

Respiratory protection

Preventing hazardous chemicals from entering your lungs is not a simple matter. There are several types of respirators, filters and cartridges, and each one only protects you against certain chemicals.

Although the SDS includes guidelines for respiratory protection, a qualified person must select the correct respirator, filter and cartridge for you, and must train you to use it properly. Fit is especially important for respirators. For men, even a day's growth of beard might prevent it from fitting properly.

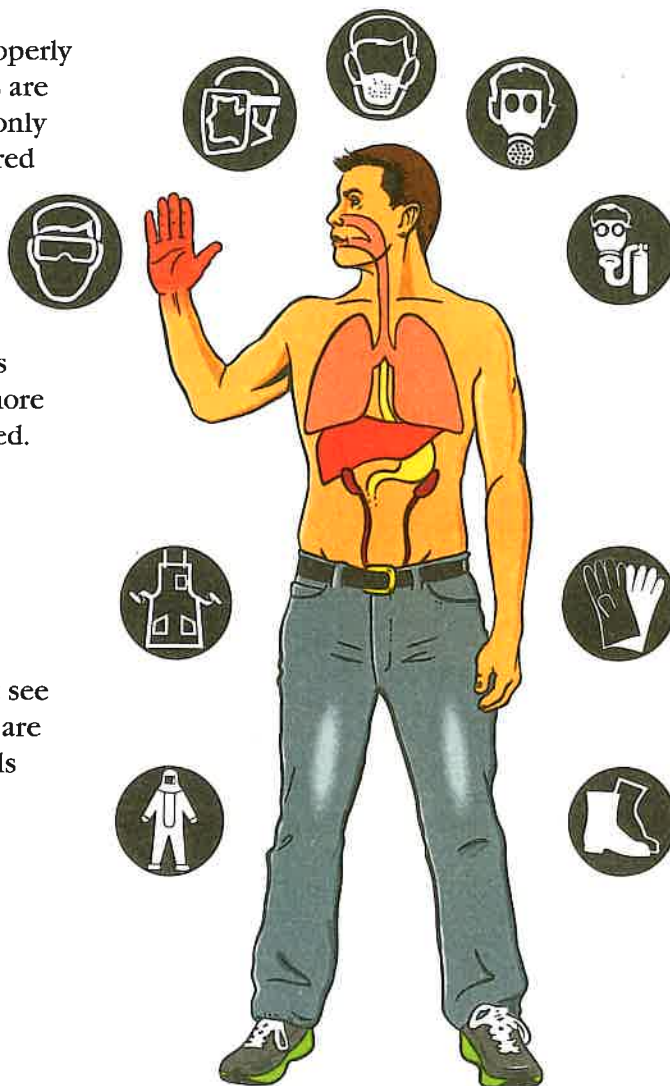
You should make sure the respirator is properly maintained. For example, some cartridges are designed to last for eight hours, so if you only use it for a couple of hours, it must be stored in an airtight container until its next use. If you don't, by the time you need it again the cartridge may not provide adequate protection.

You may be working around dust particles and a dust mask is all you need, but in a more hazardous situation, supplied air is required.

Whatever the circumstances, take a good look at what you need to protect the air you breathe.

PPE symbols

These are examples of symbols you might see for personal protective equipment. There are lots of variations out there and the symbols are not required on labels or SDSs.



Other Considerations for Personal Protection

Degree of harm

If you are over-exposed to a hazardous material, the extent of your injury or illness may depend on many factors, including:

- the quantity and concentration of the chemical
- how long the exposure lasts
- the general state of your health

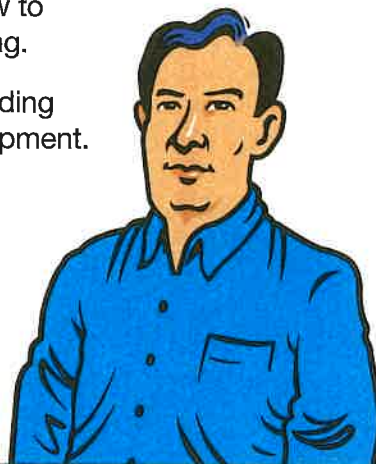
Even your age or the size of your body can be a factor. If you inhale a harmful substance, the degree of damage might be affected by how hard you are breathing and whether you are a smoker.

Pregnancy

If you are pregnant, keep in mind that tiny quantities of a chemical (which might be perfectly safe for you) can harm a fetus.

The caution statements on a WHMIS label tell Dan how to protect himself and what to do if something goes wrong.

They cover a wide range of preventive measures, including general recommendations for personal protective equipment.



RemoKleen DANGER



Toxic if swallowed or inhaled.
Causes severe skin burns and eye damage.

May cause damage to organs through prolonged or repeated exposure.

Precautions

- Do not get in eyes, on skin or clothing.
- Do not breathe mist, vapours or spray.
- Wear protective gloves/protective clothing/eye protection/face protection.
- Wash thoroughly after handling
- Keep container tightly closed.
- Store locked up in a well-ventilated place. Keep cool.

Hazardous Ingredients

- Sodium hydroxide (5 – 10% by weight)
- Ethylene glycol mono-n-butyl ether (3 – 10% by weight)

First Aid

- **If on skin:** Flush with water for at least 15 minutes. Remove immediately all contaminated clothing.
- **If in eyes:** Flush with water immediately and continue flushing for 15 to 60 minutes.
- **If swallowed:** Do NOT induce vomiting. Rinse mouth.
- **If inhaled:** Remove victim to fresh air. Keep at rest in a position comfortable for breathing.

Trakewest Solutions Inc.

18 Forrest Road, Barreville, MB R0L 2L0
1-877-555-8997

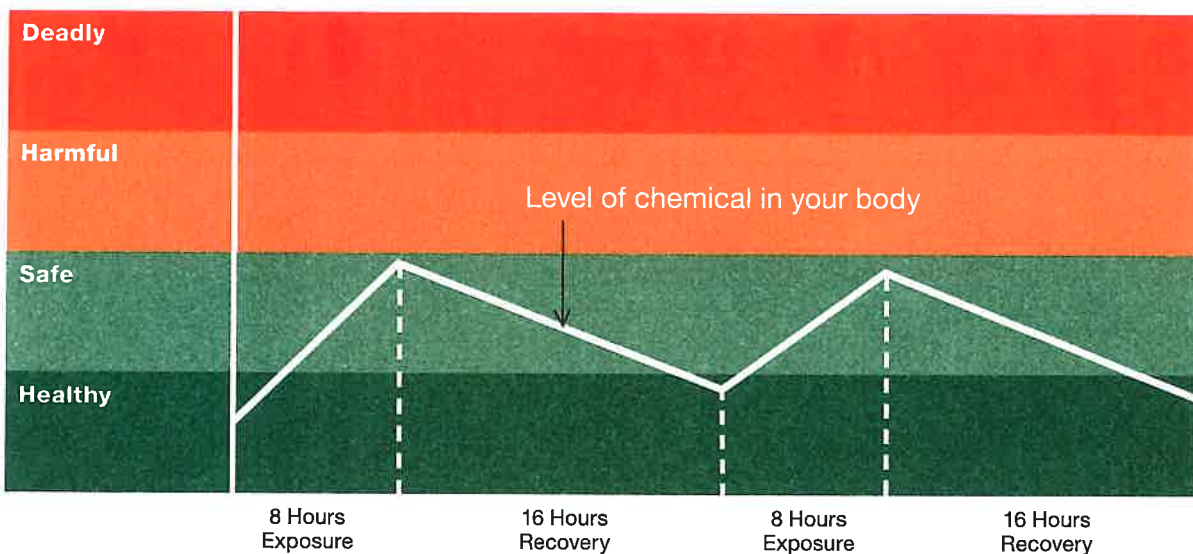
Exposure limits

The SDS often lists exposure limits for a product, based on a healthy employee working eight-hour shifts, five days a week. The limits take into account the time you spend away from work as well, while your body recovers from the exposure.

The idea is that a chemical may slowly build up in your body during your work shift. While you're away from work, your body will get rid of most of the chemical, enough so that if you're exposed again the next day, your level will stay within the safe range.

If you work twelve-hour shifts instead of eight hours, the limits would have to change. You'd need to reduce your exposure in order to stay in the safe range. There are formulas to re-calculate exposure limits for longer shifts.

Safe Limits



There are lots of terms on the safety data sheet that refer to how much of a product someone can safely tolerate.

Q

What do these acronyms stand for? (Refer to the glossary.)

a) TLV _____

b) STEL _____

The correct answers are at the back of the book in case you need to check.

How WHMIS Can Help You Make Decisions That Affect Your Health

After Thelma's accident, the company paid a large fine.

They expanded their safety training to include more detailed information about the specific products employees would be working with.



Sodium Hypochlorite

LABEL – excerpt

DANGER



Hazards:

Causes severe skin burns and eye damage.

Contact with acids liberates toxic gas.

Precautions:

Wear protective gloves/protective clothing/eye protection/face protection.

Do not breathe mist/vapour/spray.

Wash thoroughly after handling.

Sodium Hypochlorite

SDS – from Section 10 – Stability and Reactivity

Reactivity: Contact with acids liberates toxic gas.

Possibility of hazardous reactions: Reacts exothermically with acids. Decomposes to produce chlorine gas.

Conditions to avoid: Avoid contact with foodstuffs. Avoid exposure to light, heat, sources of ignition and open flames. Avoid contact with acids.

Incompatible materials: Incompatible with acids, metals, peroxides, ammonia and ammonia compounds.

Hazardous decomposition products: Chlorine gas.

Q

If Thelma had read the label on the bleach (sodium hypochlorite), what would she have known would happen after she mixed bleach with a product containing acid?

- a) It would blow up.
- b) It would catch fire.
- c) It would release toxic gas.

The correct answer is at the back of the book in case you need to check.

Q

If Thelma had read the SDS for sodium hypochlorite, what would she have known about the kind of toxic gas produced by mixing bleach and acid?

- a) The mixture produces chlorine gas.
- b) The mixture produces hydrogen cyanide.
- c) The mixture produces carbon monoxide.

The correct answer is at the back of the book in case you need to check.

Q

Besides contact with acids, what other conditions should the laundry employees avoid when working with bleach?

- a) ignition sources
- b) cold temperatures
- c) mixing the product with water

The correct answer is at the back of the book in case you need to check.

If Thelma had just read the labels she would never have mixed the two chemicals and the accident wouldn't have happened.

– Miriam Navarro

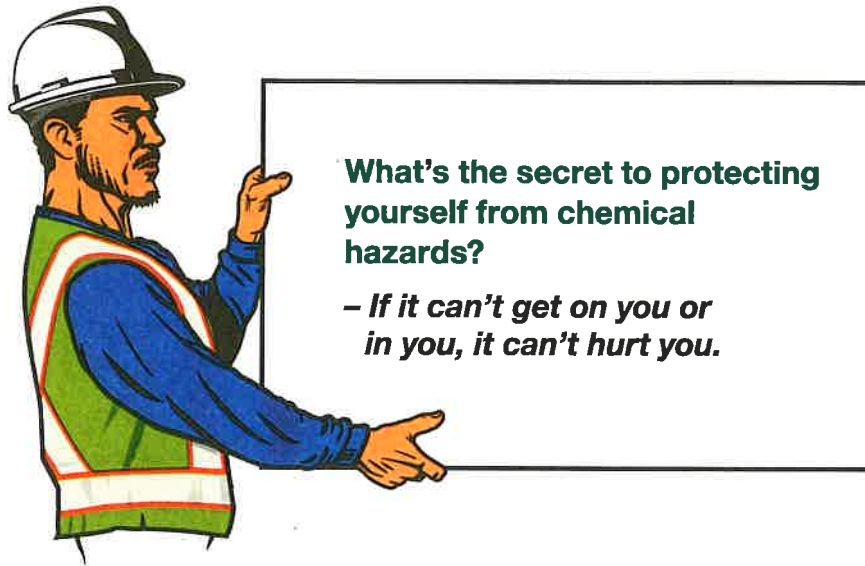


Chapter Summary

In Chapter 4 we looked at different ways of controlling chemical hazards in the workplace, including - as a last line of defence - the right personal protective equipment.

It's important to limit the length of time you're exposed to hazardous products in order to prevent or reduce any harmful effects. The topic of exposure limits is a complex subject, so if you're not sure, ask.

The label and SDS both contain important information that you can use to protect your own health and safety.



Notes

5 What if something goes wrong?

Chandra (based on a true story)

Chandra works in the warehouse for a company that provides disaster restoration services for domestic and commercial properties.

The moment Bill and I started working together we knew we were going to be good buddies. We'd joke around, play pranks on the other guys, go out for beers after work.

Our main job was loading and unloading the trucks. Sometimes we'd be responsible for cleaning up the warehouse, organizing equipment and making sure all the chemicals were stored safely.



The company provided WHMIS training, including proper procedures for decanting products and relabelling the smaller containers so everyone knows exactly what's in them.

It was Thursday afternoon and the supervisor told us that after we finished loading the last truck we should clean up some oil spots around the loading dock. Billy went to look for some cleaning supplies and he came back with what looked like a liquor bottle with a weird label on it and said, "Hey, Chandra. Look what I found."



I asked him where he got it and he said it was in behind a pail with all the cleaning supplies.

He twists off the cap and takes a drink and goes, "Ugh" and says, "Here Chandra, you try it." So I take a sip - and it was disgusting! I couldn't tell what it was and I didn't want any more. I told him, "Let's just finish up and go to the bar. Put this stuff back."

And he said, "No, I'm gonna take it home." Then he took the bottle and left, and I just wish I could tell him not to.

The next morning Chandra learned what happened.

Billy didn't show up and a couple of police officers came in to ask me questions. They said Billy died the night before. They said he drank something - some chemical - that killed him, and they wanted to know more about what we were doing last night.

It turns out it wasn't liquor in the bottle. It was methanol.

– Chandra Taylor

The company was charged but was able to show that every employee had been trained to label containers before transferring chemicals. They never found out who was responsible for filling the liquor bottle with methanol.

Emergency Actions

Both you and your employer can do a lot of things to prepare for an emergency.

You can look ahead and think about how to protect yourself in case of a spill, a leak, an explosion or a fire. If you're the one who discovers the emergency:

- How will you alert your co-workers and call for help?
- How will you escape?



Depending on the specific chemicals in your workplace, you may need access to a first aid kit, eyewash/shower station, fire extinguisher or spill kit. The equipment should be well-maintained and you should be trained to use it.

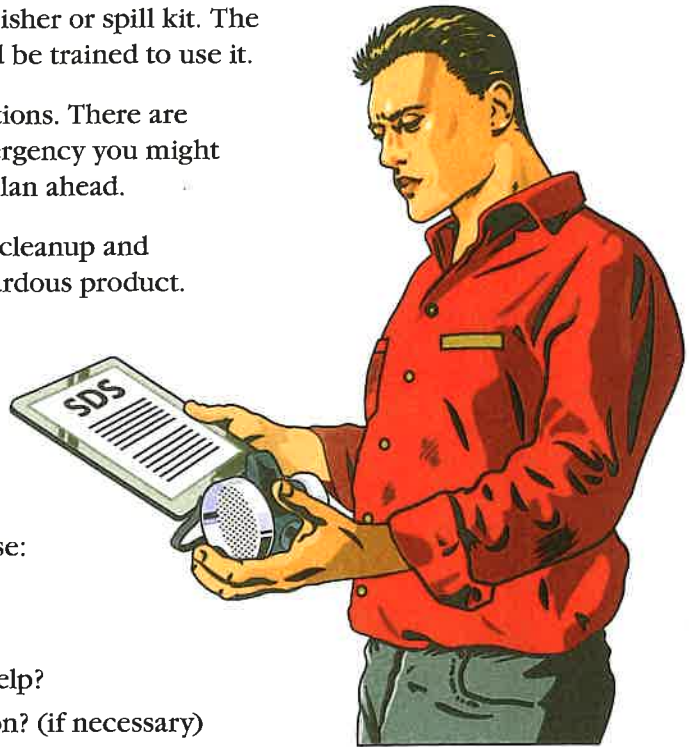
Labels and SDSs include guidelines for emergency actions. There are sections on first aid and firefighting, but in a real emergency you might not have time to find and read the SDS. You have to plan ahead.

SDSs also include recommendations for spill control, cleanup and disposal procedures following a spill or leak of a hazardous product.

Soon you'll have a chance to look at chemical products, labels and SDSs in your own workplace and write down information about emergency procedures and first aid equipment.

Here are some of the questions you'll be asked when you complete the *WHMIS in Your Workplace* exercise:

- Where is the nearest emergency alarm?
- What is the evacuation plan?
- Where is the nearest first aid kit or medical help?
- Is there an eyewash/emergency shower station? (if necessary)
- Where is the nearest fire extinguisher?
- Is there a spill kit? (if necessary)



WHMIS in Your Workplace
WHMIS Self-Teach Program

Danatec

Name _____
Date _____

It's time to find out how WHMIS applies to you and your job. (If you are studying at home or in a classroom, you may not be able to complete this part of the training program until you can look at the labels and SDSs in your own workplace. In that case, go ahead and write the text.)

There are no points or scores. It's for your own information, to see if you can identify chemical products in your workplace and find the safety information you need from labels and safety data sheets (SDSHs).

Take this sheet with you and make sure you have permission to go into the work area. You can team up with another person to search our products in a place that's not very familiar to you, like a storeroom.











Chemical Products

List the names of some of the chemical products you find:

Hazard Symbols

Which hazard symbols do you see on the labels? (Check all that apply.)

WHMIS pictograms

 Compressed gas	 Flammable	 Acute toxicity	 Biohazardous infectious materials
 Corrosive	 Oxidizer	 Health hazard	
 Explosive	 Environmental hazard	 Exclamation mark	

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First Aid

The first aid section of the safety data sheet lists what to do if someone is accidentally exposed to the chemical product. It's broken down by routes of entry, such as inhalation, skin contact, eye contact and ingestion.

SDSs also list possible long-term health effects of over-exposure to the product.

So even though nobody plans on getting hurt, it's a good idea when you're reading the SDS to ask yourself questions like, "What would I do if one of my co-workers inhaled the vapours and stopped breathing?"

Q

Dan is moving a full drum of RemoKleen when it tips over and spills onto the floor. Some of the liquid splashes into his eyes.

Which category of information would you need immediately to help Dan? (Check the RemoKleen SDS.)

- a) 4 b) 7 c) 10

Which category of information would you need to help clean up the spill?

- a) 3 b) 6 c) 15

Which category of information would you need if there is an open flame or spark nearby?

- a) 1 b) 5 c) 12

The correct answers are at the back of the book in case you need to check.



Knowing that these three emergency categories are always in the same place near the beginning of every safety data sheet can be a real help in a crisis.

Trade Secrets

If an employee is over-exposed to a chemical and needs medical attention, the employer should provide a copy of the safety data sheet. It often includes specific details to assist medical professionals in diagnosis and treatment. Remember Kellie's story? Her employer couldn't find an SDS for the industrial glue, and she still doesn't know if it might have provided her doctors with useful information.

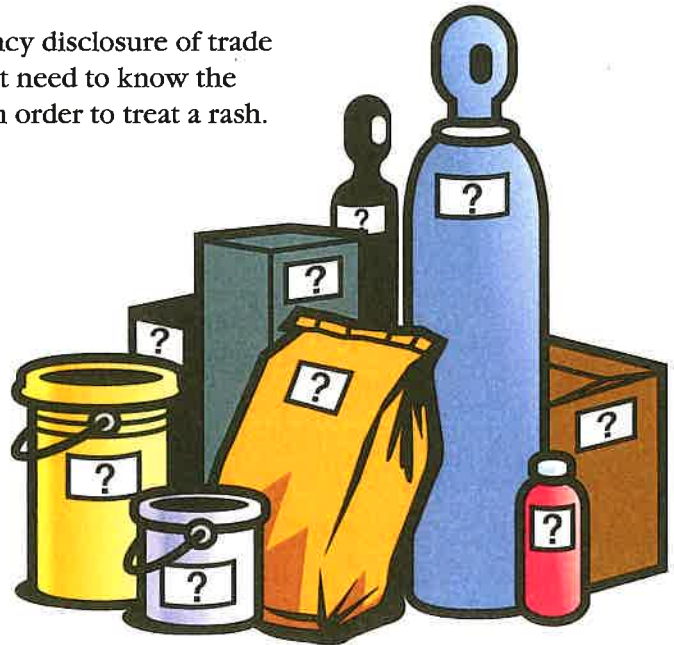
From time to time, manufacturers have something they want to keep secret from their competitors - like the exact chemical name and concentration of ingredients. Health and safety information, of course, cannot be withheld.

This is what a trade secret might look like on the SDS:

Ingredient	CAS Number	% by weight
Quartz sand	014808-60-7	35
Resin	HMIRA Registry Number 55551 granted by Health Canada August 15, 2018	30
Acrylic acid ester	HMIRA Registry Number 55552 granted by Health Canada August 15, 2018	15

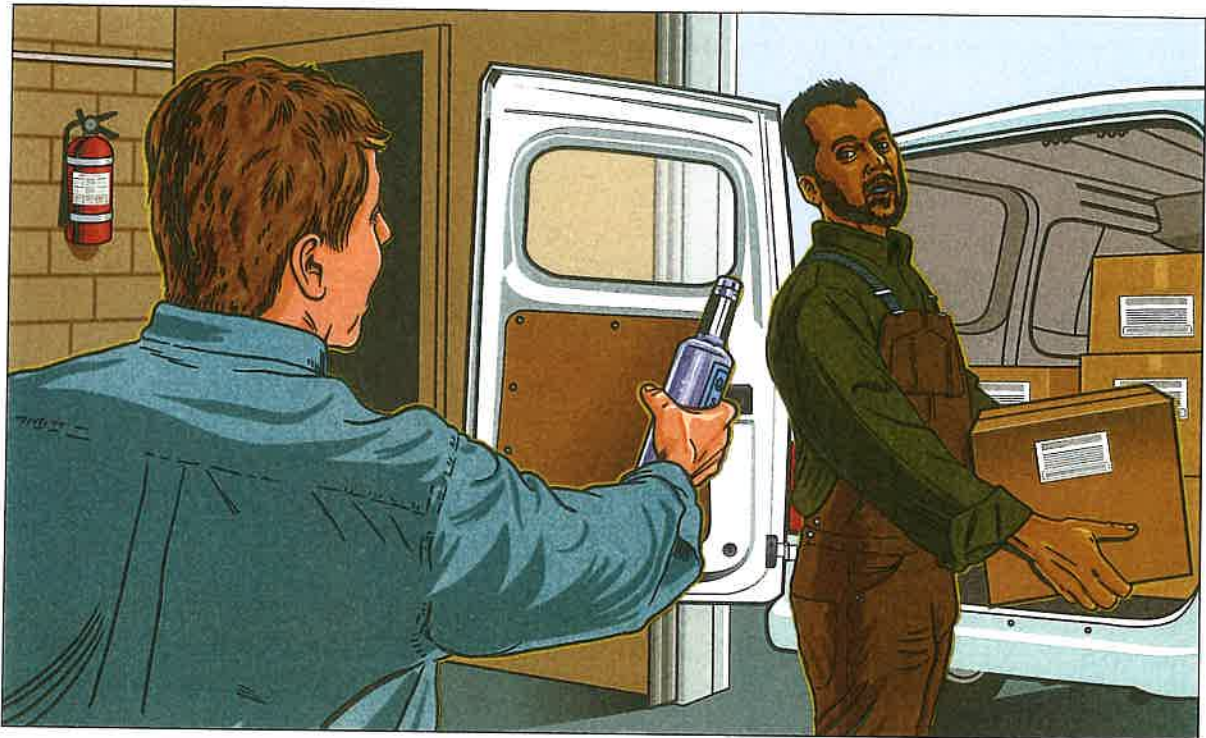
In an emergency, a doctor or nurse might need some of this trade secret information to treat someone who has been over-exposed to the product. A medical professional can phone the supplier at the number listed on the SDS and obtain the details they need in order to treat the patient.

There are also procedures for non-emergency disclosure of trade secrets. For example, a dermatologist might need to know the exact chemical composition of a product in order to treat a rash.



How WHMIS Can Help In An Emergency

Chandra's friend Bill didn't realize that the bottle he was drinking from contained methanol, a hazardous chemical. There was no WHMIS label or SDS.



Methanol

LABEL – excerpt

DANGER



Highly flammable liquid and vapour.



Toxic if swallowed.

Toxic if inhaled.

Toxic in contact with skin.



Causes damage to organs.

If medical assistance is needed, have the product container or label at hand.

Methanol

SDS – from Section 4 – First Aid Measures

After inhalation: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If breathing is difficult, give oxygen. Obtain medical attention.

After skin contact: Rinse skin with water/shower. Remove all contaminated clothing. Immediately call a poison center or doctor/physician.

After eye contact: Rinse immediately and thoroughly, pulling the eyelids well away from the eye (15 minutes minimum). Remove contact lenses, if present and easy to do. Continue rinsing. Obtain medical attention if pain, blinking or redness persist.

After ingestion: Rinse mouth. Do NOT induce vomiting. Obtain emergency medical attention. Never give anything by mouth to an unconscious person.

Q

What would Chandra and Billy have learned about methanol if the bottle had a WHMIS label?

- a) Methanol is an oxidizer.
- b) Methanol is corrosive.
- c) Methanol is toxic.

The correct answer is at the back of the book in case you need to check.

Q

If Chandra had stayed with Billy when he became unconscious from drinking methanol, how should he have responded?

- a) Rinse Billy's mouth with water and call 911.
- b) Force Billy to vomit to get rid of all the methanol in his system and call 911.
- c) Make Billy drink lots of water to dilute the methanol and call 911.

The correct answer is at the back of the book in case you need to check.

*I just really miss him. It's not much fun at work any more.
It's not just me - other people aren't as happy as they used
to be. They miss him, I miss him.*

– Chandra Taylor



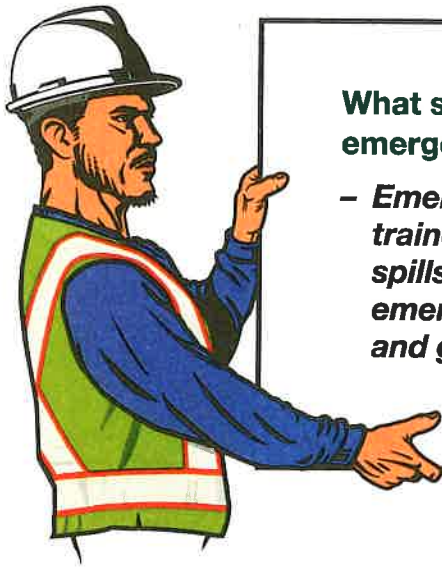
Chapter Summary

Chapter 5 explains what you and your employer need to do in order to prepare for an emergency involving the chemical products in your workplace.

You can find first aid, firefighting and spill clean-up guidelines near the beginning of every safety data sheet.

It's important to make sure a copy of the SDS accompanies an injured person to a medical facility. If any of the details on the SDS are withheld under trade secret protection, a medical professional will still be able to get access to the information when it's needed in an emergency.

Keep asking those "What if?" questions and plan ahead.



What should I do if there is a serious emergency?

- *Emergency responders are specially trained to deal with fires, explosions, spills and leaks. If you're not a trained emergency responder, sound the alarm and get out of there as fast as you can.*

Notes

6 What are my rights and responsibilities?

Barry (a true story)

Barry Weatherall was an experienced plumber who was blinded in a workplace accident.

I miss the simple things of life, like seeing the stars at night, and seeing the people I love and care about.

I grew up in a small village in southeast England, and when I left school I got a job as an apprentice plumber. I travelled whenever I could, and on a trip to Canada I met the woman who was the love of my life. We got married and settled in Red Deer.



Barry was hired by a large plumbing and heating company, and specialized in custom hot water systems. To clean residue from copper manifold headers, he soaked them in sulphuric acid, in a long pipe sunk into the shop floor. Eventually the acid became contaminated, and Barry had to find a way to neutralize it so he could have the acid pumped out and replaced.

I talked to a chemical company and they told me to pour some caustic soda beads into the pipe to neutralize the acid.



The “expert” Barry talked to was actually a sales rep for the chemical company, and he told Barry the process was very safe and simple. When the caustic soda beads were delivered to the plumbing shop, there was a WHMIS label on the bags and a safety data sheet with the shipment, but Barry thought he knew what to do and didn’t read them.

I'd forgotten my WHMIS training, because it was seven years since I'd done the course. I had no clue about the reaction between sulphuric acid and caustic soda.

I put on all my safety gear, then poured about three quarters of a bag of the caustic soda beads into the pipe. I walked away, took off all my safety equipment except for a paper dust mask, wrote up a work procedure and then went back to check on it. I knelt down and looked into the pipe, and just at that precise moment it blew up in my face.

I was instantly blinded in the right eye but I still had a little bit of sight in my left eye. My co-workers made me lie down and poured water over my face until the ambulance turned up. The last clear image I have is of my wife coming into the emergency room, and the look of shock and horror on her face.

Barry eventually lost 100% of his vision, and went through several difficult years.

I became very depressed. I didn't want to get out of bed or see anybody. My relationship with my wife changed completely because she had to take care of me. I went through more than 20 surgeries on my face, and eventually our marriage broke up.

It took a while, but now I love life. My dog gives me so much independence and freedom, and people start conversations with me when we're out walking around town. I enjoy trying new adventures - rock climbing, ice climbing, caving. I've done a lot of travelling on my own across Canada and back to England to visit my family and friends. Life is pretty good for me now.

– Barry Weatherall

Barry’s employer had a responsibility to train his employees and provide them with all the information and tools they needed to work safely. And Barry had the right to work in a safe environment.

However, Barry also had a responsibility to learn about the chemical products he was working with, and ask questions if he didn’t understand the hazards.

His boss had to pay a large fine, but Barry paid the real price.

Employer's Responsibilities

Your employer has quite a few responsibilities, including:

- make sure all the chemical products in your workplace are labelled or properly identified
- provide you with access to complete, up-to-date SDSs
- teach you to understand and use this information in your job
- train you about the specific chemicals in your workplace
- provide any PPE that's still necessary after trying to reduce or eliminate the hazards

Your Responsibilities

WHMIS is designed to protect you, but it only works if you:

- participate in the education and training your employer provides
- follow safe work procedures
- use the recommended control measures

If you notice a product without a proper label and you know what label is required, you could fix it right away. If you can't label it yourself, let your supervisor know. You can also help by notifying someone if you find a chemical product without a safety data sheet.

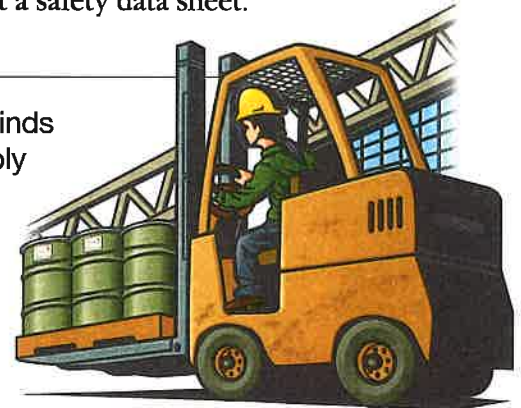
Q

Jamie is re-organizing the warehouse and finds a drum without a label. She thinks it probably contains toluene, but she's not sure.

What should Jamie do?

- a) Put a toluene label on the drum.
- b) Open the drum and check the contents.
- c) Put a note on the drum, "Unknown contents".
- d) Notify her supervisor.
- e) Move the drum to the back corner of the warehouse.

The correct answers are at the back of the book in case you need to check.



Your Rights

You have the right to know about the hazards of chemical products in your workplace, how to use them safely, and what to do if something goes wrong.

Your training must be effective enough that you can understand the WHMIS requirements and apply them to the work you do.

You're entitled to have access to the safety data sheets for products in your workplace.

You have the right to be provided with appropriate PPE and if necessary, to refuse unsafe work.

Soon you'll be asked to complete a questionnaire called *WHMIS in Your Workplace*, and if you don't believe you have enough information by the time you do the site-specific exercises, you have the right to ask for more details.



Supplier's Responsibilities

Suppliers are required to evaluate the hazards of the chemicals they manufacture, import or distribute.

They have to prepare labels and safety data sheets and provide them to their customers.

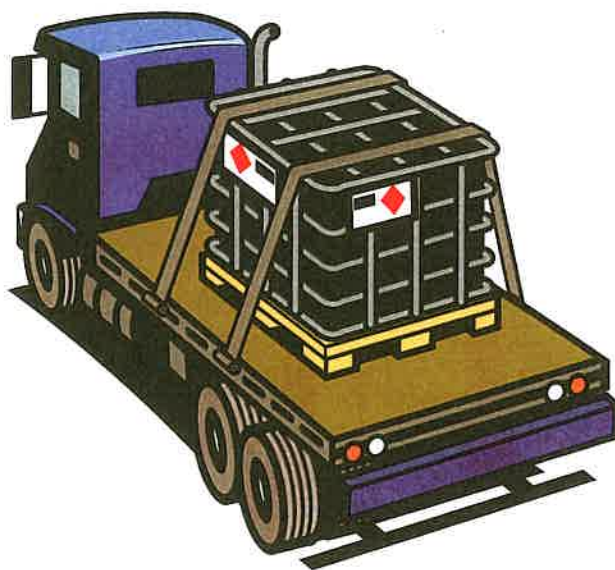
Exemptions

There are exceptions to the WHMIS requirements for certain situations. Some of these were described in Chapter 2, such as **products labelled for transport** and **consumer products**.

The **bulk shipment** exemption applies to products shipped in large containers, and also to products shipped without any packaging at all.

Products in **small containers** (less than 100 ml) are exempt only from the requirement to show hazard statements or precautionary statements on the label. Products in very small containers (less than 3 ml) do not require any label at all in some circumstances.

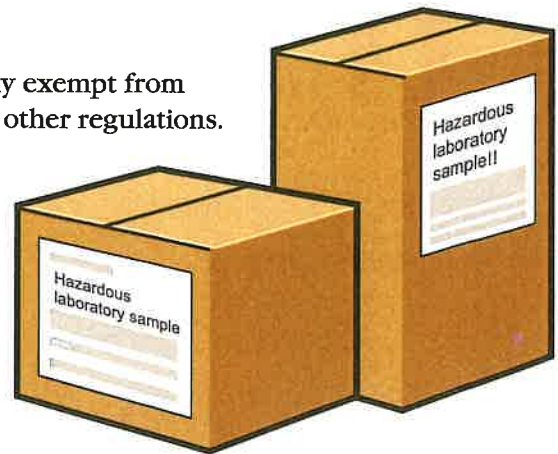
Laboratory samples sent for analysis have different labelling requirements and various exemptions from the requirement for a safety data sheet.



Some products that could be hazardous are completely exempt from WHMIS, often because they're already covered under other regulations.

These include:

- hazardous waste
- tobacco
- wood
- drugs
- alcoholic beverages



Provincial Laws

Although WHMIS applies across Canada, the regulations are enforced by federal, provincial or territorial inspectors.

In some provinces or territories, the WHMIS laws include additional requirements.

Penalties

The penalties vary, depending on the offence.

Any company or individual can be charged, including the supplier, who may be the manufacturer, importer or distributor of the product.

Your employer can be charged – the company as well as a supervisor, manager or director.

You might also be liable – if you were trained and given the proper information, but didn't follow the recommended procedures.



WHMIS Can Help – But Only If You Use It

Barry didn't read the label or the safety data sheet before he poured the caustic soda beads into the sulphuric acid.



Caustic Soda Beads

LABEL – excerpt

Causes severe skin burns and eye damage.

Caution

Do not breathe dust.

Wear gloves, protective clothing, eye protection and face protection.

Reacts violently with water and acids.

First Aid

If swallowed: Rinse mouth.
Do NOT induce vomiting.

Caustic Soda Beads

SDS – from Section 10 – Stability and Reactivity

Chemical Stability

Stable under normal storage conditions (See Section 7).

Possibility of Hazardous Reactions

Acids: Product can react explosively with acids (including sulphuric acid, hydrochloric acid, nitric acid and organic acids).

Add caustic soda very gradually, stirring constantly, otherwise a violent eruption or explosive reaction can occur.

Metals: Attacks many metals (including aluminum, zinc, tin) producing flammable hydrogen gas.

Other chemicals: Reacts violently or explosively with many other organic and inorganic chemicals, including organic peroxides.

Q

What would Barry have learned if he'd read the label?

- a) Caustic soda beads are not hazardous.
- b) When handling caustic soda beads, PPE is required.
- c) Caustic soda beads are flammable.

The correct answer is at the back of the book in case you need to check.

Q

What would Barry have learned if he'd read the SDS?

- a) Caustic soda beads should not be mixed with acid except under carefully controlled conditions.
- b) Caustic soda beads can explode under normal conditions of storage.
- c) Caustic soda beads should not be stored at cold temperatures.

The correct answer is at the back of the book in case you need to check.

Q

What would Barry have learned about how caustic soda beads react with aluminum?

- a) Caustic soda melts aluminum.
- b) Caustic soda does not react with aluminum.
- c) Caustic soda attacks aluminum producing flammable hydrogen gas.

The correct answer is at the back of the book in case you need to check.

If I'd read the safety data sheets, I wouldn't have mixed the chemicals the way I did and I'm certain the accident would not have happened.

My world would be completely different now.

– Barry Weatherall



7 Conclusion

WHMIS Stories



Jeff



Kellie



Miriam



Chandra



Barry

These are all people whose lives were affected by accidents or incidents involving chemical products in their workplaces. Their stories illustrate the importance of WHMIS training, and of reading the labels and safety data sheets before working with hazardous materials.

You're fortunate to work for an employer who cares about your health and safety by providing you with this training course to teach you about chemical hazards and encourage you to ask questions.

A National Perspective

You are one of more than five million Canadians who work with or near hazardous chemicals.

Health Canada believes that WHMIS, based on the Globally Harmonized System, makes workplaces safer by:

- better access to information about chemical products
- effective education and training so everyone understands the hazards
- improved handling and use of chemicals
- standardized information on labels and SDSs



Your Role

Everyone is doing their part to make sure that you, the employee, will be protected and can work safely. The entire WHMIS program is intended to help you answer these important questions:



WHMIS In Your Workplace

You've finished the study portion of this self-teach manual and are ready to move on to the practical application of what you've learned. *WHMIS in Your Workplace* is an exercise designed to apply this knowledge to your own working environment.

(If you're studying at home or in a classroom you may not be able to complete this part of the training program until you can look at the labels and SDSs in your own workplace. In that case, skip ahead and write the test.)

Take out the document called *WHMIS in Your Workplace* from the front pocket. Answer the questions, using examples of chemical products, labels and SDSs that you find in your workplace.

Keep your completed *WHMIS in Your Workplace* sheet with you when you write the test, so you can use some of the information you've collected to answer the optional questions on the last page of the test.



Other Training

General WHMIS education can teach you about hazards, labels and SDSs, and about your rights and responsibilities.

However, when it comes to the particular chemical products you work with – the ones you identify when you complete *WHMIS in Your Workplace* – you need specific training. This part is up to your employer.

If you need personal protective equipment, you want to be sure you know how to use it properly.

You might be given on-the-job instruction – for example, how to transfer a product safely from a drum to a can.

You might need additional training if you:

- take on new responsibilities
- start working with a new chemical product
- are given a task where you use a familiar product in a new way

Even if you don't work directly with chemicals, you still could be at risk during storage or handling, or in an emergency like a fire, explosion, spill or leak.

Test

You're ready to move on to the test – a few questions that **will** help you remember what you've learned. You can refer to this manual as you answer **the** questions.

The last page of the test is not marked or scored. It's based on *WHMIS in Your Workplace*, so you'll only be able to answer these final questions if you **completed** the practical exercises.

When you finish, hand in the test to your employer, who **will** use it to confirm that you participated in this training and that you understand what **you** learned.

Certificate

If your employer is satisfied that you are trained, he or she **will** fill out and sign the certificates that are included with this manual. There is **a** full-size one to hang on your wall and a smaller one that will fit in your **wallet**.

The wallet certificate has a place for your employer to add **details** about other WHMIS-related training you receive.

Congratulations! You have successfully completed the WHMIS self-teach training program.

Here are some more suggestions. You can:

- Put up the small poster to remind you of what you **need** to know about each of the chemical products you **work** with.
- Keep this self-teach manual handy for reference.
- Ask questions.



G Glossary

WHMIS Pictograms



A

ACGIH – American Conference of Governmental Industrial Hygienists. They publish chemical exposure guidelines which are used around the world.

acid – a chemical with a pH value less than 7 that can be corrosive to skin or metal. Acids can be weak (e.g. vinegar – about pH 3) or strong (e.g. sulphuric acid – about pH 0).

acute effect – a health effect that develops immediately after exposure to a chemical.

acute exposure – a single exposure to a substance or multiple exposures within a short time, usually 24 hours or less.

acute toxicity – the ability of a substance to very quickly cause damage to living tissue or body organs, including severe illness or death.



aerosol – a fine mist of solid or liquid particles suspended in the air.

alkali – a chemical with a pH value greater than 7 that can be corrosive to skin or metal. Alkalis can be weak (e.g. baking soda – about pH 9) or strong (e.g. ammonia – about pH 11).

allergic reaction – a health effect, such as a skin rash or a breathing problem, caused by exposure to a chemical substance.

anhydrous – a chemical that does not contain water; exposure to water may cause a violent reaction.

aquatic toxicity – the ability of a chemical to be harmful or fatal to marine or freshwater organisms (fish, crustacea, algae, etc.) during short term (acute) or long term (chronic) exposure to the chemical.

aspiration hazard - aspiration means the entry of a liquid or solid chemical directly through the oral or nasal cavity, or indirectly through vomiting, into the trachea and lower respiratory system.

aspiration toxicity - aspiration toxins cause severe acute effects such as chemical pneumonia, varying degrees of pulmonary injury or death following aspiration.

ASTM - ASTM International, formerly known as the American Society for Testing and Materials.

autoignition temperature - the minimum temperature at which a substance will catch fire without a spark or flame.

B

base - a chemical in solution which has a pH value higher than 7.

bioaccumulation - bioaccumulation occurs when organisms such as fish absorb a toxic substance at a rate greater than that at which the substance is lost.

biocide - a chemical that acts to kill or control a biological growth or infestation, such as bacteria or fungus.

biohazardous material - microorganisms such as viruses and bacteria that can cause disease.

boiling point - the temperature at which a liquid changes to a vapour (starts to boil).



C

°C - degrees Celsius, also known as centigrade, is a scale of measurement for temperature, where the freezing point of water is 0°C and the boiling point of water is 100°C.

carcinogen - a substance capable of causing cancer.

carcinogenicity - the ability of a substance to cause cancer.

CAS registry number - Chemical Abstract Service registry number, used to identify a specific material no matter what name it might be called. It appears in Section 3 of a standard 16-part SDS.

ceiling limit - the ceiling limit is the amount of a toxic chemical in workroom air that may not be exceeded even for a moment.

chemical name - the name that identifies a chemical substance for the purpose of hazard classification using the rules of the Chemical Abstract Service (CAS) or IUPAC.

chronic effect - a health effect that develops over time as a result of long-term exposure or sometimes a single extreme exposure.

chronic exposure - repeated exposures to a substance over a relatively long period of time. Even very small individual exposures to certain chemicals may "accumulate" and result in a toxic effect, including sensitization.

chronic toxicity – the ability of a chemical to cause harm from repeated exposures over a long period of time. Chronic toxicity is usually separated into the effects that can cause cancer (carcinogenic toxicity) and the effects that cause other types of harm (non-carcinogenic effects such as silicosis).

coefficient of water/oil distribution – a way of comparing a product's solubility in water with its solubility in oil. A value greater than 1 indicates that the product dissolves more readily in water; these materials may be absorbed by the membranes of the eyes or the respiratory tract. Values less than 1 indicate that the product is more soluble in oil; these materials may be absorbed by the skin.

combustible – capable of burning easily.

compound – a substance formed from two or more elements chemically united (bonded) in definite proportions by weight; e.g. water is a compound of hydrogen and oxygen, and salt (sodium chloride) is a compound of sodium and chlorine.

compressed gas – a gas which, when packaged under pressure is entirely gaseous at -50°C , including all gases with a critical temperature $\leq -50^{\circ}\text{C}$. Compressed gases can be toxic, flammable, oxidizing, corrosive, or inert. In the event of a leak, inert gases can quickly displace air in a large area creating an oxygen-deficient atmosphere.



concentration – the relative amount of a substance in a mixture with other substances. Small concentrations are usually expressed in parts per million (ppm) or in milligrams per liter (mg/L). Large concentrations can be expressed as a percent (%).

conditions of instability – the situations in which the product will polymerize, decompose, or condense. These conditions might include pressure, vibration, jarring, heating or the presence of moisture or air.

conditions of reactivity – the situations in which a material will react. These conditions might include the presence of light, elevated temperature, aging, or the absence of an inhibitor.

confidential business information (CBI) – *see: trade secrets*

consumer product – a product that is packaged for the consumer and available to the general public through retail systems.

corrosive – a substance that can destroy living tissue at the site of contact. This distinguishes corrosive effects from toxic effects which occur away from the contact point.



corrosive to metal – a substance which will damage or destroy metals such as steel or aluminum by chemical reactions.

critical temperature – the temperature above which a gas cannot be liquefied, regardless of the pressure applied.

CSA – Canadian Standards Association. An organization that sets standards for safety in designs and procedures.

D

decomposition – the breakdown of a chemical into other substances as a result of heat, chemical reactions or other processes.

dermal toxicity – the ability of a substance to cause harmful effects by absorption through the skin. Skin prevents loss of liquids from the body and forms a barrier to the entry of many toxic substances, especially solids. Oily liquids will penetrate the skin more easily than watery liquids.

dermatitis – inflammation of the skin caused by an irritant substance.

Domestic Substances List – an inventory of about 23,000 substances manufactured in, imported into or used in Canada on a commercial scale.

dust – solid particles in air, formed by mechanical actions such as grinding or crushing.

E

EC₅₀ – the effective concentration of a chemical that causes 50% of the maximum response.

engineering controls – the control of hazards by isolating the worker from the hazard or by removing the hazard from the work area; e.g. ventilation, isolation and enclosure.

environmental hazard – the potential of a substance to cause short or long term air or water pollution, soil contamination or harm to living organisms.



evaporation rate – how fast a substance vapourizes, compared with a standard substance such as butyl acetate. (Butyl acetate has an evaporation rate of 1.) Substances with a high evaporation rate can get into the air very quickly. This is of particular concern when the vapours must be controlled because they are toxic or flammable.

exclamation mark – a pictogram indicating a substance that can cause inflammation of the eyes, skin, or respiratory system from one or more exposures.



explosive – a chemical or mixture of chemicals that may instantaneously release large amounts of energy as heat and gas. Explosives are not regulated under WHMIS, but the symbol may appear on labels for products that have explosive characteristics.



exposure limit – the concentration of chemicals that may not be exceeded in workplace air, based on the concentration to which most people can be exposed without harm, usually during a certain period of time. TLVs (Threshold Limit Values) developed by ACGIH, and PELs (Permissible Exposure Limits) regulated by OSHA, are both widely used.

extraction – a system designed to capture and remove fumes, dust or waste at the source during a manufacturing process.

F

flammable – capable of being ignited easily and burning rapidly.

flammable limits – the upper and lower concentrations of a flammable gas or vapour in air between which ignition can occur.

flash point – the lowest temperature at which a product will give off enough vapour to catch fire if a source of ignition is present. The lower the flash point, the greater the potential fire hazard.

freezing point – the temperature below which a liquid material turns into a solid. It's the same as the melting point, the temperature above which the solid material becomes liquid.

fumes – very small, solid particles in air, formed when hot vapour cools – for example, during welding.



G

g (gram) – one pound equals 454 grams.

gas – a material with no specific shape or volume, which spreads out to fill the space available at normal room pressure and temperature.

GHS – Globally Harmonized System for Classification and Labelling of Chemicals. GHS was developed by the United Nations in 2003 and incorporated into WHMIS in 2015.

H

hazard class – the nature of a physical, health or environmental hazard, for example, flammable solid, carcinogen, oral acute toxicity.

hazard statement – a statement in standardized wording that describes the dangers of a chemical substance.

hazardous combustion products – chemicals that are formed when a material burns.

hazardous decomposition products – chemicals that are produced when a material breaks down (decomposes) because it is unstable or reacts with materials such as water or oxygen.

Hazardous Products Act (HPA) – the legislation that governs WHMIS, along with the Hazardous Products Regulations.

Hazardous Products Regulations (HPR) – based on the international Globally Harmonized System, and developed under the Hazardous Products Act. The HPR specifies the criteria for classification of hazardous products and the information that must be included on labels and safety data sheets (SDSs).

health hazard - a chemical which has been classified as posing one of the following effects: acute toxicity, skin corrosion or irritation, serious eye damage or irritation, respiratory or skin sensitization, germ cell mutagenicity, carcinogenicity, reproductive toxicity, specific target organ toxicity or aspiration hazard.



HMIRA - Hazardous Materials Information Review Act.

HMIRA registry number - the number issued by Health Canada when a WHMIS trade secret is registered.

hygroscopic - a substance that readily takes in moisture, often from the air.

IARC - International Agency for Research on Cancer. They publish lists of chemicals which are proven or suspected to cause cancer.

IDLH - Immediately Dangerous to Life or Health. (NIOSH definition)

ignition source - anything that can provide heat, flame or spark and cause a fire or explosion.

immediate use - the chemical will be used only by the person who transfers it from a labelled container and it will only be used in that work shift.

impervious - does not allow another substance to penetrate or pass through it; a requirement for some protective clothing. Different materials are impervious to different chemicals, but no material is impervious to all chemicals.

incompatible materials - substances which could react dangerously with one another; e.g. sodium cyanide and water will produce toxic hydrogen cyanide gas.

inflammable - *see: flammable*

ingestion - intake of a substance through the mouth. Chemicals, like food, have to pass through the liver before reaching the intestines. The liver may convert some toxic chemicals into less toxic substances but the intestines are where food is absorbed into the body and toxic substances may also be absorbed.

inhalation - breathing in a gas, vapour, dust, fumes or mist through the nose or mouth. Lung tissue allows easy movement of air and oxygen into the body so most gases and vapours can enter the body by this route.

inhibitor - a substance added to a chemical to slow down or prevent a reaction, to increase stability.

insoluble - not capable of dissolving in liquid.

irritant - a substance that can cause inflammation of the eyes, skin, or respiratory system from one or more exposures.

IUPAC - International Union of Pure and Applied Chemistry

K

kg (kilogram) – one kilogram equals about 2.2 pounds.

kPa – kiloPascal. A unit of pressure; 1 atmosphere equals 101.3 kPa.

L

L or l – Litre. One litre equals about 35 fluid ounces.

label – on a hazardous product, this can be a mark, sign, device, stamp, seal, sticker, ticket, tag or wrapper.

LC₅₀ – Lethal Concentration. A way of measuring the acute toxicity of a gas when it is inhaled by the test animal. It means the airborne concentration of a substance that kills 50% of the test animals. The LC₅₀ is usually expressed as parts of test substance per million (ppm) parts of air for gases, or as milligrams of test substance per cubic meter of air (mg/m³) for dusts, mists and fumes. The lower the LC₅₀ value in comparable tests, the greater the toxicity.

LD₅₀ – Lethal Dose. A way of measuring the acute toxicity of a chemical when it is swallowed by the test animal or when it is absorbed through the animal's skin. It means the single dose of a substance that kills 50% of the animals tested. The LD₅₀ for a product varies by species of test animal and by the route of entry, so this information has to be specified along with the LD₅₀ value. It is expressed as milligrams of substance per kilogram of test animal body weight (mg/kg). The lower the LD₅₀ value in comparable tests, the greater the toxicity.

LEL – Lower Explosive Limit. The lowest concentration of a product in air that will catch fire (or explode) if an ignition source is present. At concentrations lower than the LEL, the mixture is “too lean” to burn (or explode). It is expressed as a percent (%).

LFL – Lower Flammable Limit – *same as LEL*

liquid – the only state of matter (others include solid, gas) with a definite volume but no fixed shape. Like a gas, a liquid is able to flow and take the shape of a container. (*see also: physical state*)

lower explosive limit – *see: LEL*

lower flammable limit – *see: LEL*

M

m³ – cubic meter. One cubic meter is equal to approximately 1¹/₃ cubic yards.

means of extinction – includes both the type of fire extinguisher that should be used on a small fire involving the product, and the firefighting agents that should be used for fighting a major fire.

melting point – the temperature above which a solid material turns into a liquid. It's the same as the freezing point, the temperature below which the liquid material becomes solid.

mg – milligram. One one-thousandth of a gram.

mg/m³ - milligrams per cubic meter.

miscible liquids - liquids that are capable of mixing completely so that the result looks like a single liquid.

mist - liquid droplets suspended in air, formed when a liquid is sprayed or splashed, or when vapour condenses in the air.

mutagen - mutagens are chemical products which can cause changes (mutations) in the genetic material of living cells. A mutation in a body cell may cause a tumor but it cannot be inherited; a mutation in a reproductive cell (egg or sperm) can be inherited.

N

neutralize - to make a substance non-corrosive by bringing it to a neutral level of pH 7.

NFPA - National Fire Protection Association; the NFPA rating system uses colour coding and numbers to warn of hazards.

NIOSH - National Institute for Occupational Safety and Health, an agency of the U.S. Department of Health and Human Services.

NTP - National Toxicology Program. A U.S. government agency that tests the carcinogenicity of chemicals and studies short-term and long-term health effects.

O

occupational exposure limit - the maximum concentration of a chemical allowed to be present in workplace air.

odour threshold - the lowest airborne concentration of a substance that can be detected by the sense of smell.

oral - taken into the body through the mouth.

oral toxicity - the ability of a substance to cause harm to the body when swallowed.

organic peroxide - a carbon compound that has two atoms of oxygen joined together (a "peroxy" group). Organic peroxides are oxidizers and are severe fire and explosion hazards; they may also be toxic or corrosive.

OSHA - Occupational Safety and Health Administration. A U.S. government agency that establishes and enforces health and safety regulations.

oxidizer - a chemical that by releasing oxygen can cause or contribute to the combustion of other material. Oxidizing agents include nitrate compounds, halogens (chlorine, fluorine) and their compounds (chlorates, perchlorates) and inorganic peroxides.



P

PEL – Permissible Exposure Limit. A legal limit set by OSHA, indicating the maximum amount or concentration of a substance permitted in the air.

personal protective equipment (PPE) – clothing or equipment to protect against hazards in the work environment; e.g. gloves or respirators.

pH – a measure of a substance's acidity or alkalinity. A pH of 7 is neutral. Substances with a pH greater than 7 are alkaline. Alkalinity increases as the pH increases. Substances with a pH less than 7 are acidic. Acidity increases as the pH decreases.

physical state – the physical condition of a material; e.g. a solid, liquid or gas.

pictogram – Most WHMIS pictograms are based on the international Globally Harmonized System, and consist of a symbol inside a diamond shape with a red border. For biohazardous infectious materials, the symbol is enclosed in a black circle. There are no words, letters or numbers in WHMIS pictograms.

polymerize – a chemical reaction where small molecules link together to form larger molecules. The process can be used to produce useful compounds such as polyethylene and PVC. Uncontrolled polymerization can cause fires and explosions.

PPE – *see: personal protective equipment*

ppb – parts per billion. A unit used for measuring the concentration of one substance in another substance; e.g. one second of time in 32 years.

ppm – parts per million. A unit used to measure the concentration of one substance in another substance; for example, 1 ppm of hydrogen sulphide in air is 1 part hydrogen sulphide in 1 million parts of air. One ppm is like 1 minute in 2 years or 1 cent in \$10,000.

precautionary statement – a standardized phrase that describes how to safely use, handle and store hazardous chemicals, and the recommended measures to deal with exposures, fires and spills.

product identifier – a unique name or number used on a label or an SDS to identify the chemical.

pyrophoric – Pyrophoric and water-reactive materials ignite instantly or explode upon exposure to air, oxygen, water or moisture in the air. Water-reactive materials can produce heat and hydrogen (a flammable gas).

R

reactivity – the tendency of a substance to undergo chemical reaction with the release of energy; may result in an increase in pressure or temperature or formation of toxic or corrosive by-products.

REL – Recommended Exposure Limit.

relative density – *see: specific gravity*

- reproductive toxicity** - the ability of a chemical product to affect the fertility of exposed persons. The effects include changes in the sperm or egg cells, and miscarriages.
- respirator** - personal protective equipment designed to keep the wearer from inhaling a hazardous substance.
- respiratory sensitizer** - a substance that leads to hypersensitivity of the airways following inhalation.
- route of entry** - the way a substance comes in contact with the body. It may cause damage by skin or eye contact, or the chemical can get inside the body by inhalation (breathing), ingestion (swallowing), injection (with a needle or a contaminated sharp object) or by absorption through the skin.

S

- safety data sheet (SDS)** - a technical bulletin required for hazardous products which provides detailed hazard and precautionary information.
- SCBA** - Self-Contained Breathing Apparatus.
- SDS** - *see: safety data sheet*
- self-heating substance** - a solid or liquid, other than a pyrophoric substance, which, by reaction with air and without energy supply, is liable to self-heat; this substance differs from a pyrophoric liquid or solid in that it will ignite only when in large amounts and after long periods of time.
- self-reactive substance** - self-reactive substances are unstable liquids or solids liable to undergo strongly exothermic decomposition even without the presence of oxygen (air).
- sensitizer** - a substance that may cause a response such as redness, itching or swelling. The effects may become more severe with each additional exposure.
- signal word** - a word used on WHMIS labels and safety data sheets to indicate the degree of potential risk. "Danger" is used for the most hazardous chemicals and "Warning" for less hazardous chemicals.
- silicosis** - a disease caused by inflammation of the lung tissue around trapped particles of crystalline silica ("quartz sand") causing scarring and reducing the ability of the lungs to take in oxygen.
- smoke** - smoke is a collection of airborne solid and liquid particles and gases produced when a material burns. Hazardous combustion products in smoke may include carbon monoxide and hydrogen cyanide.
- solid** - a state of matter (others include liquid, gas) characterized by structural rigidity and resistance to changes of shape or volume. (*see also: physical state*)
- solubility in water** - the percentage of a material (by weight) that will dissolve in water at normal room temperature.
- solvent** - a material that can dissolve other materials; e.g. water is a solvent.

specific gravity – how the weight of a substance compares to the weight of an equal volume of water. Substances with a specific gravity greater than 1 are heavier than water. They will sink to the bottom of water mixtures. Substances with a specific gravity less than 1, such as oil, are lighter than water: they will float on water.

specific target organ toxicity – *see: target organ toxicity*

stability – the ability of a material to remain unchanged under reasonable conditions of storage or use.

STEL – Short-Term Exposure Limit. The average concentration to which a worker can be exposed for a short period (usually 15 minutes) without serious effects.

supplier – a person who manufactures, processes, packages, imports, sells or distributes a hazardous chemical product.

supplier label – a label that is provided on a chemical product by the supplier.

supplied air – a system that supplies fresh, filtered air to the user's respirator from a central source: the source of breathing air is not designed to be carried by the user.

T

target organ toxicity – some chemicals affect specific organs or systems of the body, such as the liver, kidneys or blood system.

TCC – Tagliabue Closed Cup. A flash point test method.

TDG – Transportation of Dangerous Goods Act and Regulations.

teratogen – a chemical product that can damage an unborn child without adversely affecting the pregnant woman. Teratogens cause harm or miscarriage during the critical stage of organ development, approximately the first three months of pregnancy. There are few known human chemical teratogens.

threshold limit value – *see: TLV and exposure limit*

time-weighted average – *see: TWA and exposure limit*

TLV – Threshold Limit Value. The concentration of a material in the air to which nearly all persons can be exposed day after day, without harmful effects.

TOC – Tagliabue Open Cup. A flash point test method.

toxicity – the ability of a substance to cause damage to living tissue or body organs, including severe illness or death. Toxic harm occurs somewhere in the body distant from where the chemical entered the body.

trade secrets – in some circumstances the supplier will be allowed to withhold the exact chemical name of one or more of the product's ingredients, or their concentrations, as confidential business information (CBI). In these cases, the SDS will state that the ingredient and/or concentration is a trade secret, and will include an HMIRA Registry number.

TWA – Time-Weighted Average. The concentration of a substance to which a person is exposed when averaged over a period of time.

U

UEL - Upper Explosive Limit. The highest concentration of a product in air that will catch fire (or explode) if an ignition source is present. At concentrations higher than the UEL, the mixture is "too rich" to burn (or explode). It is expressed as percent (%).

UFL - Upper Flammable Limit - *same as UEL*

UN Number - a 4-digit number used to identify dangerous goods in the Transportation of Dangerous Goods regulations.

upper explosive limit - *see: UEL*

upper flammable limit - *see: UEL*

V

vapour - the gaseous form of a material that would normally be a liquid or solid under ordinary conditions of room temperature and pressure.

vapour density - a comparison of the weight of a vapour to the weight of an equal volume of air. Substances with vapour densities greater than 1, such as propane and hydrogen sulphide, will "fall" to a low area and accumulate there. If the substance is flammable, a dropped match or a spark can cause a fire or explosion. If it is toxic, persons working in low areas may be exposed to high concentrations of the vapour and suffer the acute effects of the product.

vapour pressure - tells how likely a substance is to form vapours. Substances with high vapour pressures will evaporate very rapidly. The presence of those vapours in the air may be a hazard, especially if the vapours are flammable or toxic, or in confined spaces where they may push out the air.

ventilation - ventilation provides fresh air for breathing, to dilute and remove airborne pollutants, and to control excess humidity. Workplace ventilation systems may be necessary to keep the concentration of hazardous chemicals in workplace air below the TLV.

viscosity - the ability of a liquid to resist flow; e.g. molasses is very viscous.

volatility - the ease with which a material evaporates. This is important if the vapours are flammable or toxic.

W

WHMIS - Workplace Hazardous Materials Information System. A legislated system throughout Canada for providing information on hazardous materials in the workplace.

workplace label - a label placed on a hazardous product in the workplace, indicating the product name (matching the name on the supplier label and SDS), safe handling information such as risks and precautions, and a reference to the SDS. A workplace label can be pre-printed or hand-written.

A

Answers to questions in manual

- Page 2** b) Although we usually refer to it as “GHS”, the complete title reflects the complex classification system developed by an international group of scientists.
- Page 7** a) The law requires that even people who may be briefly exposed to hazardous products must be trained.
- Page 8** c) Hazards indicated by the exclamation mark include irritation of the skin or eyes and skin sensitization.
- Page 9** a) RemoKleen is corrosive and toxic.
- Page 15 (i)** b) Sections 2, 3, 9, 10 and 11 describe the hazards of a product.
- Page 15 (ii)** c) Sections 7 and 8 provide safe handling instructions.
- Page 15 (iii)** a) Sections 4, 5 and 6 describe what to do in case of an accident, incident, spill or leak involving the product.
- Page 17** b) RemoKleen contains sodium hydroxide.
- Page 18 (i)** b) RemoKleen smells like ether.
- Page 18 (ii)** a) Yes. RemoKleen will react with an oxidizer.
- Page 19** a) RemoKleen is a Class 8, Corrosive, for purposes of transportation.
- Page 21 (i)** c) Sodium chlorate is an oxidizer.
- Page 21 (ii)** b) Sodium chlorate can soak into wood and become a fire hazard.
- Page 27** c) Sensitization means that the symptoms become worse with repeated exposures.
- Page 28** b) A chronic reaction is long-term or delayed.
- Page 29** b) A higher flash point means a lower risk, because the vapours can't ignite as easily.
- Page 30 (i)** Compressed gas and flammable. Propane cylinders can explode if they get too hot, or if they're dropped or punctured. The vapours can ignite if there is a source of ignition.
- Page 30 (ii)** Compressed gas and oxidizer. The oxidizer symbol is similar to the flammable symbol, but there is an “O” (for oxygen) in the centre, supporting a flame.
- Page 31** a) Sulphuric acid is more corrosive than ammonia. It is further from the neutral point of 7 on the pH scale.
- Page 32** b) A teratogen can damage a fetus, and cause birth defects or miscarriage.

- Page 33** b) The exclamation mark indicates the product is an irritant. It can cause a sensitization response such as a rash that recurs with exposure even to small amounts of the product.
- Page 35 (i)** c) Kellie should have protected her skin and eyes to prevent contact with the industrial glue.
- Page 35 (ii)** a) The increased lung sensitivity can be temporary or permanent.
- Page 40 (i)** a) The SDS says, "When using very small quantities, wear gloves... Additional PPE recommended for other uses."
- Page 40 (ii)** c) Gloves, face shield and respirator are recommended for working with large quantities of the product.
- Page 43** a) Threshold limit value. This is the concentration of a material in the air to which nearly all persons can be exposed day after day without harmful effects.
- b) Short term exposure limit. This is the average concentration to which someone can be exposed for a short period (usually 15 minutes) without serious effects.
- Page 45 (i)** c) Mixing sodium hypochlorite (bleach) with an acid will produce toxic gas.
- Page 45 (ii)** a) The chlorine gas produced by mixing bleach and acid is highly toxic and deadly.
- Page 45 (iii)** a) Bleach should not be exposed to sources of ignition.
- Page 50 (i)** a) Section 4 - First aid measures
- Page 50 (ii)** b) Section 6 - Accidental release measures
- Page 50 (iii)** b) Section 5 - Fire-fighting measures
- Page 53 (i)** c) Methanol is toxic if swallowed, inhaled or absorbed through the skin.
- Page 53 (ii)** a) The correct first aid response for treating someone who has swallowed methanol is to rinse their mouth with water and get medical help immediately.
- Page 57** d) In this situation, the supervisor should be notified that there is an unlabelled chemical product.
- Page 61 (i)** b) Barry should wear gloves, protective clothing, eye protection and face protection.
- Page 61 (ii)** a) When mixing caustic soda beads with acid there is a danger of a violent eruption or explosive reaction, so it must be done very carefully.
- Page 61 (iii)** c) Caustic soda can damage aluminum and produce flammable hydrogen gas.



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