
WHMIS Part I - Classification of Controlled Products

Learning Outcome

When you complete this module you will be able to:

Explain the significance of the Workplace Hazardous Materials Information System (WHMIS) and its application to the worksite.

Learning Objectives

Here is what you will be able to do when you complete each objective:

1. Describe the classification system for "controlled products".
2. List the six WHMIS classes, their subdivisions and exempted materials.
3. Describe the criteria for classifications.





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INTRODUCTION

This module is designed to help develop an understanding of the requirements of the Workplace Hazardous Materials Information System (WHMIS) and its application to the worksite.

It will provide an outline of the three basic components of the regulations:

1. labelling
2. material safety data sheet (MSDS), and
3. employee training

WHMIS is a pan-Canadian law, meaning it applies equally in all provincial and territorial jurisdictions.

Supplier labels and MSDSs are a condition of sale or importation of controlled products in Canada. That means that every controlled product sold or imported into a Canadian workplace must have a supplier label on the package or container and an MSDS must be provided to the employer. The employer must make sure that such MSDSs are made available to the workers using such products.

Worksite labels and worker training are responsibilities equally shared between employers and employees.

Legislation

The primary vehicle governing the application of WHMIS is the model Controlled Products Regulation (SOR/88-66 am. SOR/88-555). Most jurisdictions have enacted companion regulations to adopt the model laws as shown in Table 1.

Alberta	Chemical Hazards Regulation (Reg. 393/88)
British Columbia	Workplace Hazardous Materials Information System Regulation (B.C. Reg. 258/88)
Manitoba	Workplace Hazardous Materials Information System Regulation (Reg. 52/88)
New Brunswick	Workplace Hazardous Materials Information System Regulation (Reg. 88/221)
Newfoundland	Workplace Hazardous Materials Information System Regulations (WHMIS) (Reg. 169/88)
Northwest Territories	Workplace Hazardous Materials Information System Regulations (R-002-89)
Nova Scotia	Workplace Hazardous Materials Information System Regulations (WHMIS) (Reg. 88-987)
Ontario	Occupational Health and Safety Act (R.S.O. 1990 c.7)
Prince Edward Island	Workplace Hazardous Materials Information System Regulations (No. EC 577/88)
Quebec	Occupational Health and Safety Act (S.Q. 1988 c.61)
Saskatchewan	Occupational Health and Safety Amendment Regulations (Reg. 90/88)
Yukon	Workplace Hazardous Materials Information System Regulations (Reg. O.I.C. 1988/107 am. 1988/193)

*Table 1
WHMIS Legislation by Province*





THE SYSTEM

The Workplace Hazardous Materials Information System, WHMIS, is a system dealing with the identification of controlled products and their hazards and the delivery of that information to the Canadian workplace. This is a condition of sale or importation.

Essentially a “workers right to know” legislation, WHMIS provides specific hazard information to every workplace where controlled products are in use. It also deals with the training needs of workers handling such products as part of their job.

The system has three basic components:

1. Supplier label and workplace label
2. Material safety data sheet, MSDS
3. Employee training

The first, supplier and workplace label, provides for the identification of controlled products by requiring labels with specific content. This is the primary step, creating an immediate awareness of the inherent hazards of such products.

The labeling system not only includes marking requirements for packages and containers, but extends to identification of piping and vessels and similar process equipment. This may be in the form of colour coding or similar types of visual identification.

An important part of the supplier label is the requirement to display the appropriate WHMIS hazard symbol(s). WHMIS includes eight specific hazard symbols.

The workplace label extends the controlled product identification to products that are decanted at the workplace. Almost every time a controlled product is moved at the workplace from its original container into another container, some form of labelling is required. There are only a few exceptions to this rule, such as “for immediate use” or for certain types of “consumer products”.

Because the labelling system includes only limited hazard information, the Material Safety Data Sheet, MSDS, provides additional data about a specific product.

This added information, addressing nine specific areas, must be available at every workplace to workers actually working with the product. It contains information on the physical and toxicological properties of the product and on how to store, use, handle, and dispose of it.

The final component of WHMIS is employee training. It requires that employers establish a training system that ensures that every employee fully understands the hazards of controlled products that they are working with.

Putting all three components together effectively will ultimately result in a safer and healthier workplace for all workers.

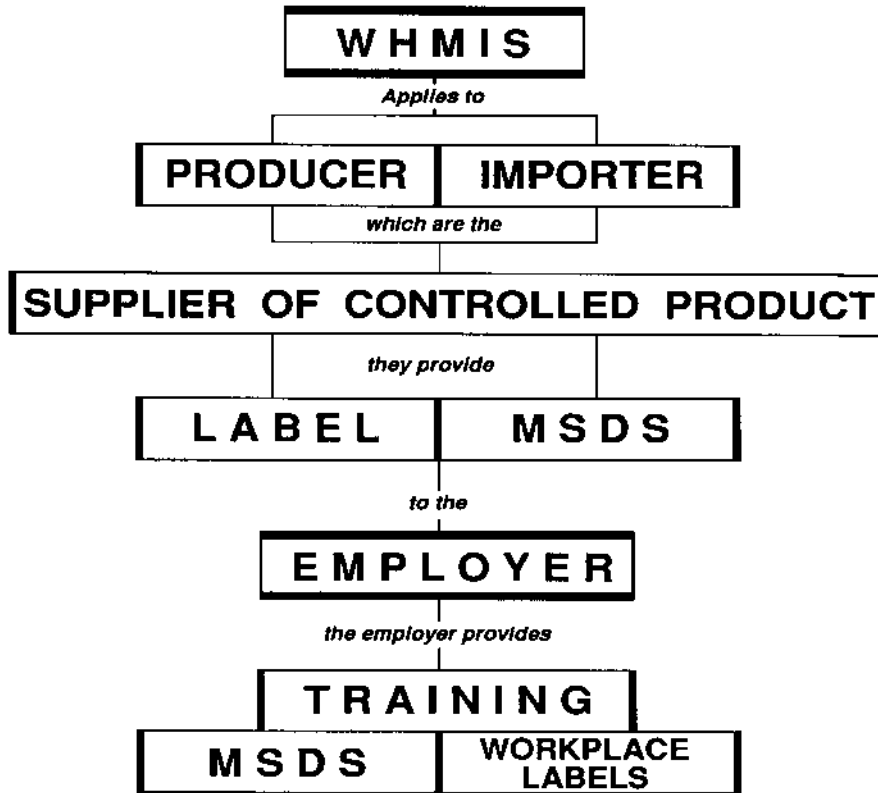


Figure 1
WHMIS Components





CLASSIFICATION

The Controlled Product Regulations apply only to those products that meet one or more of the criteria as defined by Sections 34 - 66 of the regulations (SOR/88-66).

The system includes six classes of controlled products:

1. Class A Compressed Gases
2. Class B Flammable and Combustible Material
3. Class C Oxidizing Material
4. Class D Poisonous and Infectious Material
5. Class E Corrosive Material
6. Class F Dangerously Reactive Material

To accommodate different hazards within the same group of material, some classes are subdivided. An example would be the difference in flammability between gasoline and diesel fuel. Even though they are both “flammable” in common terms, gasoline is certainly much more hazardous because of its extremely low flash point. Some gasolines readily ignite at temperatures as low as -45°C , where diesel fuels ignite usually only if heated above 55°C .

Divisions

Class A Compressed Gases

Class B Flammable and Combustible Material

Division 1: Flammable Gas

Division 2: Flammable Liquid

Division 3: Combustible Liquid

Division 4: Flammable Solid

Division 5: Flammable Aerosol

Division 6: Reactive Flammable Materials

Class C Oxidizing Material

Class D Poisonous and Infectious Materials

Division 1: Materials causing Immediate and Serious Toxic Effects

Division 2: Materials causing Other Toxic Effects

Division 3: Infectious Materials

Class E Corrosive Materials

Class F Dangerously Reactive Materials

Subdivisions

In addition, two of the divisions in Class D are further subdivided to distinguish between different degrees of toxicity. Because some materials are very poisonous while others are less so, the terms “very toxic” and “toxic” are used to describe that difference.

Class D Division 1, Acute Lethality



Subdivision A, Very Toxic:

- Oral less than 50 mg/kg
- Dermal less than 200 mg/kg
- Inhalation less than 2500 ppm/Gas
- Inhalation less than 1500 ppm/Vapor
- Inhalation less than 0.5 mg/L Dust, Mist, Fumes

Subdivision B, Toxic:

- Oral more than 50 but less than 500 mg/kg
- Dermal more than 200 but less than 1000 mg/kg
- Inhalation more than 1500 but less than 2500 ppm/ Vapor
- Inhalation more than 0.5 but less than 2.5 mg/L Dust, Mist, Fumes

In addition to the above, any poisonous gas listed in Class 2.3 and any liquid or solid poison listed in Class 6.1, Packing Group I & II of TDG are included in Subdivision A of Division 1.



TDG Class 2.3



TDG Class 6.1



Any liquid or solid poison listed in Class 6.1, Packing Group III of TDG falls into Subdivision B of Division 1.



TDG Class 6.1, Packing Group III materials

Class D Division 2, Chronic Toxic Effects



Subdivision A, Very Toxic:

- LD₅₀ Subchronic oral less than 10 mg/kg
- LD₅₀ Oral less than 20 mg/kg per day
- LC₅₀ Inhalation less than 25 ppm/Gas or Vapor
- LC₅₀ Inhalation less than 10 μ g/L Dust, Mist, Fumes

Teratogens and Embryotoxicity
Carcinogens
Reproductive Toxins
Respiratory Tract Sensitizers
Mutagens (heritable)

Subdivision B, Toxic:

- LD₅₀ Subchronic oral more than 10 mg/kg but less than 100 mg/kg per day
- LD₅₀ Subchronic dermal more than 20 mg/kg but less than 200 mg/kg per day
- LC₅₀ Inhalation more than 25 ppm but less than 200 ppm/Gas or Vapor
- LC₅₀ Inhalation more than 10 μ g/L but less than 100 mg/Dust, Mist, Fumes

Skin and Eye Irritation
Skin Sensitization
Mutagens

The Class D, Division 2 hazard symbol represents chronic toxicity, poisoning over long periods of time. It is never used in conjunction with the acute poison hazard symbol!



If this appears



this does not

Exempted Materials

Even though they appear to be controlled products, some groups of materials are currently fully or partially exempt from the Controlled Products Regulations.

Fully exempt materials:

- Manufactured articles
- Tobacco and products made of tobacco
- Wood products or products made of wood

Materials exempt from supplier labels and MSDS:

- Consumer products (as per HPA-Schedule I, Part II)
- Explosives under the Explosives Act
- Foods, drugs, cosmetics, etc., under the Food and Drug Act
- Materials regulated under the Pest Control Products Act
- Radioactive substances regulated under the Atomic Energy Control Act

Special materials:

- Hazardous Waste
Safe handling and storage at the workplace must be ensured. Any combination of identification, marking and worker education that achieves the above is acceptable.
- Special Shape Controlled Products which cannot endanger worker health because of their size and shape, such as sand containing crystalline silica, require label and MSDS and employee training.





Subject to TDGR

While controlled products are subject to the Transportation of Dangerous Goods Regulations (TDGR), none of the WHMIS requirements apply. Many controlled products are equally identified as regulated “Dangerous Goods”. Let’s look at an example to explain the above.

A company manufactures a windshield washer fluid. Upon classifying the finished product, using WHMIS criteria, it is found that the fluid has a flash point of 32°C and an LD₅₀ of 480 mg/kg. This puts the material into Class B, Division 2 and Class D, Division 1, Subdivision B. Because of its flash point, the fluid also matches the classification criteria for a Class 3.3 Flammable liquid under TDGR.

In order to offer the fluid for transport, handle it for transport or transport it, the consignor must comply with the TDG Act and Regulations. When the manufacturer ships the fluid, WHMIS does not apply to anyone involved in the transporting of the product.

In order to comply with both regulations, the package would reflect two systems and look something like this:

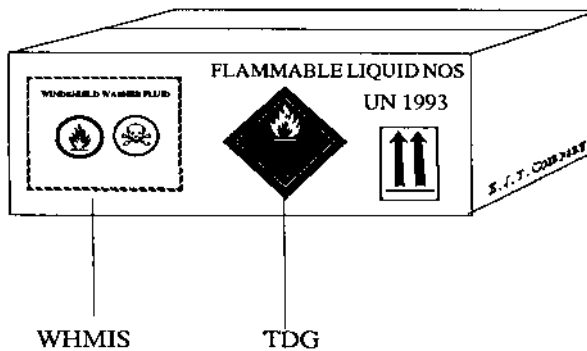
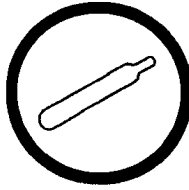


Figure 2
Typical TDGR Package

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CRITERIA FOR CLASSIFICATION

Class A - Compressed Gas



Class A includes any product, material, or substance contained under pressure, including compressed gas, dissolved gas or gas liquefied by compression or refrigeration that matches any of the following:

- Has a critical temperature of less than 50°C.
- Has an absolute vapor pressure greater than 294 kPa (2.90 atmospheres) at 50°C.
- Has an absolute pressure in the vessel that it is contained in exceeding 275 kPa (± 1 kPa) at 21.1°C (70°F), or 717 kPa (± 2 kPa) at 50°C (122°F).
- Has an absolute Reid Vapor Pressure (ASTM D-323-82) greater than 275 kPa at 37.8°C (100°F).

Summarizing the above, any product that is normally a gas below 50°C (122°F) or is contained under pressure greater than about 42 psia, at 21.1°C (70°F) or has an RVP greater than about 42 psia at 37.8°C (100°F) is in Class A.

Example:

Propane has a boiling point of -42.1°C at atmospheric pressure. That means that it is a vapour at any temperature higher than -42.1°C. The only way that we can contain it as a liquid above its boiling point is to confine it under pressure.

At room temperature, that pressure equals about 830 kPa (120 psi). The warmer it gets, the higher the pressure will be in the container. On a hot summer day, the pressure in a propane cylinder can increase to more than 1380 kPa (200 psi), often resulting in gas venting off through the safety valve.



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Class B - Flammable and Combustible Materials



Class B includes materials meeting the following physical characteristics:

Division 1: Flammable Gas

Any compressed gas included in Class A that at normal atmospheric pressure forms a flammable mixture with air when in concentration of 13% or less by volume, or over a concentration range of at least 12% by volume. (example: acetylene, hydrogen, propane)

Division 2: Flammable Liquid

Any liquid that has a flash point of less than 37.8°C. (example: gasoline, methanol, acetone)

Division 3: Combustible Liquid

Any liquid that has a flash point between 37.8°C and 93.3°C. (example: diesel fuel, varsol)

Division 4: Flammable Solid

Any solid that causes fire through friction or retained heat from manufacturing or processing. (example: matches, molten sulphur)

Any solid that can be readily ignited and burns so persistently and vigorously as to create a special hazard. (example: flares, charcoal starter cubes)

Any solid material that ignites readily and burns with a self-sustaining flame at a rate of more than 0.254 cm (0.1 inch) per second along its major axis.

Any dangerous goods that are included in Class 4.1 of the IDG regulations.

Division 5: Flammable Aerosols

Any product that is packaged as an aerosol and, when tested, yields a flame projection at full valve opening or a flash back at any amount of valve opening.

Division 6: Reactive Flammable Materials

Any product liable to spontaneous combustion or ignition when in contact with air, or liable to emit a flammable gas or become spontaneously combustible when in contact with water or steam. (examples: red phosphorus, sodium, calcium carbide)

Class C - Oxidizing Materials



Any material that causes or contributes to the combustion of another product by yielding oxygen or any other oxidizing substance, whether or not the material is itself combustible. (example: ammonium nitrate, potassium permanganate)

Any organic peroxide that contains the covalent O-O structure. (example: dibenzoyl peroxide, butyl hydroperoxide)

Class D - Poisonous and Infectious Material

Division 1: Immediate and Serious Toxic Effects



Any product or material that has immediate toxic effects, causing serious illness or death in a short period of time.



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Subdivision A, Very Toxic

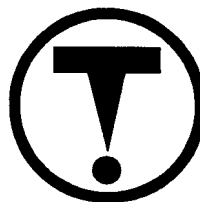
Any product that results in death if very small amounts are ingested or inhaled. (LD_{50} of less than 50 mg/kg of body weight, LC_{50} of less than 2500 ppm). (example: sodium cyanide, arsenic, nitric oxide, phosgene)

Subdivision B, Toxic

Any product that results in death if moderate amounts are ingested, absorbed or inhaled. (LD_{50} between 50 and 500 mg/kg of body weight). (example: hydrazine, benzedrine)

(LD_{50} and LC_{50} refer to lethal dose (solids and liquids) and lethal concentration (gas, vapor, fume, dust, mist), an amount that results in death to at least 50% of the test population.)

Division 2: Materials Causing Other Toxic Effects (Chronic Toxicity)



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Subdivision A, Very Toxic

Any material that if ingested, absorbed or inhaled in small amounts, results in sufficient severity to threaten life or causes serious permanent impairment. (LD_{50} of less than 10 mg/kg per day, LC_{50} of less than 25 ppm).

Any material that that causes injury to the embryo or fetus in a concentration that has no effect on the pregnant female. (Teratogenicity or embryotoxicity)

Any material that is known to cause cancer in humans or animals. (Carcinogenicity)

Any material that causes sterility or has adverse effects on reproductive capability in humans or animals. (Reproductive toxicity)

Any material that shows evidence of heritable genetic effects or mutagenicity in in vivo testing, or evidence of mutations transmitted to offspring, chemical interaction with genetic material, gene mutation, or chromosomal aberration.

Subdivision B, Toxic

Any material that if ingested, absorbed, or inhaled in small amounts, results in sufficient severity to threaten life or causes serious permanent impairment. (LD₅₀ of more than 10 but less than 100 mg/kg per day, LC₅₀ of more than 25 ppm but less than 250 ppm).

Any material that is proven to cause an effect graded at a mean of two or more for erythema formation, edema formation, corneal damage, two or one or more for iris damage, or 2.5 or more for conjunctival swelling or redness. (Skin or eye sensitization)

Any material that produces a response in 30% or more of the test animals when using an adjuvant, or 15% or more when not using an adjuvant, or where evidence shows that it causes skin sensitization in persons following exposure in a workplace. (Skin sensitization)

Any material that shows evidence of mutagenicity in mammalian somatic cells in vivo in a test to assess either gene mutation or chromosomal aberration. (Mutagenicity)

Division 3 Biohazardous Infectious Materials



Division 3 of Class D includes very special materials:

- Organisms that are known or suspected to cause serious
- Illness or death in humans or animals.
- The toxins of such organisms.

Organisms referred to above may be bacterial, viral, fungal, protozoal, rickettsial, or helminthic.

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Examples of materials falling into Division 3 would be:

- Cultures of such organisms.
- Specimens such as blood, urine, sputum, feces, or tissue samples for diagnostic purposes.
- Vaccines containing such organisms.

Organisms are assigned to one of four risk groups, using the World Health Organization's classification system:

Risk Group I (low risk):

Organisms that are unlikely to cause serious human disease. (Escherichia coli)

Risk Group II (moderate risk):

Pathogens that can cause severe human disease, but present only moderate risks to the community. Usually effective treatment is available. (Salmonella)

Risk Group III (high risk):

Pathogens that produce serious human diseases but are not spread by casual contact. (AIDS viruses)

Risk Group IV (very high risk):

These pathogens usually produce very serious human disease often resulting in death. They are highly infectious and often untreatable. (Marburg virus)

Class E - Corrosives



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Class E contains any acid or caustic that meet one or more of the following criteria:

They corrode steel (SAE 1020) or non-clad aluminum (SAE 7075T6) at a rate exceeding 6.25 mm per year when tested in accordance with NACE (National Association of Corrosion Engineers) standard test TM-01-69.

They are corrosive to skin when tested by the appropriate OECD standard test No. 404.

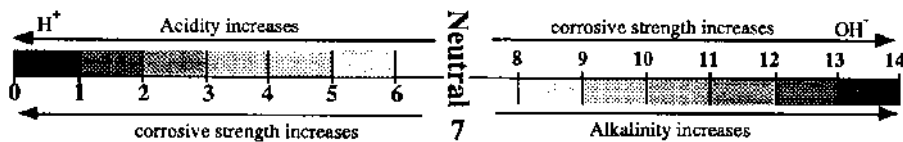
They are materials that are included in Class 8 of the Transportation of Dangerous Goods Regulations.

They are corrosive gases that are included in Class 2, Division 4 of the Transportation of Dangerous Goods Regulations.

They cause visible necrosis (death) of human skin tissue.

The common expression for corrosiveness is the pH value. This value expresses the concentration of hydrogen ions (by way of its negative logarithm) on a scale of 0 to 14. The middle of that scale, 7, is considered to be neutral. Numbers below 7 indicate acids, numbers above 7 indicate bases (caustics). The closer the pH value is to 0, the stronger the acid and the closer the pH value is to 14, the stronger the base.

Sulphuric acid, such as found in a car battery, is a strong acid with a pH of very near 0. Powdered or granular drain cleaners, such as “Drano”, are strong caustics. When mixed with water, they will have a pH very close to 14.



*Figure 3
The pH Scale*



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Class F - Dangerously Reactive Materials



Class F contains controlled products which meet one or more of the following criteria:

Products that can undergo vigorous polymerization, decomposition or condensation (liquefied acetylene, unless stabilized, can explosively decompose).

Products that become self-reactive under conditions of pressure or shock (example: ammonium azide, cyanuric triazide, etc.).

Products that on contact with water react by releasing a poisonous gas with an LC_{50} of less than 2500 ppm (alkali metal cyanides can release the highly toxic gas hydrogen cyanide on contact with water).

Class F is often confused with incompatibility of products. Many chemicals, or controlled products, are incompatible with other chemicals or whole families of other chemicals. Examples of such incompatibility are acids and caustics, oxidizers and flammable substances, etc.

Mixing ammonium nitrate with diesel produces a substance like dynamite; oiling the pressure regulator used on a compressed oxygen cylinder can result in a violent explosion.

Class F does not deal with the above hazards. The only criteria found in this class that involves incompatibility is that between a product and water. All other incompatibilities are normally addressed on the material safety data sheet under the section of "Reactivity Data".

CONSUMER PRODUCTS

Consumer products exemptions occur for commodities that:

- Are included in Part II of Schedule I of the Hazardous Products Act, and
- Are packaged as “consumer products”.

To qualify, the product has to meet the following criteria:

It must be packaged for the consumer in a size that is primarily intended to be sold to the public for personal use and consumption

It is available to the public through retail outlets

The labelling and packaging complies with the Consumer Chemicals and Container Regulations and the Consumer Packaging and Labelling Act and Regulations

Examples of such products are household cleaners readily available at retail outlets such as certain types of oven cleaners, bowl cleaners, drain cleaners, paint and wax strippers, ammonia, bleaches and certain detergents.

Other typical consumer products are such items as enamels, varnishes, BBQ lighter fluid, lamp oils, varsol, turpentine, and camp stove fuel.

Any of the above products, because of their size and intended use, do not require a supplier label nor a material safety data sheet when used by workers at a workplace.

A drum of gasoline, even though often available through retail outlets such as gasoline bulk dealers, would not fit the above criteria and would be a controlled product if used at the workplace.

To ensure workplace safety, some suppliers separate their products into two distinctive streams, one for consumer use with consumer labelling and another for industrial use with WHMIS labelling and material safety data sheets.

The employer’s responsibility for consumer products at the workplace is to ensure that employees handle and use them correctly and safely. Some basic training on the hazards of such products should be included in the WHMIS training program.





GLOSSARY of TERMS

ACGIH	American Conference of Government Industrial Hygienists
ANSI	American National Standards Institute
CAS	Chemical Abstract Service
CCOHS	Canadian Centre for Occupational Health & Safety
CPR	Controlled Products Regulations
F. P.	Flash point in degrees Celsius (°C)
HMIRA	Hazardous Materials Information Review Act
HMIRR	Hazardous Materials Information Review Regulations
HPA	Hazardous Products Act
IARC	International Agency for Research on Cancer
IDL	Ingredient Disclosure List
LFL	Lower Flammable Limit (% of product in air)
LD₅₀	Lethal Dose, 50% kill of test population
LC₅₀	Lethal Concentration, 50% kill of test population
MSDS	Material Safety Data Sheet
mm Hg	Millimetre of mercury
mg/kg	Milligrams per kilogram of body weight
mg/m³	Milligrams per cubic metre
NA	North American Product Identification Number (TDGR)
OEL	Occupational Exposure Limits (TLV equivalent)
OSHA	Occupational Safety and Health Administration (U.S.)

pH	A numerical expression of acidity/alkalinity
PPM	Parts per million
STEL	Short Term Exposure Limit
TDGR	Transportation of Dangerous Goods Act & Regulations
TLV^R	Threshold Limit Value
TWA	Time Weighted Average (over an 8-hour shift)
UFL	Upper Flammable Limit (% of product in air)
UN	United Nations Identification Number (TDGR)





Notes: