

Understanding a Material Safety Data Sheet (MSDS)



Canadian Centre for Occupational Health and Safety

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Table of Contents

Introduction	1
1. Product and Company Identification	3
2. Hazards Identification	3
3. Composition, Information on Ingredients	6
4. First Aid Measures	6
5. Fire Fighting Measures	7
6. Accidental Release Measures	7
7. Handling and Storage	8
8. Exposure Controls/Personal Protection	8
9. Physical and Chemical Properties	10
10. Stability and Reactivity	10
11. Toxicological Information	11
12. Ecological Information	11
13. Disposal Considerations	12
14. Transport Information	12
15. Regulatory Information	13
16. Other Information	13

Introduction

A Material Safety Data Sheet (MSDS) provides basic information on a material or chemical product. A MSDS describes the properties and potential hazards of the material, how to use it safely, and what to do in an emergency. The purpose of this document is to assist Canadian employees in understanding and interpreting this type of information.

The MSDS is an essential starting point for the development of a complete health and safety program for the material. MSDSs are prepared by the manufacturer or supplier of the material. They tend to be general in nature, since they provide summarized information which tries to address all reasonably anticipated uses of the material.

The information on MSDSs is organized into sections. The specific names and content of these sections can vary from one supplier's MSDS to another, but are often similar to the 16 sections of the ANSI Standard for MSDS preparation, as listed below. If you are using a 9-section MSDS, the types of information may be in a different order and under slightly different headings.

1. Product and Company Identification

The product identifier (normally the product name) appears both on the MSDS and on the WHMIS label. To locate the correct MSDS, always use the product identifier, not a shortened name that may be used at your workplace. Check that the name of the manufacturer and/or supplier matches the label as well. The MSDS and label may also display other identification, such as a product code or catalog number.

2. Hazards Identification

The Hazards Identification section describes the ways you may be exposed to the material and the harmful health effects it can have. Effects observed in experimental animals may be included, if they are considered relevant to people.

Emergency Overview

The material's appearance (e.g. colour, physical form, odour) and the most significant immediate concerns, including fire, reactivity and health and environmental hazards are described in this subsection.

Regulatory Status

Information on the regulatory status of the material under the Controlled Products Regulations (WHMIS) and/or the US Hazard Communication Standard may be included in this subsection.

Potential Health Effects

Route of Entry (Primary Routes of Exposure)

The possible routes of exposure are skin contact, eye contact, inhalation (respiratory system), and ingestion (swallowing). How important each route of entry is for a particular material depends on many factors, such as the physical properties of the material and how it is used. When designing ways to minimize exposure, each Route of Entry needs to be considered. Chemicals can cause harm either at the point of contact, by absorption into the body, or both. Chemicals absorbed into the body can affect body systems and organs far away from the point of entry. For example, phenol absorbed through the skin can cause fatal nervous system and kidney injury.

Effects of Acute Exposure to Product

An acute exposure is one that takes place over a short period of time (minutes, hours or days). Health effects caused by an acute exposure are usually seen at the time of exposure. Sometimes, they may not appear for several hours or even days after an exposure.

You need information on the typical effects of a short-term exposure (signs and symptoms) because they can alert you that you are being accidentally exposed. Any symptoms you experience which may be associated with use of a material should be reported so that your workplace can be investigated to find out the cause. Possible reasons for the symptoms can vary widely. For example, perhaps the material has passed through your gloves, or the ventilation system is not working effectively. Sometimes the symptoms may not be related to an exposure at work; they may be caused by a cold, for example.

Effects of Chronic Exposure to Product

A chronic exposure is a long-term exposure (months or years). Chronic exposures may be described as prolonged, meaning very long, or repeated, meaning many exposures. Any illness related to a chronic exposure may develop very slowly or may not appear until many years after the exposure has stopped. You should be aware that at the time of the exposure you may experience no warning symptoms, but an illness possibly related to the exposure may appear months or years later. If these types of effects are possible for the material you are handling, it is especially important to minimize your exposure by following established safe handling procedures.

Irritancy of Product

Some products can cause irritation (reversible reddening, swelling and pain) if they come into direct contact with the skin, eyes or respiratory tract (nose, breathing airways and lungs). If there is information available about irritancy of the product, for example from tests on experimental animals, it will be indicated in this section.

Sensitization to Product

Sensitization is the development, over time, of an allergic reaction to a chemical. Sensitizers may cause a mild response on the first few exposures but, as the sensitivity develops, the response becomes worse with subsequent exposures. Eventually, even short exposures to low concentrations can cause a very severe reaction.

There are two different types of occupational sensitization: skin and respiratory. Typical symptoms of skin sensitivity are swelling, redness, itching, pain, and blistering. Sensitization of the respiratory system may result in symptoms similar to a severe asthmatic attack. These symptoms include wheezing, difficulty in breathing, chest tightness, coughing and shortness of breath.

Carcinogenicity

Materials are identified as carcinogens if they are recognized as carcinogens by the American Conference of Governmental Industrial Hygienists (ACGIH), or the International Agency for Research on Cancer (IARC). The lists of carcinogens published by these organizations include known human carcinogens and some materials which cause cancer in animal experiments. Certain chemicals may be listed as suspect or possible carcinogens if the evidence is limited or inconclusive.

Reproductive Toxicity

Reproductive toxicity includes effects on the reproductive process of adult males and/or females. Possible reproductive effects include reduced fertility and menstrual changes.

Teratogenicity and Embryotoxicity

A teratogen is a substance that can cause birth defects. An embryotoxin is a substance which can cause toxic effect on the developing embryo. Both teratogenicity and embryotoxicity result from a harmful effect on the embryo or the developing fetus during pregnancy.

Many chemicals can cause teratogenic / embryotoxic effects if there is an extremely high exposure. In these cases, the exposed person would experience other noticeable signs and symptoms caused by the exposure. Chemicals which cause teratogenic / embryotoxic effects in the absence of other significant harmful effects are regarded as true teratogens / embryotoxins. Pregnant women need to be particularly careful to minimize their exposure to these materials.

Mutagenicity

A mutagen is a substance that can cause changes (mutations) in the DNA of cells. DNA determines the characteristics that children inherit from their parents and also determines how cells in the body divide or reproduce. Mutagenicity is the ability of a substance to cause mutations.

A number of laboratory tests are used to screen chemicals for possible mutagenic effects which may also be linked to carcinogenic, teratogenic or reproductive risks. In themselves, mutagenicity test results may not reliably predict the risk to humans since the human body can eliminate mutagens and repair many mutations. Mutagenicity information is included on the MSDS because it is an early indicator of potential hazard.

Toxicologically Synergistic Products

Synergism means that exposure to more than one chemical over the same period of time can result in health effects greater than expected when the effects of exposure to each chemical are added together. Very simply, it is like saying $1 + 1 = 3$. When chemicals are synergistic, the potential hazards of the chemicals should be reevaluated, taking their synergistic properties into consideration. It is important to know whether certain combinations of chemicals may cause health effects that are more severe than might be anticipated by considering the effects of each chemical separately.

* * * * *

The health effects information in the Hazards Identification section of the MSDS should be considered general since a particular material will not affect everyone the same way. In addition, the way in which a material is used or handled in a particular workplace will influence the degree of the health hazard.

If the product you are using contains skin or respiratory sensitizers, carcinogens or reproductive toxins, following safe handling practices and procedures is particularly important so that you minimize your exposure.

As you read MSDSs from different suppliers, you will see that they are not all written in the same way. Most provide information on health effects which would reasonably be anticipated under conditions of normal use, spills or emergencies. Others provide worst case information, describing any known health effect which may possibly occur at any dose, by any route of exposure. Because of these different approaches, one must be cautious in assuming that a certain product is more or less hazardous than another on the basis of information given in this section.

Potential Environmental Effects

This subsection describes the potential effects of the material if it is released into the environment, for example whether it will harm fish or wildlife or accumulate in the environment.

3. Composition, Information on Ingredients

Potentially hazardous chemical components, by-products and impurities of the product are listed in this section along with the approximate amount (percentage) of each. CAS numbers for the ingredients are usually included as well. These are unique identifiers for chemicals, assigned by the Chemical Abstracts Service (CAS) of the American Chemical Society. Since a chemical can have many different names, this number can be very useful when trying to find more information.

This section may also indicate if one or more of the components is an approved trade secret.

4. First Aid Measures

The First Aid Measures section describes actions to be taken immediately in case you are accidentally exposed to the material. The purpose of first aid is to minimize injury and future disability. In serious cases, first aid may be necessary to keep the victim alive.

First aid information needs to be known before you start working with the material. There is no time to find and read the MSDS during an emergency. First aid procedures should be periodically reviewed, especially by employees trained to give first aid. All employees should know the location of the facilities and equipment for providing first aid; for example, the eyewash fountains, safety showers and first aid kits.

When medical treatment is necessary, send the MSDS, if it is readily available, to the emergency facility with the victim. If the MSDS is not available, you should send the material's label or a labelled container of the material, if it is small enough. Emergency medical responders need to know what the material is and what First Aid Measures have been recommended and used. Occasionally, the MSDS has additional instructions (or a Note to Physician) which may be useful to the emergency doctor.

5. Fire Fighting Measures

This section describes any fire hazards associated with the material and fire fighting procedures. The information can be used to select the appropriate type of fire extinguishers and to plan the best response to a fire for a particular work site. Much of the information is intended for firefighters and emergency response personnel. If the material is a potential fire hazard, you should also refer to Section 7 for special handling precautions.

The information in this section, combined with information from Section 7 (Handling and Storage) and Section 10 (Stability and Reactivity) can be used to determine where a certain material should be stored (for example, flammable liquids should be stored in specially designed facilities away from incompatible chemicals).

6. Accidental Release Measures

General instructions for responding to an accidental release or cleaning up a spill are provided in this section. Specific information, such as recommended absorbent materials for spill cleanup, may be included. The information is intended to be used mainly by emergency responders and environmental professionals.

7. Handling and Storage

In this section, you will find general precautions necessary for the safe handling of the material, including any equipment that may be required. All possible hazards (fire, reactivity, health and environmental) need to be considered when developing safe handling procedures. For example, for dispensing a flammable liquid, the MSDS may suggest electrical grounding and bonding of containers.

The storage recommendations provided in this section provide a good starting point for deciding where and how materials should be stored (e.g. at what temperature). Refer also to Section 5 (Fire Fighting Measures) and Section 10 (Stability and Reactivity).

Much of the information in this section is intended for occupational health and safety professionals or those responsible for designing safe storage / handling facilities.

8. Exposure Controls/ Personal Protection

This section provides information which is used to develop procedures and practices for working safely with the material. Most MSDSs are written to address all reasonably anticipated uses of the material. Because they must address such a wide range of usage situations, the information may not be entirely applicable to your job. A health and safety professional can help you in interpreting the information and assessing its relevance.

Exposure Guidelines

Exposure guidelines, if available, are given for each component. Typically these are occupational exposure limits such as TLVs (Threshold Limit Values), published by the American Conference of Governmental Industrial Hygienists (ACGIH). Some manufacturers provide their own recommended exposure limits for their products. Legal (regulated) exposure limits in your jurisdiction (provincial, territorial or federal) may be different from those listed on the MSDS. Health and safety professionals use exposure limits as standards when air sampling is conducted.

Engineering Controls

Engineering control systems reduce potential hazards either by isolating the hazard or by removing the hazard from the work environment. They either control the potential hazard at its source (local exhaust ventilation), remove it from the general area (general ventilation) or put up a permanent barrier between the worker and the potential hazard (isolation or enclosure). Engineering control systems are important because they are built into the work process to reduce the hazards automatically.

Substitution of a less hazardous material or industrial process is always the best way to reduce a hazard

and should be considered first. Engineering control systems are the next best option and are preferred over other control measures such as the use of personal protective equipment.

You need to make sure that engineering control systems recommended for your job are properly checked and maintained and that they are operating when you are working with the material. If there are changes in the process or materials, the controls may have to be changed as well.

Personal Protective Equipment (PPE)

General guidance is provided on the need for and selection of personal protective equipment.

Eye Protection

Depending on the job you are doing and the type of material you are handling, you may need various levels of eye protection (e.g. safety glasses, chemical safety goggles, a face shield or some combination of these).

Skin Protection

Skin protection includes items such as gloves, aprons, full body suits, and boots. The MSDS should tell you the types of rubbers or other materials that provide the best protection against the product you are using. No one material acts as a barrier to all chemicals. It is also important to consider the temperature conditions and the need for materials not easily cut or torn. Sometimes, the MSDS may simply advise you to use impervious (resistant) materials. In this case, you need to find out which specific materials are best. You may be able to obtain this information from the product supplier or manufacturer or from a protective clothing supplier or manufacturer. It is also important to maintain your protective clothing or gloves properly and replace them when necessary.

Respiratory Protection

There are many different types of respirators. One type may be effective against some chemicals but may provide little or no protection against others. Selecting the best respirator for you can be quite complicated. Usually a qualified person must carry out a detailed assessment of the workplace, including all chemicals used and their airborne concentrations and forms. Consequently, complete respiratory protection guidelines generally cannot be given on the MSDS.

If respirators are required at your work site, a complete respiratory protection program including respirator selection, fit testing, training and maintenance is necessary. The relevant regulatory and consensus standards should be consulted.

General Hygiene Considerations

This subsection provides general hygiene information that is usually not material specific, e.g. "wash thoroughly after handling and before eating or drinking", but is considered good practice.

9. Physical and Chemical Properties

You should check that the description (physical state and appearance) of the material on the MSDS is the same as the material you have. If it isn't, you may not have the correct MSDS. Alternatively, the material may be old or may have decomposed during shipping or storage. In either case, the information on the MSDS may not apply, and you should obtain additional advice.

The rest of the information in this section is used to help determine the conditions under which the material may be hazardous. Technical specialists use this information to develop specific work site procedures for exposure control, storage, handling, fire fighting, spill clean-up, etc.

10. Stability and Reactivity

This section of the MSDS describes any conditions under which the material is unstable or can react dangerously and conditions that should be avoided. Unstable materials may break down (decompose) and cause fires or explosions or cause the formation of new chemicals that have different hazards. Conditions such as heat, sunlight, and aging of the chemical may cause unstable chemicals to break down.

Some chemicals are hazardous because they can polymerize or undergo a chain reaction. This reaction may generate a lot of heat, may generate enough pressure to burst a container, or may be explosive.

Chemicals that can decompose or polymerize often contain additives called stabilizers or inhibitors which reduce or eliminate the possibility of a hazardous reaction.

Incompatible materials are materials which may react violently or explosively if mixed or brought together. These materials should be stored separately and should not be mixed unless special procedures are followed.

You need to be aware of the information in this section so you can store and handle the material safely and avoid mixing incompatible materials.

* * * * *

11. Toxicological Information

This section of the MSDS contains toxicity information, either for the ingredients of the product or the product as a whole. This information can be quite technical and difficult to interpret. It is used to support the conclusions presented in Potential Health Effects provided in Section 2 - Hazards

Identification. If you are uncertain whether the information is relevant to your workplace and your job, you should ask a knowledgeable health and safety professional. When reading about the effects of the material on animals, it is important to remember that the effects are not necessarily the same for people.

LD50 (species and route)

LC50 (species)

These values are obtained from toxicity testing using experimental animals and are used to indicate the short-term poisoning potential of a material (the lower the value, the more toxic the material). LD50 (lethal dose 50%) is the amount of a material, given all at once, which causes the death of 50% of a group of test animals. The LD50 can be determined using any route of exposure, but dermal (applied to skin) and oral (given by mouth) LD50s are most common. If the route of exposure is inhalation, the value is called an LC50, which stands for lethal (airborne) concentration 50%.

Since the information provided in this section supports the conclusions drawn for Potential Health Effects, you may also see information on topics such as: Effects of Acute Exposure to Product, Effects of Chronic Exposure to Product, Irritancy of Product, Sensitization to Product, Carcinogenicity, Reproductive Toxicity, Teratogenicity and Embryotoxicity, Mutagenicity and Toxicologically Synergistic Products.

12. Ecological Information

Ecological Information is not specifically required under WHMIS. If included, this section contains information that is useful in evaluating the environmental impact of the material if it is released (e.g. toxicity to fish, birds, plants and micro-organisms). This information is intended mainly for environmental professionals and other company staff evaluating use, disposal or spill control.

13. Disposal Considerations

This section of the MSDS is intended mainly for environmental professionals. General waste disposal information will normally be included. The MSDS does not usually contain all the steps and precautions necessary for adequate hazardous waste disposal. As well, the MSDS often does not give the federal, provincial, or local regulations which must be followed. The appropriate authorities for your area should be contacted for this information.

14. Transport Information

This section of the MSDS is intended for those responsible for shipping the material. If there are special precautions necessary during shipment, they will be provided. The TDG (Transportation of Dangerous Goods) PIN number (product identification number) will also be provided if the product meets the TDG criteria. The supplier may also include the TDG classification.

15. Regulatory Information

Information in this section is aimed primarily at regulatory compliance personnel. Useful references to applicable health, safety and environmental laws and regulations may be provided, along with information on the regulatory status of the product. The WHMIS classification for the product may also be given.

16. Other Information

This section is used to provide supplementary information which the author of the data sheet considers important for the safe use of the material (e.g. label text, hazard ratings). Reference sources used in preparing the data sheet are sometimes listed.

The date the MSDS was prepared (or the last time it was reviewed or revised) should be indicated. The data sheet will be updated when new information becomes available. You should check that the MSDS you are using is less than 3 years old. If it isn't, you need to request an updated MSDS from the supplier or manufacturer. You can also use the manufacturer and/or distributor telephone number(s) provided to obtain more safe handling information if you need it.

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It is important to remember that an MSDS is not a complete source of health and safety information on its own but should be seen as a starting point in developing safe handling practices and procedures. Always refer to your company's safety rules and procedures for more information.