

Workplace Hazardous Materials Information System (WHMIS)

Safety & Security Services

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ALGONQUIN
COLLEGE

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1. Glossary of Terms

Acute Exposure:	A single exposure to a substance or multiple exposures occurring within a short time, usually 24 hours or less.
Allergens:	Substances, which trigger the body's immune response and produce an allergic response.
Asphyxiants:	Substances that replace oxygen, and eventually making breathing impossible.
Auto-ignition Temperature:	Temperature at which the vapour from a liquid will ignite without a source of ignition such as a spark or flame.
Carcinogens:	Substances or agents capable of causing cancer in mammals.
Ceiling Exposure Limit [C or CEL]:	The maximum concentration of a chemical to which one may be exposed at any time. This value is never to be exceeded without special precautions.
Chronic Exposure:	Repeated exposure to a substance over a relatively long period of time [typically more than ten per cent of lifetime in laboratory studies].
Combustible Liquid:	Liquids with flash points 100 F [37.8 C] or more, but less than 93.3 F [200 C] when tested in accordance with an established procedure.
Flammable Limits:	The upper and lower concentrations of a gas or vapour in air between which an explosion or propagation of flame will occur when an ignition source is present.
Flammable Liquid:	A liquid with a flash point below 100 F [38.7 C.] when tested in accordance with an established procedure.
Flash Point:	The minimum temperature at which a liquid gives off enough vapour to ignite in the presence of a source of ignition under specified test conditions.
Half Life:	The period of time for a chemical or radioactive substance to lose half its concentration or activity due to metabolic uptake, decay, or other chemical change.
I.D.L.H.:	Immediately Dangerous to Life and Health. An atmosphere where the concentration of oxygen or flammable or toxic air contaminants would cause a person without respiratory protection to be fatally injured or would cause irreversible and incapacitating effects on that person's health.
Irritants:	Substances, which cause reddening, itching or pain to exposed bodily parts.
LC50 and LD50:	These are not exposure criteria, but represent the concentrations taken orally or inhaled, which killed about 50% of a test population. One need not remember the exact meaning of the terms. It is useful however, to know that a low LC or LD50 quantity indicates the relative toxicity of a substance.
Mutagen:	Substances that cause genetic mutation in living cells. May occur in either reproductive or body cells.
Odour Threshold:	The lowest airborne concentration of a chemical that can be perceived by

the sense of smell.

Pictogram:	Refers to the stylized graphical material, which appears within a hazard symbol.
Poisons:	Any substances which injurious to health when taken into the body.
Polymerization:	A chemical reaction in which one or more small molecules combine to form larger molecules. A hazardous polymerization is one that takes place at a rate, which releases large amounts of energy.
Risk Phrase:	A statement identifying a hazard that may arise from the nature of the controlled product or the class, division or subdivision of controlled products.
Sensitizer:	A substance, which on first exposure causes little or no reaction in man or test animals, but which on repeated exposure may cause a marked response not necessarily, limited to the contact site. Skin sensitization is the most common form in industry, although respiratory tract sensitization also occurs.
Short Term Exposure Limit [STEL]:	The maximum exposure limit to which one may exposed for a brief (generally 15 minute) period for a maximum of 4 such periods per day, without suffering serious health effects.
Solvent:	A liquid that will dissolve another substance.
Synergist:	An agent or substance that augments or increases the activity or effects of another agent or substance. Often increases the dangerous effects of the mixture.
TDG:	Refers to Transportation of Dangerous Goods Act
Teratogen:	Substances that deform a fetus or cause birth defects.
Threshold Limit Value:	Threshold Limit Value is a term used by the American Conference of Governmental Industrial Hygienists [ACGIH] to express the airborne concentration of a material to which nearly all persons can be exposed day after day, without adverse effects.
Time Weighted Average [TWA]:	The airborne concentration of a substance to which a person is exposed when calculated as a weighted average over a period of time [usually 8 hours].
Vapour:	The gaseous form of a substance that is found in a solid or liquid state at normal atmospheric pressure.
Vapour Pressure:	The pressure exerted by a saturated vapour above its own liquid in a closed container.
Ventilation - exhaust:	Considered as either "general" or "local" exhaust ventilation, and involve mechanical systems, which are designed, installed and maintained for the control of airborne contaminants. Local exhaust systems are preferred for the control of harmful substances. Designs should be in accordance with established ventilation principles produced by the American Conference of Government Industrial Hygienists.

Warning
Properties:

The capability of chemicals to be noticed by human senses at levels in the air below those, which may cause ill health effects.

2. PREAMBLE

The Occupational Health and Safety Act Part IV and Workplace Hazardous Material Information System (WHMIS) Regulation 860, require all workplaces to follow specific regulations in order to minimize exposure to *hazardous* materials. The College shall comply with the WHMIS regulations in all its facilities.

Applicable *hazardous* materials used in the College shall comply with the requirements of WHMIS.

3. ROLES AND RESPONSIBILITIES

I) Suppliers

Suppliers of hazardous materials are responsible for:

- a) Classifying hazardous materials into the six WHMIS classes. A supplier must consider the technical criteria of each of the six classes and determine the applicability to its products.
- b) Providing supplier labels on the hazardous materials going to the workplace.
- c) Providing MSDSs with the hazardous materials going to the workplace.
- d) Providing any information available including trade secrets (confidential business information) to a doctor or nurse in the case of a medical emergency.

II) Supervisors

Supervisors are responsible for:

- a) Advising workers of hazards in their workplace (OHSA, sec. 25, 27 and WHMIS (860) sec. 6). Supervisors have a legal duty to be familiar with the WHMIS requirements as outlined in this program and all other hazards associated with the job.
- b) Identifying equipment, protective devices and measures to be taken to enable the employee to work safely.
- c) Ensuring that employees work as required, using the required equipment and protective measures identified by the supervisor or by the Occupational Health and Safety Act or regulations.
- d) Ensuring all hazardous materials in the workplace are properly labelled.
- e) Maintaining a current file of MSDSs for all controlled products used in a work area. All MSDSs must be current to within three years. New or updated MSDSs should be obtained from the supplier.
- f) Providing worker education. Employee positions must be rated in terms of the potential risk of exposure to hazardous materials on the job. Supervisors must ensure that adequate and appropriate training is attained by employees who work with or in close proximity to hazardous chemicals.
- g) Updating hazardous materials inventories on an annual basis, as requested by the Occupational Health and Safety Department.

III) Workers

All Algonquin College employees are workers as defined by the Occupational Health and Safety Act and are responsible for:

- a) Working in compliance with OH&S legislation and the WHMIS regulation (860) and following safe work procedures.
- b) Reporting any hazards or personal chemical exposure incidents to their supervisor.
- c) Not using any machine, equipment, etc., in such a way, or working in a manner, that places them or others in danger.
- d) Applying their WHMIS training to work safely on the job.

IV) Joint Occupational Health & Safety Committees

The Joint Occupational Health and Safety Committees (JOHSC) are responsible for :









- a) Identifying hazards related to hazardous materials and processes.
- b) Consulting in the development and review of the Algonquin College WHMIS program.




V) Occupational Health & Safety Section




The Occupational Health and Safety Section is responsible for:



- a) Developing, reviewing and revising the WHMIS program at Algonquin College in consultation with the Joint Health and Safety Committees. This program complies with the WHMIS regulation and assists employees of Algonquin College to work safely.
- b) Providing advice, consultation and training to Senior Management, Deans, Directors, Department Managers, Coordinators, employees, unions, and Joint Health and Safety Committees related to the WHMIS program.
- c) Maintaining records of WHMIS training for employees at Algonquin College.
- d) Soliciting inventories of hazardous materials annually from departments and updating the centralized records as required.
- e) Responding to or providing advice with respect to chemical emergencies where the user is unable to deal with the problem.
- f) Developing procedures to enable the employees to work safely.
- g) Providing consultation with supervisors regarding the development of written procedures for employees, where necessary.

4. WHMIS CLASS AND DIVISION HAZARD SYMBOLS

Hazard Symbol	Class of Controlled Product
	<p style="text-align: center;">Class A Compressed Gas</p>
	<p style="text-align: center;">Class B Flammable and Combustible Materials</p>
	<p style="text-align: center;">Class C Oxidizing Materials</p>
	<p style="text-align: center;">Class D1 Poisonous and Infectious Materials: Immediate and Serious Toxic Effects</p>
	<p style="text-align: center;">Class D2 Poisonous and Infectious Materials: Other Toxic Effects</p>
	<p style="text-align: center;">Class D3 Poisonous and Infectious Materials: Biohazard Infections Material</p>
	<p style="text-align: center;">Class E Corrosive Materials</p>
	<p style="text-align: center;">Class F Dangerously Reactive Materials</p>

Hazard Symbol	Class of Controlled Products	Potential Hazard	Handling Instructions	Examples
	Class A - Compressed Gas	<p>Poses an explosion danger because gas in cylinder is held under pressure.</p> <p>Container may explode if heated.</p> <p>May be an asphyxiant</p> <p>Container may explode if dropped.</p>	<p>Do not drop container.</p> <p>Keep container away from all ignition sources.</p> <p>Store only in designated areas.</p>	<p>Acetylene, Oxygen, Carbon Dioxide in Fire Extinguishers, Propane.</p>
	Class B - Flammable and Combustible Material	<p>May burn at relatively low temperatures.</p> <p>May burst into flame spontaneously in air or release a flammable gas on contact with water.</p> <p>May cause a fire when exposed to heat, sparks, or flames or as a result of friction.</p>	<p>Keep the material away from heat sources and other combustible materials.</p> <p>Never smoke when working with or around material.</p> <p>Store in a cool fire proof area.</p>	<p>Acetone, Kerosene, Butane, charcoal, varnish, spray paints, Ammonia, Chlorine</p>
	Class C - Oxidizing Material	<p>Poses a fire and or explosion risk in the presence of flammable combustible material.</p> <p>May cause fire when it comes into contact with combustible materials such as wood.</p> <p>May react violently or cause an explosion when it comes into contact with combustible materials such as fuels.</p> <p>May burn skin and eyes upon contact.</p>	<p>Keep the material away from combustible materials and store in designated area.</p> <p>Keep the material away from sources of ignition.</p> <p>Wear proper protective equipment, including eye, face and hand protection and protective clothing.</p>	<p>Nitric Acid, Organic peroxides, Hydrogen peroxide.</p>

	<p>Class D, Division 1 Poisonous and Infectious Material: Immediate and serious toxic effects</p>	<p>Is a potentially fatal and poisonous substance.</p> <p>May be fatal or cause permanent damage if it is inhaled or swallowed or if it enters the body through skin contact.</p> <p>May burn skin and eyes upon contact.</p>	<p>Handle material with extreme caution.</p> <p>Avoid contact with the skin or eyes by wearing the proper protective equipment, including eye, face and hand protection and protective clothing.</p> <p>Avoid inhaling by working in well –ventilated areas and or wearing respiratory equipment.</p> <p>Wash and shower thoroughly after using</p> <p>Store the material in designated places only.</p>	<p>Sulphuric Acid, Acrylonitrile, Cyanide, Hydrofluric Acid, Fuming Nitric Acid</p>
	<p>Class D, Division 2 Poisonous and Infectious Material: Other toxic effects</p>	<p>Is a poisonous substance that is not immediately dangerous to health</p> <p>May cause death or permanent damage as a result of repeated exposures over time.</p> <p>May be a skin or eye irritant.</p> <p>May be a sensitizer, which produces a chemical allergy.</p> <p>May cause cancer.</p> <p>May cause birth defects or sterility.</p>	<p>Avoid skin and eye contact by wearing all protective equipment necessary including eye, face and hand protection and protective clothing</p> <p>Avoid inhaling by working in well-ventilated area and/or using respiratory equipment.</p> <p>Store the material in designated places only.</p>	<p>Lead, Mercury, Toluene, Xylene, Methylene Chloride.</p>
	<p>Class D, Division 3 Poisonous and Infectious Material: Biohazardous infectious materials</p>	<p>May cause a serious disease resulting in illness or death.</p>	<p>Take every measure to avoid contamination.</p> <p>Handle the material only when fully protected by the proper, designated equipment.</p> <p>Handle the material in designated areas where engineering controls are in place to prevent exposure.</p>	<p>Aids, Hepatitis B, Salmonella, Malaria.</p>

	<p>Class E - Corrosive Material</p>	<p>Causes severe eye and skin irritation upon contact.</p> <p>Causes severe tissue damage with prolonged contact.</p> <p>May be harmful if inhaled.</p>	<p>Keep containers tightly closed.</p> <p>Avoid skin and eye contact by wearing all necessary protective equipment, including eye, face and hand protection and protective clothing.</p> <p>Avoid inhaling by using in well-ventilated areas only and/or wearing the proper respiratory equipment.</p>	<p>Bleach, Hydrochloric Acid, Sulfuric Acid, Ammonium Hydroxide, Sodium Hydroxide</p>
	<p>Class F - Dangerously Reactive Material</p>	<p>Is very unstable.</p> <p>May react with water to release a toxic or flammable gas.</p> <p>May explode as a result of shock, friction or increase in temperature.</p> <p>May explode if heated when in a closed container.</p>	<p>Keep material away from heat.</p> <p>Open containers carefully, Do not drop them.</p> <p>Store the material in a cool, flame-proof area.</p>	<p>Ozone, Picric Acid, Florine, Hydrogen Cyanide, Sulfuric acid</p>

5. WHMIS CLASSES AND POTENTIAL HEALTH EFFECTS

Class A: Compressed Gas

A substance that at room temperature (20 °C) is in the gaseous state and kept under pressure, e.g. oxygen, anhydrous ammonia, chlorine, acetylene, etc. Examples found on campus are acetylene, helium, ammonia, argon, chlorine, hydrogen, nitrogen, oxygen, and propane.

Possible Hazards:

- If the head of a gas cylinder is broken off, the escaping gas can propel it like a rocket.
- If overheated, the cylinder could explode even if the gas is not explosive or flammable.
- Some gases such as chlorine and ammonia are poisonous.
- If a leak develops, concentrations of the gas in the air could become life threatening.
- A major leak from a cylinder in an enclosed space will replace some of the air.
- Some compressed gases (e.g. acetylene, propane and hydrogen) are flammable. An air-gas mixture leak of this nature in a room can be dangerously explosive.

Storage and Handling:

- All cylinders of compressed gases must be secured by chains or straps so they won't fall over.
- Cylinders are strapped or chained to a cart, and are always transported with the protective cylinder cap (not a regulator) in place.
- Pressurized cylinders should be stored where they will not be exposed to temperatures above 50 °C.
- Empty cylinders should be labelled as such and stored separately from full ones.

Class B: Flammable and Combustible Material

A solid, liquid or gas that will ignite and continue to burn if exposed to a flame. Combustible liquids have a flash point between 37.8 °C to 93.3 °C, whereas flammable liquids have a flash point below 37.8 °C. Flash point is defined as the lowest temperature at which a flammable liquid gives off sufficient vapour to form an ignitable mixture with air near its surface or within a vessel.

This class includes six types of materials:

- Flammable gas, e.g. acetylene, propane
- Flammable liquid, e.g. methanol, xylene
- Combustible liquid, e.g. acetic acid
- Flammable solid, e.g. aluminum powder
- Flammable aerosol which uses a flammable gas as a propellant, e.g. propane, butane
- Reactive flammable material which reacts violently with water, e.g. calcium carbide, metal powders.

Some examples found on campus are varsol, acetone, methanol, methylene chloride, WD-40, motor oil, ether, paints, and gasoline.

Possible Hazards:

Many solvents and lubricants are flammable or combustible liquids (e.g. diethyl ether, varsol) and many aerosols (e.g. spray paints, WD-40) contain flammable compressed gases as propellants. If inhaled, solvent vapours can affect the brain. Symptoms include dizziness, nausea, staggering, fainting, and slurred speech. Some solvents (e.g. diethyl ether) are anaesthetics. Solvents tend to remove protective oils from the skin, causing chapped skin, dermatitis or skin rashes after prolonged or repeated exposures. Solvents splashed into the eyes can cause severe irritation. If excessive amounts of the chlorinated vapours (ie., carbon tetrachloride, methylene chloride) are inhaled regularly over months or years, they may cause cancer or chronic liver and kidney damage. Petroleum distillates (e.g. varsol, gasoline) can cause a severe reaction if the liquid gets into the lungs.

Storage:

- Avoid sparks and flames near solvents, especially flammable or combustible solvents.
- Do not store solvents, particularly flammable ones, in sunlight or where they may be heated above room temperature.
- Do not store or transport solvents together with strong acids or with oxidizers.

Emergency Measures:

- Move victims of vapour inhalation to fresh air and give artificial respiration if required.
- If the material is splashed into the eyes, flush with plenty of water for at least 15 minutes.
- Use a non-abrasive soap when washing these materials from the skin.
- If a spill occurs, identify the spilled material, get help immediately, use protective equipment, and contain the spill using a suitable absorbent such as sand.
- Use a respirator when handling spills in an enclosed space.
- Use the buddy system when cleaning up hazardous spills.

Class C: Oxidizing Material

Any material that causes or contributes to the combustion of another material by yielding oxygen or any other oxidizing material, whether or not the material itself is combustible, e.g. hydrogen peroxide, oxygen, potassium permanganate.

Class D: Poisonous and Infectious Material

This class includes three further divisions:

Class D1 Materials causing immediate and serious toxic effects

These are materials which cause serious harmful effects, including death, within a short period of time after exposure. This division has two further subdivisions:

Subdivision A: Very Toxic Material

i.e., LD50(oral)<50mg/kg

e.g. chlorine, potassium cyanide

Subdivision B: Toxic Material

i.e., 500mg/kg>LD50(oral)>50mg/kg

e.g. hydroquinone

NB: LD50 is lethal dose 50 – the single dose of a substance that causes death in 50% of a test animal population by exposure to the substance via absorption, ingestion or injection. It is expressed as milligrams of substance per kilogram of the animal's body weight. The route of exposure and the species of animal is often also indicated.

Class D2 Materials causing other toxic effects

This division includes materials which cause chronic toxic effects. This division has two further subdivisions:

Subdivision A: Very Toxic Material

This includes materials which can cause:

- Chronic toxicity (90-day study) at a dose of <10mg/kg/day
- Teratogenicity
- Embryo toxicity
- Carcinogenicity (e.g. benzene)
- Reproductive toxicity (e.g. Lead compounds)
- Respiratory tract sensitization (e.g. toluene diisocyanate)
- Mutagenicity of germ cells (e.g. methylene chloride)

Subdivision B: Toxic Material

This includes materials which can cause:

- Chronic toxicity (90-day study) at a dose of 10 to 100mg/kg/day
- Skin or eye irritation e.g. xylene
- Skin sensitization e.g. formaldehyde
- Mutagenicity (somatic cells)

Class D3 Biohazardous infectious material.

An organism or its toxins that may cause serious infectious disease, e.g. viruses, bacteria.

Class E: Corrosive Material

A substance that will erode steel or aluminum or destroy animal tissues, e.g. sodium hydroxide (caustic soda), hydrochloric acid.

Some examples of acids are sulphuric, nitric and muriatic acids. Some examples of alkalis are sodium hydroxide (caustic soda, lye), potassium hydroxide, ammonium hydroxide (ammonia), and liquid drain opener. Some examples of other chemical irritants are formaldehyde and calcium chloride.

Hazards:

Many acids and alkalis are corrosive when concentrated. They will burn the skin and eyes. If diluted, they are better described as irritants. Irritants will cause reddening and pain, but probably no permanent damage if washed off promptly.

Storage and Handling:

- Strong acids should be stored separately from other types of chemicals.
- Many strong acids and alkalis generate heat when mixed with water which could cause them to boil.
- Always add acid to water, not water to acid.

Emergency Measures:

- For splashes on the skin or in the eyes, wash with water for at least 15 minutes and seek medical attention.
- If a spill occurs, identify the spilled material and get help immediately. Sweep up solid materials or soak up liquids with a neutralizer (available from the spills kit in Science Stores).
- Always wear protective equipment.

Class F: Dangerously Reactive Material



A material which will react with water to produce a poisonous gas or which will undergo a reaction if the container is heated, pressurized or agitated, e.g. hydrogen peroxide and aluminum sulphide produce hydrogen sulphide gas in water.

6. LABELLING

I) Supplier Labels

A "supplier" is anyone who manufactures, processes, packages or imports controlled products. The supplier is obligated to provide package labelling and MSDS's. The "supplier label" will have the following seven categories of information:

SULPHURIC ACID, FUMING
ACIDE SULFURIQUE

<p>Risk phrases: HIGHLY IRRITATING TO SKIN, EYES AND NOSE.</p> <p>Health Hazard Data: STRONG ACID, VAPOURS HIGHLY TOXIC, BURNS SKIN ON CONTACT.</p> <p>Precautionary Statements: EYES: FACESHIELD AND GOGGLES GLOVES: RUBBER</p> <p>Personal Protective Equipment: RUBBER APRON, RUBBER BOOTS.</p> <p>First Aid Measures: EYES: FLUSH WITH LARGE QUANTITIES OF WATER. CONSULT PHYSICIAN AT ONCE. SKIN: FLUSH WITH WATER. CONSULT PHYSICIAN. Ingestion: TREAT WITH BAKING SODA, MILK OF MAGNESIA OR LARGE QUANTITIES OF MILK. DO NOT INDUCE VOMITING.</p>	 	<p>Risque(s) possible(s): EXTREMEMENT IRRITANT POUR LA PEAU, LES YEUX ET LE NEZ.</p> <p>Reinseignement sur les dangers pour la sante: ACIDE FORTE, TRAITER COMME POUR L'ACIDE FORTE.</p> <p>Surexposition aigue: PEAU ET YEUX.</p> <p>Measures de precaution: EQUIPMENT DE PROTECTION SPECIFIQUE: YEUX: ECRAN FACIAL ET LUNETTES GANTS: EN CAOUTCHOUC</p> <p>Autre vêtements et equipment: TABLIER EN CAOUTCHOUC, BOTTES EN CAOUTCHOUC.</p> <p>Premiers Soins: YEUX: BIEN RINCER A GRANDE EAU PENDANT 15 MINUTES. CONSULTER UN MEDECIN. Peau: RINSER A L'EAU. CONSULTER UN MEDECIN. Ingestion: TRATER COMME POUR L'ACIDE FORTE. CONSULTER UN MEDECIN.</p>	<p>REFER TO MATERIAL DATA SHEET FOR FURTHER INFORMATION. POUR PLUS D'INFORMATION, CONSULTER LA FICHE SIGNALÉTIQUE.</p> <p>SOUTHERN ALBERTA INSTITUTE OF TECHNOLOGY, 1301-16 AVENUE N.W. CALGARY, AB. T2M 0L4</p>
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- **Product Identifier:**
The product name or number must be identical to the product identifier on the MSDS.
- **Supplier Identifier:**
This will include the supplier, manufacturer or importer's name and the location of the principal place of business.
- **Reference to MSDS:**
A statement such as "SEE MATERIAL SAFETY DATA SHEET" is required and must appear on the WHMIS label when an MSDS is required.
- **WHMIS Hazard Symbols:**
These must meet the regulatory specifications. All symbols will have a distinctive

circular border, and must be displayed in a colour that will not be confused with TDG safety marks, such as the orange explosive symbol found in TDG regulations. Prohibited colours are contained in the WHMIS Regulations. Often these symbols appear in black and white only.

- **Risk Phrases:**

Wording which clearly indicates the risks involved when using the product.

- **Precautionary Measures:**

Safe handling, use and storage information for the product.

- **First Aid Measures:**

A clear description of the immediate steps to be taken in the event of harmful contact with the product.

In addition to the above, supplier labels must also have a distinctive "hash mark" border, letters, numbers which contrast distinctly from any other markings on the containers.

For "suppliers labels" information must be in English and French, for all seven categories. For containers of 100 millilitres [ml] or less only the following four categories of information need be provided on a supplier label:

1. Product identifier
2. Supplier identifier
3. A reference to the MSDS
4. Hazard symbols

II) Workplace Labels

If a controlled product is transferred at the workplace to other containers, the employer may need to apply a **workplace label** to the new container.

Workplace labels provide the following information:

- product identification;
- information for safe handling;
- a statement indicating that the MSDS is available.

Workplace labels may be in the language of choice at the workplace.

A workplace label is not needed when:

- used in a laboratory; or
- will be under the control of the employee who transferred the product to the new container for use on the same shift; or
- a controlled product is produced in a laboratory for research and development work in the same laboratory.

Product Identification	
Flammability <input type="checkbox"/>	Reactivity <input type="checkbox"/>
Health <input type="checkbox"/>	Personal Protection <input type="checkbox"/>
SEE MATERIAL SAFETY DATA SHEET	

7. MATERIAL SAFETY DATA SHEETS (MSDS)

The MSDS is a technical bulletin which provides detailed hazard, precautionary and emergency information on the controlled product. It's the second element of the WHMIS information system and is meant to supplement the alert information found on the label. The MSDS must be made available to workers for review and use. An example of the format of a MSDS is shown on the following pages. Although no particular format or design of a MSDS is stipulated in the WHMIS legislation, the MSDS must provide all the information required in the nine categories set out in the regulations. No section of the MSDS can be left blank. If information for a section is not available or not applicable the MSDS must indicate that fact; the abbreviation N/A is not acceptable. An MSDS must not be more than three years old from the date of preparation.

It is against regulations to use a controlled product without the appropriate MSDS on hand. Therefore, one should make sure that the MSDS is available and consult it before using a product. In the event of an emergency, as in the case of an accident where a person requires medical attention due to overexposure to a controlled product, a copy of an MSDS should be provided to the attending medical personnel.

The following pages include the various sections of an MSDS and a brief explanation of the corresponding relevant technical information.

SECTION 1 — PRODUCT IDENTIFICATION AND USE

PRODUCT IDENTIFIER		PRODUCT IDENTIFICATION NUMBER (PIN)	
PRODUCT USE			
MANUFACTURER'S NAME		SUPPLIER'S NAME	
STREET ADDRESS		STREET ADDRESS	
CITY	PROVINCE	CITY	PROVINCE
POSTAL CODE	EMERGENCY TELEPHONE NO.	POSTAL CODE	EMERGENCY TELEPHONE NO.

SECTION 2 — HAZARDOUS INGREDIENTS

HAZARDOUS INGREDIENTS	%	CAS NUMBER	LD ₅₀ OF INGREDIENT (SPECIFY SPECIES AND ROUTE)	LC ₅₀ OF INGREDIENT (SPECIFY SPECIES)

SECTION 3 — PHYSICAL DATA

PHYSICAL STATE	ODOUR AND APPEARANCE			ODOUR THRESHOLD (ppm)
VAPOUR PRESSURE (mm Hg)	VAPOUR DENSITY (AIR=1)	EVAPORATION RATE	BOILING POINT (°C)	FREEZING POINT (°C)
pH	SPECIFIC GRAVITY	COEFF. WATER/DIST		

SECTION 4 — FIRE AND EXPLOSION DATA

FLAMMABILITY YES <input type="checkbox"/> NO <input type="checkbox"/> IF YES, UNDER WHICH CONDITIONS?		
MEANS OF EXTINCTION		
FLASH-POINT (°C) AND METHOD	UPPER FLAMMABLE LIMIT (% BY VOLUME)	LOWER FLAMMABLE LIMIT (% BY VOLUME)
AUTOIGNITION TEMPERATURE (°C)	HAZARDOUS COMBUSTION PRODUCTS	
EXPLOSION DATA	SENSITIVITY TO IMPACT	SENSITIVITY TO STATIC DISCHARGE

SECTION 5 — REACTIVITY DATA

CHEMICAL STABILITY YES <input type="checkbox"/> NO <input type="checkbox"/> IF NO, UNDER WHICH CONDITIONS?
INCOMPATIBILITY WITH OTHER SUBSTANCES YES <input type="checkbox"/> NO <input type="checkbox"/> IF SO, WHICH ONES?
REACTIVITY, AND UNDER WHAT CONDITIONS
HAZARDOUS DECOMPOSITION PRODUCTS

ST. IER

SECTION 6 — TOXICOLOGICAL PROPERTIES

OF ENTRY

SKIN CONTACT

SKIN ABSORPTION

EYE CONTACT

INHALATION

INGESTION

OF ACUTE EXPOSURE TO PRODUCT

OF CHRONIC EXPOSURE TO PRODUCT

PE LIMITS

IRRITANCY OF PRODUCT

SENSITIZATION TO PRODUCT

CARCINOGENICITY

GENICITY

REPRODUCTIVE TOXICITY

MUTAGENICITY

SYNERGISTIC PRODUCTS

SECTION 7 — PREVENTIVE MEASURES

ENTIAL PROTECTIVE EQUIPMENT:

ES (SPECIFY)

RESPIRATOR (SPECIFY)

EYE (SPECIFY)

EAR (SPECIFY)

CLOTHING (SPECIFY)

OTHER (SPECIFY)

KEEPING CONTROLS (SPECIFY, EG, VENTILATION, ENCLOSED PROCESS)

AND SPILL PROCEDURE

DISPOSAL

WORK PROCEDURES AND EQUIPMENT

STORAGE REQUIREMENTS

ADDITIONAL SHIPPING INFORMATION

SECTION 8 — FIRST AID MEASURES

FIRST AID MEASURES

SECTION 9 — PREPARATION DATE OF MSDS

PREPARED BY (GROUP, DEPARTMENT, ETC.)

PHONE NUMBER

DATE

SECTION 1 – PRODUCT IDENTIFICATION AND USE

This section identifies the material by trade name, brand name, code name or number specified by the supplier, chemical name, common name or generic name. The name of the material should be the same as it appears on the container label.

The name, address and emergency telephone number of the product's manufacturer, and if different, supplier, is included in this section. The intended use of the product, for which the information supplied is solely applicable, is also mentioned. For example, a solvent meant for use in degreasing tanks may pose a significant risk to workers if it is used as a manual cleaning solvent because of its volatility.

SECTION 2 - HAZARDOUS INGREDIENTS

All potentially hazardous ingredients of the material and the approximate concentration of each ingredient must be listed in this section. This section also states the toxicity of each ingredient. When a material contains ingredients that are registered as trade secret, a registration number assigned by the Hazardous Materials Information Review Commission will appear in place of the ingredients; hazards and safety information, however, must be reported. In the event of medical emergency the company must disclose the identity of the ingredients to a medical professional.

Chemical Identity and Concentration

Chemical identity is the name of the substance (ex. acetone). A substance may be a pure substance or it may be a mixture of a number of substances. Each of the substances making the mixture is called an ingredient. The concentration refers to the percentage of an ingredient contained in a substance; this may be expressed either as the ratio of the ingredient's weight to the total weight of the substance (w/W%), weight to total volume (w/V%) or volume to total volume of the substance (v/V%). If the substance is a mixture, the chemical identity and concentration of each ingredient that meets the criteria for disclosure will be listed in this section. The information is important because it can alert you to a hazard and the need to exercise caution.

CAS Number

The CAS registry number is a unique identification number assigned to each chemical by the Chemical Abstracts Service (CAS) Division of the American Chemical Society. This unique number can be used to confirm the chemical identity or obtain more information about the ingredient.

PIN

The Product Identification Number (PIN) is a four digit number for pure chemicals or groups of chemicals used for materials during transportation to assist with locating hazard information. PIN's can be of UN (United Nations) or NA (North American) origin.

LD50 Species and Route

The LD50 ("Lethal Dose 50") of an ingredient is the amount of the ingredient that, when administered in a single dose to a group of test animals by a defined route (e.g. ingestion or absorption through skin) will kill 50% of the test population of animals. The LD50 values are obtained from animal studies and are expressed in milligrams per kilogram of the body weight. Remember that the lower the LD50, the greater the toxicity because less of the ingredient is required to kill the test population.

LC50 Species and Route

The LC50 ("Lethal Concentration 50") of an ingredient is the concentration of the ingredient in air which when inhaled by a group of test animals for a certain length of time (usually 4 hours), will kill 50% of those animals. LC50 is expressed in parts of material per million parts of air by volume (ppm) or as milligrams per cubic metre of air (mg/m³).

Both LD50 and LC50 are obtained from animal studies and the MSDS must indicate the species of animal tested and the route by which the hazardous ingredient was administered. Note that these values refer to pure ingredients. In a material, which is a mixture, the ingredients are present in the stated percentage concentration only.

SECTION 3 - PHYSICAL DATA

This section describes the physical properties of the substance and helps in the identification of the substance. However, more importantly, safe handling is ensured when you know beforehand how the material will behave at a different temperature or pressure or when it is exposed to water, air or light, etc. A correct interpretation of the properties listed in this section can alert you to the possible hazards.

Physical State

This indicates whether the material is a solid, liquid or gas at room temperature (20°C) and atmospheric pressure. The physical state of a substance is a good indicator as to how the substance may enter the body. Gases mainly enter the body by inhalation. Liquids that evaporate to form a vapour, or are atomized to form a mist can enter the body by inhalation. Liquids and solids can enter the body by skin contact (absorption) and also by ingestion.

Odour and Appearance

The description of odour (e.g. sweet, fruity, almond-like, strong, mild, faint, irritating, etc.) and appearance (e.g. colour, greasy, soft, powder, granules, flakes, gelatinous, viscous, thick, paste, etc.) of a substance may also aid in its identification i.e., allows you to make sure that you are handling the correct material. Hazards posed by granular or powdery material would be different from those posed by lumps of solid of the same substance; as

an example, granular sodium is more reactive than a piece of sodium, zinc dust is more reactive than granular zinc.

Odour Threshold

The odour threshold is the lowest concentration of the material in air that can be smelled. Normally this is expressed in parts per million (ppm) or in mg/m³. Odour threshold may be used in evaluating the material's warning properties: a substance has good warning properties if the odour threshold is less than 1/10 of the exposure limit and poor warning properties if it is three times, or more, above exposure limit. Odour thresholds should be used with caution in evaluating warning properties because individual sensitivities to odour vary and some odourant substances (e.g. hydrogen sulphide), may de-sensitize the sense of smell.

Specific Gravity

Specific gravity is the weight of a given volume of material compared to the weight of an equal volume of water at the same temperature. Water at 4°C has a specific gravity of 1.00 and is used as a standard against which specific gravity of other liquids are measured. Insoluble materials with specific gravity greater than 1.00 will sink in water, for example, mercury (specific gravity 13.555). Flammable liquids which have specific gravities less than 1.00 and are water insoluble, e.g. benzene, which has a specific gravity 0.88, will float on water, which is an important piece of information in cleaning up spills or fighting fire.

Vapour Pressure

Vapour pressure is the pressure exerted by a saturated vapour above its own liquid (or volatile solid, e.g. iodine, naphthalene, moth balls, camphor) in a closed container at 20°C (unless a different temperature is specified). This is measured in millimetres of mercury (mm-Hg) where one atmosphere equals 760 mm-Hg. The vapour pressure of acetone is 181.7 mm-Hg at 20°C. Vapour pressure is a measure of the tendency of the material to form a vapour, the higher the vapour pressure the greater the ease with which the material will evaporate. Materials with high vapour pressures can be hazardous in enclosed, non-ventilated areas.

Vapour Density

Vapour density is the weight of a given volume of a vapour or gas compared to the weight of an equal volume of air.

Vapour density of air is 1.0. Gases or vapours lighter than air have vapour densities less than 1.0. For example, hydrogen, helium and methane will rise in the air. Those with vapour densities more than 1.0, for example, chlorine, carbon dioxide, acetone (2.0), diethyl ether (2.56), are heavier than air and will collect in low lying areas or enclosed

places, along or under floors, in sumps, sewers, manholes, ditches, trenches. These create fire, explosion or health hazards. These attributes will also be affected by changes in temperature, turbulence and time. This information is useful when determining position of baffles in fume hood and orientation of the exhaust duct in flammable liquid storage cabinets.

Evaporation Rate

The evaporation rate is a measure of how quickly the material becomes a vapour in air at a specified temperature, usually normal room temperature (20°C). The rate is given in comparison to a chemical that evaporates fairly quickly, generally n-butyl acetate, but other chemicals such as ether are also used. The chemical used for comparison must be listed. Compared to n-butyl acetate, which is assigned a rate of 1.0, evaporation rates can be classified as:

- FAST evaporating if greater than 3.0, e.g. - methyl ethyl ketone (MEK), 3.8; acetone, 5.6 hexane, 8.3; diethyl ether, 37.5.
- MEDIUM evaporating if ranging from 0.8 to 3.0, e.g. - 95% ethanol, 1.4; VM&P naphtha, 1.4; methyl isobutyl ketone, 1.6.
- SLOW evaporating if less than 0.8, e.g. - xylene, 0.6; isobutyl alcohol, 0.6; normal butyl alcohol 0.4; water, 0.3; mineral spirits, 0.1.

Boiling Point

This is the temperature at which a liquid becomes a gas at normal atmospheric pressure (760 mm-Hg). At this temperature, the vapour pressure of the liquid is equal to the surrounding atmospheric pressure. Of course, below this temperature liquids can still evaporate to form a vapour. As the liquid approaches the boiling point, the change from liquid to vapour or gas is very rapid and the vapour concentration in the air can be very high. The boiling point of a liquid is important because of the sudden volume change of the product and the extent of its presence in air. Flammable materials with low boiling points present special fire hazards, example - gasoline, 38°C; diethyl ether, 35°C, pentane, 35-36°C.

Freezing Point

Freezing point is the temperature at which a substance changes its physical state from liquid to solid, at normal atmospheric pressure. This information is important for storage and handling purposes. Volume changes may occur at the freezing point and the frozen material may cause its container to rupture. A change of the physical state could also alter the hazardous nature of the material.

pH

pH on a numerical scale from 0 to 14 is a measure of acidity or basicity (alkalinity) of a material when dissolved in water. pH of 7 represents neutrality (pure water) at 20°C. pH values lower than 7 represent acidity; greater than 7 represents alkalinity. Corrosive acidic solutions will have a value ranging from pH 0-3; and corrosive basic solutions will have a pH in the range of 11-14. The pH scale is logarithmic and a difference of one pH unit represents a factor of 10. Both strong acids and bases (alkalies) are corrosive to the skin and eyes.

Coefficient of Oil/Water distribution

The coefficient of oil/water distribution is the ratio of the solubility of the material in water to its solubility in oil (in lab test n-octanol is used as "oil"). A value of less than 1 indicates that the material may be more soluble in oils and greases than in water; such a material is more likely to be absorbed by the skin. A value of greater than 1 indicates better solubility in water; such a material could be absorbed by the mucosal tissue of the eyes and lungs. This information can be useful in selecting personal protective equipment (respirators, mask, coverall etc.) and assessing first aid requirements.

Percent Volatile

This number indicates the percentage of a liquid or solid (by volume) that will evaporate at ambient temperature (unless some other temperature is stated). For example, gasoline and mineral spirits (paint thinner) is 100% volatile since over a period of time each will evaporate completely. This information is important because it alerts you to the potential for releasing harmful vapour into the air and creating a fire or health hazard. In such a situation special ventilation and storage controls may be required.

SECTION 4 - FIRE OR EXPLOSION HAZARD

This section describes the potential fire hazards posed by the material and the conditions under which the material may be flammable, as well as the type of fire extinguisher to be used to put out the fire.

Conditions of Flammability

Conditions under which the material will burn or explode are stated here. The information presented here is useful for taking proper measures in using, storing or disposing of the material.

Means of Extinction

Here the appropriate means of extinguishing a fire involving the material are described, e.g., the type of fire extinguisher to use. The wrong approach can make the situation

worse. Some burning substances can react with water and may best be smothered with carbon dioxide, foam or dry chemical fire extinguishers. In most fires, the greatest danger is from the toxic smoke produced that can quickly fill the work area.

Flash Point and Method

Flash point (FP) is the lowest temperature at which a liquid gives off enough vapour to form an ignitable mixture with air over its surface in the presence of a source of ignition (such as an open flame or spark) under specified test conditions. Flash points are determined in both enclosed ("closed-cup") and non-enclosed ("open-cup") test systems; flash points measured by closed-cup methods tend to be lower than by open-cup. For a given test method, the lower the flash point of a material the greater the potential fire hazard.

Compare diethyl ether (FP -45°C), gasoline (FP -42°C), acetone (FP -17.8°C), Ethyl alcohol (FP 12.8°C).

Flash Back

Flash back occurs when a trail of flammable vapour is ignited by a distant flame, spark or other ignition source. The flame travels back along the trail of vapour to its source. The result could be a serious fire or explosion.

Flammable Limits in Air:

- Upper Flammable or Explosive Limit (UFL or UEL) - The highest concentration of a material in air that will ignite or explode if it contacts an ignition source (spark, electric arc, flame or high heat). At concentrations higher than the UEL, the mixture is too rich to burn or explode.
- Lower Flammable or Explosive Limit, (LFL or LEL) - The lowest concentration of a material in air (% volume in air) that will burn or explode in presence of an ignition source. At concentration lower than the LEL, the mixture is too lean to burn. The lower explosive limit is particularly important, because if this value is low, it will require only a small amount of the flammable/combustible liquid vaporized in air to form an ignitable mixture.
- The concentration range between the upper and lower flammability limits, where the gas or vapour is flammable, is known as the flammable or explosive range. The larger the range the greater the potential hazard. For example, the flammable or explosive range for acetone in air is 2.6% to 12.8% (26,000 ppm to 128,000 ppm); for diethyl ether 1.9% to 48%.

Autoignition Temperature

The lowest temperature at which a flammable gas or vapour mixture in air will ignite without a spark or an open flame. This is an important piece of information in areas where gases or vapours may be exposed to high temperatures or hot surfaces. For example, with an autoignition temperature of 100°C, a steam line or a glowing light bulb may ignite

carbon disulphide; diethyl ether (autoignition temperature, 160°C) can be ignited by the surface of a hot plate.

Hazardous Combustion Products

The burning of a substance may give off products that may be hazardous. In that case such products will be listed here. This information alerts the user to these possible harmful materials. The information is especially useful for emergency response and fire fighting personnel.

Explosion Data - sensitivity to mechanical impact and static discharge

The information in this section indicates whether or not the material will burn or explode on shock or mechanical impact (e.g. dropping the container or jarring the container during transport) or as a result of friction as in scooping up spilled material. Metal azides and acetylides, organic nitrates, and organic peroxides are shock sensitive.

Information on how readily the material can be ignited by static discharge or electric spark is also given in this section.

There are limits established for storage of flammable liquids according to national and local Fire Codes.

SECTION 5 – REACTIVITY DATA

This section provides information on the stability of the material and the likelihood of its dangerous reaction with other chemicals. The information is significant for handling procedures, storage arrangements and, along with data in Section 4, may be useful in prevention and the control of fire and explosions.

Chemical Stability

A chemical is unstable if, in the pure state, or as it is produced or transported, it will vigorously polymerize, decompose or become self-reactive under the physical conditions of mechanical shock, vibration, pressure, temperature, or when exposed to light, air or water. These reactions may generate a lot of heat, may generate enough pressure to burst a container, or may be explosive.

Chemicals that can decompose, peroxidize or polymerize often contain additives called inhibitors or stabilizers which reduce or eliminate the possibility of hazardous reactions. Copper and mercury azides and acetylides, some organic peroxides and organic nitrates are chemically unstable. The information in this section indicates whether the substance is stable or not, and under what conditions. It is essential that the material is stored and handled to avoid conditions that may cause an adverse reaction.

Incompatibility

Two substances are incompatible, if on combination, they react dangerously and produce toxic, corrosive or flammable substances, excessive heat or explosion. For example: 1. strong acids are incompatible with bases 2. sodium is incompatible with water 3. flammables are incompatible with toxics, and with oxidizers 4. oxidizers are incompatible with reducers. A common example is "Javex" (bleach) and household ammonia, which when mixed, produce explosive chloramines. On contact with acids, hypochlorite emits highly toxic fumes of chlorine and chlorides. Incompatible substances must be handled and stored with care to prevent accidental mixing by spillage or breakage.

Reactivity

This section lists specific conditions under which the product can become reactive, such as high temperature, pressure and exposure to light, air or moisture. For example, a monomeric substance, which is stable in the presence of an inhibitor, may violently polymerize if the inhibitor content is reduced and may cause the container to break and the contents to be spilled.

Hazardous Decomposition Products

This section lists any hazardous substances produced when the material decomposes as a result of ageing, heating, burning or reaction. Organic peroxides are formed on ageing of ethers and unsaturated cyclic compounds, formation of irritant gases and chemical asphyxiants occur on combustion of some materials (carbon monoxide is produced by the decomposition of acetone).

The stability, incompatibility and reactivity are very important points to consider in terms of storage and using/handling of hazardous materials. The University's 'Controlled Product Standard' provides guidelines on standard practices for the use and storage of controlled products.

SECTION 6 - TOXICOLOGICAL PROPERTIES

This section contains health hazard information and describes the possible health effects, which may result from overexposure to the material.

Route of Entry

All primary routes of entry of the material into the body are listed here so that effective measures against exposures can be taken. Four primary routes of entry into the body are: contact, ingestion, absorption and inhalation.

Contact – Some chemicals may cause local, dermal effects upon contact. (irritation, burns, drying of the skin)

Ingestion - This means taking the material into the body by mouth (swallowing). Ingestion of toxic materials may occur by transfer from contaminated fingers as a result of eating and drinking in a contaminated work area. Good personal hygiene as well as other protective measures are required to prevent ingestion.

Absorption - Some chemicals may be absorbed into the body through skin or mucous membranes such as eyes. Many organic chemicals are absorbed through the skin and the mucosal membranes, e.g., phenols, amines, alkyl lead compounds and pesticides. Skin protection is required to prevent dermal hazard absorption.

Inhalation - This means taking the material into the body by breathing it in. Very tiny blood vessels in the lungs are in constant contact with the air you inhale. Airborne contaminants can be easily absorbed through this tissue. In the occupational environment, substances are likely to exist in an airborne state as fumes, dust, fibres, mists, vapours or gases. This is the most common route of entry. Inhalation hazards often require air contaminant controls such as ventilation or, as a last resort, respiratory protection.

Effects of Acute Exposure

These refer to adverse health effects on a human or animal body with symptoms ranging from headache, coughing, skin rash, and nausea and vomiting to loss of consciousness, coma and death. These can develop rapidly and come quickly to a crisis resulting from short-term exposure to the material either as a single exposure or multiple exposures within a short time (24 hours or less). For example, an acute exposure to carbon monoxide or cyanide can, depending on the dose, induce symptoms such as headache, dizziness, coma and death.

Effects of Chronic Exposure

These refer to adverse health effects on a human or animal body resulting from repeated exposure (daily or weekly) to the substance over a relatively long period of time or from a single exposure with symptoms that develop over a long period of time, or that recur frequently. As for example, recurrent exposure to low levels of carbon monoxide may initiate or enhance heart problems particularly in persons with predisposing conditions of heart ailments; repeated exposure to free silica in air may cause lung disease (silicosis).

Exposure Limits

These are maximum limits of exposure to an airborne substance as recommended by various bodies such as ACGIH (American Conference of Governmental Industrial Hygienists), NIOSH (National Institute of Occupational Safety and Health) or as legislated by a health and safety regulatory agency.

Exposure limit is the maximum concentration in air of a hazardous substance (in the form of a gas, vapour, dust, fibre, mist, fume) to which nearly all workers without personal protective equipment can be repeatedly exposed without adverse health effects. Because individual susceptibilities may vary, some may be affected more seriously by the aggravation of a pre-existing condition.

Exposure limits are intended for use as guidelines in the control of potential health hazards and are not fine lines between safe and unsafe exposures. In Ontario, the ACGIH Threshold Limit Values (TLVs) are referenced in determining Occupational Exposure Levels (OELs). The three types of exposure limits (TLVs) are:

- TWA - Time Weighted Average: The maximum average airborne concentration of a material to which workers may be exposed for a 8 hour work day or 40 hour work week.
- STEL - Short Term Exposure Limit, is the maximum airborne concentration of a material to which a worker may be exposed for a period up to 15 minutes without suffering from adverse health effects. (A maximum of four such periods per day, with at least 60 minutes between exposure periods, provided that the daily TWA is not exceeded.)
- C - Ceiling Limit: The maximum airborne concentration of a material to which a worker may be exposed at any time. This limit should not be exceeded even instantaneously. The ACGIH publishes annually the "Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices" that explains and documents TLVs.

Exposure limits are expressed in ppm for gases and vapours and as mg/m³ for dusts, fumes and mists.

Irritancy of Product

Information is provided here about the capability of the material to cause localized effects such as inflammation, irritation, reddening, itching, blistering or swelling at the site of contact on the eye, skin or respiratory system. The effects are normally reversible. Acids, caustics, amines, ketones, trichloroethylene, ammonia and nitrogen dioxide are some of the examples. This information is useful in selecting skin and eye protective equipment.

Sensitization to the Product

Information is given here about whether the product is a sensitizer i.e., it may cause allergic reactions. Initially, exposure to a sensitizer may cause little or no reaction in persons or test animals, but after repeated exposure, some individuals develop an allergy. Subsequent exposures to the same substance at a much lower concentration than before produces an allergic response such as skin rash (dermatitis) or an asthmatic-like attack depending on the route of exposure. Examples are: isocyanates in polyurethane foam operations and in paint spraying operations, cutting oils, and some laboratory solvents.

Skin and respiratory protection is necessary to prevent sensitization of workers handling such products.

Carcinogenicity

Information is given here on the cancer-causing properties of the product. Examples of such products are: benzene, arsenic, beryllium, Chromium(VI) oxide, carbon tetrachloride, vinyl chloride.

Effective control measures must be taken to minimize the risk of exposure to carcinogens e.g. working in a fumehood.

Teratogenicity and Embryotoxicity

Teratogenicity and embryotoxicity can be defined as the capability of a product to cause physical damage to the developing embryo or fetus when a pregnant female is exposed to that product at a concentration that has no adverse effect on the female. The embryonic stage of development of the fetus is particularly at risk of injury from such a product. Examples of teratogens are: thalidomide, rubella infections, dimethyl mercury, ionizing radiation.

Reproductive Toxicity

This is the ability of a material to adversely affect the reproductive system causing mutations, birth defects and sterility. This has implications for the capability to produce offspring as well as for teratogenicity and embryotoxicity. Examples are: lead, halogenated hydrocarbons, polynuclear aromatic compounds, cadmium, ethylene glycol, vinyl chloride, dibromochloropropane, carbon disulphide, ethylene oxide.

Mutagenicity

The capability of the material to cause mutation (genetic changes) in living cells. Changes in reproductive (germ) cells may result in heritable genetic effects, changes in the somatic (body) cells may be associated with increased risks of other effects such as cancer. Examples of mutagens are: ethidium bromide, perchloroethylene, aflatoxins. Since both parents contribute to the child's genetic complement, exposure of either parent to mutagens can affect the offspring.

Much of the information on carcinogenicity, teratogenicity and embryotoxicity, reproductive toxicity and mutagenicity is based on data from experiments on animals and may or may not apply to humans. The information is intended to give you guidance on taking specific precautions.

Synergistic Materials

Included in this section are materials that interact with the controlled product to produce a toxic effect greater than the combined toxic effects of the material and the controlled product acting separately. For example, exposure to asbestos and cigarette smoke has been shown to produce a risk of lung cancer far greater than the sum of the risks of exposures to each agent alone.

SECTION 7 - PREVENTIVE MEASURES

This is probably the most important section to you since it tells you how to protect yourself and others from potential hazards. On the basis of information in Sections 1-6, this section provides directions for provisions of measures to protect workers' health and safety during transportation, storage, use, handling and disposal of the product, as well as emergency procedures in the event of accidental release of the material.

The information includes two general ways of controlling hazards - engineering controls (e.g. general dilution ventilation, local exhaust ventilation as in laboratory hoods, process enclosure, process equipment design, etc.) and personal protective equipment (PPE) (e.g. chemically resistant gloves, apron, suit or coveralls, the type of material whether neoprene, butyl, polyvinyl chloride (PVC), polyvinyl alcohol (PVA), Viton(R), latex, nylon, polyurethane etc.; protective safety eye glasses, goggles, face shields; respirators).

Often, it may turn out that the information in an MSDS, about personal protective equipment to be worn is given with the use of the material in a large industrial setting and an extreme case scenario in mind. Some statements such as "wear rubber boots, tyvek suits and self contained breathing apparatus" have to be taken in the context of the extent of possible exposure in relation to the amount of material used and the toxicity of the material. In case of doubt, always consult your supervisor.

This section also deals with information on storage requirements, leak and spill clean-up procedure, handling procedures, equipment and waste disposal. Special shipping information (reference to sensitivity to shock, temperature etc. and TDG (Transportation of Dangerous Goods) Class and Division and Packing Group) is also included.

SECTION 8 - FIRST AID MEASURES

This section describes the actions to be taken in case of acute overexposure to the material. It is important that one should be aware of this first aid information before one starts working with the material. The purpose of first aid is to minimize injury and future disability; the action taken in the first few minutes after an accident/overexposure can

make a difference between a minor and a major injury. Everyone should know the location of facilities and equipment for providing first aid e.g. the eyewash unit and first aid station. Specific first aid information for four categories: skin contact, eye contact, inhalation and ingestion are given here. Professional medical treatment should be obtained as soon as possible after an accident and a copy of the MSDS of the material should be given to the attending medical personnel.

SECTION 9 - PREPARATION INFORMATION

Listed in this section is the name and phone number of the group, department or party responsible in the preparation of the MSDS and the date of preparation of the MSDS. An MSDS is valid for three years from the date of preparation. A new MSDS must be obtained or prepared by the employer (the university) when an old one expires so that a current MSDS is available at all times.

8. INVENTORY

All Managers/Supervisors shall compile and maintain an inventory of hazardous materials in the areas for which they are responsible and shall forward a copy of the updated inventory on a yearly basis to the OHS section. The updated inventory lists for each storage location shall be kept at the front of the binder of MSDSs for that storage location. The binder shall be readily accessible to the employees at all times.

OHS shall maintain a College inventory list of hazardous materials. The following pages must be filled out (you can find the information on the MSDS) and submitted to OHS.

9. TRAINING

OHS coordinates basic WHMIS training in conjunction with College orientation activities for new employees. In addition, regularly scheduled WHMIS refresher training will be held and open for attendance by all staff requiring refresher training.

Supervisors are responsible to ensure that employees who work with hazardous materials attend refresher training at least once every three years and more frequently , as required.