

Chemical Safety Manual

OCAD University

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The Office of Safety and Risk Management
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Introduction to WHMIS and Chemical Management

Employers and workers are often unaware of the dangers associated with hazardous materials used in the workplace. This unawareness is usually the result of a lack of information. In the past, the labeling or other information available about workplace materials was often incomplete and inconsistent or, in most cases not provided at all.

This prompted government, industry and labour to develop legislation designed to give workers the “Right-to-Know” about hazardous materials to which they are exposed to on the job.

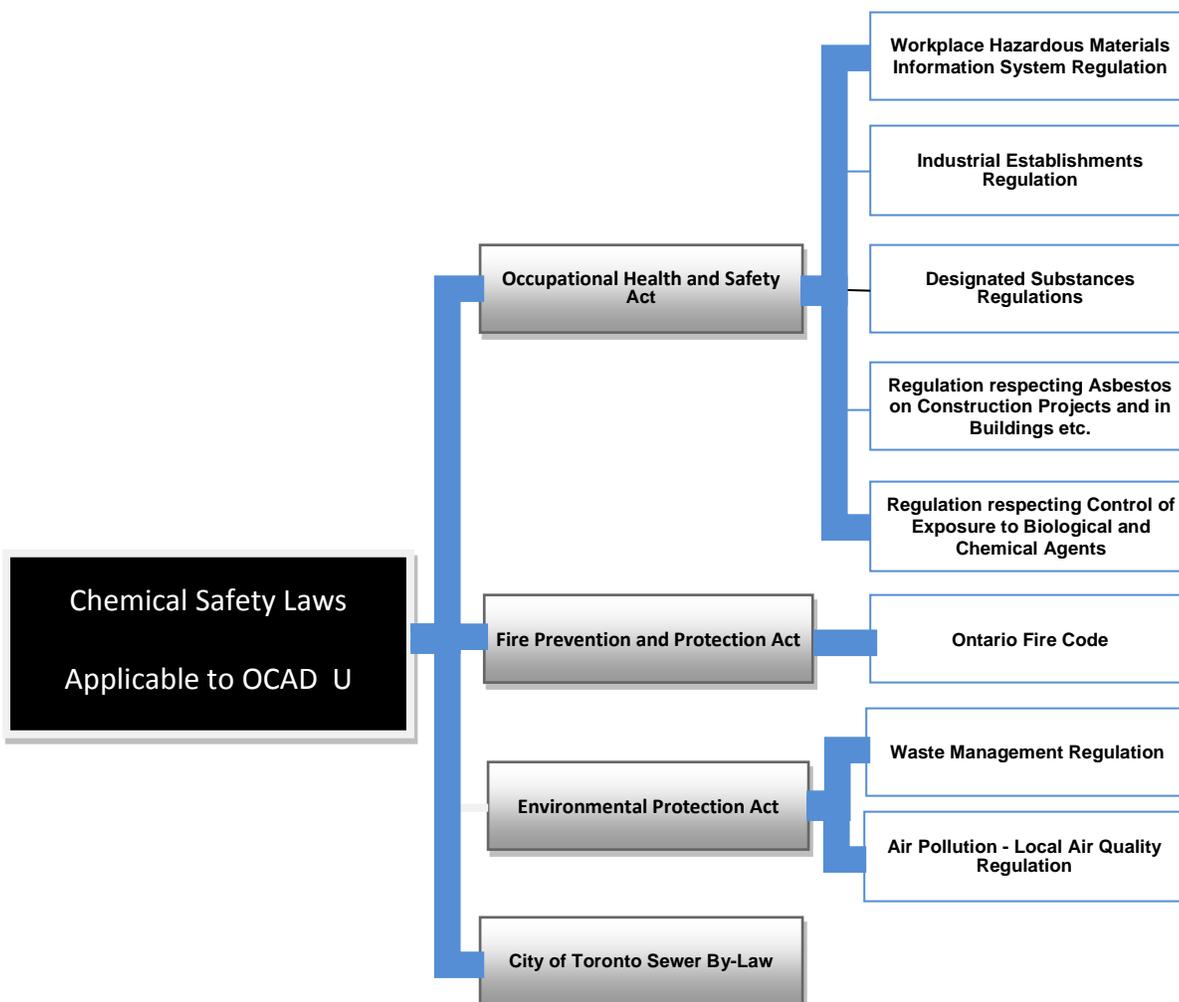
This legislation is known as the Workplace Hazardous Materials Information System or WHMIS.

The sole purpose of WHMIS is to provide you with standard information in a uniform manner so you will be aware of any and all hazards associated with those hazardous materials you use in the course of your job.

Under the WHMIS legislation, there are 3 ways in which information will be provided to you:

1. **Labels**
2. **Material Safety Data Sheets**
3. **Worker Training**

In addition, further legislation that applies to OCAD U includes:



Section 1

WHMIS Classes and Symbols

Classes and Symbols

Class/Division/Subdivision	Description	Description
	<p>Class A</p>	<p>Compressed Gas</p>
	<p>Class B Division 1 Division 2 Division 3 Division 4 Division 5 Division 6</p>	<p>Flammable and Combustible Material Flammable Gases Flammable Liquids Combustible Liquids Flammable Solids Flammable Aerosols Reactive Flammable Materials</p>
	<p>Class C</p>	<p>Oxidizing Material</p>
  	<p>Class D</p> <p>Division 1</p> <ul style="list-style-type: none"> ▪ Subdivision A ▪ Subdivision B <p>Division 2</p> <ul style="list-style-type: none"> ▪ Subdivision A ▪ Subdivision B <p>Division 3</p>	<p>Poisonous and Infectious Material</p> <p>Materials Causing Immediate and Serious Toxic Effects</p> <ul style="list-style-type: none"> ▪ Very Toxic Material ▪ Toxic Material <p>Materials Causing Other Toxic Effects</p> <ul style="list-style-type: none"> ▪ Very Toxic Material ▪ Toxic Material <p>Biohazardous Infectious Materials</p>
	<p>Class E</p>	<p>Corrosive Material</p>
	<p>Class F</p>	<p>Dangerously Reactive Material</p>

Class A: Compressed Gas



Definition:

A product, material, or substance falls within in Class A if it is a gas at normal room temperature (20° C) and kept:

1. Under pressure
2. As a dissolved gas under pressure
3. As a gas liquefied by compression or refrigeration

Examples:

- Liquefied petroleum gas
- Cylinders of acetylene
- Oxygen, nitrogen, ammonia, acetylene, helium
- Fire extinguishers
- Propane
- Scott air packs
- Aerosol cans are not under sufficient pressure to be considered compressed gases.

Precautions:

- Know the hazards associated with the gases you work with
- Secure cylinders upright at all times
- Use the personal protective equipment that is provided for your safety
- Keep cylinders away from fire, sparks and electricity
- Always have an approved fire extinguisher in the area where flammable gases are in use
- Never drop cylinders, bang them against each other or permit anything to fall on them
- Move full cylinders with special hand trucks - so not to drag or roll them on the ground
- Never use cylinders as rollers or supports
- Never leave flammable gas cylinders in stairwells or hallways
- Protect cylinders from any objects that might cut or scrape them - avoid contamination by oil and grease, whether in storage or use
- Store cylinders with valve caps in place, even when empty
- With propane, only cylinders that are hooked up to an appliance, such as an ice machine, truck, etc., should be stored inside a building

Class B: Flammable and Combustible Material



Definition:

There are six divisions within this class: Flammable Gases, Flammable Liquids, Combustible Liquids, Flammable Solids, Flammable Aerosols, and Reactive Flammable Materials.

Division 1: Flammable Gases

A product, material, or substance is classified into this Division 1 if it is a Compressed Gas (Class A), and at normal atmospheric pressure forms a flammable mixture with air when the compressed gas is between 12-13% by volume:

Examples:

- Hydrogen
- Methane
- Propane

Division 2: Flammable Liquids

A product, material, or substance is classified into Division 2 if it has a flashpoint less than 37.8° C (100° F).

Examples:

- Benzene
- Gasoline
- Turpentine
- Toluene

Division 3: Combustible Liquids

A product, material, or substance is classified into Division 3 if it has a flashpoint of 37.8° C (100° F) or more but less than 93.3° C (200° F).

Examples:

- Mineral spirits
- Kerosene
- Diesel Fuel

Division 4: Flammable Solids

A product, material, or substance is classified into Division 4 if it meets any one of four criteria:

- a) It causes fire through friction or through retained heat from manufacturing or processing.
- b) It can be ignited readily and when ignited burns so vigorously and persistently as to create a hazard.
- c) It ignites readily and burns with a self-sustained flame
- d) It meets the criterion for flammable solids (Division 1 of Class 4) of the TDG Regulations.

Examples:

- Magnesium
- Beryllium
- Sodium
- Potassium
- Magnesium alloys

Division 5: Flammable Aerosols

Any product, material, or substance is classified into Division 5 if it is packaged in an aerosol container and when tested in accordance with test method in Schedule VI of the Controlled Products Regulation produces a flame projection or a flashback of any length. Most aerosols contain flammable propellants.

Examples:

- Butane
- Isobutene

Division 6: Reactive Flammable Materials

A product, material, or substance is classified into Division 6 if it meets either of the following conditions:

- a) It is spontaneously combustible and liable to spontaneous heating under normal conditions of use or liable to heat in contact with air to the point where it begins to burn.
- b) It emits a flammable gas or becomes spontaneously combustible on contact with water or water vapour.

Examples:

Spontaneously combustible with air:

- Lithium aluminum hydride
- Celluloid
- Aluminum alkyl compounds

Spontaneously combustible with water:

- Metallic sodium
- Lithium amide
- Lithium aluminum hydride

Precautions:

- Never smoke when working with or near flammable and combustible materials
- Keep the material away from heat sources and other combustible materials
- Don't carry matches, lighters or other spark-producing devices around flammable and combustible materials
- Store the material in a cool, fire-proof area
- Keep away from powerful oxidizing materials, susceptible spontaneous heating materials, explosives, and materials that react with air/moisture to produce heat
- Keep flammable liquids in a closed safety container when not in use
- Clean up spills promptly and dispose of oily rags and waste in all-metal, covered safety containers
- Never pour flammable liquids into sewers or drains
- Never mix flammables - mixing flammables can lower the flashpoint of flammables they are added to
- Do not cause static discharges or impacts that could cause sparks
- Wear the proper protective equipment when pouring from metal container to metal container
- Properly ground and bond the containers before pouring to prevent a fire from occurring.

Class C: Oxidizing Material



Definition:

Oxidizing materials are liquids or solids that readily give off oxygen or other oxidizing substances (such as bromine, chlorine, or fluorine).

They also include materials that react chemically to oxidize combustible (burnable) materials; this means that oxygen combines chemically with the other material in a way that increases the chance of a fire or explosion. This reaction may be spontaneous at either room temperature or may occur under slight heating.

Examples:

- Sulphuric acid
- Nitrates
- Nitrites
- Inorganic peroxides
- Dichromates
- Chlorine
- Permanganates

Precautions:

- Storage area should be well ventilated and kept cool (as some oxidizers require heat before they will yield oxygen)
- Avoid storing strong or powerful oxidizers on wooden floors or shelves
- Keep the material away from flammable and combustible materials
- Keep the material away from sources of ignition
- Use large quantities of water for fire-fighting procedures
- Never smoke when working near the materials

Class D: Poisonous and Infectious Material

Definition:

A product, material, or substance known to cause temporary or permanent adverse health effects in humans are classified into Class D. Adverse effects cover a broad range from acute lethality to mutagenicity and cancer.

There are three divisions within Class D.

Division 1 (D-1): Materials Causing Immediate and Serious Toxic Effects:

These are products, substances, and materials that may cause acute lethal effects, immediately or within 24 hours following a single dose exposure to a toxic material. Products that cause such effects have low LC50 and LD50 values.



Examples:

- Carbon monoxide
- Toluene
- Cyanide
- Ammonia
- Chlorine

Division 2 (D-2): Materials Causing Other Toxic Effects:

This includes materials with effects other than those that are immediate. For example, eyes, skin and lung irritation, organ damage. Long-term effects in persons or animals include mutagenicity, allergies, sensitization and cancer. The effects usually result from repeated exposures over a long period of time.



Examples:

- Asbestos
- Silica
- Lead
- Solvents (benzene, acetone, turpentine, d-limonene)

Division 3 (D-3): Biohazardous Infectious Material:

This Division applies to organisms and the toxins they produce which cause disease or are reasonably believed to cause disease in persons or animals.

Organisms which cause disease in animals are of concern to WHMIS particularly where transmission of the disease may occur from animals to persons.



Examples:

- Blood samples
- Viruses (HIV, hepatitis)
- Bacteria
- Moulds

Precautions for Class D Materials:

- Handle material with extreme caution
- Avoid contact with the skin or eyes by wearing the proper protective equipment
- Avoid inhaling by working in well-ventilated areas and/or wearing respiratory equipment as required
- Store the material in designated areas only
- Do not eat, drink or smoke in areas where chemicals are used or stored
- After handling poisonous materials, before eating, smoking, drinking or going home, wash your hands and face.

Class E: Corrosive Materials



Definitions:

Corrosives are materials or substances that will corrode steel, destroy aluminum or human tissue at the site of contact. Corrosion is the production of **irreversible** tissue damage to the skin as a result of chemical reaction between the product and dermal tissue. It differs from irritation, which is the production of **reversible** inflammatory changes.

Examples:

- Acetic acid
- Bromine
- Chlorine
- Fluorine
- Hydrochloric acid, muriatic acid
- Nitric acid
- Potassium hydroxide
- Sodium hydroxide
- Sulfuric acid – battery acid
- Chromic acid

Precautions:

- Keep containers tightly closed
- Store in cool, dry area well above freezing points
- Adequate ventilation to prevent accumulation of corrosive vapours that could be leaking from imperfectly sealed containers
- Storage area should have a floor that is protected against corrosion in the event of a spill
- Acids and bases can be stored in similar areas, but they must be well separated
- Corrosives should not be stored near oxidizing materials
- Avoid skin and eye contact by wearing all necessary protective equipment, including eye, face and hand protection and protective clothing

Class F: Dangerously Reactive Materials



Definition:

A product, material, or substance belongs in this Class if it meets any one of three criteria:

- a) It undergoes vigorous polymerization, decomposition, or condensation.
- b) It becomes self-reactive under conditions of shock or increased pressure or temperature.
- c) It reacts vigorously with water to release a gas

Note:

- Polymerization is a chemical reaction in which many small molecules (monomers) join together to form a large molecule (polymer). Often the reaction produces heat and pressure
- Condensation is when two or more molecules join together to produce a new substance
- The category “Dangerously Reactive Material” must not be confused with the hazard concept of “incompatibility.” Materials that are incompatible are those that react dangerously on contact to produce excessive heat, explosions, or toxic products. For example, many caustics are incompatible with acids, and many oxidizers are incompatible with flammables. Only criterion #3 of Class F involves an incompatibility—between a product and water. Many other materials that are incompatible with other products are not classified as Dangerously Reactive. This point must be considered when reviewing the MSDS item on “Incompatibility.”

Examples:

- Acrylic acid
- Ethyl acrylate
- Hydrocyanic acid
- Vinyl Acetate

Precautions:

- Keep material away from heat
- Store the material in a cool, flame-proof area
- Containers should be water-tight and air-tight
- Wear suitable protective clothing
- Avoid shock and friction
- Before storing large quantities of water-sensitive material, make sure that proper extinguishers are provided in case of emergency

Exclusions

Ten types of products are exempt in whole or part from WHMIS information requirements. The following categories of products are exempt from WHMIS labels and MSDSs:

Partially Exempted

Partially exempt products, which are labelled under federal legislation other than WHMIS, can be sold without WHMIS labels and MSDSs. However, when these products are used in the workplace, provincial OSH regulations require worker education and training, and workplace labels must be applied if they are not in their original containers.

- Consumer products (packaged as a consumer product and labelled under the *Consumer Chemicals Containers Regulations (CCCR)* in quantities normally used by a member of the general public);
- Cosmetics, food, drugs or devices (within the meaning of the Food and Drugs Act) ;
- Explosives (under the Explosives Act);
- Pesticides (under the Pest Control Products Act);
- Radioactive materials (under the Nuclear Safety and Control Act);

Completely Exempted

Completely exempt products are excluded from both federal (HPA, CPR) and provincial OHS WHMIS requirements, although general occupational health and safety requirements governing workplace education and training, as well as hazard identification, must be met. Completely exempt products are:

- Wood or products made of wood
- Manufactured articles
- Tobacco or products made of tobacco
- Hazardous wastes
- Products handled or transported pursuant to the *TDG Act*

These products are controlled by other safety laws and should be referred to when handling such products. A workplace label must still be applied if the product is decanted into another container.

Section 2

WHMIS Labels

Labels

A WHMIS label provides immediate information that you need to handle a hazardous material safely and the precautions to be taken with it. The label may be a sign, stamp, sticker, tag that must be attached to the controlled product or container that is legible.

The label provides information in the following ways:

1. Alerts you to the hazards the given product represents.
2. Informs you of the risks that the product presents and the precautions to be taken when handling or storing it.
3. Refers you to the Material Safety Data Sheet (MSDS) for more detailed hazard information.

It is the responsibility of both your supervisor and yourself to ensure that all containers of hazardous materials are properly labeled before they are used or stored.

Types of Labels

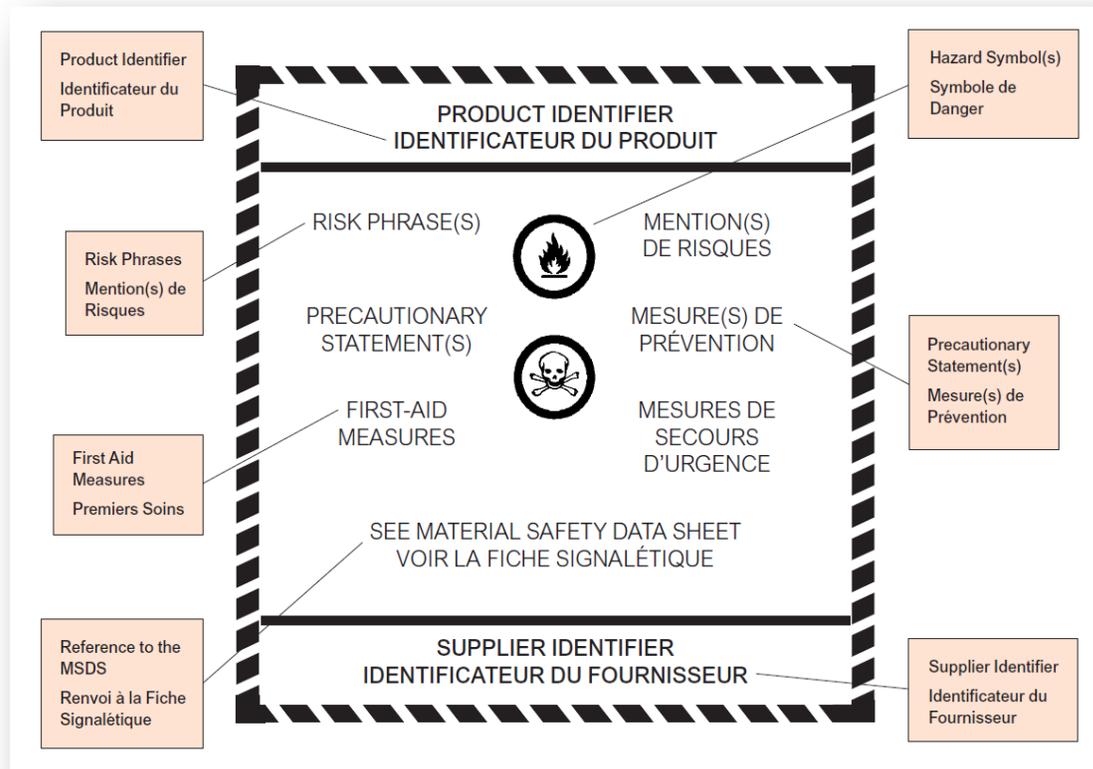
There are 2 types of labels used on a container of a hazardous material:

1. Supplier labels
2. Workplace labels

Both labels have the same purpose but differ from each other in content and format.

1. Supplier Labels

A supplier label can be identified on a hazardous material by its unique hash-marked border. A Supplier label must be in both English and French and may be any size, format or colour as long as it has this distinctive border. To ease label recognition, its colour should contrast with the container it is on.



The supplier label must contain the following pieces of information:

1. **Product Identifier** - The name of the product, which can be its common name, brand name, code name, number.
2. **Applicable Hazard Symbol** - One or more of the eight hazard symbols which apply to the product.
3. **Risk Phrases** - Briefly telling you of any hazards; i.e., “dangerous if inhaled”.
4. **Precautionary Measures** - Statements on proper storage; what to do to avoid injury or illness; i.e., “avoid inhaling” or “wash thoroughly after handling”.
5. **First- Aid Measures** - Explains how to treat a person who has been over-exposed to the product.
6. **A Reference to the MSDS** – A statement advising additional information is available on the MSDS.
7. **Supplier/Manufacturer Identifier** - Name and location of the product’s supplier and manufacturer.

Sample WHMIS Supplier Label:

Hazard symbols

ACETONE ACÉTONE

**SEE MATERIAL SAFETY DATA SHEET FOR THIS PRODUCT
VOIR LA FICHE SIGNALÉTIQUE POUR CE PRODUIT**

DANGER! EXTREMELY FLAMMABLE. IRRITATES EYES.
PRECAUTIONS: Keep away from heat, sparks, and flames. Ground containers when pouring. Avoid breathing vapours or mists. Avoid eye contact. Avoid prolonged or repeated contact with skin. Wear splash-proof safety goggles or faceshield and butyl rubber gloves. If acetone is present in concentrations greater than 250 ppm, wear a NIOSH-approved respirator with an organic vapour cartridge. Use with adequate ventilation, especially in enclosed areas. Store in a cool, well-ventilated area, away from incompatibles.
FIRST AID: In case of contact with eyes, immediately flush eyes with lots of running water for 15 minutes, lifting the upper and lower eyelids occasionally. Get medical attention immediately. In case of contact with skin, immediately wash skin with lots of soap and water. Remove contaminated clothing and shoes. Get medical attention if irritation persists after washing. Wash clothing before reuse. If inhaled, remove subject to fresh air. Give artificial respiration if not breathing. Get medical attention immediately. If swallowed, contact the Poison Control Centre. Get medical attention immediately. Do not give anything by mouth to an unconscious or convulsing person.
ATTENTION! THIS CONTAINER IS HAZARDOUS WHEN EMPTY. ALL LABELLED HAZARD PRECAUTIONS MUST BE OBSERVED.

DANGER! EXTRÊMEMENT INFLAMMABLE. IRRITE LES YEUX.
MESURES DE PRÉVENTION: Tenir à l'écart de la chaleur, des étincelles et des flammes. Relier les récipients à la terre lors du transvasement. Éviter de respirer les vapeurs ou les brumes. Éviter le contact avec les yeux. Éviter le contact prolongé ou répété avec la peau. Porter des lunettes contre les éclaboussures de produit chimique ou une visière de protection, et des gants en caoutchouc butyle. Si l'acétone est présent en concentration de plus de 250 pour un million, porter un respirateur muni d'une cartouche à vapeur organique approuvé par NIOSH. Utiliser avec suffisamment de ventilation surtout dans les endroits clos. Entreposer dans un endroit frais, bien aéré, à l'écart des produits incompatibles.
PREMIERS SOINS: En cas de contact avec les yeux, rincer immédiatement et copieusement avec de l'eau courante pendant 15 minutes en soulevant les paupières inférieures et supérieures de temps en temps. Obtenir des soins médicaux immédiatement. En cas de contact avec la peau, laver immédiatement la région affectée avec beaucoup d'eau et de savon. Retirer les vêtements et les chaussures contaminées. Si l'irritation persiste après le lavage, obtenir des soins médicaux. Laver les vêtements avant de les réutiliser. En cas d'inhalation, transporter la victime à l'air frais. En cas d'arrêt respiratoire, pratiquer la respiration artificielle. Obtenir des soins médicaux immédiatement. En cas d'ingestion, contacter le Centre de Contrôle des Empoisonnements. Obtenir des soins médicaux immédiatement. Ne rien faire avaler à une victime inconsciente ou en convulsions.
ATTENTION! CE RÉCIPIENT EST DANGEREUX LORSQU'IL EST VIDE. CHAQUE INDICATION DE DANGER SUR LES ÉTIQUETTES DOIVENT ÊTRE OBSERVÉES.

BIG BIG Chemical Company / 123 Nitro Avenue, Vapour Town, BC / 123-4567

Product Identifier
Reference to MSDS
Risk phrases
Precautionary statements
First aid measures
French version
WHMIS hatched border
Supplier identification

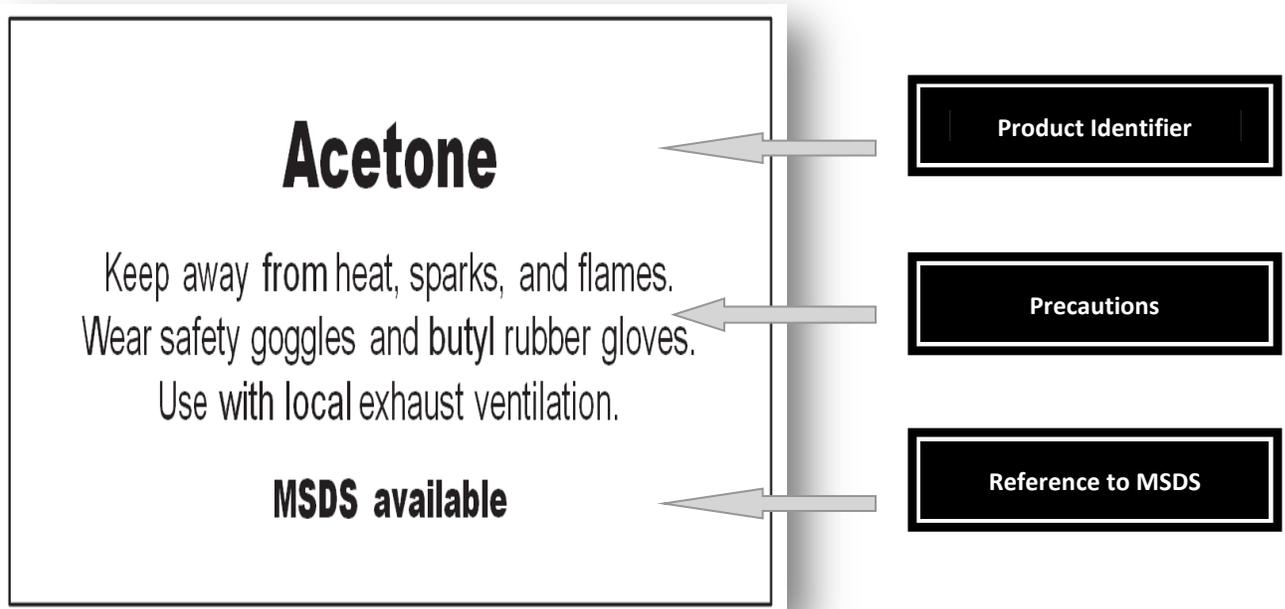
2. Workplace Labels

Workplace labels are used if there is not a supplier label on the container or:

- When the hazardous material is transferred from the original container to another container,
- When the supplier label is illegible, defaced or becomes detached from the supplier container; or,
- When the hazardous material is produced at the workplace.

Only 3 pieces of information are required on a workplace label:

1. Product identifier
2. Precautionary measures
3. A reference to the MSDS



A workplace label may also be any size, format or colour. It can be typed or hand-written, as long as it has the 3 pieces of information.

When a workplace is not required:

A workplace label is not required to be affixed to a secondary or portable container if either of the following apply:

- a) the product will be used immediately in its entirety, or
- b) the product is,
 - under the exclusive control of one person,
 - to be used exclusively use of one person,
 - to be used in its entirety during the course of the work shift, and
 - the product name is marked on the container.

Workplace Labels @ OCAD U

OCAD University has a comprehensive MSDS and Label program online. To print labels:

Option 1:

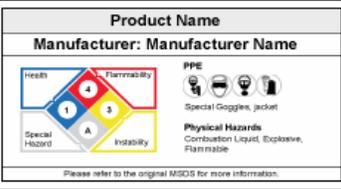
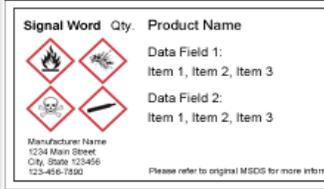
1. Enter OCAD University's MSDS database URL on a web browser - <http://hq.msdsonline.com/ocad3535>
2. Select the Studio
3. Find the product and click on generate label symbol

	Product	Revision Date	CAS #	Regulatory Format
   	COLORTEC C-41 Rapid Neg. Kit (2-Bath) f. 3x1L for 3 x 1L Manufacturer: TETENAL AG & CO. KG	05/07/2010		Not Determined
   	C41 digibase film developer STARTER Manufacturer: Compard KG Synonyms: C41 digibase film developer STARTER, C41 digibase film developer, C41 digibase film Bleacher, C41 digibase FIXER, C41 digibase Stabilizer - KIT Photographic color-developer concentrate	05/07/2010		Not Determined
   	Solid Ink Manufacturer: Xerox Research Centre of Canada	12/13/2011		Not Determined

4. Select WHMIS Workplace label

Print Labels

Select the label to print from the options below.

OSHA Secondary Container	WHMIS Workplace	GHS Container
 <p>Product Name Manufacturer: Manufacturer Name</p> <p>Health 4 Flammability 3 Special Hazard A Instability 1</p> <p>PPE Special Goggles, jacket</p> <p>Physical Hazards Combustion Liquid, Explosive, Flammable</p> <p>Please refer to the original MSDS for more information.</p>	 <p>Product Name Manufacturer: Manufacturer Name Manufacturer Address</p> <p>PPE Special Goggles, jacket</p> <p>Physical Hazards Combustion Liquid, Explosive, Flammable</p> <p>Please refer to the original MSDS for more information.</p>	 <p>Signal Word Qty. Product Name</p> <p>Data Field 1: Item 1, Item 2, Item 3</p> <p>Data Field 2: Item 1, Item 2, Item 3</p> <p>Manufacturer Name 1234 Main Street City, State 123456 123-456-7890</p> <p>Please refer to original MSDS for more information.</p>

Print OSHA Secondary Container Labels, including NFPA, HMIS, or GHS Hazard Symbols.

Print WHMIS Workplace Labels, which include WHMIS pictograms.

Print GHS Container Labels, including pictograms, signal words, and manufacturer contact information.

5. Choose desired label size

Select Label Size

Product Name	Manufacturer Name	Manufacturer Address
WHMIS pictogram	Data Field 1	text text text text text

Please refer to the original Material Safety Data Sheet for more information.

- 2x4**
 - Avery Standards 5163
 - 1-4 WHMIS Pictograms
 - 1 Data Field
 - 10 Labels per Sheet
- 3.5x5**
 - Avery Standards 5168
 - 1-4 WHMIS Pictograms
 - 2 Data Fields
 - 4 Labels per Sheet
- 5x8.125**
 - Avery Standards 6573
 - 1-4 WHMIS Pictograms
 - 2 Data Fields
 - 2 Labels per Sheet
- 8.5x11**
 - Avery Standards 5165
 - 1-4 WHMIS Pictograms
 - 3 Data Fields
 - 1 Label per Sheet

6. Select either Single label or Full page of labels then select Generate Label

Print Options

Single Label
 Full Page of the same label

Select Language: English

Generate Label | Cancel

7. Labels are saved as PDF files. Once printed, write the appropriate precautionary statements corresponding to those found in the MSDS on the label and attached to container.

C41 digibase fiild developer STARTER

Manufacturer: Compard KG

Indicate precautions

Please refer to the original MSDS for more information

Option 2:

Print out OCAD University labels from the Shops and Studio SharePoint and fill out and check all that applies that correspond to those found on product's the MSDS.

OCAD University Workplace Label	
Product Identifier: _____	
Hazard (s): <i>check all that apply</i>	
<input type="checkbox"/> Flammable <input type="checkbox"/> Oxidizer <input type="checkbox"/> Toxic/poisonous <input type="checkbox"/> Corrosive pH: _____ <input type="checkbox"/> Reactive/explosive <input type="checkbox"/> Sensitizer/allergen	<input type="checkbox"/> Biohazard <input type="checkbox"/> Carcinogen <input type="checkbox"/> Mutagen <input type="checkbox"/> Teratogen <input type="checkbox"/> Skin/eye/lung irritant <input type="checkbox"/> Other <i>specify</i> :
Safe Handling /Personal Protection: <i>check all that apply</i>	
<input type="checkbox"/> No inhalation <input type="checkbox"/> No ingestion <input type="checkbox"/> No skin/eye contact <input type="checkbox"/> No chronic exposure <input type="checkbox"/> Gloves	<input type="checkbox"/> Glasses/goggles <input type="checkbox"/> N-95 Respirator <input type="checkbox"/> Half Face Respirator with organic vapor cartridges <input type="checkbox"/> Other: _____
Name: _____ Dept: _____	
Phone #: _____ Date: _____	
Refer to Material Safety Data Sheets for more info	

Section 3

MSDS

What is a MSDS?

A Material Safety Data Sheet (MSDS) is an electronic and hardcopy document containing detailed and comprehensive information on hazards, precautionary and emergency information for a given hazardous material. The MSDS is meant to supplement the information contained in the Supplier or Workplace Label. It is prepared and supplied by the product's manufacturer; therefore MSDS's will vary in length, format and appearance.

An MSDS must be present for each hazardous material regulated under WHMIS and used in the workplace. A hardcopy of the MSDS must be located close to the work area and accessible to everyone who may be exposed. Suppliers must send a MSDS for every new controlled product they sell to the University and the purchaser must request a MSDS. A MSDS must not be more than three (3) years old from the date of preparation or revision.

In the event of an emergency, as in the case of an accident where a person requires medical attention due to overexposure of a controlled product, a copy of an MSDS should be provided to the attending medical personnel.

MSDS Contents

There are nine (9) categories of information which minimally must appear on the MSDS:

1. Product Information
2. Hazardous Ingredients
3. Physical Data
4. Fire and Explosion Data
5. Reactivity Data
6. Toxicological Properties
7. Preventative Measures
8. First Aid Measures
9. Preparation Information

1. Product Identification

SECTION 1 — Product Information

Product Identifier		WHMIS Classification (optional)	
Product Use			
Manufacturer's Name		Supplier's Name	
Street Address		Street Address	
City	Province	City	Province
Postal Code	Emergency Telephone	Postal Code	Emergency Telephone

This section gives you the information you need to ensure that the MSDS is the right one. The material is identified by trade name, brand name, code name or number specified by the supplier, chemical name, common name or generic name. The name found on the MSDS will be the same name that you will find on a supplier or workplace label. Other information includes:

- Manufacturer's Name, Address, Emergency Phone Number, Etc.
- Supplier's Name, Address, Emergency Phone Number, Etc.
- Product Use

2. Hazardous Ingredients

SECTION 2 — Hazardous Ingredients

Hazardous Ingredients (specific)	%	CAS Number	LD ₅₀ of Ingredient (specify species and route)	LC ₅₀ of Ingredient (specify species)

- **Hazardous Ingredients:** All of the potentially hazardous ingredients in the product and the toxicity will be listed here. The approximate amount (percentage) of each ingredient will also be stated. 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.
- **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.
- **LD₅₀:** The LD₅₀ ("Lethal Dose 50") of an ingredient is the measure of acute lethality of the ingredient that, when administered in a single dose to a group of test animals by a defined route (oral or dermal) will cause death to 50% of the test population. The LD₅₀ values are expressed in milligrams per kilogram of the body weight, the lower the LD₅₀, the greater the toxicity.
- **LC₅₀:** 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) for gases and vapours and as milligrams per cubic meter of air (mg/m³) for dusts and mists as well as for gases and vapours.

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.

3. Physical Data

SECTION 3 — Physical Data

Physical State	Odour and Appearance		Odour Threshold (ppm)
Specific Gravity	Vapour Density (air = 1)	Vapour Pressure (mmHg)	Evaporation Rate
Boiling Point (°C)	Freezing Point (°C)	pH	Coefficient of Water/Oil Distribution

This section describes the material and gives technical information on its properties.

- **Physical state** - solid, liquid or gas.
- **Odour and appearance** - what the chemical usually looks and smells like.
- **Odour threshold** - the lowest concentration of chemical that can be smelled.
- **pH** - a measure of the acidity or basicity (alkalinity) of a material when dissolved in water. It is a good indicator of the corrosive properties of the material.
- **Vapour pressure** - this is an indicator of the products ability to form vapours (i.e., products with a high vapour pressure can be extremely hazardous, particularly in confined spaces and unventilated areas).
- **Vapour density** - whether the chemical will rise or sink in air.
- **Evaporation rate** - how fast a material evaporates (i.e., the higher the evaporation rate, the more hazardous the product).
- **Boiling and freezing points** - indicates if the material will change its physical state at normal process temperature or room temperature.
- **Specific gravity** - reveals whether the material is likely to float or sink in water, and is useful in the planning of clean-up procedures and controls solubility in water.

4. Fire and Explosion Data:

SECTION 4 — Fire and Explosion Data

Flammability <input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, under which conditions?	
Means of Extinction		
Flashpoint (°C) and Method	Upper Flammable Limit (% by volume)	Lower Flammable Limit (% by volume)
Autoignition Temperature (°C)	Explosion Data — Sensitivity to Impact	Explosion Data — Sensitivity to Static Discharge
Hazardous Combustion Products		

The purpose of this section is to describe the nature of the fire hazard of the material; i.e., potential to catch fire and explode. Information includes:

- **Flashpoint** - lowest temperature at which a liquid gives off enough vapour to ignite if an ignition source (such as spark) is present.
- **Exposure limits or Flammability range** - details about the minimum concentrations of vapours that will support combustion so you can prevent fires.
- **Auto-ignition temperature** - lowest temperature at which the chemical will ignite from its own heat source (no spark needed).
- **Hazardous combustion products** - dangerous chemicals which may be formed when a material burns.
- **Conditions of flammability** - indicates the conditions under which the material may be flammable.
- **Means of extinction** - the appropriate fire extinguishers for the material are identified in the section.
- **Explosion data** - describes whether or not the material presents an explosion hazard. Also indicates safe handling methods for these materials

5. Reactivity Data

SECTION 5 — Reactivity Data

Chemical Stability <input type="checkbox"/> Yes <input type="checkbox"/> No	If no, under which conditions?
Incompatibility with Other Substances <input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, which ones?
Reactivity, and Under What Conditions?	
Hazardous Decomposition Products	

This section describes how stable the material is and any conditions, which can cause it to react dangerously.

- **Stability** - how likely it is that a chemical will decompose by itself, creating a dangerous situation.
- **Hazardous decomposition products** - what may be produced when the chemical reacts with other substances. Sometimes the product of a reaction is far more hazardous than the chemical itself.
- **Incompatibility with other substances** - materials which are incompatible may react violently or explosively if they are mixed or brought together. Such products should not be stored, mixed together or come in contact with each other.

6. Toxicological Properties

SECTION 6 — Toxicological Properties

Routes of Entry <input type="checkbox"/> Skin Contact <input type="checkbox"/> Skin Absorption <input type="checkbox"/> Eye Contact <input type="checkbox"/> Inhalation <input type="checkbox"/> Ingestion	
Effects of Acute Exposure to Product	
Effects of Chronic Exposure to Product	
Exposure Limits (<i>value, source, date</i>)	Irritancy (<i>if yes, explain</i>) <input type="checkbox"/> Yes <input type="checkbox"/> No
Sensitization (<i>if yes, explain</i>) <input type="checkbox"/> Yes <input type="checkbox"/> No	Carcinogenicity (<i>if yes, explain</i>) <input type="checkbox"/> Yes <input type="checkbox"/> No
Reproductive Toxicity (<i>if yes, explain</i>) <input type="checkbox"/> Yes <input type="checkbox"/> No	Teratogenicity (<i>if yes, explain</i>) <input type="checkbox"/> Yes <input type="checkbox"/> No
Mutagenicity (<i>if yes, explain</i>) <input type="checkbox"/> Yes <input type="checkbox"/> No	Synergistic Products (<i>if yes, explain</i>) <input type="checkbox"/> Yes <input type="checkbox"/> No

This section describes the ways you can be exposed to the material and the potential harmful effects such exposure can have.

- **Routes of exposure** - how chemicals may enter the body (inhalation, absorption, and ingestion).
- **Effects of acute short-term exposure** - describes the health effects resulting immediately or a short time after an exposure, usually within 24 hours.
- **Effects of chronic long-term exposure** - describes the health effects resulting from repeated exposure to the material over long periods; (i.e., exposure to regular low doses of carbon monoxide over many years may initiate or aggravate heart problems).

- **Exposure limits** - refer to concentration of the substance in the air below which it is generally believed most people exposed to it will not be adversely affected.
- **Irritancy to product** - indicates whether the material will cause irritation to the eyes, nose, throat or skin, which provides important data for the selection of protective equipment.
- **Evidence of carcinogenicity, reproductive toxicity, teratogenicity or mutagenicity** - states whether the material has or is suspected of having any cancerous or reproductive effects.

7. Preventative Measures

SECTION 7 — Preventive Measures

Personal Protective Equipment	
<input type="checkbox"/> Gloves	<input type="checkbox"/> Respirator
<input type="checkbox"/> Eye	<input type="checkbox"/> Footwear
<input type="checkbox"/> Clothing	<input type="checkbox"/> Other
If checked, specify type	
Engineering Controls (<i>specify, such as ventilation, enclosed process</i>)	
Leak and Spill Procedure	
Waste Disposal	
Handling Procedures and Equipment	
Storage Requirements	
Special Shipping Information	PIN

This section provides information, which is used to develop a program for working safely with the material. Information includes:

- Personal Protective Equipment required to be worn to prevent overexposure
- Engineering controls e.g. details on required ventilation
- Safe handling and storage procedures
- Spillage clean-up and waste disposal procedures

8. First Aid Measure

SECTION 8 – First Aid Measures

Inhalation
Ingestion
Skin Contact
Eye Contact

This section describes actions to be taken immediately in case you are overexposed to the material. The purpose of first aid is to minimize injury and future disability. The time to know of these measures is before exposure occurs, so review/read this section before using the product.

9. Preparation Date and Group

SECTION 9 – Preparation Information

Prepared by (<i>group, department, etc.</i>)	Telephone Number	Preparation Date
--	------------------	------------------

Names the person/group who prepared the MSDS, and its date of preparation.

MSDS Access Online @ OCAD U

1. OCAD University has a comprehensive Workplace Label and MSDS program online:

The screenshot shows the OCAD University website's Safety & Risk Management page. The navigation menu includes: ABOUT OCAD U, STUDENTS, PROSPECTIVE STUDENTS, ALUMNI, FACULTY, ACADEMIC PROGRAMS, RESEARCH, and LIBRARY. The main content area is titled 'OFFICE OF SAFETY & RISK MANAGEMENT' and includes sections for 'Health and Safety', 'Insurance and Risk', and 'Key Responsibilities'. A sidebar on the left lists various safety-related topics, and a 'MSDS ONLINE' logo is circled in red. The right sidebar features 'HEADLINES' and 'WHAT'S NEW' sections.

2. MSDSonline home page:

The screenshot shows the MSDSonline home page. At the top, there is a 'Safety Center' and a 'MSDS Search' bar. Below this, there are tabs for 'All Products', 'Locations', and 'Manufacturers'. The 'Locations' section is active, showing a search bar with the text 'Enter Location Name' and a 'Search' button. Below the search bar, there is a checkbox for 'Show only locations with products'. The main content area displays a list of locations under 'Level 1', including 'Art (451)', 'Design (578)', and 'Fabrication Studios (336)'. Each location has a list of sub-locations and their respective counts.

Section 4

Toxicology

Occupational Health

Any chemical you use incorrectly can result in over-exposure leading to adverse health effects immediately or in the future.

All hazardous materials can be handled in complete safety without being exposed or coming in contact with them. If you keep chemicals that harm you away from your body, they will not cause adverse health effects.

- The Health Hazard Data section of the MSDS will tell you what the effects of the substance might be.
- The Preventive Measures section will tell you how to avoid exposure and protect yourself.
- The First Aid Measures section will tell you what to do should an over-exposure occurs.

There are several factors, which determine and influence the degree of harm a hazardous material can cause to the body. Some of the major factors are:

1. Route of entry into the body
2. Length of exposure
3. Target of accumulation sites in the body
4. Metabolism and elimination of the material in the body
5. Biological or individual variation
6. Amount or dose entering the body

1. Route of Entry into the Body

Before any hazardous material can cause or elicit an adverse health effect, a person must not only be exposed to the material, but it must enter the body.

Hazardous materials can enter the body in three primary routes:

a) Inhalation

Entry into the Body: Inhalation is the most common route of entry of substances into the body. Dusts, fumes, gases, mists, vapours and smoke are breathed in and enter the respiratory tract. 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. If the particles are small enough, they can get into the lungs, where they can then be absorbed into the blood.

Protection: Air contaminant controls such as ventilation and fume hoods help keep hazardous dust, fumes and vapours away from your breathing zone. Make sure the ventilation system is always in good working condition, is turned on, and fans, motors, filters and vents are clean and well maintained.

Personal protective equipment, such as respirators, covering the nose and mouth can prevent you from inhaling the material.

b) Absorption

Entry into the Body: Some chemicals may contact the eye and the skin and be either absorbed into the body or cause local dermal effects (skin or eye irritation or burn). Hazardous materials can be absorbed into the body by dissolving the protective fatty/oily covering on the skin. Once skin fats/oils are removed, the natural barrier to infection is lost. The material may then be easily absorbed through the skin and enter the mucosal membranes and the bloodstream. Organic solvents such as methanol, acetone, varsol, toluene and alcohol are examples of materials that can dissolve fats/oils in the skin. Absorption through the skin can occur rapidly if the skin is cut or abraded.

Acids or alkalis spilled on the skin will first burn through the flesh and then enter the blood stream where they can poison the body.

Chemicals entering through the eye are less common but may occur by dissolving in the liquid surrounding the eyes. The eyes are richly supplied with blood vessels and many chemicals can penetrate the outer tissues and pass into the body. The eye may or may not be damaged during this process, depending on the corrosive nature of the chemical and its ability to penetrate into the eye.

Protection: Certain types of “barrier creams” prevent and reduce some materials from contacting the skin. Clothing, such as gloves, aprons, and boots shield the skin from chemical contact. The type of clothing worn must be suited to protect against the chemical used. Appropriate eye protection will prevent chemicals from entering the body by this route as well as preventing physical damage to the eye itself. Engineering controls, which isolate the material from you also, prevent skin contact.

c) Ingestion

Entry into the body: Hazardous materials can enter the body through the digestive system by mouth if they swallowed.

They can reach the stomach when food or drink are left unprotected in the work area and then eaten by placing contaminated fingers or contaminated cigarettes in the mouth, and by failing to wash your hands before eating or smoking. Once swallowed, the substances can enter the digestive tract, and thus may enter the bloodstream.

All forms of hazardous materials, whether they exist as vapours, mists, dusts, smoke or fumes, can be swallowed.

Protection: Appropriate facilities for eating should be available and separate from the general workplace or workroom contamination.

Washing hands thoroughly after working and before eating.

2. Length of Exposure:

The amount of time you are exposed to a hazardous material is another important factor that may result in adverse health effects.

Depending on the hazardous material, the longer an over-exposure occurs, the more likely it is for the material to enter into your body thus leading to an adverse health effect.

3. Target or Accumulation Sites in the Body:

Hazardous materials in the workplace may cause harm in the body at four main sites:

- Where they enter the body - entry routes such as the lungs, skin and intestines.
- In the blood that carries them throughout the body.
- In the central nervous system; and
- In the organs which have the ability to concentrate toxicants and remove them from the body; i.e., the liver, kidneys and bladder (exit routes).

4. Metabolism and Elimination from the Body:

Many chemicals, which enter the body, are excreted unchanged. Others are broken down to other chemicals. The breakdown product may be more toxic or less toxic than the original chemical which entered the body.

Some chemicals and/or their by-products are stored temporarily in body organs and are removed over a short period of time as waste in the feces, urine, sweat or exhaled breath.

A few chemicals such as graphite or silica dusts can be inhaled into the lungs where they lodge for many years and may never be completely removed.

The longer a given hazardous material remains in the body, the greater potential that material has for causing harmful health effects.

5. Biological Variation:

Several characteristics of the exposed person can influence the degree of poisoning which can or cannot occur:

- Age
- Sex
- Species
- Body temperature
- Nutritional status
- Individual susceptibility
- Pathological status

6. Amount or Dose Entering the Body:

The amount of hazardous material entering the *body is the most important factor*, which determines whether or not a material will cause adverse health effects. The greater the amount of material which enters the body, the greater the potential for that material to cause harm. For example, an excessively large dose of table salt (sodium chloride) is capable of causing death, but we do not consider it to be toxic in the future quantities in which it is normally consumed.

Exposure limits are used to gauge safe levels of exposure.

Exposure Limits (TLV)

Exposure limits are airborne concentrations of a material to which it is believed that nearly all workers may be exposed without experiencing any adverse effects. However, because some workers may be sensitive to the material, a percentage of workers may experience discomfort at or below the exposure limit and a smaller percentage may be affected more seriously by the aggravation of a pre-existing condition or illness.

Exposure limits known as Threshold Limit Values (TLV) have been established and these will be found in either the Regulation Respecting Control of Exposure to Biological and Chemical Agents (Reg. 654/86) or the respective Designated Substance Regulation.

There are 3 different types of TLVs:

1. Time Weighted Average (TWA)

The time weighted average concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be exposed, day after day, without adverse effect.

2. Short Term Exposure Limit (STEL)

A 15 minutes time weighted average exposure, which should not be exceeded at any time during a workday even if the 8-hour time weighted average, is within the TLV. Exposures at the STEL should not be longer than 15 minutes and should not be repeated more than 4 times a day. There should be at least 60 minutes between successive exposures at the STEL.

3. Ceiling Exposure Limit (CEL)

This applies to fast-acting and irritating substances, the concentration that should not be exceeded at any time even for an instant.

Health Effects

The health effects that can be produced by hazardous materials are many and very broadly, from a slight irritation to a burn, from effects that disappear in minutes or hours to permanent damage of body tissue. Health effects are categorized into two types:

1. Acute Toxicity

These are health effects that develop either immediately or a short time after and exposure, usually within 24 hours. Health effects may be temporary (skin irritation, sickness or nausea), or they may be permanent (blindness scars from acid burns, mental impairment).

- **Irritancy** - This is the capability to cause localized effects such as irritation, redness, or swelling at the site of contact on the skin, eyes, or mucosal areas. The severity of irritation can be mild, moderate, or severe. Chemical families that generally exhibit primary irritant qualities include amines and ketones. This information is important for the selection of skin and eye protection and emergency wash facilities.

2. Chronic Toxicity

These are health effects that usually result from long term exposure to a small dose over many years (10+ years).

The resulting injury or disease occurs because the exposure has taken place repeatedly over many years. It does not seem to be caused by sudden one-time exposures; i.e., the inhalation of asbestos fibers may cause asbestosis 20 years after the period of exposure.

- **Sensitizing Capability** - A sensitizer is a substance that on first exposure likely causes little or no reaction in persons or test animals, but that on repeated exposure may cause a marked response not necessarily limited to the contact site. Skin sensitization is the most common form of sensitization in the industrial setting, although respiratory sensitization is also known. Isocyanates are an example of a family of sensitizers. Appropriate dermal and respiratory protective controls must be disclosed on the MSDS to prevent sensitization of workers.
- **Carcinogenicity** - Carcinogenicity refers to the capability of a product to cause cancer in animals or people that are exposed to it. Substances classified as carcinogens appearing on current classification lists issued by either of two agencies, the American Conference of Governmental Industrial Hygienists or the International Agency for Research on Cancer.

The "Guidelines for the Classification of Occupational Carcinogens" describes the three categories of carcinogens to which substances or industrial processes may be assigned:

- a) A1 - Confirmed Human Carcinogen
- b) A2 - Suspected Human Carcinogen
- c) A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans.

- **Teratogenicity and Embryotoxicity** - Teratogenicity and embryotoxicity refer to the capability of a product to produce injuries in offspring of pregnant women exposed to the product at a concentration that has no adverse effect on the mother. The MSDS will indicate any adverse effect on fetal development or reproductive parameters. Injuries include death, malformation, permanent metabolic or physiological dysfunction, growth retardation, or psychological or behavioural alteration that occurs during pregnancy, at birth, or in the postnatal period. The embryonic stage of the human fetus, during the first two to eight weeks of development, is particularly at risk of injury from such products. Methyl mercury is an example of a teratogen.

- **Reproductive Toxicity** - This is the ability of a material to cause reproductive toxicity (mutations, birth defects, sterility). Reproductive toxicity has implications for the capability to produce offspring as well as for teratogenicity and embryotoxicity.

- **Mutagenicity** - Mutagenicity is the capability of a product to cause mutations in the genetic material of living cells. Changes to reproductive (germ) cells may result in heritable genetic effects. Changes to non-reproductive (body or somatic) cells may be associated with increased risk of other effects such as cancer. Males or females of a species may be at risk of adverse effect upon exposure to a product that is mutagenic to the species. Results of tests on bacteria, insects, and cells, as well as in vivo tests on living mammals and epidemiology studies on human populations, must be disclosed on the MSDS.

Section 5

Controls & Precautions (Standard Operating Procedures)

1. Screening procedures for Introducing new chemicals OCAD U

Purpose for this Procedure:

1. To define chemical products that are restricted and cannot be introduced to the facility without explicit permission of the Office of Safety and Risk Management.
2. To the extent practicable, avoid introducing to the facility any new products or chemicals that are:
 - a) highly hazardous to health, safety, the environment, or the property, or
 - b) require significant effort to maintain regulatory compliance.
3. To ensure that we comply with all applicable regulatory requirements and good safety practices in relation to any newly introduced products or chemicals.
4. Describe the information gathering activities and compliance actions that must be taken prior to or in connection with introducing and procuring chemicals and products.

Restricted Substances List:

1. No "new product" containing any substance on the OCAD U Restricted Substance List shall be purchased or brought onto OCAD U property unless prior written approval is obtained from the Office of Safety and Risk Management. A "new product" is one that was not listed on the OCAD U Master Chemical Inventory, as of December 2011.
2. "OCAD U Restricted Substances" are substances that are subject to significant health, safety or environmental regulatory compliance obligations, and / or may present significant hazards to health, safety or the environment. Approval to purchase or bring onto the property an OCAD U Restricted Substance shall only be granted if the compliance requirements identified in the list are complied with.
3. It is the responsibility of the "new product user" (i.e. the person wishing to obtain the new product, or his / her supervisor or manager) to ensure compliance with the requirements shown on the list.
4. For assistance and guidance in complying with any OCAD U Restricted Substances requirements, contact the Office of Safety and Risk Management.

List of OCAD U Restricted Substances

Restricted Substance	Reason for Restriction	Not Permitted on OCAD U Property	Designated Substance Assessment	Emergency Response Plan	Substance-Specific Safety Plan	Specific Regulatory Training	City of Toronto Pollution Prevention Plan
1,1,2,2-tetrachloroethane	City of Toronto Appendix 1 substance						√
1,2-dichlorobenzene	City of Toronto Appendix 1 substance						√
1,4-dichlorobenzene	City of Toronto Appendix 1 substance						√
3,3'-dichlorobenzidine	City of Toronto Appendix 1 substance						√
acrylonitrile (monomer)	Designated substance		√		√		
aldrin/dieldrin	City of Toronto Appendix 1 substance						√
alkylphenol ethoxylates	City of Toronto Appendix 1 substance						√
alkylphenols	City of Toronto Appendix 1 substance						√
ammonia (as a compressed gas)	Inherent hazard			√	√		
an ozone depleting substance (see Prohibited Substances list)	Federal and provincial environmental law prohibitions	√					
any radioisotope (unless contained within a consumer product)	Inherent hazard and regulatory control requirements	√					
arsenic as a salt or in solution	OHSA designated substance, and City of Toronto Appendix 1 substance		√		√		√
asbestos	OHSA designated substance		√				
benzene	OHSA designated substance, and City of Toronto Appendix 1 substance		√		√		√
bis (2-ethylhexyl) phthalate	City of Toronto Appendix 1 substance						√
carbon tetrachloride	Inherent hazard				√		
chlordane	City of Toronto Appendix 1 substance						√
chlorine (as a compressed gas)	Inherent hazard			√	√		
chloroform	City of Toronto Appendix 1 substance						√
chromium (in a metal, salt or in solution)	City of Toronto Appendix 1 substance				√		√
cis-1,2-dichloroethylene	City of Toronto Appendix 1 substance						√
cobalt	City of Toronto Appendix 1 substance						√
copper	City of Toronto Appendix 1 substance						√
DDT	City of Toronto Appendix 1 substance						√
di-n-butyl phthalate	City of Toronto Appendix 1 substance						√
ethyl benzene	City of Toronto Appendix 1 substance						√
ethylene oxide	OHSA designated substance		√		√		
hexachlorobenzene	City of Toronto Appendix 1 substance						√
hexachlorocyclohexane	City of Toronto Appendix 1 substance						√
hydrofluoric acid	Inherent hazard				√		
hydrogen (as a compressed gas)	Inherent hazard, Ontario Fire Code requirements				√	√	
isocyanates (any type of monomer)	OHSA designated substance		√		√		
lead	OHSA designated substance, and City of Toronto Appendix 1 substance		√		√		√

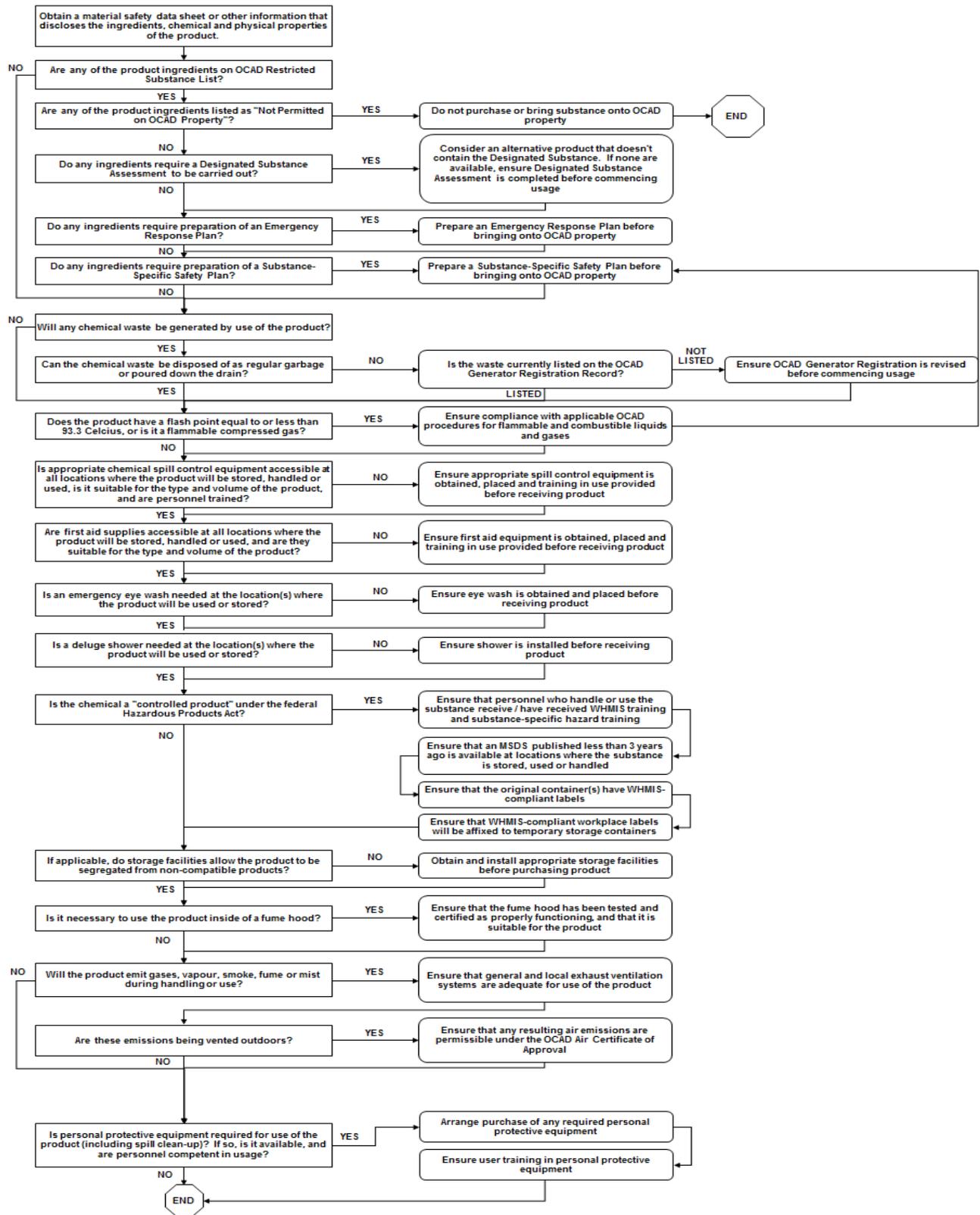
Restricted Substance	Reason for Restriction	Not Permitted on OCAD U Property	Designated Substance Assessment	Emergency Response Plan	Substance-Specific Safety Plan	Specific Regulatory Training	City of Toronto Pollution Prevention Plan
manganese (as a salt or in solution)	Toxicity				√		
mercury	OHSA designated substance, and City of Toronto Appendix 1 substance		√		√		√
methylene chloride	City of Toronto Appendix 1 substance						√
mirex	City of Toronto Appendix 1 substance						√
molybdenum	City of Toronto Appendix 1 substance						√
nickel (as a salt or in solution)	City of Toronto Appendix 1 substance				√		√
polychlorinated biphenyl	City of Toronto Appendix 1 substance, provincial and federal environmental law prohibitions	√					√
pentachlorophenol	City of Toronto Appendix 1 substance						√
picric acid	Inherent hazard	√					
propane	Inherent hazard, Ontario Fire Code requirements				√	√	√
selenium	City of Toronto Appendix 1 substance						√
silica (any crystalline form)	OHSA designated substance		√		√		
styrene (monomer)	Inherent hazard				√		
tetrachloroethylene	City of Toronto Appendix 1 substance						√
toluene	City of Toronto Appendix 1 substance						√
xylene	City of Toronto Appendix 1 substance						√
trans-1,3-dichloropropylene	City of Toronto Appendix 1 substance						√
trinitrotoluene ("TNT")	Inherent hazard	√					
vermiculite	Potential asbestos content, resultant OHSA regulatory controls	√					
vinyl chloride (monomer)	OHSA designated substance		√		√		
zinc	City of Toronto Appendix 1 substance						√

List of OCAD U Prohibited Substances

Environmental Protection Act Ozone Depleting Substances	
EPA, 718/94 and 717/94 Class 1 ODS	CFC-11, also known as fluorotrichloromethane
EPA, 718/94 and 717/94 Class 1 ODS	CFC-12, also known as dichlorodifluoromethane
718/94 and 717/94 Class 1 ODS	CFC-13, also known as chlorotrifluoromethane
718/94 and 717/94 Class 1 ODS	CFC-111, also known as pentachlorofluoroethane
718/94 and 717/94 Class 1 ODS	CFC-112, also known as tetrachlorodifluoroethane
EPA, 718/94 and 717/94 Class 1 ODS	CFC-113, also known as trichlorotrifluoroethane
EPA, 718/94 and 717/94 Class 1 ODS	CFC-114, also known as dichlorotetrafluoroethane
EPA, 718/94 and 717/94 Class 1 ODS	CFC-115, also known as monochloropentafluoroethane
718/94 and 717/94 Class 1 ODS	CFC-211, also known as fluoroheptachloropropane
718/94 and 717/94 Class 1 ODS	CFC-212, also known as difluorohexachloropropane
718/94 and 717/94 Class 1 ODS	CFC-213, also known as trifluoropentachloropropane
718/94 and 717/94 Class 1 ODS	CFC-214, also known as tetrafluorotetrachloropropane
718/94 and 717/94 Class 1 ODS	CFC-215, also known as pentafluorotrichloropropane
718/94 and 717/94 Class 1 ODS	CFC-216, also known as hexafluorodichloropropane
718/94 and 717/94 Class 1 ODS	CFC-217, also known as heptafluorochloropropane
EPA, 718/94 and 717/94 Class 1 ODS	Halon-1211, also known as bromochlorodifluoromethane
EPA, 718/94 and 717/94 Class 1 ODS	Halon-1301, also known as bromotrifluoromethane
EPA, 718/94 and 717/94 Class 1 ODS	Halon-2402, also known as dibromotetrafluoroethane
718/94 and 717/94 Class 1 ODS	carbon tetrachloride
718/94 and 717/94 Class 1 ODS	methyl chloroform, also known as 1,1,1 trichloroethane
718/94 and 717/94 Class 1 ODS	any hydrobromofluorocarbon
718/94 and 717/94 Class 1 ODS	any isomer of any 718/94 or 717/93 Class 1 ODS
718/94 Class 1 ODS	any hydrochlorofluorocarbon
717/94 Class 2 ODS	HCFC-21, also known as dichlorofluoromethane
717/94 Class 2 ODS	HCFC-22, also known as chlorodifluoromethane
717/94 Class 2 ODS	HCFC-31, also known as chlorofluoromethane
717/94 Class 2 ODS	HCFC-121, also known as tetrachlorofluoroethane
717/94 Class 2 ODS	HCFC-122, also known as trichlorodifluoroethane
717/94 Class 2 ODS	HCFC-123, also known as dichlorotrifluoroethane
717/94 Class 2 ODS	HCFC-124, also known as chlorotetrafluoroethane
717/94 Class 2 ODS	HCFC-131, also known as trichlorofluoroethane
717/94 Class 2 ODS	HCFC-132, also known as dichlorodifluoroethane
717/94 Class 2 ODS	HCFC-133, also known as chlorotrifluoroethane
717/94 Class 2 ODS	HCFC-141, also known as dichlorofluoroethane
717/94 Class 2 ODS	HCFC-142, also known as chlorodifluoroethane
717/94 Class 2 ODS	HCFC-151, also known as chlorofluoroethane
717/94 Class 2 ODS	HCFC-221, also known as hexachlorofluoropropane
717/94 Class 2 ODS	HCFC-222, also known as pentachlorodifluoropropane
717/94 Class 2 ODS	HCFC-223, also known as tetrachlorotrifluoropropane
717/94 Class 2 ODS	HCFC-224, also known as trichlorotetrafluoropropane
717/94 Class 2 ODS	HCFC-226, also known as chlorohexafluoropropane
717/94 Class 2 ODS	HCFC-231, also known as pentachlorofluoropropane
717/94 Class 2 ODS	HCFC-232, also known as tetrachlorodifluoropropane
717/94 Class 2 ODS	HCFC-233, also known as trichlorotrifluoropropane
717/94 Class 2 ODS	HCFC-234, also known as dichlorotetrafluoropropane
717/94 Class 2 ODS	HCFC-235, also known as chloropentafluoropropane

Environmental Protection Act Ozone Depleting Substances	
717/94 Class 2 ODS	HCFC-241, also known as tetrachlorofluoropropane
717/94 Class 2 ODS	HCFC-242, also known as trichlorodifluoropropane
717/94 Class 2 ODS	HCFC-243, also known as dichlorotrifluoropropane
717/94 Class 2 ODS	HCFC-244, also known as chlorotetrafluoropropane
717/94 Class 2 ODS	HCFC-251, also known as trichlorofluoropropane
717/94 Class 2 ODS	HCFC-252, also known as dichlorodifluoropropane
717/94 Class 2 ODS	HCFC-253, also known as chlorotrifluoropropane
717/94 Class 2 ODS	HCFC-261, also known as dichlorofluoropropane
717/94 Class 2 ODS	HCFC-262, also known as chlorodifluoropropane
717/94 Class 2 ODS	HCFC-271, also known as chlorofluoropropane
717/94 Class 2 ODS	all other hydrochlorofluorocarbons not specifically named as 717/94 Class 2 ODS, other than HCFC-225, also known as dichloropentafluoropropane
717/94 Class 2 ODS	all mixtures containing any 717/94 Class 2 ODS
717/94 Class 3 ODS	HCFC-225, also known as dichloropentafluoropropane

Pre-Introduction Screening and Compliance Procedure Flow Diagram:



User Record Keeping Checklist

A checklist must be filled in to serve as a record of having completed all of the activities required by the screening and compliance process. The completed checklist must be provided to the responsible manager for verification and signature. The verified and signed checklist must be provided to the Office of Safety and Risk Management for final review and record keeping purposes.

User Record Keeping Checklist			
OCAD U Department / User:			
New Product / Substance:			
Proposed Use:			
Estimated Quantity to be Kept on Hand:			
Estimated Quantity Used per Month:			
Name of verifying Manager:			
Signature of verifying Manager:			Date:
Step	Action	Completed On	Initials
1	Obtain a material safety data sheet or other information that discloses the ingredients, chemical and physical properties of the substance.		
2	Are any of the product ingredients on OCAD Restricted Substance List?		
3	Are any of the product ingredients listed as "Not Permitted on OCAD Property"?		
4	Are there any "designated substances" listed as ingredients in the product? If so, designated substance assessment must be carried out in conjunction with purchase.		
5	Do any ingredients require preparation of an Emergency Response Plan?		
6	Do any ingredients require preparation of a Substance-Specific Safety Plan?		
7	Will use of the product result in any chemical waste being generated?		
8	Can wastes be disposed of via the drain or in regular garbage, or are the wastes considered to be hazardous waste?		
9	If the waste is a hazardous waste, is that waste currently on the OCAD Generator Registration Record? If not, the Generator Registration Record must be updated.		
10	Is the chemical a liquid with a flash point under 93.3 Celsius, or a flammable compressed gas?		
11	Have provisions been made to ensure compliance with applicable OCAD procedures relating to the use of flammable and combustible liquids (as applicable)?		
12	Have provisions been made to ensure compliance with applicable OCAD procedures relating to flammable compressed gases?		
13	Is existing available spill response equipment at the site of storage and use adequate for the chemical type and volume?		
14	Are existing first aid supplies at the site of storage and use adequate for the chemical type and volume?		

Step	Action	Completed On	Initials
15	Do the locations of chemical storage and use require emergency eye wash and deluge shower? If so, are they present?		
16	Is the chemical a "controlled product" under the federal Hazardous Products Act?		
17	If the product is a "controlled product", have users received WHMIS training in the chemical?		
18	If the product is a "controlled product", ensure that a material safety data sheet published less than 3 years ago will be available at locations where the substance is stored, used or handled.		
19	If the product is a "controlled product", ensure that the original container(s) have WHMIS-compliant labels.		
20	If the product is a "controlled product", ensure that WHMIS-compliant workplace labels will be available if necessary to affix to temporary storage containers		
21	Where on-site will the chemical be stored by the user? Will it be stored beside other chemicals? Are the chemicals with which it will be stored compatible with the new chemical?		
22	Is the chemical one that can only be used inside a fume hood? Is one present? Has it been tested / certified to be functioning properly?		
24	If the chemical will emit gases, vapour, smoke, fume or mist during handling or use, how are these emissions being contained and vented outdoors?		
25	If any emitted gases, vapour, smoke, fume or mist is being released to the indoor atmosphere, is the current general ventilation system a suitable and adequate control measure?		
26	If the chemical will emit gases, vapour, smoke, fume or mist, does the existing OCAD Air Certificate of Approval cover these emissions?		
27	What personal protective equipment is required to be worn by users? Is it available and have users been trained in proper use?		
28	Who will be designated as having ultimate responsibility for compliance with safety requirements relating to the chemical?		

Screening Guidance Notes (corresponds with the table on the proceeding page)

The following table provides guidance on how to perform the various pre-introduction screening activities.

Screening Guidance Notes		
Step	Action	Guidance
1	Obtain a material safety data sheet or other information that discloses the ingredients, chemical and physical properties of the substance.	A material safety data sheet can be obtained from the proposed supplier / vendor. Many suppliers and vendors also make material safety data sheets available via their web sites.
2	Are any of the product ingredients on OCAD U Restricted Substance List?	Compare the ingredients listed on the material safety data sheet with the list of substances in Restricted Substances list.
3	Are any of the product ingredients listed as "Not Permitted on OCAD U Property"?	If "yes", then the product cannot be purchased.
4	Are there any "designated substances" listed as ingredients in the product? If so, designated substance assessment must be carried out in conjunction with purchase.	Restricted Substances list identifies the 11 "designated substances". It is necessary to perform a "designated substance assessment" if any of these substances are to be used.
5	Do any ingredients require preparation of an Emergency Response Plan?	Restricted Substances list identifies substances for which an Emergency Response Plan is required. Plans are required because of the potential for severe harm associated with spills or releases of these substances. Consult the procedure entitled "Preparation of Emergency Response Plans".
6	Do any ingredients require preparation of a Substance-Specific Safety Plan?	Restricted Substances list identifies substances for which a Substance-Specific Safety Plan is required. Plans are required because of the potential for severe harm associated with spills or releases of these substances.
7	Will use of the product result in any chemical waste being generated?	The product user is responsible for determining whether the use of the product will generate waste materials.
8	Can wastes be disposed of via the drain or in regular garbage, or are the wastes considered to be hazardous waste?	Consult the procedure entitled "Chemical Waste Disposal Procedures" to determine if the waste must be treated as hazardous waste, or whether it can be disposed via the drain or in regular garbage.
9	If the waste is a hazardous waste, is that waste currently on the OCAD U Generator Registration Record? If not, the Generator Registration Record must be updated.	Consult with Safety & Risk Management to determine whether the current Generator Registration Record permits OCAD to dispose of these substances. If not, the Generator Registration Record must be updated as a result of the introduction of the product.

Screening Guidance Notes		
Step	Action	Guidance
10	Is the chemical a liquid with a flash point under 93.3 Celcius, or a flammable compressed gas?	This information can be obtained from the material safety data sheet. If the chemical is a liquid and has a flash point between 37.8 C and 93.3 C, it is classed as a "combustible liquid" under the Ontario Fire Code. If the chemical is a liquid with a flash point less than 37.8 C, it is classed as a "flammable liquid" under the Ontario Fire Code. Substance-specific safety plans must be prepared for flammable or combustible liquids, and for flammable compressed gases, and these classes of substances are also subject to additional OCAD procedures that are intended to ensure compliance with Ontario Fire Code and Ontario Electrical Safety Code requirements.
11	Have provisions been made to ensure compliance with applicable OCAD procedures relating to the use of flammable and combustible liquids (as applicable)?	Determine occupancy classification for the proposed storage and usage locations, and ensure the occupancy complies with requirements of the Ontario Fire Code
12	Have provisions been made to ensure compliance with applicable OCAD procedures relating to flammable compressed gases?	Determine occupancy classification for the proposed storage and usage locations, and ensure the occupancy complies with requirements of the Ontario Fire Code
13	Is existing available spill response equipment at the site of storage and use adequate for the chemical type and volume?	Consult the procedure entitled "Chemical Emergency Response", and compare the requirements listed in Restricted Substances list of that procedure with the equipment that is present and available at or in the vicinity of the sites of planned storage and use.
14	Are existing first aid supplies at the site of storage and use adequate for the chemical type and volume?	Consult the procedure entitled " Chemical Emergency Response ", and compare the requirements listed in Restricted Substances list of that procedure with the equipment that is present and available at or in the vicinity of the sites of planned storage and use.
15	Do the locations of chemical storage and use require emergency eye wash and deluge shower? If so, are they present?	Consult the procedure entitled "Requirements for Chemical Emergency Response", and compare the requirements listed in Restricted Substances list of that procedure with the equipment that is present and available at or in the vicinity of the sites of planned storage and use.

Screening Guidance Notes		
Step	Action	Guidance
16	Is the chemical a "controlled product" under the federal Hazardous Products Act?	"Controlled product" is the term used for pure substances and products that possess chemical, physical, toxic, biohazardous or radioactive characteristics defined by the Controlled Products Regulations under the federal Hazardous Products Act. "Controlled products" are also often referred to as "WHMIS products", since those substances and products are subject to the Ontario Workplace Hazardous Materials Information System Regulation. If the material is a "controlled product", the material safety data sheet may specify the "WHMIS Class" or "Controlled Product Class" for the substance, which will be a number or number+letter combination, but it is not mandatory for this information to be on the material safety data sheet. It is also the case that many products that are not "controlled products" have material safety data sheets, despite the absence of a regulatory requirement for one. A sure way of determining if a substance is a "controlled product" is to examine the label. If it is a "controlled product", then the label will have one or more of the symbols shown in "Screening Procedures Prior to the Introduction of New Chemicals or Products to OCAD University" procedure.
17	If the product is a "controlled product", have users received WHMIS training in the chemical?	See the procedure entitled "Training of Personnel in Chemical Safety" for information on arranging this training.
18	If the product is a "controlled product", ensure that a material safety data sheet published less than 3 years ago will be available at locations where the substance is stored, used or handled.	The most practical way of doing so is to copy the material safety data sheet and place the copy into MSDS binders at the appropriate locations.
19	If the product is a "controlled product", ensure that the original container(s) have WHMIS-compliant labels.	It is a responsibility of the manufacturer and supplier to ensure compliant labelling.
20	If the product is a "controlled product", ensure that WHMIS-compliant workplace labels will be available if necessary to affix to temporary storage containers	See the procedure entitled "Requirements for Material Safety Data Sheet and Labels" for guidance on how to when workplace WHMIS labels are required for temporary containers, and how to prepare same.
21	Where on-site will the chemical be stored by the user? Will it be stored beside other chemicals? Are the chemicals with which it will be stored compatible with the new chemical?	Consult the procedure entitled "Chemical Storage Procedures" for advice on safe storage practices.

Screening Guidance Notes		
Step	Action	Guidance
22	Is the chemical one that can only be used inside a fume hood? Is one present? Has it been tested / certified to be functioning properly?	The determination of whether a chemical must be used in a fume hood is based on factors such as: (1) the potential for release of harmful airborne emissions; (2) potential for harmful spills; (3) potential for runaway reactions; (4) potential for explosions. If you are uncertain as to whether usage should be restricted to a fume hood, contact Studio Management or Studio Technician for assistance. If a fumehood is required and is available, it is necessary to verify that it has been tested and certified as functioning properly. If it has been certified, there will be a sticker affixed to the fume hood at a visible place indicating who performed the testing, when the certification occurred, and when it expires.
24	If the chemical will emit gases, vapour, smoke, fume or mist during handling or use, how are these emissions being contained and vented outdoors?	If the chemical is not being used in a fume hood or with other local exhaust ventilation, then any air emissions will be diluted in the general atmosphere inside the building, and will be partially exhausted and partially recirculated by the general ventilation system.
25	If any emitted gases, vapour, smoke, fume or mist is being released to the indoor atmosphere, is the current general ventilation system a suitable and adequate control measure?	Substances that can be emitted into the general atmosphere of the building without perceptible impacts include carbon dioxide, nitrogen, argon, helium, small quantities of low toxicity organic solvents, and residues from the evaporation of cleaning products. If you are uncertain as to the acceptability of emissions to the general atmosphere inside the building, or the adequacy of the general ventilation in the area where the emissions would occur, contact Facilities Planning & Management for assistance.
26	If the chemical will emit gases, vapour, smoke, fume or mist, does the existing OCAD Air Certificate of Approval cover these emissions?	The Office of Safety and Risk Management will make arrangements to add product on the CoA if required.
27	What personal protective equipment is required to be worn by users? Is it available and have users been trained in proper use?	The material safety data sheet for the product will specify the types of personal protective equipment recommended for use by the manufacturer. If you are concerned that additional or lesser protective measures are appropriate, contact Studio Management for assistance. Verify that proposed users have or will have the necessary protective equipment, and that they have been or will be trained in proper use. For guidance on training, see the procedure entitled "Training of Personnel in Chemical Safety" for information on arranging this training.
28	Who will be designated as having ultimate responsibility for compliance with safety requirements relating to the chemical?	This needs to be determined, and should be documented on the screening form. The person assigned should be competent to exercise the necessary responsibilities.

Verification of Implementation Compliance:

Following receipt of a "new product", the verifying manager shall examine the manner of product storage, handling, use and disposal, to verify the correctness of these practices.

2. Procedure for managing MSDS and labels

Purpose for this Procedure

1. To ensure that personnel have ready access to information for safe use of chemical products.
2. Comply with requirements of the *Workplace Hazardous Materials Information System ("WHMIS") Regulation*.
3. To specify the processes for obtaining and maintaining material safety data sheets ("MSDSs").
4. To provide instruction on when workplace labels are required, and their format and content.

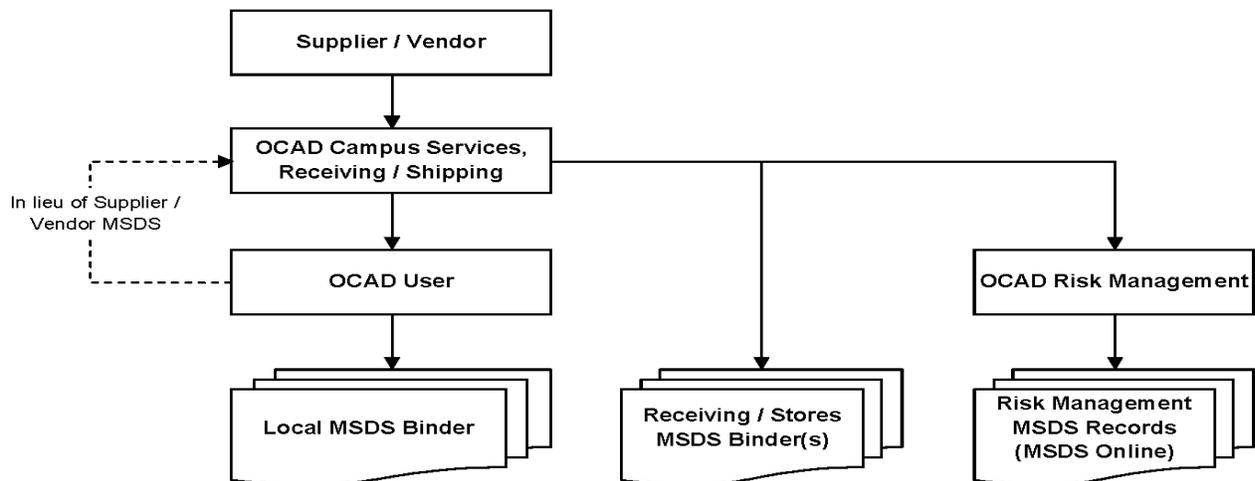
Regulatory Context

1. The *Workplace Hazardous Materials Information System Regulation – made under the Occupational Health and Safety Act*, requires employers to have and make readily available to employees material safety data sheets for all "controlled products".
2. It also requires employers to ensure that "workplace labels" are prepared and applied to any container into which a controlled product is decanted (i.e. a container other than the one in which the product was originally received from the supplier).

1. Material Safety Data Sheets (MSDS):

Obtaining Material Safety Data Sheets with Product Orders

1. OCAD University Purchase Order shall contain an instruction to vendors specifying that (a) a MSDS must accompany each shipment of a chemical substance or product, and (b) OCAD University reserves the right to decline to accept or reject any shipment or delivery of a chemical substance or product that is not accompanied by a MSDS.
2. OCAD University and the Campus Services Department will not release to any user any controlled chemical substance or product that has been received without being accompanied by a MSDS, unless the user provides the Office of Safety and Risk Management a current MSDS for the chemical substance or product prepared by the actual supplier.
3. In cases where a MSDS has not been received with a shipment or delivery, it is acceptable for an OCAD University user to download from the internet the supplier's MSDS for the chemical substance or product, and provide this to Studio Management.
4. The following diagram illustrates the flow of MSDSs:



Process for Maintaining Central Files of Material Safety Data Sheets

1. Studio Management will maintain a set of binders containing MSDSs for all products received or delivered.
2. Studio Management will provide the Office of Safety and Risk Management with an electronic copy of each MSDS received as described in 4. below.
3. The Office of Safety and Risk Management shall create a PDF file for every MSDS. PDF files shall be named as the name of the product, plus an abbreviation for the supplier, plus the MSDS creation date (in the format YYMMDD), each separated by a period (e.g. Acetone.JTBaker.090430).
4. The electronic directory of MSDS' shall be located on MSDS Online through the Office of Safety and Risk Management.

Process for Maintaining Binders of MSDSs at Work Locations

1. A white, 3-ring MSDS binder shall be kept in close proximity of locations where chemicals are stored.
2. The binder shall be labeled as follows:
 - a. Material Safety Data Sheets
 - b. Department Name
 - c. Location (Building, Floor, Room Number)
3. Each binder shall contain a set of "A" through "Z" alphabetic tab dividers. Products starting with numbers shall be filed before the "A" tab.
4. MSDSs shall be filed in the binder by product name, such that the MSDS is placed behind the tab corresponding to the first letter in the product name (e.g. acetone would be behind the "A" tab).
5. Where there are MSDSs for several products having names starting with the same letter, the MSDSs shall be filed in alphabetical order according to the subsequent letters in the product name (e.g. "acetone" would be filed behind "acetic acid").
6. A MSDS shall be added to the binder each time a new MSDS is received for a product.
7. When a MSDS is added to the binder,
 - a) the chemical inventory for the location must be updated (see "Chemical Inventory Record Keeping Requirements"),
 - b) any older version of the MSDS for the product shall be removed and disposed.
8. Should any alphanumeric tab divider be empty (due to there being no products having names beginning with that letter), a sheet shall be inserted that states "NO PRODUCTS IN THIS TAB".
9. At least once per year, at the time of reviewing and updating the location-specific inventory (see "Chemical Inventory Record Keeping Requirements"), the contents of the MSDS binder must be reconciled against the inventory, and any inconsistencies must be remedied, so that the contents of the MSDS binder match the up-to-date inventory.

2. Labels:

Supplier Container Labeling Obligations

It is a responsibility of the manufacturer and supplier to ensure WHMIS compliant labeling of every controlled product container.

Levels of compliance are typically high for Canadian and American suppliers. Should a user contemplate ordering a product from a supplier in another jurisdiction, verify that the containers will have WHMIS compliant labeling before placing the order.

Workplace Labeling Obligations for Decanted Products

1. If a controlled product is decanted or transferred from the original supplier container into a secondary or portable container, or mixed together with another controlled product or non-controlled product, the user must ensure that a WHMIS-compliant “workplace label” is affixed to the container, except in circumstances described in 3 below.
2. A workplace label can be hand-written, a pre-printed form, or downloaded from MSDS Online so long as the information described in 4. below is present.
3. A workplace label is not required to be affixed to a secondary or portable container if either of the following conditions apply:
 - c) the product will be used immediately in its entirety, or
 - d) the product is,
 - under the exclusive control of one person,
 - to be used exclusively use of one person,
 - to be used in its entirety during the course of the work shift, and
 - the product name is marked on the container.
4. Workplace labels for secondary containers must contain the following information:
 - a) The product / substance name (identical to that on the MSDS)
 - b) Safe handling information (a synopsis of key points from the supplier label)
 - c) A statement that an MSDS is available
5. Pre-printed workplace labels can be obtained online from MSDS Online as well as the Sharepoint link created for the Shops and Studio Technicians.

3. Procedures for transporting chemicals within OCAD U

Purpose for this Procedure

1. To ensure that chemical products are moved from place to place within the facility in a safe manner, and reduce the risk of spills or other incidents.

1. Compressed Gas Cylinders

a) Empty or Full Gas Cylinders – Nominal Height under 38 cm (Except Acetylene)

1. Gas cylinders having a nominal height (i.e. base to top of valve cap) under 38 cm are permitted to be manually carried from place to place by personnel, so long as the valve stem is protected by a valve cap or other device that prevents leakage or release if the cylinder is dropped or damaged.
2. If it is impractical to manually carry cylinders of these sizes from place to place, you must use a small cylinder cart as shown here.
3. If necessary to transport between levels in the building, these cylinders may be taken onto elevators, but only outside of public access hours.



b) Empty or Full Gas Cylinders – Nominal Height 38 cm or More (Except Acetylene)

1. Gas cylinders having a nominal height (i.e. base to top of valve cap) of 38 cm or more must be transported using a gas cylinder cart of the type shown in 2.1 above (for cylinders having diameters under 11 cm), or a dolly (for larger cylinders), as shown here.
2. When using the dolly for transporting large cylinders,
 - ensure that the cylinder is secured in position by the strap
 - ensure that the valve is fully closed and the valve cap is in place
 - never leave the dolly unattended
 - always keep the dolly in the upright or 4-wheel tilted position
 - never allow the dolly with a cylinder to rest with the cylinder “lying down” in the horizontal position
3. If necessary to transport between levels in the building, large cylinders requiring dolly transport are not to be taken onto public usage elevators nor onto escalators, and can only be elevated using the service elevator(s)
4. Never transport large cylinders through public access areas during public access hours.



c) Acetylene Cylinders

1. Acetylene cylinders must always be transported using a cart or dolly
2. When using the dolly for transporting large cylinders,
 - ensure that the cylinder is secured in position by the strap
 - ensure that the valve is fully closed and the valve cap is in place
 - never leave the dolly unattended
 - always keep the cylinder in the upright tilted position – this is particularly important for acetylene cylinders because they contain a liquid solvent
 - never allow the dolly with a cylinder to rest with the cylinder “lying down” in the horizontal position – this is particularly important for acetylene cylinders because they contain a liquid solvent
3. If necessary to transport between levels in the building, acetylene cylinders are not to be taken onto public usage elevators nor onto escalators, and can only be elevated using the service elevator(s).
4. Never transport acetylene cylinders through public access areas during public access hours.

2. Solids and Liquids in Supplier Containers or Secondary / Portable Containers **Supplier Boxed Shipments (Dock Area to User Storage Location)**

1. For hazardous chemicals delivered in boxes (e.g. plastic or glass container(s) inside of a packing box), or in bulk primary containers up to 20 liters, either of the following types of carrier should be used to transport the item(s) from the chemical storage room to the user’s storage location.
2. Chemical kits that are shipped by suppliers in a boxed or containerized format that is inherently protected and designed to contain spillage (may be transported by being manually carried, or in accordance with Section 3 (b)).
3. When using this type of carrier for transporting hazardous chemicals,
 - a) load the bottom shelf before loading the top shelf (be careful to avoid strains and sprains when lifting and bending)
 - b) make sure that the total weight of the load on the top shelf is not more than about half the weight of the load on the bottom shelf (this keeps the center of gravity low, making it easier to handle, and reducing risk of toppling over)
 - c) never pile objects on the top shelf at a height that obstructs your view when pushing the carrier
 - d) never stack boxes two high or higher on a shelf without securing the load using straps or heavy tape
 - e) never leave the carrier unattended while in transit
4. The carrier shown above must not be used for transporting any compressed gas.
5. If necessary to transport between levels in the building, these are not to be taken onto public usage elevators during public access hours, and can only be elevated using the service elevator(s) during public access hours. If it is not possible or practical to use service elevator(s) after public access hours, then public usage elevators or escalators may be used.
6. Never transport hazardous chemicals using these carriers through public access areas during public access hours.



3. Individual Bottles / Containers

1. Transporting individual containers of hazardous chemicals that are not held inside of a kit or other type of secondary container should be avoided if possible.
2. If it is necessary to transport individual bottles or containers of hazardous chemicals, use either of the types of carriers shown. If the cart for individual bottles and chemicals is used, ensure that the containers placed inside the drawers are secured against tipping over while in transit.
3. If using a carrier to transport two or more chemically incompatible or reactive materials that are not pre-packaged into kits, separate the incompatible items to reduce potential for mixing in the event of container leakage or breakage.



Hazardous Waste Materials

1. Containers with hazardous waste materials must be transported from their point of production to the chemical waste lock-up by Campus Services Staff using any of the carriers described above.
2. The choice of carrier must be made on the basis of the type of container holding the hazardous waste.

Markings on Carriers

1. Whenever a chemical container is transported inside of a tote or an enclosed carrier, the person responsible for transporting the material must ensure that a description of the non-visible contents is provided on the outside of the tote and or carrier.
2. Hand-written paper or cardboard temporary signs, affixed to the container with tape, are adequate, so long as they are legible and can be read at a distance of about 2 meters (e.g. write the contents in capital letters, using a dark magic marker on white paper or cardboard).

4. Procedure for storing chemicals

Principles and Rules Governing Storage Practices

1. Chemicals possess a variety of chemical and physical properties. Some of these properties are incompatible. If chemicals with incompatible properties are inadvertently or unexpectedly mixed together, dangerous reactions can occur, resulting in risks to health, safety, property or the environment.
2. For the reasons described above, it is important to store chemicals at locations, and in ways that reduce the potential for incompatible chemicals mixing together as a result of spills, leakage, container rupture, or fires.
3. Chemicals at OCAD University must be stored in accordance with rules contained in this procedure.

Determining Storage Requirements for a Substance

1. To determine the storage requirements for a chemical, consult the relevant sections of this procedure, and the Material Safety Data Sheet for the chemical.
2. In the event of any contradiction between this Procedure and Material Safety Data Sheets, contact the Office of Safety and Risk Management for instructions on proper storage procedures.

Standardized Signage and Markings for Storage Locations and Cabinets

1. Storage locations and cabinets for chemical products shall have signage and / or markings as described herein.

1. Flammable or Combustible Liquids

1. A “Flammable Liquid” is one having a flash point less than 37.8 C.
2. A “Combustible Liquid” is one having a flash point between 37.8 C and 93.3 C.

Approval Required to Increase Quantities of Flammable or Combustible Liquids Typically On-Hand

1. The list below presents a listing of flammable and combustible liquids contained in the most recent OCAD University inventory of hazardous materials.
2. Approval from the Office of Safety and Risk Management is required before any OCAD University user is allowed to increase the quantity of flammable or combustible liquids typically on-hand and under the control of the user.
3. The total quantity of all flammable and combustible liquids at OCAD University shall be kept at less than 500 L at all times. It is the responsibility of Studio Management to monitor quantities present on site and to take action to prevent accumulation of amounts in excess of 500 L.

Flammable and Combustible Liquids at OCAD University (as of February 2012)

Substance/Product Name	Phase	Site within OCAD U	Flammable / Explosive	Combustible	Flash Point	Typical Quantity on Hand	
						Q	Units
07730 MSA Varnish w/ UVLS (Gloss) A,B,C,H; 07735 MSA Varnish w/ UVLS (Satin) A,B,C,H,5; 07740 MSA Varnish w/ UVLS (Matte) A,B,C,H,5; 93300 MSA Gel A,B,C; 07742 Hard MSA Varnish w/ UVLS (Gloss) A,H; 07743 Hard MSA Varnish w/ UVLS (Satin) A,H,5; 07744 Hard	Liquid	Draw/Print	X		41		
3M SPRAY MOUNT ARTIST'S ADHESIVE (CANADA)	Liquid	Ind Design	X		-50		
Acetic Acid, Glacial	Liquid	Lithography	X		104		
Acetone	Liquid	Ceramics	X		-4		
Acetone	Liquid	Foundry	X		-4		
Acetone	Liquid	Ind Design	X		-4		
Acetone	Liquid	Jewellery	X		-4		
Acetone	Liquid	Lithography	X		-4		
Acetone	Liquid	Mouldmaking	X		-4		
Acetone	Liquid	Plastics	X		-4		
Acetone	Liquid	Sculpture	X		-4		
Acetylene	Gas	Jewellery	X				
Acetylene	Gas	Metals	X				
Air Tool Oil	Liquid	Foundry		X	128		
Air Tool Oil	Liquid	Sculpture		X	128		
Ball Paint Marker	Liquid in pen	Metals	X		88		
Blue Marking Ink Kleenscribe Layout Dye	Liquid	Metals	X		-4		
Boeshield T-9 Liquid	Aerosol	Ind Design		X	120		
Boeshield T-9 Liquid	Aerosol	Photography		X	120		
Boeshield T-9 Liquid	Aerosol	Woodworking		X	120		
Brasso	Liquid	Etching	X		105		
CASTALDO Jewelry Mold Release Spray	Aerosol	Jewellery	X				
Chalkboard paint	Liquid	Ceramics	X		205		
Chalkboard paint	Liquid	Plastics	X		205		
Champion Spraypaint	Aerosol	Woodworking	X		-5		
Charcoal powder / granular	Powder	Jewellery	X	X			
Citric Acid	Powder	Photography	X	X			
Clear Laqueur Thinner	Liquid	Lithography	X		3		
Clear Paste Wax	Paste	Sculpture		X			
Contact 2000	Liquid	Photography	X		45		
CORNSTARCH	Powder	Jewellery	X	X			
Crown Reliable Release Mold Releases - Aerosol, 3423 Reliable Release General Purpose Silicone Mold Release, 3445 Reliable Release Heavy Duty Silicone Mold Release, 3452 Reliable Release Lecithin Mold Release, 3460 Reliable Release Paintable Mold Release	Aerosol	Jewellery	X				
Danish oil	Liquid	Sculpture	X		41		
Danish Oil - Natural	Liquid	Woodworking	X		41		
Danish Oil - Walnut	Liquid	Woodworking	X		41		
DOW CORNING HS II THIXOTROPIC ADDITIVE	Liquid	Mouldmaking		X	153		

Substance/Product Name	Phase	Site within OCAD U	Flammable / Explosive	Combustible	Flash Point	Typical Quantity on Hand	
						Q	Units
Elmer's spray adhesive	Aerosol	Photography	X				
Ethyl Alcohol, 95% Denatured	Liquid	Photography	X		-173		
FLUORESCENT PAINT; Fluorescent - White (No. 5779), Fluorescent - Red (No. 5780), Fluorescent - Yellow (No. 5782), Fluorescent - Green (No. 5783), Fluorescent - Blue (No. 5784), Fluorescent - Invisible Blue (No. 5785), Fluorescent - Pink (No. 5786)	Aerosol	Ind Design	X		0		
GAMSOL	Liquid	Draw/Print	X		145		
HB PVC 40 GREY CEMENT	Liquid	Photography	X		-5		
Isopropyl Alcohol – 99%	Liquid	Lithography	X		535		
Isopropyl Alcohol	Liquid	Draw/Print	X		53		
Kerosene	Liquid	Sculpture	X		100		
Kerosene	Liquid	Foundry	X		100		
KODAK Farmer's Reducer, Part A	Powder	Photography	X				
KODAK Farmer's Reducer, Part B	Powder	Photography	X				
Krylon all purpose spray adhesive (No MSDS)	Aerosol	Ind Design	X		<0		
Krylon Clear Glaze	Aerosol	Woodworking	X		<0		
Krylon Grey Glaze	Aerosol	Woodworking	X		<0		
Krylon H2O Latex Aerosol Paint, White Primer	Aerosol	Photography	X		<0		
KRYLON Interior/Exterior Paint, Glossy White	Aerosol	Photography	X		<0		
Lepage - Thinner Rubber Cement	Liquid	Sculpture	X		-12		
LEPAGE CONTACT CEMENT THINNER/CLEANER	Liquid	Ind Design	X		-12		
LEPAGE CONTACT CEMENT THINNER/CLEANER	Liquid	Jewellery	X		-12		
Liberon Wax	Solid	Woodworking	X		100		
LIGHTER FLUID/CHARCOAL STARTER	Liquid	Metals	X		42		
LIQUID WRENCH PENETRATION OIL (Liquid)	Liquid	Metals		X	137		
Methanol (Methyl hydrate)	Liquid	Foundry	X		54		
Methanol (Methyl hydrate)	Liquid	Jewellery	X		54		
Methanol (Methyl hydrate)	Liquid	Mouldmaking	X		54		
Methanol (Methyl hydrate)	Liquid	Photography	X		54		
Methanol (Methyl hydrate)	Liquid	Sculpture	X		54		
Methanol (Methyl hydrate)	Liquid	Woodworking	X		54		
Methyl Hydrate	Liquid		X		51.8		
Mineral Spirits	Liquid	Draw/Print	X		100		
Minwax Wood Finish	Liquid	Sculpture	X		100		
Minwax Wood Finish	Liquid	Woodworking	X		100		
NGR Stain Reducer	Liquid	Woodworking	X		1		
NGR Stains - various colours	Liquid	Woodworking	X		0		
NGR Stains	Liquid	Mouldmaking	X		0		
OATEY CANADIAN PURPLE PRIMER/CLEANER	Liquid	Photography	X		14		
Odourless Mineral Spirits	Liquid	Lithography		X	104		
ORANGE GLO	Liquid	Ind Design		X	149		
Original Wood Finish (linseed oil)	Liquid	Woodworking	X		95		
Poly Super Strippa Paint Stripper	Liquid	Woodworking	X		100		

Substance/Product Name	Phase	Site within OCAD U	Flammable / Explosive	Combustible	Flash Point	Typical Quantity on Hand	
						Q	Units
Propane	Gas	Woodworking	X				
Propane	Gas	Foundry	X				
Renaissance Wax Polish	Solid	Foundry	X		100		
RICE FLOUR	Powder	Fibre	X	X			
SODIUM HYDROSULPHITE	Powder	Fibre	X				
Spray Paint – latex	Compressed Gas	Etching	X		< 0		
Spray Shellac	Aerosol	Ind Design	X		<0		
Spray Shellac	Aerosol	Mouldmaking	X		<0		
Starrett M-1 All Purpose Lubricant	Liquid	Woodworking		X	162		
STOP-OFF LACQUER	Liquid	Jewellery	X		0		
Stop-out Varnish	Liquid	Etching	X		54		
Strontium	Powder	Ceramics	X				
Strontium	Powder	Plastics	X				
Sucrose	Powder	Fibre	X	X			
Super Lube Spray	Aerosol	Woodworking	X		25		
Top-Cote Aerosol Series	Aerosol	Ind Design	X		<0		
Top-Cote Aerosol Series	Aerosol	Jewellery	X		<0		
Tremclad Gloss Black	Aerosol	Woodworking	X		<0		
Tremclad Real Orange	Aerosol	Woodworking	X		<0		
Tremclad Red Oxide Primer	Aerosol	Woodworking	X		<0		
Tremclad Rust Paint	Aerosol	Sculpture	X		<0		
Tremclad Rust paint	Aerosol	Woodworking	X		<0		
Turpentine	Liquid	Woodworking	X		95		
Turpentine	Liquid	Jewellery	X		95		
Universal Release (Liquid)	Liquid	Mouldmaking	X		-7		
Various spray paints	Aerosol	Sculpture	X		<0		
Varsol	Liquid	Foundry		X	140		
Varsol	Liquid	Photography		X	140		
VELVALITE CG35 COATING 32744	Liquid	Foundry	X		53		
VELVALITE SOLVENT 100	Liquid	Foundry		X	109		
WD40	Liquid	Metals		X	122		
WD40	Liquid	Sculpture		X	122		
WD40	Liquid	Woodworking		X	122		
WD-40 Aerosol	Aerosol	Metals		X	122		
WD-40 Aerosol	Aerosol	Photography		X	122		
Weld - on 16	Liquid	Ind Design	X		0		
White shellac	Liquid	Ceramics	X		54		
White shellac	Liquid	Plastics	X		54		
White shellac	Liquid	Woodworking	X		54		
Witch Hazel	Liquid	Jewellery		X	110		
Zinsser - Shellac	Liquid	Sculpture	X		60		

Restriction on Locations Where Flammable or Combustible Liquids Can be Stored and Used

1. Flammable or combustible liquids can only be stored at OCAD University at the locations shown below.

Permitted Storage Locations for Flammable or Combustible Liquids	
Site within OCAD	Permissible Storage Location
Printing Making	Flammable Storage Cabinet
Photography	Flammable Storage Cabinet
Metals	Flammable Storage Cabinet
Foundry	Flammable Storage Cabinet
Sculpture	Flammable Storage Cabinet
Jewellery	Flammable Storage Cabinet
Plastics	Flammable Storage Cabinet
Industrial Design	Flammable Storage Cabinet

2. Flammable or combustible liquids can only be used at OCAD University at the locations shown below.

Permitted Usage Locations for Flammable or Combustible Liquids
Printing Making
Photography
Metals
Foundry
Sculpture
Jewellery
Plastics
Industrial Design

Equipment Required for Flammable or Combustible Liquid Storage

1. Flammable or combustible liquids must be kept in flammable storage cabinets that,
 - a) conform to ULC-C1275, "Storage Cabinets for Flammable Liquid Containers", or
 - b) conform to ULI 1275, "Flammable Liquid Storage Cabinets", or
 - c) are Factory Mutual Research Approved, or
 - d) are listed as meeting NFPA 30.
2. The maximum quantity of flammable and combustible liquids stored in a cabinet shall be 500 L, of which not more than 250 L shall be "flammable liquids".
3. Flammable and combustible liquids stored in cabinets shall be in closed containers.
4. Cabinets for container storage shall be labeled in conspicuous lettering to indicate that the cabinet contains flammable materials and that open flames must be kept away.

5. If a flammable or combustible storage cabinets has ventilation openings,
 - a) the ventilation openings shall be sealed with materials providing fire protection at least equivalent to that required for the construction of the cabinet, or
 - b) the cabinet shall be vented outdoors using vent piping providing fire protection at least equivalent to that required in Clause a. for seals.
 - c) Containers for flammable or combustible liquids shall be kept closed when not in use.
6. Flammable or combustible liquids and storage cabinets must not be in or adjacent to exits, including exits to outdoors, elevators or principal routes that provide access to exits.
7. No other type of dangerous good shall be stored in the same cabinet as a flammable or combustible liquid.

Dispensing Practices

1. When any flammable liquid is dispensed from one a container into another,
 - a) if the container is made of metallic or electrically conducting material, the container must be electrically connected to the fill stem, or rest on a conductive floor that is electrically connected to the fill stem, or
 - b) if the container or storage tank is made of non-electrically conducting material, static can be controlled by making an electrical connection between the fluids in the source container and secondary container simply by dipping a thin copper or other metal wire into both liquids inside their containers (ensure that the liquid is compatible with the metal of the wire).

2. Compressed Gases

Restriction on Locations Where Compressed Gases Can be Stored

1. Cylinders containing compressed gas (i.e. not empty) may only be stored indoors at room locations shown below.

Permitted Locations for Storage of Cylinders Containing Compressed Gas		
Site within OSC	Permitted	Current Storage Location
Jewellery	Oxygen	
Wood Working	Propane	Workbench at location protected from damage and heat / ignition sources.
Ceramic	Propane	
Foundry	Argon	
Metal	Argon, Buleshield AL, Acetylene	

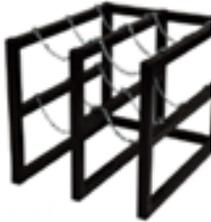
2. To the extent practicable, any location where flammable gas cylinders exceeding 100 L in expanded capacity should only be stored at rooms that are separated from the rest of the building by a 2 hour fire rating.
3. Compressed gas cylinders (whether full or empty) are not permitted to be stored outdoors on OCAD University property.

Facilities Required for Storage of Non-Flammable and Flammable Compressed Gas Cylinders

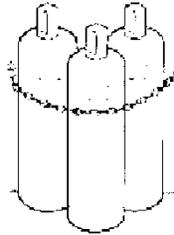
Indoor storage areas for compressed gas cylinders must be kept dry and ventilated.

a) Requirements for All Compressed Gas Cylinders Over 38 cm in Height (Measured from Base to Top of Valve Cap)

1. Cylinders containing compressed gas must be stored to hold them securely in place on racks, or by nesting, or in cages, as shown below.



Cylinder Rack



Nested and
Chained
Cylinders



Small Cylinder
Cage



Tall Cylinder Cage

2. The valve connection on a cylinder must be unique for the type of gas in order to prevent creation of a hazard by inadvertent connection with a line containing another gas.
3. Gas cylinders must have a valve protection cap in position at all times when the cylinder is not in use.
4. Gas cylinders and valves must be located and /or physically guarded in order to prevent accidental physical damage by impact with other objects.

b) Requirements for Acetylene Compressed Gas Cylinders

Acetylene cylinders must always be stored in an upright position.

c) Requirements for Propane Compressed Gas Cylinders and Other Flammable Compressed Gases that are Heavier than Air

Cylinders of propane and other flammable compressed gas which are heavier than air must be stored in a flammable storage cabinet used solely for flammable compressed gases that:

- has a fire-resistance rating of at least $\frac{3}{4}$ hr,
- has an aggregate capacity that does not exceed 100 kg,
- contains no more than 3 cylinders, and
- is located in a room that has mechanical ventilation providing at least 1 air change per hour.

3. Corrosives and Oxidizers

1. Containers of acids, bases and oxidizers must be stored in safety cabinets designated for storage of these substances and none other.
2. Containers of acids and bases are to be stored apart on separate shelves, or if this is not possible separated by distance on the same shelf, in order to minimize potential for mixing in the event of leakage or spillage.
3. Containers shall be kept closed when not in use.

4. Other Hazardous Substances

1. Hazardous substances that are not flammable, combustible, corrosive or oxidizing do not require storage in designated safety cabinets, and can be stored in ordinary cupboards or other suitable storage cabinets.
2. Cupboards and storage cabinets used for these hazardous substances must have signage or other appropriate markings to indicate the contents therein.

Hazardous Chemical Wastes and Containers

1. Pending removal from site, hazardous chemical wastes shall be,
 - a) stored in containers suitable for the type of waste,
 - b) labeled as to the type of waste,
 - c) stored in accordance with rules described above for specific classes and properties of chemicals.
2. See the procedure entitled "Chemical Waste Disposal Procedures" for details on hazardous waste storage, labeling, handling and movement.

Hazardous Waste Storage Lock-Up Area by Campus Services

1. Hazardous wastes stored at the lock-up area by Campus Services must be kept segregated by placing incoming wastes into the appropriate storage cabinet or shelf, as follows:
 - a) flammable or combustible wastes must be stored in the flammable storage cabinet
 - b) corrosive wastes must be stored in the corrosives storage cabinet, placed on the appropriate shelf for acids, bases or oxidizers
 - c) toxic wastes that are not flammable, combustible or corrosive must be stored in the toxics storage cabinet
 - d) waste batteries in the battery tote
 - e) bags of fluorescent tube breakage waste in the fluorescent tube waste tote

5. Procedure for responding to chemical emergencies

Requisite Equipment and Supplies

The list identifies locations where the following equipment and supplies must be present and maintained:

- a) spill clean-up kits
- b) deluge showers
- c) eye wash stations
- d) first aid kits

Locations of Emergency Response Equipment

Location	Spill Kit	Fixed Eyewash Station	Portable Eyewash Station	Emergency Shower	First Aid Kit
Ceramics	✓	✓			<input checked="" type="checkbox"/>
Wood		<input checked="" type="checkbox"/>			✓
Sculpture		<input checked="" type="checkbox"/>			✓
Print Making				✓	✓
Photography					✓
Foundry					✓
Metal	✓				✓
Mold Making		<input checked="" type="checkbox"/>	✓		✓
Drawing and Painting	✓				<input checked="" type="checkbox"/>
Industrial Design	✓	✓			✓
Jewellery	✓	✓			✓
Plastics	<input checked="" type="checkbox"/>	✓			✓
Fibre			✓		<input checked="" type="checkbox"/>

✓ Indicates item is located in the location

Indicates item present nearby

- The locations of fire extinguishers in the building are shown in the fire safety plan, which is posted at various locations in the facility.
- Spill clean-up kits and first aid kits shall be inspected at least once every month to verify that contents are complete and in good condition. The Office of Safety and Risk Management is responsible for performing these inspections, recording findings on the inspection checklists contained with the kits, and advising Studio Management of any deficiencies. The Office of Safety and Risk Management is responsible for replenishing any supplies as necessary.
- Deluge showers and eye wash stations must be tested to verify functionality at least once every year. The Office of Safety and Risk Management is responsible for performing these inspections, and advising Studio Management of any deficiencies. Studio Management is responsible for remedying any deficiencies.

Be Prepared in Advance

1. The chances for successfully dealing with a spill, accident or emergency involving a chemical are significantly increased by,
 - a) thinking before using the chemical about the types of things that could go wrong or cause a spill, accident, or other emergency,
 - b) planning the work in a manner that minimizes the risk of these scenarios,
 - c) ensuring that you understand the magnitude of the potential hazard that could result from a spill, accident or other emergency, should it occur,
 - d) ensuring that you or others know what to do in the event of a spill, accident or other emergency, and have the ability to rapidly and effectively respond to the emergency, in order to protect yourself and others, and
 - e) ensuring that any necessary emergency equipment and supplies are readily accessible for use if needed, and that the quantities available are sufficient for the potential magnitude of spill or emergency,
 - f) knowing the locations of the nearest eye wash, emergency shower, and washrooms, for use in case of a need to flush skin or eyes.
2. All chemical users and their supervisors are responsible for “knowing what to do” in case of an emergency involving a chemical under their control.

Actions to Take in Case of a Spill of any Hazardous Material

1. Have unnecessary personnel (employees and students) leave the area of potential danger.
2. If a corrosive chemical has been splashed onto a person’s skin or in their eyes, assist them in getting immediately to the nearest eye wash station, or emergency shower, or washroom, as appropriate, to flush their skin or eyes. Have another person call for first aid or emergency medical assistance, as appropriate, and continue flushing for at least 10 minutes in the case of minor contact or until emergency medical assistance arrives in the case of major contact.
3. If the substance that has spilled is flammable or combustible, eliminate any nearby sources of ignition, if possible. If the amount spilled is large enough to present a potential fire risk, smother the spilled material with the foam from an ABC fire extinguisher.
4. If the substance is not flammable, have one person obtain a spill control kit and any necessary additional personal protective equipment, while another person remains near the spill to keep persons out of harm’s way.
5. Once the spill kit arrives, use the appropriate materials to stop the spread of the spill, absorb it, and clean it up. Use the appropriate personal protective equipment while cleaning up the spill.
6. If the spilled material is flammable or combustible, have a person stand-by with a fire extinguisher while the spill is being cleaned up, ready to respond if the material catches fire.
7. Used spill clean-up materials must be handled in accordance with applicable procedures for on-site chemical waste transport, and waste storage and handling.

Internal Notifications

The Office of Safety and Risk Management and Campus Services shall be promptly advised of the occurrence of any chemical spill or inadvertent release.

External Notifications

Specific government agencies must be notified of certain kinds of incidents or emergencies involving chemicals, as described below.

a) Reporting Explosions

Explosions must be reported to the Technical Standards and Safety Authority (Telephone: 416-734-3327) where they have caused injury, damage to the equipment, or a fire by Facilities Management. Minor 'delayed ignitions' would not normally be considered to be reportable.

b) Reporting Liquid Petroleum Spills

1. Any spill of a petroleum product must be reported to the Ministry of Environment Spills Action Centre (Telephone: 1 (800) 268-6060, or (416) 325-3000) if the spill is in excess of:

- 100 liters at sites restricted from public access
- 25 liters at sites with public access

2. It is not mandatory to report spills of lesser quantities unless the spill would:

- create a hazard to public health or safety
- contaminate any fresh water source or waterway
- interfere with the rights of any person, or
- allow entry of product into a sewer system or underground stream or drainage system.

c) Discovery of a Petroleum Product that has escaped to the Environment or Inside a Building

The discovery of a petroleum product that has escaped to the environment or inside a building must be reported to the Ministry of Environment Spills Action Centre (Telephone: 1 (800) 268-6060, or (416) 325-3000) by the Office of Safety and Risk Management.

d) Reporting Spills to the Environment

1. Spills are defined as releases of pollutants into the natural environment originating from a structure, vehicle, or other container, and that are abnormal in light of all circumstances.

2. Spills must be reported immediately to the Ministry of Environment and to the municipality when they cause or are likely to cause any of the following:

- impairment to the quality of the natural environment - air, water, or land;
- injury or damage to property or animal life;
- adverse health effects;
- safety risk;
- making property, plant, or animal life unfit for use;
- loss of enjoyment of normal use of property; or
- interference with the normal conduct of business.

3. Spills must be reported to the Ministry of Environment Spills Action Centre (Telephone 1-800-268-6060, or (416) 325-3000, Fax: (416) 325-3011) by the Office of Safety and Risk Management.

Posting this Procedure

This procedure must be posted in close proximity to locations where personnel store and use hazardous chemicals in a manner that presents risk of a hazardous spill, leak or release.

6. Safety Procedures for Chemical Users

Preparation for Use

1. Consult the current material safety data sheet and container label prior to using any chemical substance for the first time.
2. If the chemical is one for which a substance-specific emergency plan, safety plan, or designated substance assessment is required, consult the appropriate documents prior to use.
3. Ensure that you know the basic minimum personal protective equipment that must be used that it is available, and that you know how to use it.
4. Ensure that you know the types of harm that can result from overexposure to the chemical, leakage, or spills.
5. Ensure that you know the locations of emergency equipment and supplies (safety showers, emergency eye wash stations, first aid kits, spill kits, fire extinguishers), and that you know how to use and operate same.
6. Don't work alone or in isolation with chemicals that are flammable, combustible, or can cause serious injury from skin contact or inhalation. The idea is to ensure that someone is close enough to render help if necessary.
7. If you don't fully understand the hazards and safety requirements for a chemical, don't use it.
8. If you need further information on hazards and safety practices contact your Studio Managers.

Mandatory Personal Protective and Safety Equipment for Employees

The following table identifies the minimum personal protective and safety equipment requirements for employees when using hazardous chemicals.

Mandatory Minimum Personal Protective and Safety Equipment Use Requirements																
Hazard / Activity	Face			Body						Hands		Feet		Kit For Student Demonstrations		
	Chemical Safety Glasses	Face Shield	Welding Helmet and Lens	Flame Resistant Lab Coat	Chemical Splash Apron	Cryo- Apron	Long Pants, Worn Over Footwear	Painter's Shirt and Pants or Coveralls	Flame Resistant Shop Coat	Chemical Protective Gloves per MSDS	Cryo- Gloves	Closed Footwear	Safety Footwear	Fire Extinguisher within 5 m	First Aid Kit within 5 m	Spill kit within 5 m
Acids	√	√		√	√		√			√		√		√	√	√
Bases	√	√		√	√		√			√		√		√	√	√
Oxidizers	√	√		√	√		√			√		√		√	√	√
Flammable liquids	√			√			√			√		√		√	√	√
Combustible liquids	√			√			√			√		√		√	√	√
Flammable or ignitable solids	√			√			√			√		√		√	√	√
Toxics with none of the above properties	√			√			√			√		√		√	√	√
Cryogenic liquids, containers, piping	√	√		√		√	√				√	√		√	√	√
Using open flame				√								√		√	√	√
Welding			√					√				√				
Painting								√				√				

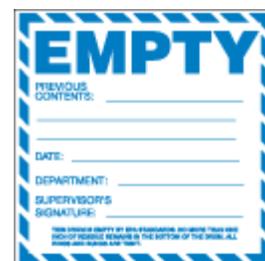
7. Chemical Waste Disposal Procedures

Substances that Can and Cannot be Disposed of via Sink Drains or in Regular Solid Refuse Containers

1. It is prohibited to pour down a sink or floor drain, or place into any regular solid refuse container, any of the following substances:
 - a) a solution with a pH less than 6.0 or greater than 11.5
 - b) a solution consisting of two or more separate liquid layers
 - c) any liquid with a temperature greater than 60 degrees Celsius
 - d) acute hazardous waste chemicals
 - e) flammable or combustible liquids (i.e. those having a flash point under 93.3 Celsius)
 - f) biomedical waste
 - g) fuels
 - h) ignitable wastes
 - i) hazardous waste chemicals
 - j) pathological waste
 - k) pesticides
 - l) reactive waste
 - m) severely toxic waste
 - n) waste radioactive substances
2. Wastes must not be intentionally mixed with any solid or liquid so that the waste's hazardous characteristics would be diluted below a regulatory level.
3. If you uncertain as to the proper manner for disposal of any particular substance, contact the Office of Safety and Risk Management for guidance.

Empty Containers of Hazardous Substances

1. Containers which formerly contained regulated (hazardous) substances must be empty to be classified as a non-hazardous waste. An empty container is defined as having < 2.5 cm of residue remaining at the bottom of the container or less than 3% of the original contents, whichever is the lesser amount.
2. Former hazardous substances containers that meet the condition described above must be labeled as shown prior to disposal:
3. Labels may be obtained from the Studio Management Office who is also responsible for maintaining stock of these labels.



Locations Where Hazardous Waste Storage is Permitted and Prohibited

1. Hazardous wastes generated at a user's location are to be stored (pending removal to the hazardous waste storage area by Campus Service) in accordance with the procedure entitled "Chemical Storage Procedures".
2. Hazardous wastes shall not be stored at any location other than the chemical storage room.
3. As soon as practicable after generation, hazardous wastes must be taken to the hazardous waste storage lock-up area located near the Ceramics Studio. Hazardous wastes must be transported within the facility in accordance with the procedure entitled "Procedures for Transporting Hazardous Chemicals within OCAD University".

4. Once taken to the hazardous waste storage area located near the Ceramics Studio, the hazardous waste must be placed in the appropriate storage cabinet or container, as follows:
 - a) flammable or combustible wastes must be stored in the flammable storage cabinet
 - b) corrosive wastes must be stored in the corrosives storage cabinet, placed on the appropriate shelf for acids, bases or oxidizers
 - c) toxic wastes that are not flammable, combustible or corrosive must be stored in the toxics storage cabinet
 - d) waste batteries in the battery tote
 - e) bags of fluorescent tube breakage waste in the fluorescent tube waste tote

Segregation, Labeling and Interim Containment Requirements at User Locations

1. Hazardous wastes kept at a user location must be physically segregated from other hazardous materials according to their physical and chemical properties, in the manner described in the procedure entitled “Chemical Storage Procedures”.
2. Hazardous wastes must be held in containers that are suitable for the chemical and physical properties of the waste (e.g. corrosion resistant). If the hazardous waste has the same properties as the original substance, use a container comparable to the container in which the original substance was held.
3. If you are uncertain as to the proper type of container to use, contact the Office of Safety and Risk Management.
4. All hazardous waste containers must be labeled with the following information.
 - a) Location or activity that produced the waste.
 - b) Major chemical components or trade name of the waste.
 - c) Date the waste was produced.
 - d) Name of the OCAD University contact person.
 - e) When waste is being added to the container over a period of time, the initial START date as well as the FILLED date, should be written on the container. (This provides a mechanism to determine the storage time and potential need for a change in waste management practices.)
5. If you do not know some or all of the information in 4.a. through 4.e., contact Studio Management for assistance.
6. The following is an example of a commercially printed label that can be used for waste containers



Hazardous Waste Label

Users can obtain hazardous waste labels and packing supplies from Studio Management and Campus Services. Studio Management is responsible for maintaining these items in stock.

Time Limits for On-site Storage of Hazardous Wastes

1. Full hazardous wastes must be transported to the hazardous waste storage area located near the Ceramics Studio as soon as practicable after being filled.
2. Ontario regulations limit on-site storage of hazardous wastes to 90 days. To comply with this requirement, OCAD University has hazardous waste pick-ups from RPR Environmental occur every 90 days.

Packing and Manifesting Hazardous Wastes for Pick-up

1. Prior to pick-up, it is necessary for (1) hazardous wastes in the lock-up area near the Ceramics Studio to be packed into labeled shipping containers, and (2) a manifest to be prepared.
2. Campus Services is responsible for removing containers of hazardous waste from the lock-up storage cabinets, placing the same classes of wastes into suitable designated shipping containers for the waste, and labeling the container with the shipping class information. The following provides information for this purpose.

Waste Information			Transportation (TDG Information)			
Common Waste Name	Manifest Required	Hazardous or Non-Hazardous?	Shipping Name	PIN	Class	Packing Group
Absorbents (Spent Socks, Pads)	YES	HAZ,	Waste Solids Containing Flammable Liquids, nos, (Technical Name)	UN 3175	4.1	II
Absorbents (Spent Socks, Pads) ~ Lube Oil	YES	HAZ	Waste Environmentally Hazardous Substances, Solid, nos, (Used Oil with Lead)	UN 3077	9	III
Acid Solutions	YES	HAZ	Waste Corrosive Liquids, nos, (Technical Name)	UN 1760	8	II
Activated Carbon ~ Spent	YES	Testing Required or assume HAZ	Waste Carbon, Activated	UN 1362	4.2	I
Aerosol Cans	YES	HAZ	Waste Aerosols, Flammable	UN 1950	2.1	
Batteries: Alkaline	YES	HAZ	Waste Batteries, Wet, Filled with Alkali, Electric Storage	UN 2795	8	III
Batteries: Lead Acid	YES	HAZ	Waste Batteries, Wet, Filled with Acid, Electric Storage	UN 2794	8	III
Batteries: NiCd	YES	HAZ	Waste Environmentally Hazardous Substances, Solid, nos, (NiCd Batteries)	UN 3077	9	III
Caustic Solutions	YES	HAZ	Waste Corrosive Liquids, nos, (Technical Name)	UN 1760	8	II
Compressed Gas Cylinders ~ Empty	NO	NHAZ	Not TDG Regulated	n/a	n/a	n/a
Construction and Demolition Material ~ Uncontaminated	NO	NHAZ	Not TDG Regulated	n/a	n/a	n/a
Contaminated Debris & Soil	YES	Testing Required	To be determined	-	-	-
Desiccants ~ Spent (All Types)	YES	Testing Required or assume HAZ	NHAZ ~ Not TDG Regulated (instrument air) HAZ~ Waste Water Reactive, Solid, nos, (Technical Name)	UN 2813	4.3	I
Empty Containers (Metal and Plastic Including Drums, Pails, Jugs, etc.) ~ (Refundable)	NO	NHAZ	Not TDG Regulated	n/a	n/a	n/a
Empty Containers (Metal and Plastic Including Drums, Pails, Jugs, etc.) ~ (Non Refundable)	NO	NHAZ	Not TDG Regulated	n/a	n/a	n/a
Filters ~ Glycols (EG/TEG)	YES	HAZ	Waste Environmentally Hazardous Substances, Solid, nos, (Technical Name)	UN 3077	9	III
Filters ~ Instrument Air	NO	NHAZ	Not TDG Regulated	n/a	n/a	n/a
Filters ~ Lube Oil (Drained)	YES	NHAZ	Not TDG Regulated	n/a	n/a	n/a
Filters ~ Lube Oil	YES	HAZ	Waste Environmentally Hazardous Substances, Solid, nos, (Technical Name)	UN 3077	9	III
Filters ~ (Raw/Fuel Gas, NGL's, etc.)	YES	HAZ	Waste Solids Containing Flammable Liquids, nos, (Technical Name)	UN 3175	4.1	II
Fluorescent Tubes ~ Spent	NO	NHAZ	Not TDG Regulated	n/a	n/a	n/a
Garbage ~ Domestic Waste	NO	NHAZ	Not TDG Regulated	n/a	n/a	n/a
Gaskets (non-asbestos)	NO	NHAZ	Not TDG Regulated	n/a	n/a	n/a

Waste Information			Transportation (TDG Information)			
Common Waste Name	Manifest Required	Hazardous or Non-Hazardous?	Shipping Name	PIN	Class	Packin g Group
Glycol Solutions (MEG/DEG/TEG) ~ Metals	YES	HAZ	Waste Environmentally Hazardous Substances, Liquid, nos, (Technical Name)	UN 3082	9	III
Glycol Solutions (MEG/DEG/TEG)	NO	HAZ	Not TDG Regulated	n/a	n/a	n/a
Grease Cartridges ~ Empty	NO	NHAZ	Not TDG Regulated	n/a	n/a	n/a
Hydraulic and Transmission Oil (Vehicle and Equipment)	YES	HAZ	Waste Environmentally Hazardous Substances, Liquid, nos, (Technical Name)	UN 3082	9	III
Insulation/Refractory ~ Non Asbestos	NO	NHAZ	Not TDG regulated	n/a	n/a	n/a
Ion Exchange Resin ~ Water Treatment	NO	NHAZ	Not TDG regulated	n/a	n/a	n/a
Lab Chemicals	YES	HAZ	Waste Environmentally Hazardous Substances, Liquid, nos, (Technical Name)		-	-
Lubricating Oil	YES	HAZ	Waste Environmentally Hazardous Substances, Liquid, nos, (Technical Name)	UN 3082	9	III
Methanol	YES	HAZ	Waste Methanol	UN 1230	3(6.1)	II
Office Material (Paper)	NO	NHAZ	Not TDG regulated	n/a	n/a	n/a
Paints (Cans, Drums and Pails)	YES	HAZ	Waste Paint Related Material	UN 1263	3	III
Paint Cans (Empty) and Brushes	NO	NHAZ	Not TDG regulated	n/a	n/a	n/a
Pesticides/Herbicides Spent	YES	HAZ	Waste Pesticides, Liquid, Toxic, nos, (Technical Name)	UN 2902	6.1	II
Photo Copier / Laser Printer Toner	NO	NHAZ	Not TDG regulated	n/a	n/a	n/a
Pipe Dope Containers and Brushes ~ Empty	NO	NHAZ	Not TDG regulated	n/a	n/a	n/a
Pipe Dope/Grease ~ Lead Based	YES	HAS	Waste Environmentally Hazardous Substance, Solid, nos, (Technical Name)	UN 3077	9	III
Pipe Dope/Grease ~ Non Lead Based	NO	NHAZ	Not TDG regulated	n/a	n/a	n/a
Rags ~ Oily	YES	HAZ	Waste Environmentally Hazardous Substance, Solid, nos, (Technical Name)	Un 3077	9	III
Sand Blasting Sand ~ Contaminated	YES	HAZ	Waste Environmentally Hazardous Substance, Solid, nos, (Technical Name)	Un 3077	9	III
Sand Blasting Sand ~ Uncontaminated	NO	NHAZ	Not TDG regulated	n/a	n/a	n/a
Scale (Non-Radioactive)	NO	NHAZ	Not TDG regulated	n/a	n/a	n/a
Scrap Metal (Galvanized, Aluminum, Stainless Steel, etc.)	NO	NHAZ	Not TDG regulated	n/a	n/a	n/a
Solvents (Non-Halogenated) ~ Spent	YES	HAZ	Waste Flammable Liquid, nos, (Technical Name)	UN 1993	3	II
Varsol	YES	NHAZ	Waste Flammable Liquid, nos, (Varsol)	UN 1993	3	II
Wash Fluids ~ Equipment Cleaning Operations	**SPECIFY PARTY	**SPECIFY PARTY	To be determined	-	-	-
Wash Fluids ~ Solvents	YES	HAZ	Waste Flammable Liquid, nos, (Technical Name)	UN 1993	3	II

Waste Manifesting, Disposal and Transportation Information

1. Campus Services is responsible for completing the shipping manifest for each outbound hazardous waste shipment. Manifests can be prepared on-line using the Ministry of Environment HWIN web site: <http://www.hwin.ca/hwin/index.jsp>.
2. When using an electronic manifest, OCAD University must provide the hazardous waste hauler with electronic access to the manifest to complete section B (Carrier) of the manifest.
3. When using the electronic manifest, a paper copy does not have to be returned to Ministry of Environment, nor is the generator required to retain a record.
4. Units to be utilized on the manifest are either L (liters) for liquid wastes or Kg (kilogram) for solid wastes. If waste density is unknown assume 1 L = 1 Kg

Pick-up of Hazardous Wastes by Licensed Hauler for Disposal

1. Campus Services is responsible for arranging pick-up and disposal of hazardous wastes by a licensed hazardous waste disposal company.
2. In order to ship hazardous wastes off-site via a Ministry of Environment licensed hazardous waste hauler, OCAD University must have a valid Generator Registration Number, covering the classes of waste.
3. The Generator Registration Numbers for OCAD University are:
 - a) 100 McCaul – ON0265000
 - b) 205 Richmond – ON3600802
 - c) 230/240 Richmond – ON6138736
 - d) 51 McCaul – ON 8963623
4. Below are the Active Waste Classes listed on OCAD University's Generator Registration profile. As of December, 2011, all hazardous wastes known to be generated at OCAD University were on this Profile. If any activities generate a class of hazardous waste not listed in the Generator Registration Record, it is necessary to advise the Office of Safety and Risk Management to initiate an updating of the Generator Registration Profile.

OCAD University Registered Waste Classes

114-T	Liquid	OTHER INORGANIC ACID WASTES
145-I	Liquid	PAINT/PIGMENT/COATING RESIDUES
145-L	Liquid	PAINT/PIGMENT/COATING RESIDUES
146-T	Solid	OTHER SPECIFIED INORGANICS
148-I	Liquid	INORGANIC LABORATORY CHEMICALS
148-I	Solid	INORGANIC LABORATORY CHEMICALS
148-B	Liquid	INORGANIC LABORATORY CHEMICALS
148-C	Liquid	INORGANIC LABORATORY CHEMICALS
148-C	Solid	INORGANIC LABORATORY CHEMICALS
213-I	Liquid	PETROLEUM DISTILLATES
252-L	Liquid	WASTE OILS & LUBRICANTS
263-I	Liquid	ORGANIC LABORATORY CHEMICALS
263-B	Liquid	ORGANIC LABORATORY CHEMICALS
264-I	Liquid	PHOTOPROCESSING WASTES
264-C	Liquid	PHOTOPROCESSING WASTES
312-P	Solid	PATHOLOGICAL WASTES
331-I	Gas	Compressed

Disposition of Empty Compressed Gas Cylinders

1. Empty compressed gas cylinders must be labeled, capped and marked "EMPTY".
2. Empty compressed gas cylinders are to be returned to the supplier – not disposed of.

Disposal of Compact Fluorescent Light Bulbs

1. Compact fluorescent light bulbs and tubes are a hazardous waste as they contain mercury (approximately 5 mg per 25W bulb).
2. Old fluorescent tubes should be stored in used tube boxes at a location protected from damage.
3. Contact Campus Services to arrange disposal.
4. If a compact fluorescent light bulb or tube breaks, sweep up all of the glass fragments and phosphor powder. DO NOT vacuum. Place in a plastic bag; wipe the area with a damp paper towel to pick up stray shards of glass or fine particles, and place the used towel in the plastic bag.

Disposal of Batteries

1. Spent or still usable batteries should be stored in a secure, dry place.
2. Waste batteries are classes as hazardous waste and must not be discarded or disposed of in regular garbage
3. All waste battery types will be collected for recycling or proper disposal



Section 6

Solvents

6. Hazards and Precautions for Solvent Use in the Arts

By Angela Babin and Michael McCann

1. What are solvents?

Solvents can be defined as liquids that dissolve other materials or are used to make evenly dispersed mixtures. Water is an extremely common solvent. The advantages of using water as a solvent include the facts that it is inexpensive, easy to dispose of, and nontoxic.

Soap and water solutions can be used for many cleanup jobs. If one wants to clean, dissolve, or thin materials that are not soluble in water, organic solvents must usually be used. These types of solvents can dissolve grease, dirt, resins, oils, varnish and other materials; they are used to thin paints, varnishes, and lacquers; to clean pieces of art, tools, brushes, work surfaces, and even, unfortunately, hands.

Frequently used solvents include kerosene, acetone, turpentine, toluene, ethyl alcohol, etc. Mixtures of solvents are also common, for example lacquer thinners, mineral spirits, naphthas, and petroleum distillates.

Solvents are ubiquitous in our lives. They thin oil paints, and are found in some drawing and printing inks, wood preparation and finishes, photography and plastics materials, metal cleaners, and some adhesives. Most commercial art products contain solvents. Those who work in the performing arts use solvents are in prop, scene and set fabrication, dressing, and cleanup.

Solvents are found in hair sprays and costume products, fabric finishes, and some theatrical fogs. Ballet dancers spray point shoes with solvent products, and musicians clean instruments with solvent-based cleaners.

Composition of Solvents

Solvents can have unique chemical structures or can be mixtures of chemicals. For example, acetone is a unique chemical, whereas mineral spirits is a mixture of several solvents in the same boiling range. Each chemical is assigned a Chemical Abstract Number (CAS #) which identifies it. In some instances CAS Numbers are also assigned to well-known mixtures like mineral spirits. Solvents can come in different grades of purity, and can sometimes be contaminated with small amounts of other solvents in the manufacturing process. If purity is of concern, then it is important to get your solvents from a source that will give detailed information on contents.

The names of solvents can also vary. For example, methyl alcohol and methanol are chemical names for one solvent, and 1,1,1-trichloroethane and methyl chloroform are chemical names for another solvent. Solvents can also have other synonyms, for example wood alcohol is a synonym for methyl alcohol. Hawley's Condensed Chemical Dictionary and the NIOSH Registry of Toxic Effects of Chemical Substances (RTECS), are good sources of information on synonyms.

Unfortunately, a solvent or solvent mixture can also be sold by a product name or trade name which gives no information about its composition. Lacquer thinners from different manufacturers, for example, can have entirely different compositions.

Similarly, trade names such as Varsol do not give information about the composition. The Material Safety Data Sheet for such products should list the hazardous ingredients in the trade name product.

Another problem with trade name products is that their composition can change without warning since manufacturers often change the composition of their solvent formulations based on the availability and price of the various components. Therefore, these materials may then produce variable results and have an unknown toxicity.

Volatility

Solvents can vary widely in their volatility, with low boiling point solvents being much more volatile. This means that large amounts can evaporate into the air in short periods of time. The accumulation of solvent vapors in the workspace air can become both a health and a fire risk.

The volatility of a solvent is best indicated by its vapor pressure (vp), the pressure that the vapors, generated by evaporation of the liquid, exert upon the atmosphere above the liquid. The higher the vapor pressure, the more volatile the liquid, and the more easily it evaporates at room temperatures.

For example, acetone, which has a vapor pressure of 150 mm of mercury at room temperature and standard atmospheric pressure, evaporates quicker than methyl ethyl ketone with a vapor pressure of 71 mm.

The volatility of solvents increases when their temperature is increased. Solvents should be heated only with caution and contact with hot surfaces and ignition sources must be prevented.

2. Toxicity and Exposure Limits

Knowing the exact chemical ingredients of the solvents and other materials that you work with will enable you to determine their toxicity. If the ingredient information is not adequately provided on the label, one can request a Material Safety Data Sheet (MSDS) from the manufacturer or distributor of the solvent.

A general indication of the material's toxicity is its Threshold Limit Value (TLV), which is established by the American Conference of Governmental Industrial Hygienists (ACGIH). The TLV of a substance is the airborne concentration of a substance to which nearly all workers can be exposed repeatedly day after day without adverse effects. TLVs are expressed as parts of the substance per million parts of air (ppm) or as milligrams of the substance per cubic meter of air (mg/m³), averaged over an 8-hour day. For example, the TLV of xylene is 100 ppm or 434 mg/m³.

For substances that are highly irritating, highly toxic, or that have immediate effects, Short Term exposure Limits (STEL) are also used. The STEL of a substance is the allowable average concentration measured over a 15 minute interval. For example, while the TLV for xylene is 100 ppm, its STEL is 150 ppm. This means that the average concentration of xylene over an 8-hour period should not exceed 100 ppm, and that during any 15 minute period should not exceed an average of 150 ppm. Sometimes a TLV has a C assigned to it, indicating the TLV is a ceiling concentration which must not be exceeded at any time.

Generally, substances with TLVs at or below 100 ppm are considered highly toxic. Between 100 ppm and 500 ppm is considered moderately toxic, and above 500 ppm, slightly toxic. Remember that TLVs are advisory, and should just be used as a guide for further evaluation of chemicals in your materials.

In contrast to the voluntary TLVs, the Occupational Safety and Health Administration (OSHA) has set Permissible Exposure Limits. (PELs), which are similar in definition to TLVs, but are mandatory and enforceable. Most PELs are similar to the 1988 TLVs. Table 1 lists TLVs of common solvents, unless the PEL for a particular solvent is lower.

The National Institute for Occupational Safety and Health (NIOSH) has established Recommended Exposure Limits (RELs) for many chemicals, based on its research. NIOSH RELs are usually lower than either TLVs or PELs. For carcinogens, NIOSH also recommends reducing exposure to the lowest feasible concentrations.

3. Health Effects of Solvents

Although some solvents are less hazardous than others, all solvents can cause toxic effects. There are no safe organic solvents, only more and less toxic ones. All organic solvents can affect the nervous system, respiratory system, skin, eyes, and internal organs to some degree. Solvents are also implicated in damage to both the male and the female reproductive systems.

Skin Diseases

Solvents can damage the skin in three ways: by drying, by irritation, and by sensitization. Solvents can dissolve the skin's natural protective barrier of oils and waxes to cause drying, defatting, cracking, and fissuring of the skin. They can also irritate the skin to cause reddening and inflammation. Some solvents are sensitizers, and can cause allergic reactions, for example, turpentine.

In addition, many solvents can penetrate the skin, enter the bloodstream, and cause injury to internal organs. Examples of skin-penetrating solvents are dimethylformamide (DMF), glycol, ethers, toluene, and methyl alcohol.

Brain and Nervous System Damage

The most commonly experienced symptom of solvent vapor inhalation is narcosis (dizziness, light-headedness, irritability, fatigue, headaches, sleepiness, loss of coordination, nausea, etc.). These symptoms are produced by solvent dissolved in the bloodstream acting directly on the brain to depress the central nervous system (CNS). The effect is similar to alcohol intoxication. These effects are usually reversible if exposure to the solvent is discontinued. However, if exposure is high enough, further CNS depression can lead to unconsciousness and death.

Solvent-exposed individuals operating machinery are at a higher risk of accidents because of decreased coordination and fatigue.

Studies over the last decade have shown that repeated heavy solvent exposure over several years may cause permanent brain damage, called chronic toxic encephalopathy. Symptoms can include memory loss, behavioral changes, emotional instability, confusion, inability to concentrate, neurological and personality changes, and problems with manual dexterity. The solvents implicated in most studies are the chlorinated hydrocarbons, aromatic hydrocarbons, and aliphatic hydrocarbons (see chart).

Repeated exposure to some solvents can also temporarily damage the peripheral nervous system (PNS), which is the system of nerves leading from the spinal cord to the rest of the body.

Symptoms include numbness and tingling sensations, difficulty in grasping objects, loss of ankle reflexes, weakness, and in severe cases, paralysis of the arms and legs. Methyl butyl ketone (MBK), n-hexane, and carbon disulfide are solvents known to cause this effect. N-hexane is commonly found in spray adhesives, spray fixatives, rubber cements and rubber cement thinners, contact adhesives, some lacquer thinners, cleaning and sanitizing agents, and in low-boiling naphthas.

Respiratory System Damage

Most organic solvents can irritate the sensitive membranes of the nose, throat, and eyes. Solvent concentrations that cause this irritation may also damage lung tissue. Chemical pneumonia may be caused by very high concentrations of irritating organic solvents; however, such high levels are usually so offensive that exposed individuals cannot tolerate the exposure. More commonly, lower solvent doses are tolerated in the work environment and after years of exposures, may cause chronic bronchitis.

Chemical pneumonia can also be caused by aspiration of aliphatic and aromatic hydrocarbons in liquid form into the lungs, for example from vomiting after ingestion of these solvents.

Damage to Internal Organs

Upon entering the bloodstream, solvents can be transported to and injure specific internal organs and organ systems. This is especially true for the liver and kidneys, since these organs are often damaged during detoxification and elimination of solvents from the body.

Chlorinated solvents, such as perchloroethylene and carbon tetrachloride, are especially toxic to the liver and kidneys. Chlorinated solvents, in general, are among the most hazardous solvents, and should be avoided whenever possible. Chlorinated solvents may form a highly toxic gas called phosgene, if heated or if they come in contact with ultraviolet light.

The heart and circulatory system are also vulnerable to the toxic effects of solvents. Benzene and many glycol ethers can damage the bone marrow and cause anemia. Benzene can also cause leukemia. Another solvent, methylene chloride, is metabolized into carbon monoxide, which reduces the level of oxygen in the blood. This exposure can cause heart attacks and especially endangers people with pre-existing heart or lung impairment. Methylene chloride also affects the heart by producing arrhythmias (irregular beating) of the heart at high concentrations, which can lead to heart attacks. High concentrations of freons, trichloroethylene, 1,1,1-trichloroethane, toluene and gasoline have also caused arrhythmias resulting in heart attacks. If an individual is susceptible to arrhythmias, then they could be at risk at even lower concentrations than other people.

Although rare, fatalities from acute overexposures to some solvents do occur, usually from heart and respiratory failure. One case study of furniture stripping in dip tanks reported two separate fatalities from methylene chloride paint strippers. The victims were without respiratory protection or adequate local exhaust ventilation. The concentration of a chemical necessary to provoke an acute fatality is usually much higher than levels found in normal, everyday exposures.

Cancer

Certain solvents have been found to cause cancer. Benzene causes cancer, (although the closely related solvent toluene does not). Most chlorinated solvents, for example, are carcinogenic in laboratory animals, and are probable human carcinogens. These include: carbon tetrachloride, chloroform, trichloroethylene, perchloroethylene, and methylene chloride. Other probable human carcinogens are dioxane and dimethylformamide.

4. Fire Hazards

Most organic solvents become potential fire hazards when they evaporate, causing a build-up of flammable vapors. The National Fire Protection Association (NFPA) classifies the flammability and combustibility of liquids according to their flash points.

The flash point (fp) of a liquid is the lowest temperature at which vapors will form an ignitable mixture in air at the liquid's surface. Any liquid will burn at or above its flash point if a source of ignition is present. The table below highlights NFPA flammability classifications.

Class IA and IB liquids, such as acetone, toluene, and gasoline, have flash points below normal room temperatures and can start flash fires in the presence of a flame, spark, or even static electricity. Class IC flammable liquids would burn on hot days or if heated. Refer to Pages 84-86 for the flash points of specific solvents.

NFPA Flammability Definitions

Flammable Liquids

- 1. Class IA**
Flash point: below 73⁰ F (23⁰ C)
Boiling point: below 100 F (38 C)
- 2. Class IB**
Flash point: below 73⁰ F (23⁰ C)
Boiling point: at or above 100⁰ F (38⁰ C)
- 3. Class IC**
Flash point: 73-100⁰ F (23-38⁰ C)
Boiling point: at or above 100⁰ F (38⁰ C)

Combustible Liquids

- 1. Class II**
Flash point: 100-140⁰ F (38-60⁰ C)
- 2. Class IIIA**
Flash point: 140-200⁰ F (60-93⁰ C)
- 3. Class IIIB**
Flash point: at or above 200⁰ F (93⁰ C)

Combustible liquids, such as kerosene, mineral spirits, and cellosolves, with flash points at or above 100⁰ F, are divided into Classes II, IIIA, and IIIB. Although any combustible liquid is a fire threat if heated, Class IIIB liquids generally cause little concern as fire hazards because of their high flash points. Not all arts and crafts materials, however, are labeled according to NFPA requirements. The Federal Hazardous Substances Act (FSHA) regulates the flammability labeling of consumer products, including many materials sold in art supply stores, such as paint strippers, thinners, and aerosol sprays. Although we recommend only NFPA flammability definitions for industrial and professional use, it is important to be familiar with both systems.

FHSA Flammability Definitions

Hazard Category	Flash point
Extremely flammable	below 20 ⁰ F (-7 ⁰ C)
Flammable	20-80 ⁰ F (-7-27 ⁰ C)
Combustible	80-150 ⁰ F (27-66 ⁰ C)

Some solvents, such as ethyl ether, are too hazardous to be used or stored safely in ordinary shops or studios. In addition, ethyl ether, isopropyl ether, dioxane, and tetrahydrofuran absorb oxygen from the air to form explosive peroxides. When containers of these solvents containing small amounts of their peroxide residues are heated (for example by storing them near a radiator or in sunlight), they can be explosive. Friction from screwing on the container lids of these solvents has been known to cause explosions when peroxides had formed on the container lip.

5. Precautions with solvents

Health Precautions

1. Compile an inventory of all solvents and solvent-containing materials. Label all containers, even small vials. Obtain Material Safety Data Sheets (MSDS) on all products.
2. Use water-based materials whenever possible. This minimizes inhalation problems. Note that some water-based materials contain small amounts of solvents to dissolve resins.
3. Use the least toxic solvent possible. Substitute safer solvents from the same class whenever possible. For example, use heptane instead of hexane, and ethyl alcohol or isopropyl alcohol instead of methyl alcohol.
4. Avoid breathing vapors. Dilution ventilation may be adequate for exhausting small amounts of solvent. For large amounts of solvents, or highly toxic solvents, use local exhaust ventilation to capture the solvent vapors before they escape into the room (for example, a laboratory hood, slot hood, or window exhaust fan 1-2 feet away at work level). See the CSA's book Ventilation for more information. Cover containers when not in use.
5. Avoid skin contact. Wear suitable gloves whenever work brings skin in contact with solvents. Make sure that the type of glove material is appropriate for solvents used since the permeability of different glove materials varies with the solvent. See CSA's data sheet on Glove Selection for more information.
6. Avoid eye contact. Wear protective goggles when you pour solvents or when an accidental splash is possible. Do not rely on regular eyeglasses for protection. Do not wear contact lenses. In case of eye contact, flush immediately with clean running water for 15 minutes and seek medical attention. A plumbed eyewash fountain should be readily accessible.
7. Wash hands with a mild soap and water after exposure to solvents, and apply a skin moisturizer (avoid those with coloring and fragrance). Never wash hands in solvents. Baby oil or vegetable oils can remove paint from the skin.
8. Use self-closing oily waste cans to hold solvent-soaked rags. These should be emptied daily.
9. Spill control materials, available from safety supply distributors, should be kept on hand for cleaning up spills and residues. Emergency procedures should be drafted in case of a flammable solvent spill of more than a quart of liquid, because of the severe health and fire risks from the evaporating solvent. See the CSA Spill Control data sheet.
10. Whenever possible, try to reuse solvents by allowing solids to settle, and decanting off the liquid. Filter if necessary.
11. Dispose of all waste solvents properly. Solvent wastes should be collected and stored in approved safety disposal cans. Chlorinated solvents must be stored separately from other solvents. Never pour solvents down the drain. If large quantities of waste solvents are generated, a licensed hazardous waste disposal company should be contracted to remove them. In some instances, it may be appropriate to allow very small amounts (less than a pint) of solvent to evaporate inside an explosion-proof laboratory hood, on the roof, or outside, providing that no one is exposed to the solvent vapors.

Fire Precautions

1. Protect against fire and explosion. Follow all local and federal codes for the use, handling, ventilation, and storage of flammable liquids. Eliminate all ignition sources in the area. Smoking should be strictly prohibited.
2. The workspace should be equipped with a sprinkler system and appropriate fire extinguisher. Class ABC multi-purpose, dry chemical fire extinguishers are generally recommended. Because of the corrosive properties of the dry chemical, a combination of a Class A and a Class BC carbon dioxide fire extinguisher may also be used.
3. A pint or more of a flammable or combustible liquid should be stored in an approved safety can. For dispensing small amounts of liquids (e.g. for cleanup), use plunger cans.
4. Large quantities of flammable and combustible liquids should be kept in approved flammable storage cabinets. Quantities over 60 gallons (including 55-gallon drums), should be stored only in separate outside facilities or in a special storage room.
5. Use hand pumps when dispensing flammable liquids from either 5-gallon and 55-gallon metal drums, rather than tilting to pour. The metal drum should be grounded, and metal receptacles should be bonded to the drum with wire to prevent the buildup of static electricity.
6. Local exhaust ventilation systems handling flammable solvent vapors, and electrical components in areas where flammable vapors may be present, should be fire- and explosion-proof according to the NFPA and National Electrical Code (NEC).

6. Proposed Strategy for going Solvent-Free at OCAD University



7. Selecting solvents in the arts

- a) **COLUMN 1 SOLVENT CLASS** designates the chemical group into which solvents fall. Under each class heading are listed individual solvents and their common synonyms.
- b) **COLUMN 2 Threshold Limit Value-Time Weighted Averages** are the 2009 ACGIH (American Conference of Governmental Industrial Hygienists) eight-hour, time-weighted Threshold Limit Values (TLV-TWA) will be in parts per million (ppm) unless otherwise noted. A notice of intended change (NIC) indicates the new value has been proposed by ACGIH. When no TLV-TWA exists, the TLV-STEL (15 minute standard) or the TLV-Ceiling limit will be used. If ACGIH has not set a standard or if there is a more protective standard, these may be listed such as the OSHA permissible exposure limit (PEL), a Workplace Environmental Exposure Limit (WEEL) from the American Industrial Hygiene Association, or a German Republic standard (MAK). (SEE data sheet on TLVs.)
- c) **COLUMN 3 ODOR THRESHOLD (OT)** in parts per million (ppm). These are the levels at which most people tested can detect the odor. Keep in mind that this value represents a broad range of concentrations and you may not be able to detect the solvent at this level.
- d) **COLUMN 4 FLASH POINT (FP)** in degrees Fahrenheit (F o). The FP is the lowest temperature at which a solvent gives off sufficient vapor to form an ignitable mixture with air near its surface. The lower the FP, the more flammable the solvent. Some petroleum solvents exhibit a range of FPs.
- e) **COLUMN 5 EVAPORATION RATE (ER)**. These will be listed as FAST, MEDIUM OR SLOW. This is the rate at which a material will vaporize (volatilize, evaporate) from the liquid or solid state when compared to another material. The two common liquids used for comparison are butyl acetate and ethyl ether.
WHEN BUTYL ACETATE = 1.0 WHEN ETHYL ETHER = 1.0
- 3.0 = FAST < 3.0 = FAST
 - 0.8 - 3.0 = MEDIUM 3.0 - 9.0 = MEDIUM
 - < 0.8 = SLOW > 9.0 = SLOW
- f) **COLUMN 6 COMMENTS** on particular effects of the solvent. All solvents can cause narcosis at high levels.
- The symptoms listed here are those for which the TLVs were set or other special hazards.
 - Abbreviations include central nervous system (CNS) damage, peripheral nervous system (PNS) damage, upper respiratory tract (URT) damage, skin damage, narcosis, etc.

COLUMNS: 1 SOLVENT CLASS name, synonym	2 TLV-TWA ppm	3 OT ppm	4 FP F°	5 ER	6 COMMENTS: Major Hazards in addition to General Hazards noted in the Data Sheet.
ALCOHOLS					ONE OF THE SAFER CLASSES.
Benzyl Alcohol	10		200		Pure alcohol is irritating and corrosive to skin, eyes and respiratory system. Large amount of ingestion causes vomiting, diarrhea and CNS depression. Do not heat.
Ethyl Alcohol - ethanol grain and denatured alcohol,	1000 (STEL)	84	55	MED	Least Toxic. Denatured means contains small amounts of various unpalatable/toxic additives.
Isoamyl Alcohol -Amyl alcohol, fusel oil	125 (STEL)		109		Severe skin and eye irritation. Skin absorption may cause nervous and digestive system damage. Acute ingestion and inhalation may be fatal.
Isopropyl Alcohol - 2-propanol, rubbing alcohol	200	22	53	MED	Eye, URT, CNS effects. Cancer effects unknown.
Methyl Alcohol - methanol, wood alcohol	200	100	52	FAST	Headaches, eye damage. Skin absorbs. High doses can cause blindness.
N-Propyl Alcohol - n-propanol	100	5.3	59	MED	Eye, URT irritation. Not evaluated for cancer effects.
Isoamyl Alcohol - 3-methyl-1-butanol, fuel oil	100	0.03-0.07	109	SLOW	Eye, URT irritation.
N-Butyl Alcohol,	20	1.2	95	SLOW	Eye, URT irritation. Lacrimator.
n-butanol					
ALIPHATIC HYDROCARBONS					MOST ARE MIXTURES DERIVED FROM PETROLEUM.
Kerosene, jet fuels	200 mg/m3*	Unk.	100-	VERY SLOW	Low toxicity. Skin, URT irritation, CNS damage. Skin absorbs.
Heptane, n- & iso-heptanes, heptanes (mix of isomers)	400	40-547	25	FAST	One of least toxic substitutes for n-hexane. CNS impairment, URT irritation, skin absorbs
Mineral Oil – Pure	5 mg/m3*	None	High	VERY LOW	The TLV is only for large inhalable particle. No standard exists for respirable mist. Imperfectly refined mineral oil is a carcinogen.
Petroleum Distillates Aliphatic petroleum naphtha, petroleum naphtha, rubber solvent	85 (NIOSH Rel)		-86 to -40		If contains n-hexane, it may cause nerve damage.
Stodard solvent, other similar petroleum fractions	100	1-30	>100	SLOW	May contain significant amounts of aromatics. Eye, skin, kidney CNS damage; nausea.
N-Hexane, normal hexane, commercial hexanes contain 55% n-hexane	50	65-250	-7	FAST	Do not use. Potent CNS & peripheral nerve toxin causing multiple sclerosis-like disease. Eye irritant. Skin absorbs. Substitute heptane.
Hexane isomers	500	—	—	FAST	Low toxicity.
Gasoline	300	0.3	-45	FAST	Do not use. Extremely flammable. May contain skin-absorbing benzene, toxic additives.
AMIDES/AMINES					MANY ARE SENSITIZING. TOXIC AT LOW LEVELS
Dimethyl formamide (DMF)	10	0.5- 100	136	SLOW	Try to avoid. Skin absorbs. Liver damage.
Ethanolamine	3	2.6	185	VERY SLOW	Severe skin, eye irritant. Narcosis, liver & kidney damage reported at high levels.
Diethanolamine	0.2 ppm	0.27	342	VERY SLOW	Liver & kidney damage, eye damage on contact. Skin absorbs.
Triethanolamine	5 mg/m3 *	Unk.	385	**	Hazards similar to ethanolamine. Avoid. An animal carcinogen.

COLUMNS: 1	2	3	4	5	6
SOLVENT CLASS name, synonym	TLV-TWA ppm	OT ppm	FP F°	ER	COMMENTS: Major Hazards in addition to General Hazards noted in the Data Sheet.
AROMATIC HYDROCARBONS					A HAZARDOUS CLASS, AVOID IF POSSIBLE.
Ethyl Benzene, ethyl benzol, Phenylethane	100	0.1-0.6	59	SLOW	URT irritation, CNS impairment, eye irritant. ACGIH may reduce TLV to 50 ppm
Xylenes xylo, dimethyl benzenes	100	0.08-40	20	SLOW	URT & eye irritation, CNS impairment. Stomach pain reported with m-xylene.
Toluene, toluol, methyl benzene, phenyl methane	20	0.02-	90	SLOW	CNS impairment. Visual impairment; Female reproductive system damage, pregnancy loss. Try to avoid.
Styrene, vinyl benzene, phenyl ethylene		0.47			CNS impairment, URT irritation, peripheral neuropathy. Suspect carcinogen. Try to avoid.
Diethylbenzenes: 1,3-DEB, 1,4-DEB	5 (WEEL)	2.3	~130	SLOW	URT & eye irritant. CNS impairment.
Trimethylbenzenes: 1,2,3-TMB; 1,2,4-TMB; 1,3,5-TMB	25	2.4	~130	MED	CNS impairment, asthma, blood effects. Not well-studied.
Benzene, benzol	0.5	34 - 119	12	MED	Do not use. Causes leukemia. Skin absorbs.
CHLORINATED HYDROCARBONS					MANY IN THIS CLASS CAUSE CANCER. AVOID.
1,1,1-trichloroethane - methyl chloroform	350	390	**	FAST	CNS impairment, liver & kidney damage. Causes irregular heart beat reported.
1,1,2,2-tetrachloroethane Acetylene tetrachloride	1		**		Probable human carcinogen. Often fatal. Do not use.
Methylene Chloride - dichloromethane	50	160	**	FAST	Avoid. Suspect cancer agent. Metabolizes to carbon monoxide in blood. CNS damage. Stresses the heart.
Trichloroethylene	10	82	**	MED	CNS damage. Suspect cancer agent. Irregular heartbeat. Liver damage, headache.
Perchloroethylene, perc, tetrachloroethylene	25	47	**	MED	Suspect cancer agent. Irregular heartbeat, CNS damage, skin reddens after alcohol ingestion.
Chloroform	10	133-	**	FAST	Do not use. Suspect cancer agent.
Ethylene Dichloride -1,2-dichloroethane	10	6 - 185	56	MED	Strong intoxicant, causes liver damage, nausea, suspect cancer agent.
Carbon Tetrachloride -** these solvents do not have typical flash points. They dissociate with heat or ultraviolet radiation to form toxic gases such as phosgene.	5	140 - 584	**	FAST	Do not use. Cancer agent. Severe liver damage and/or death can result when combined with alcohol. Skin absorbs.
ESTERS/ACETATES					ONE OF LEAST TOXIC CLASSES.
Ethyl Acetate	400	3.9	24	FAST	Least toxic in class. URT & eye irritant.
Methyl Acetate	200	4.6	14	FAST	Headache. Upper Respiratory Tract irritant. Ocular nerve damage.
Isoamyl Acetate - banana oil , 2-pentyl acetate	50	0.22	64	MED	Eye & URT irritant. Used for fit- testing.
n-Amyl Acetate	100 (OSHA PEL)		77		Most toxic in class.
Sec-Amyl Acetates n-amyl acetate, isoamyl acetate-banana oil	125 (OSHA PEL)		89		Most toxic in class.
Butyl Acetate n-butyl acetate	150, 200 (STEL)		72		Eye & URT irritant.

COLUMNS: 1	2	3	4	5	6
SOLVENT CLASS name, synonym	TLV-TWA ppm	OT ppm	FP F°	ER	COMMENTS: Major Hazards in addition to General Hazards noted in the Data Sheet.
GLYCOLS					VARY GREATLY IN TOXICITY.
Propylene Glycol -1,2-propanediol	10	Unk.	210	*	Least toxic glycol. May cause allergies.
Ethylene Glycol -1,2-ethandiol	10	0.1- 40	232	*	URT & eye irritant. Neurological damage and blindness at high doses. Skin absorbs.
Diethylene Glycol	10	Unk.	255	*	Probably more toxic than Ethylene Glycol, but does not cause blindness. Skin absorbs.
Triethylene Glycol,		Unk.	350	*	
GLYCOL ETHERS (CELLOSOLVES) & their Acetates					TRY TO AVOID, ESPECIALLY IF PLANNING A FAMILY.
2-butoxyethanol - butyl cellosolve, ethylene glycol monobutyl ether	20	0.1	141	SLOW	Eye & URT irritation. Affects kidneys, liver, reproductive. Skin absorbs.
Ethoxydiglycol Diethylene glycol ethyl ether, 2-(2-ethoxyethyl)ethanol, carbitol	25 (AIHA)		201		Probable human developmental toxicant.
2-methoxyethanol - methyl cellosolve, ethylene glycol monomethyl ether	0.1	2.4	102	SLOW	Same as above. Skin absorbs. Do not use.
Methyl Ethyl Ketone - MEK, 2-butanone	200	5.4	16	FAST	URT irritation, CNS & PNS nerve damage. damage esp. with hexane. Skin absorbs.
Methyl Isobutyl Ketone, MIBK	(NIC 20)				URT & eye irritant. Kidney damage. Skin absorbs.
Methyl Butyl Ketone,	5	0.07-	77	MED	Do not use. PNS & testicular damage.
Isophorone 3,5,5-trimethyl-2-cyclohexene-l-one	5		184		Avoid if possible. Severe narcosis and URT irritation. Also chemical pneumonia and chronic kidney damage.
MISCELLANEOUS					
Turpentine	20	50-200	95	SLOW	Causes allergies (dermatitis, asthma), URT & skin irritation. CNS impairment, lung damage. Use odorless paint thinner.
Limonene, d-limonene, citrus oil, citrus turps, menthadiene, dipentene	20 (Germ an MAK-TWA)	Unk.	Unk.	VERY SLOW	A pesticide, food additive. Acutely toxic by ingestion. Kidney damage, skin allergies. Damages indoor air quality.
Carbon disulfide Carbon bisulfide	10		22		Absorbed through skin. May cause very strong narcosis, nerve damage, psychosis and frequently death. Chronic exposure causes central and peripheral NS damage. Affects blood, liver, heart and kidneys. Do not use.
Cutting oils	**	**	**		Some are probable human carcinogens. May cause dermatitis, skin cancer and lipoid pneumonia.
Dimethyl formamide DMF	10 (skin)		136		Probable human carcinogen. Skin, liver, kidney damage. Avoid if possible.
Morpholine	20	0.011-0.07	100	SLOW	Avoid. Skin absorbs. Eye damage, URT irritant.
Tetrahydrofuran	50	31	1.4	VERY FAST	Becomes explosive when old or exposed to air. URT irritant, CNS impairment, kidney damage. Skin absorbs.
Dioxane, 1,4-dioxane	20	12	65	FAST	Avoid. Carcinogen. Skin absorbs. Liver damage.
Cyclohexane,	100	780	1.4	FAST	CNS impairment. Chronic effects unknown. hexamethylene
Texanol7 2,2,4-trimethyl-	—	250	—	—	Found in many latex paints and craft products. Little is known about its long term effects.