Specific Chemical Hazards

The following are guidelines for working with common hazardous laboratory materials. Refer to the Safety Data Sheet (SDS) for specific chemical information. The SDS for a chemical can be accessed through CHEMWATCH. The link is available from the Science Services Webpages, just copy and paste this link into your browser. www.trentu.ca/scienceservices. Look for the Chemwatch icon and click on it.



Contents

[1.0 Flammable Chemicals 2](#_Toc13224767)

[2.0 Oxidizers and Oxidizing Materials 3](#_Toc13224768)

[**2.1** Oxidizing Solids 3](#_Toc13224769)

[**2.2** Oxidizing Liquids 4](#_Toc13224770)

[**2.3** Precautions to be taken when working with Oxidizers 4](#_Toc13224771)

[2.4 Peroxygen Compounds (Organic Peroxides) 4](#_Toc13224772)

[Chemicals that form peroxides with prolonged exposure to air. 4](#_Toc13224773)

[Chemicals that form explosive levels of peroxides without concentration 5](#_Toc13224774)

[Chemicals that are an explosion hazard with concentration 5](#_Toc13224775)

[2.5.1 Use, Handling and Storage of Peroxygen Compounds 5](#_Toc13224776)

[2.5.2 Testing for Peroxides 6](#_Toc13224777)

[3.0 Corrosives  6](#_Toc13224778)

[**3.1** Corrosive Liquids 6](#_Toc13224779)

[**3.2** Corrosive Solids 6](#_Toc13224780)

[**3.3** Corrosive Gases 7](#_Toc13224781)

[3.4 Precautions to be Taken When using Corrosives 7](#_Toc13224782)

[4.0 Water Reactive Chemicals  7](#_Toc13224783)

[5.0 Pyrophoric Chemicals 8](#_Toc13224784)

[List of Pyrophorics 8](#_Toc13224785)

[6.0 Organic Peroxides 10](#_Toc13224786)

[7.0 Explosives (with the exception of Picric Acid) 10](#_Toc13224787)

[7.1 Picric Acid 10](#_Toc13224788)

[8.0 Cryogenic Materials 11](#_Toc13224789)

[8.1 Precautions to be taken when using Cryogenic Materials 11](#_Toc13224790)

[9.0 Designated Substances 11](#_Toc13224791)

[9.1 Mercury 12](#_Toc13224792)

[9.2 Isocyanates 13](#_Toc13224793)

[9.3 Benzene 13](#_Toc13224794)

[9.4 Asbestos 13](#_Toc13224795)

[9.5 Lead 13](#_Toc13224796)

[10.0 Nanomaterials 14](#_Toc13224797)

[11.0 Other Toxic Materials 14](#_Toc13224798)

[12. Regulated Chemicals 15](#_Toc13224799)

1.0 Flammable Chemicals

Flammable materials are liquids, solids or gases which can be easily ignited at ambient temperatures and present a serious hazard to laboratory personnel. The following steps need to be taken to ensure the safe use, handling and storage of flammable materials.

* Minimize the quantities of flammable or combustible liquids kept in the lab to as small as possible. Never trade convenience for safety.
* The Fire Code (4.12.3.1(1)) stipulates that the maximum container size for a flammable or combustible chemical allowed in a lab is 5 L.
* When dispensing from containers made of metal, ensure containers are grounded and bonded appropriately. Dispensing of flammable materials should be done in well ventilated areas or in a fumehood.
* Ensure that potential ignition sources (sources that could cause a spark) are identified and removed from the area surrounding the flammable material. These include heat, sparks, flames and direct sunlight.
* Use and store flammable liquids only in well-ventilated areas. Use a fumehood when working with products that release flammable vapours.
* Laboratories that store, use or handle flammable or combustible liquids are to conform to section 4.12 of the Ontario Fire Code and the Ontario Occupational Health and Safety Regulation 851, section 22 and they stipulate that when not in use, all flammable chemicals need to be stored in NFPA or ULC rated flammable storage cabinets or in a fumehood. Refer to the Chemical Storage Program for more information.
* Before placing containers in Flammable Chemical Storage Cabinets, ensure the caps are properly sealed and that any liquid which may have dripped down the side of the container is wiped up. Flammable Chemical Storage Cabinets should not smell. If you smell chemical, then something is not properly contained.
* Flammable materials which require refrigeration, can only be stored in refrigerators rated by the NFPA or ULc as flammable safe laboratory refrigerators. Flammables must never stored in a standard residential type fridge/freezer or in any walk-in refrigerator or freezer.
* Note that due to the highly flammable nature of diethyl ether, diethyl ether extractions are to be performed only in facilities with additional fire suppression systems and ventilation, as well as intrinsically safe wiring (i.e., spark proof receptacles and endcaps).
* Keep flammable solvent containers, including those for collecting waste, well capped.
* The heating of flammable chemicals must never be done with an open flame, but with heating devices designed specifically for that purpose.
* The use of alcohol burners should be avoided.
* Handle and store flammable chemical waste the same as you would handle and store pure flammable chemicals.
* Clean spills of flammable liquids promptly. Refer to the Chemical Spills Program.

2.0 Oxidizers and Oxidizing Materials

Oxidizers and 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 produce oxygen in a way that increases the chance of fire or explosion. Oxidizers are capable of igniting flammable and combustible material even in oxygen-deficient atmospheres as well as increasing the intensity of a fire by adding to the oxygen supply and causing ignition and rapid burning of normally non-flammable materials.

Oxidizers can also:

* React with other chemicals, causing a release of toxic gases.
* Decompose and liberate toxic gases when heated.
* Burn or irritate skin, eyes, breathing passages and other tissues.

Examples of common oxidizers are Bromine, Bromates, Chlorates, Chromates, Dichromates, Hydroperoxides, Hypochlorites, Inorganic peroxides, Nitrates, Nitrites, Nitric Acid, Perborates, Perchlorates, Perchloric acid \*, Periodates, Permanganate, Peroxides, Peroxyacids, Persulfates.

## **2.1** Oxidizing Solids

Solid oxidizing agents have the ability to form explosive mixtures with common materials such as sugar, charcoal, starch, sawdust and sulphuric acid.

Examples of solid oxidizers include metallic:

chlorates;

perchlorates; (these are especially dangerous and their use should be avoided)

nitrates;

chromates; and

permanganates.

## **2.2** Oxidizing Liquids

Liquid oxidizers are often strong acids as well, making them powerful corrosives. Some examples include: Nitric acid solutions, Sulfuric acid solutions, Perchloric Acid (<50%) solutions, Chromic acid.

\*Perchloric acid: Use of perchloric acid should be avoided if possible. The use of Perchloric acid greater than 72.5% concentration is a Regulated Chemical on Campus. Refer to the Regulated Chemical Guidelines and the Perchloric Acid SOP for more information.

## **2.3** Precautions to be taken when working with Oxidizers

Working with oxidizers or oxidizing materials is hazardous and when using or storing oxidizers in the laboratory, the following procedures must be followed.

* Keep away from flammable and combustible materials.
* Keep containers tightly closed unless otherwise indicated by the supplier.
* Store strong oxidizers in inert, unbreakable containers. The use of corks or rubber stoppers is not permitted.
* Mix and dilute according to the supplier's instructions.
* Dilute with water to reduce the reactivity of solutions.
* The use of oxidizers should always be done in a fumehood.
* Wear appropriate personal protective equipment.
* Ensure that oxidizers are compatible with other oxidizers in the same storage area.
* Reaction vessels containing oxidizers shall not be heated with oil baths.
* Refer to the specific compound SDS for more information.

## 2.4 Peroxygen Compounds (Organic Peroxides)

These are chemically unstable compounds including peroxides, hydroperoxides, and peroxyesters that have a violently reactive oxygen. Some peroxygen compounds decompose slowly at room temperature, but rapidly at elevated temperatures. However, others decompose readily at room temperature and therefore must be refrigerated. Organic peroxides can violently explode when subjected to heat, friction, shock, spark, oxidizing and reducing agents or light. These compounds are very difficult to control in a fire due to their ability to generate their own oxygen upon combustion. Peroxygen compounds can seriously irritate the skin and eyes upon contact. Special consideration must be given to safe work procedures when using any compounds that have the capability of forming peroxides.

### Chemicals that form peroxides with prolonged exposure to air.

Ethers

Aldehydes, ketones

Compounds containing benzyllic, or allylic hydrogens

Compounds with a vinyl or vinylidene group

### Chemicals that form explosive levels of peroxides without concentration

Isopropyl ether Butadiene

Chlorobutadiene Potassium amide

Potassium metal Sodium amide

Tetrafluoroethylene Divinyl acetylene

Vinylidene chloride

### Chemicals that are an explosion hazard with concentration

Acetal Cumene

Cyclohexance Cyclooctene

Cyclopentene Diacetylene

Dicyclopentadiene Diethylene glycol dimethyl ether

(Diglyme) Diethyl ether

p-dioxane Ethylene glycol dimethyl ether

Methyl acetylene Methyl cyclopentance

Methyl i-butyl ketone Tetrahydrofuran (THF)

Tetrahydronaphthalene (Tetralin) Vinyl ethers

## 2.5.1 Use, Handling and Storage of Peroxygen Compounds

Specific precautions to take when using, handling and storing peroxygen or peroxide-forming compounds include the following:

* Purchase and use only the minimum amount required.
* Purchase with peroxide inhibitors whenever possible
* Mark the receipt date on the container.
* Mark the date the container was opened on the container.
* Dilute solutions with inert solvents such as aliphatic hydrocarbons. Avoid the use of aromatic solvents, such as toluene, which can initiate the decomposition of some peroxides.
* Avoid preparing peroxide solutions with volatile solvents as losses of solvent due to evaporation can cause unwanted concentration of peroxides.
* Dispense quantities as required. Do not return unused materials to stock container.
* Do not use metal spatulas.
* Do not use glass containers with ground glass or metal lids. Use polyethylene containers with screw cap lids.
* Store and use away from heat, ignition sources and light.
* Store at the lowest temperature that is above the freezing point of the solution and that will not affect the solubility of solution. This will minimize the rate of decomposition of the peroxides.
* Dispose after one month of the container being opened or if unopened, by the expiry date.
* Treat any visible solids around the cap or in the container of peroxygen or peroxide-forming liquids with extreme caution as they could be explosive. Never open a container with visible crystals around the cap or on the outside of the container. Contact your supervisor immediately.
* Ensure that solutions are free of peroxides before concentration using the tests described below.
* If concentration is necessary, avoid evaporating to dryness.
* Use a shield when evaporating or distilling any peroxide-forming compounds.

## 2.5.2 Testing for Peroxides

Peroxide test strips can be purchased from laboratory supply companies. These allow a simple and quick qualitative determination of whether peroxides are present in a solution.

# 3.0 Corrosives Corrosion

Corrosive chemicals are commonly found in laboratories as solids, liquids and gases. These materials have the ability to damage tissue at the point of contact. Soft tissues and mucous membranes (eyes, sinuses, lung tissue) are the most easily damaged.

## **3.1** Corrosive Liquids

Corrosive liquids can be particularly hazardous as they act rapidly upon contact. Examples of common corrosive liquids are:

Strong acids (chromic acid, hydrochloric acid, nitric acid, hydrofluoric acid\* etc.

Strong bases (aqueous sodium hydroxide, potassium hydroxide, ammonia, etc.)

Strong dehydrating agents (phosphorus pentoxide, calcium oxide, etc.)

Strong oxidizing agents (peroxides, etc.)

\*Hydrofluoric acid may be fatal through inhalation, absorption or ingestion and causes extensive, deep and painful burns. Avoid use if possible, however if its use is unavoidable, personnel are to be specifically trained in its use and emergency response procedures. Hydrofluoric Acid is a Regulated Chemical on Campus and its possession and use requires the approval of the EHSO and following the Hydrofluoric Acid SOP.

## **3.2** Corrosive Solids

Inhalation of corrosive dusts presents a particular hazard as the point of contact and the tissue at risk, particularly the airways and lungs, is internal, creating an injury that may be difficult to treat and cause irreversible tissue damage. Examples of corrosive solids are lithium oxide, sodium sulphide and phenol.

## **3.3** Corrosive Gases

Corrosive gases enter the body through inhalation as well as being readily absorbed through dissolution in skin and eye moisture. Typical examples are listed below:

Ammonia

Hydrogen chloride

Hydrogen fluoride – inhalation, absorption or ingestion may be fatal. Causes extensive, deep and painful burns. Avoid use if possible, however if its use is unavoidable, personnel are to be specifically trained in its use and emergency response procedures.

Formaldehyde

Bromine

Chlorine

Phosgene

Sulphur Dioxide

## 3.4 Precautions to be Taken When using Corrosives

Specific precautions to take when using or handling corrosive materials include the following:

1. Ensure that acids are always added to water and not vice versa.
2. Be prepared for heat generation upon diluting or dissolving in water.
3. Ensure that all work is completed in a chemical fume hood with adequate ventilation (see Fumehood Training).
4. Personal protective equipment is to include:
* labcoat;
* goggles/glasses;
* appropriate gloves; and
* when working with volumes greater than 4 L, a synthetic rubber apron

# 4.0 Water Reactive Chemicals Image result for definition of flammable materialHealth Hazard

The following situations may occur with water reactive chemicals upon contact with water and even the moisture in the air:

* Significant production of heat (causing potential ignition of the chemical itself or nearby flammable material);
* Release of flammable, toxic, or oxidizing gas;
* Release of metal oxide fumes (applicable to water reactive metals);
* Formation of corrosive acids.

Care must be taken to ensure that water reactive chemicals are handled and stored away from sinks, water baths or other sources of moisture. Water reactive chemicals are regulated chemicals on campus and require the EHSO authorization to possess and use and the use of the Pyrophoric and Water Reactive SOP is required. Refer to the Regulated Chemicals Guidelines.

Examples of water reactive materials include:

Alkali metals including Lithium, Sodium and Potassium Silanes

Aluminum chloride Phosphorus pentachloride

Lithium aluminum hydride Ferrous sulphide

Sodium borohydride Chlorosulphonic acid

Silicon tetrachloride Thionyl chloride

Alkylaluminums including triethyaluminum Magnesium

Phosphorus Phosphorus pentasulphide

Aluminum chloride Maleic anhydride

Acetyl choride Phosphoryl trichloride

Stannic chloride Sulphuryl chloride

Titanium tetrachloride

# 5.0 Pyrophoric Chemicals

Pyrophoric chemicals are liquids, solids, and gases that will ignite spontaneously in air at or below 130 °F.

Oxidation of the compound by oxygen or moisture in air proceeds so rapidly that ignition occurs. Many finely divided metals are pyrophoric, and their degree of reactivity depends on particle size, as well as factors such as the presence of moisture and the thermodynamics of metal oxide or metal nitride formation. Other reducing agents, such as metal hydrides, alloys of reactive metals, low-valent metal salts, and iron sulfides, are also pyrophoric.

From Prudent Practices in the Laboratory:  Handling and Management of Chemical Hazards (section 4.D.2.2 Pyrophorics) The National Academies Press:  Washington, DC, 2011.

A list of some example pyrophoric materials is given in the section below called "List of Pyrophoric Chemicals"

More information and use requirements are available in the Pyphorics and Water Reactive SOP. Pyrophoric chemicals are considered a Regulated Chemical on Campus. Their use and possession require EHSO approval and use of the Pyrophoric and Water Reactive SOP. Refer to the Regulated Chemical Guidelines.

### List of Pyrophorics

#### Liquids/Solutions

##### Organolithiums

* Alkyl and Aryl Lithiums
* n-butyllithium, t-butlylithium
* Lithium Amides
* Lithium Alkoxides

##### Organomagnesiums “Grignard Reagents”

* Alkyl and Aryl Magnesium Halides
* Methylmagnesium Chloride, Allylmagnesium Bromide

##### Organozincs

* Diethyl Zinc

##### Aluminum Alkyls

* Trimethylaluminum
* Diisobutylaluminum hydride

##### Metal Carbonyls

* Nickel Carbonyl
* Iron Pentacarbonyl

##### Silicon Halides

* Dichloromethylsilane

#### Solids (may also come as solutions)

##### Metal Hydrides

* Sodium Hydride
* Potassium Hydride
* Lithium Aluminum Hydride

##### Finely Divided Metals

* Aluminum
* Lithium
* Magnesium
* Titanium
* Zinc
* Zirconium
* Sodium
* Potassium

##### Used Hydrogenation Catalysts

* Raney Nickel
* Palladium on Carbon

#### Gases

* Silane
* Diborane
* Phosphine

#  6.0 Organic Peroxides

See section 2.5.1

# 7.0 Explosives (with the exception of Picric Acid)

Explosives are regulated by the Canadian Explosives Act and corresponding regulations along with the Ontario Fire Code. Any work with explosive must be consistent with the following general requirements described below and requires Vice Presidential approval prior to the material being ordered and work commencing. A licence maybe required from Natural Resources Canada:

1. Working alone with explosive materials is prohibited
2. Storage locations for explosive materials are to be placarded in accordance with the Explosives Act.
3. Quantities of explosive materials are to be minimized with all additional material disposed of upon completion of the activity.
4. Written safety instructions and emergency procedures are to be prepared and must include at least the following information:
	1. location of storage and use areas
	2. methods to control a fire emergency safely and efficiently
	3. contact information

## 7.1 Picric Acid

Picric acid (2,4,6-trinitrophenol) is a reagent found in departments across campus, being used in microscopy and as a component in some biological specimen preserving solutions. When dehydrated( in other words “dry”), picric acid can become a dangerous explosive. When in contact with metal, highly shock-sensitive picrate salts can be formed. The following guidelines are for the storage and handling of picric acid:

1. Picric acid must be stored in water. As a liquid Picric acid is not explosive
2. Containers of picric acid are to be inspected at least every 6 months and distilled water added to the containers as necessary to ensure that the picric acid never dries out.
3. Containers and lids for storage of picric acid or solutions of picric acid are not to be of metal construction.
4. Metal spatulas are never to be used to remove material from its container.
5. Always wipe the neck of the bottle, and the cap with a wet cloth before returning to storage.

If a container of dry picric acid is discovered, it is not to be touched or moved. Contact Campus Security at 705 748-1333 and the Risk Management Office immediately.

# 8.0 Cryogenic Materials

Cryogenics are very low temperature materials such as dry ice (CO2(s)), liquefied air, nitrogen, helium, oxygen, argon and neon. The following hazards are associated with the use of cryogenics:

1. asphyxiation due to displacement of oxygen (for materials other than liquefied air and oxygen);
2. freezing and fracturing of materials from extreme cold;
3. frostbite;
4. explosion due to pressure build up; and
5. condensation of oxygen and fuel, such as hydrogen or hydrocarbons, resulting in explosive mixtures.

## 8.1 Precautions to be taken when using Cryogenic Materials

The following are precautions for handling cryogenics:

1. Control ice build-up on containers.
2. Use only approved low-pressure containers equipped with pressure-relief devices. Lunch box Thermos-style bottles are not acceptable.
3. Protect skin and eyes from contact; wear eye protection and insulated gloves.
4. Wear safety goggles when breaking large pieces of dry ice or using mixtures of dry ice and solvent.
5. Wear a face shield when removing samples from storage dewars due to the possibility of rupture from pressure build-up.
6. Use and store in well-ventilated areas. Alarmed oxygen sensors are required in areas where the volume of gas could result in the displacement of oxygen to a level lower than what is tolerable by people, thereby causing an asphyxiation hazard.
7. Keep away from sparks or flames.
8. Use materials resistant to embrittlement.
9. Watches, rings, bracelets or other jewelry that could trap fluids against flesh should not be worn when handling cryogenic liquids.
10. To prevent thermal expansion of contents and rupture of the vessel, ensure containers are not filled to more than 80% of capacity.
11. Never store dry ice in a refrigerator/freezer (especially deep chest freezers) or walk-in fridges or freezers. Dry ice will sublimate (change from solid to gas) at -78°C and could asphyxiate the person opening the equipment or entering the chamber.

# 9.0 Designated Substances

There are eleven “designated substances” regulated under the Ontario Occupational Health and Safety Act due to their potential to cause serious health implications. Use of designated substances in research or teaching situations should be avoided. However because suitable substitution may not be possible, some of these substances may be found in university laboratories. Designated substances are listed below:

1. acrylonitrile;
2. arsenic;
3. asbestos;
4. benzene;
5. coke oven emissions;
6. ethylene oxide;
7. isocyanates;
8. lead;
9. mercury;
10. silica; and
11. vinyl chloride.

The designated substance regulations apply to employers and workers at workplaces where the substance is present and is likely to be inhaled, ingested or absorbed by the worker. The regulations require that the time weighted average exposure of the worker to the substance be less than limits prescribed in the regulations. Generally, the regulation contains three key components:

1. Assessment – requires the Principle Investigator or supervisor to consider the level or likelihood of exposure of the worker to the substance. The assessment must be in writing, use the Designated Substance Assessment form available in the Science Safety Web pages.
2. Control program – required if the assessment discloses that a worker is likely to be exposed to the substance. This documented program is to include engineering controls, hygiene practices, work practices and facilities to ensure that the worker exposure to the substance is controlled.

Both the Assessment and Control forms are available on the Science Safety Webpages.

1. Monitoring – requires air emissions monitoring and medical surveillance to determine actual exposure to the substance if it is determined in the assessment that a control program is required.

It is the responsibility of the laboratory supervisor to ensure that the letter and intent of the regulations are met. See the Designated Substance SOP for more information.

Below we discuss some Designated Substances commonly found in labs

## 9.1 Mercury

Elemental mercury, inorganic mercury salts and organic mercury compounds have the potential to cause serious acute or chronic toxic effects from the various routes of exposure.

Containers are to be stored sealed with the cap/lid along with electrical tape, parafilm or an equivalent.

All use and storage is to be in a well-ventilated area.

Any skin or eye contact is to be rinsed with copious amounts of water and medical attention is to be sought immediately.

## 9.2 Isocyanates

Various isocyanates have been determined to cause severe allergic reactions in certain individuals. Sensitization may also occur such that the allergic reaction becomes progressively worse with each exposure and occurs with exposures to very small amounts of the material. Reactions may include anaphylactic shock which can be fatal and hence requires immediate medical treatment. All laboratories, solutions or samples containing isocyanates should be clearly marked as containing such.

## 9.3 Benzene

Benzene is a highly flammable, carcinogenic solvent that has severe effects on the blood and blood-forming organs. All use of benzene should be performed in a fume hood. If practical, the use of benzene should be substituted with another appropriate solvent, such as toluene.

## 9.4 Asbestos

Asbestos is a fibrous material commonly used in equipment and construction material due to its fire and heat resistant properties. Asbestos was attributed to a variety of respiratory health effects including cancer and whose use has since been abandoned in Canada. However, a significant amount of equipment and building materials manufactured before 1990’s contained asbestos including things like Transite materials (hard fibre board fire proof material), drywall, and heat resistant coatings and insulations.

Older equipment may still contain asbestos linings or gaskets. Care should be taken when working on equipment suspected of containing asbestos (pre 1990). If in doubt contact the Risk Management Office prior to disturbing material. Where equipment or material containing Asbestos has been identified, it shall be labelled as such and entered into the university’s asbestos inventory.

## 9.5 Lead

Lead and lead containing materials have the potential for serious short and long term health effects. Pro-longed or repeated exposure to lead and lead containing materials causes damage to the nervous system, kidneys and blood if inhaled or ingested. Lead was used commonly in a variety of construction materials, paints, plumbing and in batteries. Inorganic forms of lead and elemental lead have been classified as probable carcinogens and probably mutagens and long term exposure can also lead to fertility issues. The main concern is the inhalation of lead dust or accidental ingestion. Refer to the SDS for more detailed information.

These are just some examples of Designated Substances, for additional information please refer to the Occupational Health and Safety Act and its associated regulations and the Designated Substances SOP available on the Science Safety Webpages.

# 10.0 Nanomaterials

Nanomaterials are defined as particles with at least one dimension that is less than 100 nm. Nanomaterials have been shown to have unique physical and chemical properties when compared to the corresponding micro- or macro-scale compounds. In addition there also appears to be different mechanisms of toxicity and therefore different and potentially more severe health effects although these differences are currently widely unknown. As such, use and handling of nanomaterials must be done with particular care and only after conducting a risk assessment to consider both the potential hazards and appropriate controls. Contact Science Facilities for assistance in conducting a risk and/or exposure assessment.

Examples of controls include:

1. Identification of areas, equipment and containers that contain or are used with nanomaterials;
2. Embedding the nanomaterials in a solid matrix;
3. Working with the nanomaterials in solution within a chemical fume hood
4. Working with solid, dry, dispersible nanoparticles in a fully contained system or conducting the work within a biosafety cabinet (HEPA filtered) or fumehood.
5. Being diligent in housekeeping, wet wiping of potentially contaminated areas etc.
6. Wearing appropriate personal protective equipment (gloves, lab coat, eye protection, respiratory protection etc.)

Reference source: Greaves-Holmes, Wanda L. 2010. Journal of Technology Studies, vol. 35, no. 1. pg 33-38. Visit this web page to see the article. scholar.lib.vt.edu/ejournals/JOTS/v35/v35n1/pdf/holmes

In addition, those looking to work with engineered nanomaterials should review the following document “General Safe Practices for Working with Engineered Nanomaterials in Research Laboratories” published by the Center for Disease Control and National Institute for Occupational Safety and Health (NIOSH). It can be found on.

# 11.0 Other Toxic Materials

Some other chemical materials warrant mentioning specifically because of their hazards and/or extensive usage. This list is not exclusive and users should be familiar with the hazards of all the materials in their labs before they work with any material.

Ethidium bromide – known mutagen.

Chloroform – relatively potent anaesthetic, suspected carcinogen.

Cyanides/Nitriles – acutely toxic. If use is unavoidable, personnel are to be specifically trained in its use and emergency response procedures. Contact Risk Management Office.

Hydrogen sulphide – acutely toxic. Attacks the respiratory system. Highly flammable.

Formalin/Formaldehyde – known carcinogen.

Refer to the SDS for specific hazard control information on any chemical or material.

# 12. Regulated Chemicals

Certain chemicals or groups of chemicals are either regulated by external government agencies or legislation or a considered as exceptionally hazardous and require formal approval by the Environmental Health and Safety Officer (EHSO) and specific procedures or equipment (SOP) when handling.

More information is available in the “Regulated Chemicals Guidelines” in the Science Safety Web pages.

The table below is a brief summary of the materials which are regulated on campus, some examples of the materials and how they are regulated. Please refer to the “Regulated Chemicals Guidelines” for further information

Table of Regulated Chemicals at Trent University

| **Type or Name of Material** | **Examples** | **How Regulated** |
| --- | --- | --- |
| Biohazardous MaterialHuman and Animal Risk Group 2 | Human and Animal Pathogens Risk Group 2 or 3. | Biosafety Work Permit and BSO Approval. See the Biosafety Program |
| Chemical Weapons and Precursors | Schedule 1, 2 and 3 materials of the Chemical Weapons Implementation Act | No Possession of Schedule 1 materials or import/export of Schedule 2 or 3 materials of the CWC implementation Act |
| Controlled Drugs and Substances (see the Act for a list of all materials) includes but is not limited to Narcotics | Controlled Drugs and Substances Act. | Possession or Acquisition License from Federal or Provincial Authority required.  |
| Dangerously Reactive Chemicals  | Vigorous Polymerizers, Self reactive under conditions of shock, increase in temperature or pressure, Vigorous Condensation, Vigorous Decomposition, Chemicals that react vigorously with water to release a lethal gas. | Completion of the Dangerously Reactive SOP. Read the SDS to determine if the chemical in question meets this requirement |
| Designated Substances | Acrylonitrile, Asbestos, Benzene, Coke Oven Emissions, Ethylene Oxide, Isocyanates, Lead, Mercury, Silica, Vinyl Chloride | Hazard Assessment to be performed for exposure (see assessment form) and if necessary a Hazard Control SOP. Read the Designated Substance SOP. |
| Explosives (as classified by Transportation Dangerous Goods) with the exclusion of liquid Picric Acid | See the Explosives Act and Regulations.www.nrcan.g.ca/explosives | Not permitted on Campus without the written authorization of the V.P. Academic, EHS, and a License/Permit from Natural Resources Canada |
| Hydro Fluoric Acid (HF) | Hydro Fluoric Acid | EHS approval and completion and use of HF SOP |
| Perchloric Acid > 72.5% | Perchloric Acid greater than 72.5 % concentration | EHS approval and completion and use of Perchloric Acid SOP |
| Poisonous and Corrosive Gases | Ammonia, Hydrogen Chloride, Chlorine, Carbon Monoxide | EHS Approval and completion and use of Poisonous and Corrosive Gases SOP. |
| Radioactive Material | Tritium, Carbon 14, Phospohorus 32 or any material identified by the Canadian Nuclear Safety Act and Regulations. | RSO authorization and Radioactive Work Permit. See the Radiation Safety Program |
| Pyrophoric and Water Reactive Materials | Alkyl lithium compounds, tert butyl lithium, lithium carbonyl, Group 1 Alkali metals, Metal powders (very fine particles), Metal hydrides, Non-Metal Hydrides, Non-metal alkyls | EHS approval and Pyrophoric and Water Reactive SOP completion and Use |
| Super Acids and Super Bases | Fluoroantimonic Acd, Trifluoromethanesulfonic acid, Anhydrous HF, Fluorosulphuric Acid, Lithium monoxicd anion (LiO-), Ortho diethnylbenzene diananion | EHS approval and Super Acid and Super Base SOP completion and Use. |

References:

Canadian Center for Occupational Health and Safety

McGill Occupational Health and Safety Program

University of Ottawa Health and Safety, Chemical Safety Program

University of Toronto Chemical Safety

Prudent Practices in the Laboratory, Handling and Management of Hazardous Chemicals