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Occupational Health, Safety and Biosafety

Manager	Sadeeka Dean	14032
Senior Safety Advisor	Collin Thompson	17558
Safety Assistant	Katherine Potts	15153

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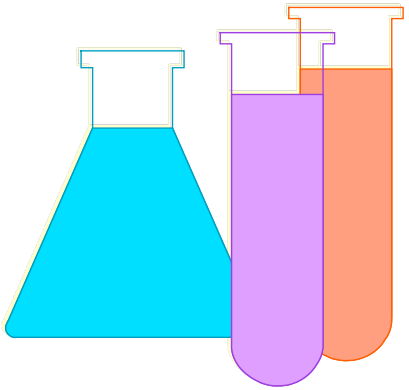
Laboratory Safety Training

Why are new lab workers required to do laboratory safety training?

- To learn about the concepts and tools necessary to work safely in the research laboratory - safety for you, your colleagues and the environment



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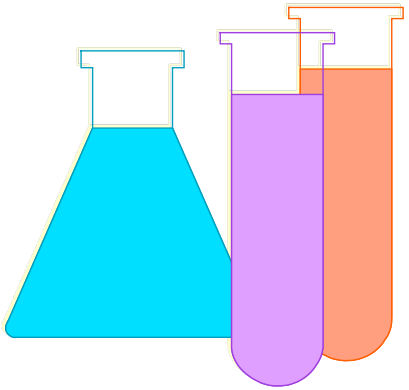
Learning Objectives

At the end of the module participants will understand the following:

- **Occupational Health and Safety Management System**
- **The principles of Chemical Safety**
- **How is protection achieved in the Lab**
  - Fumehoods
  - Personal protective equipment
- **Mechanisms of Prevention**
  - General lab safety practices
- **How to manage laboratory waste**
- **Principles of electrical safety**
- **Principles of emergency preparedness**



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Laboratory Safety Culture

- Laboratory Safety depends not only on materials and equipment but on attitudes and personal responsibility
- A safe laboratory environment is the combined responsibility of laboratory personnel (principal investigators, laboratory technicians and students), occupational health and safety staff and the management of the organization
- Legal requirement to comply with applicable safety laws and regulations
- Compliance with mandatory rules and policies established by the employer

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Occupational Health and Safety (OHS) Management System

- **The Heart Institute has established an OHS Management System that contains the following elements:**
  - Management commitment – OHS Policies, SOPs
  - Planning – identification of OHS concerns, risk assessments, legal requirements …
  - Implementation – preventive or protective measures, communication and training, emergency procedures …
  - Check and evaluate – monitor effectiveness, investigate incidents
  - Management review for continual improvement
- **Laboratory Safety is one component of the overall OHS program in the Institute**

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Occupational Health and Safety Policy

The Occupational Health and Safety Act requires the employer to prepare (and post in the workplace) an OHS policy. The main elements of the policy are:

- Provide a safe and healthy workplace
- Maintain equipment and premises in a safe condition
- Joint responsibility
- Establish a Health and Safety Program
- Carry out workplace inspections
- Provide information and training
- Injury prevention / accident investigation
- Meet or exceed legislation, standards
- Establish a Joint Health and Safety Committee
- Take every precaution reasonable

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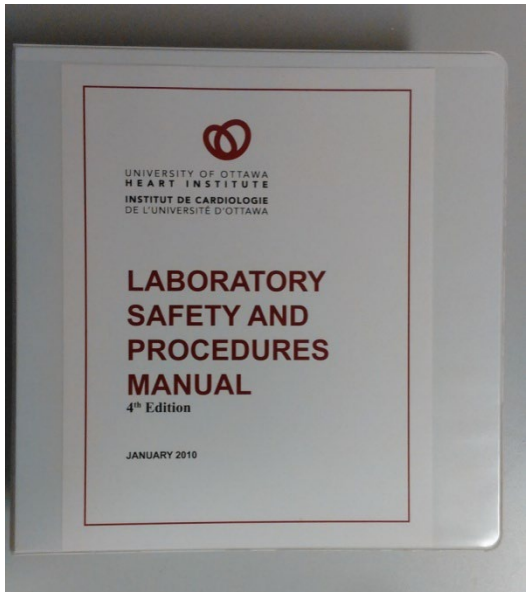
Laboratory Safety and Procedures Manual

- Throughout the training reference will be made to the Laboratory Safety and Procedures Manual
- The Manual can be found in hard copy in the laboratory (ask your supervisor) or it can be found on Hearthub at the following link:

https://hearthub.ottawaheart.ca/departments-services/occupational-health-safety-and-biosafety/laboratory-safety-and-procedures-manual



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Laboratory Security

•In recent years laboratory security has become as important as laboratory safety because of the potential dual use of laboratory materials. Dual Use refers to the inherent properties of materials that allows them to be used both for legitimate science, as well as, for criminal or terrorist activities;

•Laboratory Security refers to institutional and personal security measures designed to prevent loss, theft, misuse, diversion or intentional release of Chemicals, Radioactive materials, pathogens or toxins;

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OHIRC Laboratory Security Plan

- **Physical / Operational / Information Security**
  - the objective is to reduce the likelihood of unauthorized access to laboratories as well as to information and data that are in the laboratory
- **Personnel Reliability**
  - Only authorized persons are allowed into laboratories
    - must have completed training
    - provided OHIRC Human Resources with a Criminal Record Check from the Ottawa Police Services
    - Visitors must be accompanied
- **Material Accountability –** All labs are required to keep accurate lists of all materials present
  - Biohazards / Pathogen inventory
  - Chemical Inventory
  - Radioactive Materials etc …
- **Security Incident and Emergency Response**
  - This would be missing or lost inventory or unauthorized access
  - An internal investigation must be carried out and a report made to the Biosafety Officer/ Occupational Health and Safety
  - if not found a report made to security(12999)
- **Plan Update and Re-evaluation**
  - The Plan must be reviewed and updated on a regular basis

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Chemical Safety

Chemical Hazards

A substance is hazardous if it is capable of causing harmful effects to your health and safety.

Chemicals may have one or more of the following hazards associated to them:

– health hazards
– physical hazards
– reactivity hazards

It is important that you understand how chemicals can enter the body and the type of harm they can do

* Refer to Chapter 7, Laboratory Safety and Procedures Manual

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Working Safely with Chemicals

Four Basic Principles:

1. Plan ahead – identify potential hazards – read the label on containers, review the Safety Data Sheet and consult with the laboratory supervisor
2. Minimize exposure – prevent the chemical from entering the body – use personal protective equipment and work in the fume hood
3. Understand the risk – treat all new compounds or compounds of unknown toxicity as toxic substances
4. Be prepared for accidents – before starting to work know the first aid procedures, where emergency equipment, such as the safety shower and eye wash station, is located, spill kit, emergency telephone numbers etc

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Routes of Entry

- Exposure to chemicals in the laboratory can occur in several different ways called routes of entry. There are 5:
  - Inhalation - the most common
  - Skin absorption
  - Ingestion
  - Injection
  - Absorption through the eyes

- Chemicals may have local toxic effects at the site they enter the body or they may enter the blood stream and be carried to different parts of the body causing systemic toxicity

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Health Hazards

- These are adverse effects on the body such as damage to organs and tissues:
  - Poisons
  - Allergens
  - Carcinogens
  - Reproductive toxins
  - Asphyxiants
- There are two types of exposure related to time:
  - Acute - short term or immediate effects that are seen right away
  - Chronic - long term effects that may take months or years to develop

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Physical Hazards

- Flammable chemicals:
  - Solids liquids or gases that readily catch on fire and burn
- Explosive chemicals:
  - A chemical that can enflame extremely rapidly is said to be explosive
- Cryogenic Materials – can cause tissue damage from freezing because of the extremely cold temperature of the material
- Corrosive materials – cause tissue damage by chemical action at the site of contact
- Compressed Gases – storage under high pressure means the tank could rupture if not handled properly

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Reactivity Hazards

- Light, heat, mechanical shock and even water may cause some chemicals to undergo vigorous reactions that lead to explosions
- Reactive chemicals may polymerize vigorously, decompose, condense or self react. If not handled properly these reactions could become violent
- Incompatible chemicals – some chemicals react with other chemicals either causing explosions or toxic mixtures

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WHMIS Review

- **Workplace Hazardous Materials Information System**
  - •Product Labels – 2 types
    - Supplier: product identifier, signal words (DANGER or WARNING), precautionary statements such as personal protective equipment, engineering controls etc
    - Workplace: Product identifier, safe handling precautions and a reference to the safety data sheet
  - •Chemicals are categorized into hazard groups – health, physical or environmental
  - • 9 pictograms that represent the hazards
  - • safety data sheets (SDS) – details about the material / chemical …. Identification, fire fighting measures, toxicological information etc
  - •Worker training programs

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About Safety Data Sheets

- A primary means by which potential hazards about chemicals are communicated in the lab
- A document that describes the potential hazards (fire, reactivity, toxicity etc ..) and how to work with that chemical safely
- In planning your experiment, identify those chemicals whose properties are unknown or not well understood. Review the SDS for each

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More about SDSs

- Sometimes the information is vague and generalized
- Need to apply to a variety of workplaces from the smaller quantities used in labs to the large quantities used in industry
- Some list every conceivable health hazard without distinguishing the more significant or likely to occur
  - sometimes cause a lack of confidence in the relevance of SDSs
  - consult other sources on information

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Safety and Protection in the Laboratory

Safety and protection in the laboratory begins at the design stage…. There are several codes that must be consulted and complied with such as:

- The Building Code
- The Fire Code
- The Occupational Health and Safety Act
- The Canadian Biosafety Standards and The Canadian Biosafety Handbook
- GD52

These documents describe the requirements for the layout of the lab and the services to be provided at a minimum …..

Width of aisles, lighting, ventilation, fire extinguishers, eye wash stations, safety showers etc

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General Procedures for Working with Hazardous Chemicals

- **Prudent Planning –** determine the risk before starting to work and plan for them – ask "What if …"
- **Personal Behavior** – no practical jokes, distracting behavior, no horseplay at anytime
- **Minimize Exposure to chemicals –** work in the fume hood, use your personal protective equipment

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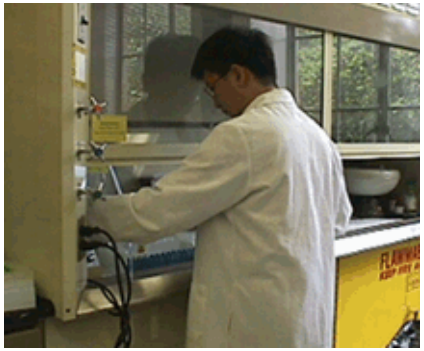
Fume Hoods

- Are the most commonly used engineering control for chemical exposure
- Control exposure to toxic, flammable or offensive vapours
- Protect the worker by permitting manipulation of the chemical in an enclosed chamber while preventing air contaminants from escaping into the laboratory
- Protect the worker but not necessarily the environment
- Do not remove/filter biological material from the air



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Fume Hood Safety

Do ....

- Inspect the hood before using it
- Avoid activity that will cause turbulence near the hood
- Use the hood for all activities that generate hazardous airborne contaminants
- Keep the sash at the indicated level
- Report problems to your supervisor
- Use the hood for its intended purpose
- Set up apparatus at least 6 inches from the hood face

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Fume Hood Safety

Do not ….

Do not put your head inside the hood

Do not use the hood chamber for storage of chemicals – clutter has a negative effect on air flow

Do not evaporate large quantities of flammable liquids or solvents in the hood

Do not obstruct the back slots

Do not use the fume hood if the alarm sounds

- Call Facilities at 14281 to report

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Personal Protective Equipment

- Final barrier to hazards reaching your body
- Individual use / something you wear
- Prevent chemical hazards from reaching one or more of the 5 routes of entry
- They have limitations – know what they are

Refer to:

***Policy 4-20 – Personal Protective Equipment and Apparel in the Research Laboratory**

*** Chapter 9 – Laboratory Safety and Procedures Manual**

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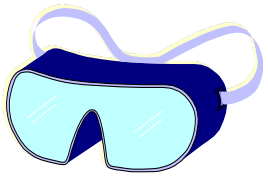
Eye and Face Protection

Eye and Face protection are required in all areas where chemicals are used or stored. Researchers should assess the risks of an experiment and choose the appropriate level of protection



Protect against chemical splashes, flying objects / particles, corrosive materials, radioactive materials, lasers……..

Only use approved eye and face wear

ANSI or CSA

Always inspect before use

Goggles are better than safety glasses. Face shield with goggles worn under them offer the best eye and face protection

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A Note About Contact Lenses

- Contact lenses offer NO protection against chemical splashes
- can increase the level of harm by concentrating the chemical under the lens and interfere with first aid and eye washing procedures
- They are discouraged in the lab – workers must self identify if you wear contacts

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Minimizing Skin Contact - Hand Protection

- Wear gloves when handling hazardous chemicals
- Make sure the gloves are suitable for your needs - the right glove for the right chemical
- Inspect the gloves for defects or damage
- Do not clean or reuse disposable gloves
- Always wash hands after removing the gloves
- Remove gloves before entering non-lab areas / do not handle common items (phone, doorknobs, ice machine, elevator buttons etc) with gloves

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Protective Clothing: Lab Coats

- Protects your clothing and your skin – They must be worn knee length, fully buttoned up with the sleeves rolled down
- Should have snaps and cuffs
- Should be made of non-flammable fabric
- Do not wash with regular clothing – home laundering of lab coats is discouraged
  - OHIRC has established a centralized laboratory coat exchange program – take your dirty coat to room H4214 to exchange for a clean coat
  - Do not write your name on the lab coat – if you need to identify your coat use tape which can be removed before washing
- Do not wear them in non lab areas – can cause cross contamination

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Protective Clothing: Footwear

- Shoes must always be worn in the lab
- Must cover the foot completely to protect it from physical, biological, chemical and radiological hazards
  - Closed toe and heel with a solid upper
  - Do not wear sandals in the lab
  - Recommend low heeled and comfortable

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Footwear ….

What to wear:

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What not to wear…






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Respiratory Protection

•Not generally required if the work is being carried out in the fume hood.

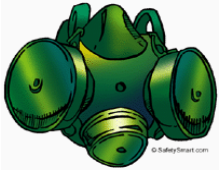
Dusk Masks

▪Used to protect against particulates such as when weighing powders

Surgical or Procedure Masks

▪Used to protect against droplets

Respirators



▪Only to be used when engineering controls are not adequate or feasible

▪They are tight fitting so the wearer must be fit tested

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Hearing Protection

•Required in environments where the sound level reaches 85 decibels and above over an eight hour period and where the level cannot be reduced by engineering methods

•Hearing protection is either ear plugs or ear muffs

•Not generally required in the research laboratory

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Emergency Showers and Eyewash Stations

- Used for emergency treatment for sudden exposures to the skin or eyes
- Know their location in the lab
- Become familiar with their operation
- They must be readily accessible and kept clear of obstructions
- Test eyewash stations at least monthly
- Report all uses (and hence incidents) to the supervisor

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Common Lab Safety Practices to Prevent Accidents

- Think safety first- be careful / be alert
- Know what you are working with – read SDSs
- Follow all safety procedures
  - Eating/drinking/chewing gum is forbidden in the lab
  - Long hair and loose clothing must be suitably restrained
  - Avoid wearing contact lenses
- Practice good housekeeping and good personal hygiene
- Report dangerous conditions or activities
- Know emergency responses and where emergency equipment is located
- Read the lab safety manual / attend training
- Plan your experiment
- Ask …if you don't know

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In addition …

Chemical handling

- Monitor reactions that are being heated
- Know which chemicals are incompatible
- Avoid contact with chemicals … protect your 5 routes of entry
- Use a (lipped) cart for transporting chemicals, protective devices such as bottle carriers, hand cart for compressed gas

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Chemical Storage

- Store chemicals in designated areas
- Below eye level – one should not have to reach overhead to retrieve containers
- Separate incompatible materials
- Label all containers / post or make available SDSs
- Respect shelf life – follow FIFO – first in first out
- Minimize quantities in storage
- Use explosion proof refrigerators to store highly flammable materials
- Maintain an up to date inventory
- Date containers when they are opened

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Laboratory Waste Management

Your lab generates waste…

Domestic – non-hazardous waste
Radioactive
Chemical
Biological

How do you get rid of it safely and legally?

Refer to:

* Chapter 8, Laboratory Safety and Procedures Manual, Waste Disposal Procedures

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The Hospital Waste Disposal Program

- The Ottawa Hospital Housekeeping Department is responsible for waste disposal
- The system uses colours to identify different streams of waste:

Colour	Description of Waste
Black	Domestic Non-hazardous waste
Yellow	Biological Waste
Red	Anatomical and cytotoxic – waste to be incinerated
Blue	Cytotoxic / chemotherapy

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Domestic Waste

- This waste includes all non-recyclable, non-hazardous waste
  - Paper towels, plastic film/wrap, food waste etc
- Use black bags or black bins
- Make sure food waste is disposed outside of the laboratory – food waste in the lab gives the appearance that food is being consumed in the lab – Never eat or drink inside the laboratory
- Empty liquids before placing in bag
- Confidential waste bin / recycling containers are available for paper, beverage cans, bottles

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Chemical Waste

Chemical waste must be properly packaged, labeled and picked up by Housekeeping for safe offsite disposal by a licensed waste carrier ……

- –Most chemicals are not to be disposed of in the drain
- –check with your lab supervisor to determine how waste chemicals are being managed in your laboratory and before you put any chemical into the sink – the City of Ottawa will fine the Hospital if any hazardous chemicals are found in wastewater above the legal limits
- –Collect waste chemicals in an appropriate, impermeable container (not yellow)
- –Label with a red and white hazardous waste label / Complete a Hazardous Waste Pick Up Request Form
- –Contact housekeeping to arrange a pickup by emailing:

waste@toh.ca

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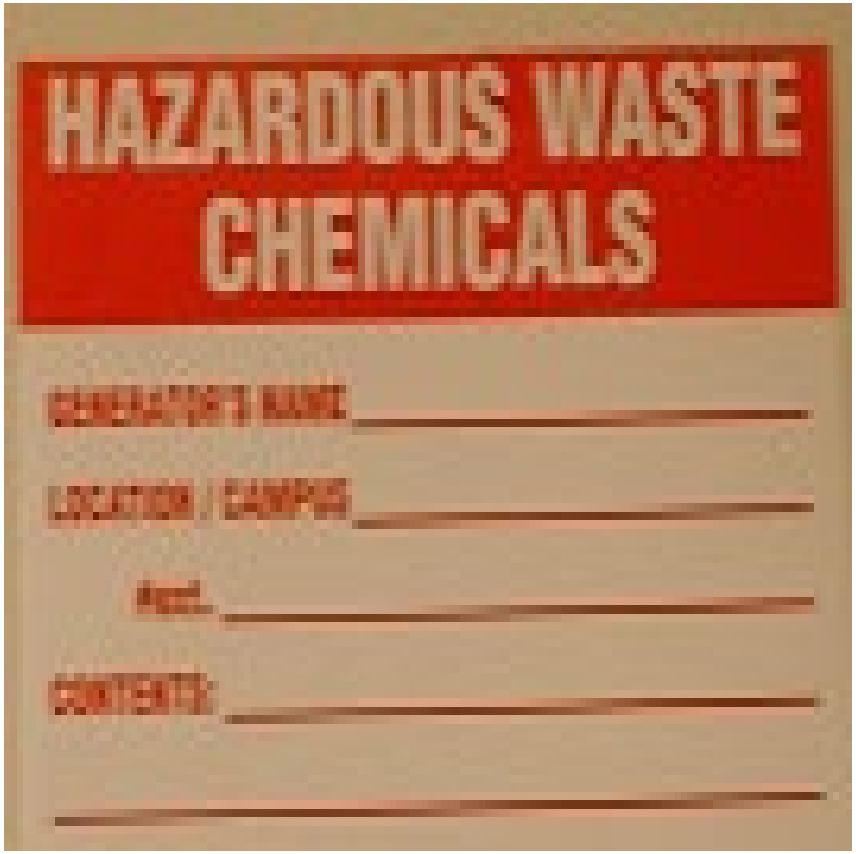
Chemical Waste Label



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Hazardous Waste Pick up Request form

Request for

HAZARDOUS CHEMICAL

Pick up-

Requestor Name:	
Department Name:	
Campus:	
Location:	
Chemical Name:	
Quantity/ Volume:	

Has waste first been CLEARED OF ALL POTENTIAL RADIOACTIVITY? ☐ YES ☐ NO
(please see Radiation Safety policy and procedure on the TOH INFONET).

Has each waste container been CLEARLY LABELED as to what is inside? ☐ YES ☐ NO
(Red & White Haz Chemical labels are available through Logistical Services, Inventory # 601695).

Has each waste container been properly sealed? ☐ YES ☐ NO

Is each waste container accompanied with its corresponding MSDS? ☐ YES ☐ NO
(available through Sharon Cavell, TOH- MSDS Officer, at Ext. 16224).

Once all the above information has been filled out completely, please e-mail this form to waste@ottawahospital.on.ca.

*NOTE: incomplete forms may result in delays.

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Biological Waste

- Sharps (needles, scalpels, contaminated glass), petri dishes, blood and bodily fluids, waste soaked with bodily fluids, animal tissue etc
- The bag or container colour is **yellow**
- Close sharps container as they approach the fill line
- Use **Yellow** bucket / pail for larger contaminated glassware
- Use grey biotubs lined with yellow bags for pipette disposal
- Animal tissues are collected in ACVS and stored at 4^{o}C for pick up by an external waste service
- Liquid tissue culture may be neutralized with bleach and disposed of in the drain (consult your PI)
- Waste is picked up and the containers are emptied, disinfected and exchanged, resulting in fewer amounts of plastic being sent to landfill

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Radioactive Waste

- Do not mix radioisotopes
- Do not dispose of radioactive material down the sink (except limited amounts of ^{3}H and ^{14}C – check with your lab manager)
- Liquid radioactive waste must be solidified
- All containers must be labeled with a radiation waste label and warning symbol
- Waste is stored for decay until the activity is decayed to legal limits or until offsite disposal can be arranged
- Radioactive waste is NOT to be picked up by Housekeeping – Contact OHS (14032) to arrange storage
- * Detailed procedures covered during Radiation Safety Training

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Other Waste

Pharmaceutical waste (Cytotoxic and chemotherapy) – This waste is incinerated off site

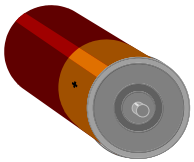
• For large volumes place in red buckets and follow the usual procedure to contact housekeeping for pick up

•Sharps waste that contains pharmaceuticals are to be placed in a blue sharps container

•Batteries

Employees are encouraged to collect spent batteries in the lab then transfer to the nearest battery disposal station or follow the usual pickup procedure with Housekeeping

You may bring in batteries from home for disposal – except car batteries



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Broken Glass

Housekeeping makes no distinction between contaminated and non-contaminated broken glass.

All broken glass must be disposed as follows:

- Place in yellow sharps containers or if pieces are too big, place in a grey biotub lined with a yellow bag
- Fill to ¾, seal the container
- Place next to black garbage can for pick up by Housekeeping

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Electrical Safety

- Inspect equipment, wires, cords etc regularly
- Do not overload electrical outlets
- Extension cords must not be used as permanent wiring
- Do not run wires where you cannot see them to inspect them (under carpet, over ceiling tiles, behind bookcases)

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Glassware Safety

- Inspect all glassware before using
- Avoid picking up broken glassware with your hands – use tweezers or a brush and pan
- Choose appropriate glassware for procedures that are heated - borosilicate
- Wear eye and face protection when working with glass apparatus
- Wear safety gloves when inserting glass tubing in rubber tubing or stoppers – Use soap or other lubricant

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Emergency Procedures

•Emergency Procedures have been developed to respond to and address the most common workplace occurrences:

- •Workplace accidents
- •Fire Emergency / Code Red
- •Hazardous Materials Spill / Code Brown

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Workplace Accidents

- The Heart Institute policy 4-80 entitled Accident Investigation Procedure applies to all workplace accidents
- All accidents that occur in the laboratory must be immediately reported to the PI or person in charge
- Appropriate first aid or medical care must be provided
- The PI must carry out an investigation of the circumstances to identify the causes and appropriate corrective action
- An accident investigation report must be completed and signed by the PI outlining all the circumstances

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Chemical Spill Response

- A detailed Chemical Spill Procedure is found in Chapter 6 of the Laboratory Safety and Procedures Manual
- Minor spills are the responsibility of the generator to clean up
- A Hazmat Spill Cart is located on HIRC 3 near Room H3238 containing:
- Neutralizing materials
  - Spill X FP for formaldehyde
  - Spill X A for acids
  - Spill X C for bases
- Absorbents
  - Ensorb
  - Spill X S for solvents
  - Spilfyter Mercury Spill Kit
- Clean Up tools and equipment

***Follow the Ottawa Hospital's Code Brown Procedure for major spills - report the spill to Security at 15555**


Caution
Wet Floor
3M 8577

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Fire Emergency- Code Red

If the fire is in your Lab:

- Notify all lab personnel to evacuate the lab
- **If safe**, turn off ignition sources, secure hazardous materials
- Close the doors as you leave
- Activate the nearest fire alarm
- Telephone 15555 to identify the exact location the location of the fire
- Alert all labs on the floor to evacuate immediately to a safe area beyond the fire doors
- If the fire is in multiple labs on the same floor a vertical evacuation will be necessary. Fire monitors on the floor will direct the evacuation

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Fire Emergency – Code Red

When the fire is in another location:

- Listen to the PA announcements for the exact location
- Floor monitors will monitor the elevators and exit doors
- Floor monitors to keep labs advised of the situation
- Remainder of staff can continue to work but be prepared to evacuate if required – can continue to work on ongoing experiment but do not start anything new

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What Does Safety Mean to You?

The Heart Institute provides you with:

- Laboratory Safety and Procedures Manual
- Hazardous Materials Spill Plan
- Safety Data Sheets
- Training Programs
- Personal Protective Equipment
- Waste Disposal Plan
- Information about the hazards in your lab
- Experienced supervision in the lab

How well you use these tools will determine your safety in the lab!

- **Follow the link below to go to the related quiz …. The password is healthandsafety**

https://www.classmarker.com/online-test/start/?quiz=q4x52efb0f85fb53