



Chemical Handling & Spills Response


Environmental & Occupational Health Support Services (EOHSS)





Agenda

- Legislation: Occupational Health & Safety Act (OHSA), Regulations and, Workplace Hazardous Information System (WHMIS)
- McMaster University's Risk Management Manual (RMM)
- Handling Chemicals Safely
- Controlling Hazards
- Waste Disposal
- Spills Response
- References & Resources



Occupational Health and Safety Act (OHSA)

<ul style="list-style-type: none"> Regulations <ul style="list-style-type: none"> ▪ Industrial ▪ Construction ▪ Health Care ▪ Mining ▪ Control of Exposure to Biological and Chemical Agents ▪ WHMIS ▪ Diving Operations ▪ First Aid 	<p>Designated Substances:</p> <ul style="list-style-type: none"> Asbestos Lead Mercury Silica Isocyanates Arsenic Benzene Acrylonitrile Vinyl Chloride Ethylene Oxide Coke Oven Emissions
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Reg. 833: Control of Exposure to Biological or Chemical Agents

Includes:

- ◆ Every employer shall take all measures reasonably necessary in the circumstances to protect workers from exposure to a hazardous biological or chemical agent because of the storage, handling, processing or use of such agent in the workplace
- ◆ Exposure means by inhalation, skin contact (absorption), through mucous membranes (e.g. eyes), ingestion and injection



Reg. 833: Control of Exposure to Biological or Chemical Agents, continued...

Provides exposure values of 700 chemicals:

- OELs (Occupational Exposure Limits),
- STEV (short term exposure values),
- CEV (ceiling exposure values),
- TWAEV (time-weighted average exposure values),
- ◆ Values are usually listed in the MSDS (Material Safety Data Sheets)



WHMIS

Ensuring workers receive the **education,**
 and **site-specific training,**
 in the **safe storage,**
handling,
 and **use**
 of controlled products in the workplace



WHMIS, cont'd


Labeling Requirements

- Supplier must provide a label
- Workplace must provide a label when decanting or manufacturing
- 8 Classifications/Symbols

MSDS (Material Safety Data Sheets)


Training

- Employer and Worker





Hazard Symbols

Class A: Compressed Gas
Any material which is a gas at normal temperature and pressure, but is packaged as pressurized, dissolved or liquefied gas by compression or refrigeration. E.g. oxygen, chlorine



Class B: Flammable & Combustible
Will ignite and continue to burn in air if exposed to a source of ignition
Can be a gas, liquid, aerosol, solid
E.g. methane, acetone







Hazard Symbols (cont'd)




Class C: Oxidizing Material

- May or may not burn but will release oxygen contributing to the combustion of other material
- E.g. ozone, chlorine, nitrogen dioxide





Hazard Symbols (cont'd)


Class D: Poisonous & Infectious Material

Materials Causing Immediate & Serious Toxic Effects
E.g. styrene, hydrogen cyanide

Materials Causing Other Toxic Effects (carcinogens, irritants, sensitizers)
E.g. asbestos, ammonia

Biohazardous Infectious Material:

- Either a living organism or the chemical toxin it produces that can cause illness in humans
- E.g. Hepatitis B, Cholera





Hazard Symbols (cont'd)


Class E: Corrosive Material

- Can attack metals and cause skin damage
- May weaken containers
- E.g. acids, ammonia

Class F: Dangerously Reactive Material

- May react violently under conditions of shock or increases in temperature or pressure
- May react with water to create a toxic gas
- E.g. ozone, benzoyl peroxide



Risk Management Programs (RMMs)

<http://www.workingatmcmaster.ca/eohss>

- RMM #100 McMaster University Environmental Health and Safety Policy
- RMM # 101 McMaster University Risk Management System
- RMM # 102 Occupational Health and Safety Act
- RMM # 103 Environmental Protection Act




Risk Management Programs (RMMs)

- RMM # 309 Laboratory Safety (see Lab Safety Handbook)
- RMM # 310 Eye Protection Program
- RMM # 311 Respiratory Protection Program
- RMM # 312 Foot Protection Program
- RMM # 313 Head Protection Program
- RMM # 320: Personal Protective Equipment Program
- RMM# 321: Hand Protection Program



Risk Management Programs (RMMs)

- RMM # 500 Designated Substances Control Program
- RMM # 501 Hazardous Materials Management Systems/ WHMIS
- RMM # 502: Hazardous Waste Management Program
- RMM # 503 Chemical Weapons Convention Program
- RMM # 504 Compressed and Liquefied Gas Program
- RMM # 505 Transportation of Dangerous Goods Program



Specific Training


- Supervisors, Principal Investigators (PI) must identify real and potential hazards and train workers on these hazards
- Training is to eliminate the risk to workers from the hazard(s)
- Supervisors/PI must provide specific training, evaluate, and retain records. Specific training may include use of equipment, standard operating procedures (SOP)
- Workers must attend site-specific training from their Supervisor/PI on the hazards they may encounter



Controlling Hazards


- **At the Source:** (e.g. eliminate, substitute)
- **Administratively, or Along the Path:** (e.g. fume hood, SOPs)
- **At the Worker, or Personal Protective Equipment:** (e.g. goggles, gloves, lab coat)




Fume Hood Use


- Verify hood is working (e.g. Ventalert, flow meter, tissue movement)
- If fume hood is not working, inform your supervisor; use another fume hood and contact appropriate maintenance
- Fume hoods are NOT meant for storage






Fume Hood Use, Cont'd


- Set up equipment at least 6 inches into hood. Raise the equipment 6 inches from the work surface inside the hood to allow for uninterrupted air flow
- Set up experiment to ensure only arms extend past the sash
- Keep sash as low as possible, a 12 inch space is considered the proper working height
- Keep sash closed when not in use
- Wear personal protective equipment as appropriate
- Clean up



Fire Protection and Prevention Act


- Ontario Fire Code and Industrial Regulations: Section 4.12 provides information re: Laboratories/Studios
- Containers used for flammable and combustible liquids in a lab shall be of not more than 5 L (Section 4.12.3.1)
- Where individual containers with a capacity of more than 5 L are required for storage, safety containers conforming to ULC/ORD-C30, "Safety Containers", and of not more than 25 L capacity, shall be used (Section 4.2.6.4)





Fire Protection and Prevention Act, Cont'd


- Except as permitted in Sentence (3), not more than 300 L of flammable liquids and combustible liquids, of which not more than 50 L shall be flammable liquids, shall be permitted in the open area of a lab [4.12.3.1 (2)]
- Quantities in excess of those permitted in Sentence (2) shall be stored in cabinets conforming to Subsection 4.2.10 or in a room conforming to Subsection 4.2.9
- Containers of flammable liquids or combustible liquids shall be kept closed when not in use



Fire Protection and Prevention Act, Cont'd


Storage Cabinets shall


- Be labeled in conspicuous lettering to indicate that the cabinet contains flammable materials and that open flames must be kept away [4.2.10.4]
- Conform to ULC-C1275, "Storage Cabinets for Flammable Liquid Containers",
- Conform to ULI 1275, "Flammable Liquid Storage Cabinets",
- Be "FM Approved" by FM Global, or
- Be listed as meeting NFPA 30, "Flammable and Combustible Liquid Code" [4.2.10.5]



Static Electricity


Static electricity is the electric charge generated when there is friction between two things made of different materials or substances
(e.g. liquid poured from a container)





Do all types of containers have to be bonded or grounded?

- Only containers that conduct electricity, such as those made from metal or special, conductive plastics
- Non-conductive containers include polyethylene plastic or glass do not require bonding
- Details on bonding and grounding can be found in the Lab Safety Handbook





Refrigerators must meet Electrical Safety Code to store Class 1 Liquids [4.1.4.1]





Basic Principles of Personal Protective Equipment (PPE)

- PPE only provides a barrier between the hazard(s) and you
- Therefore must provide the maximum protection based on the hazard
- For example, rubber boots and rubber aprons must be worn when working with large volumes
- When selecting PPE, consult MSDS, your Supervisor/PI and Review the applicable Risk Management Manuals (RMMs)



Personal Protective Equipment Eyewear

- Safety goggles when handling hazardous chemicals (RMM# 310)
- Full face shield recommended when handling cryogenics, any explosion hazard or combustion and high-temp reactions.
- Contact lenses not recommended when working with chemicals





Personal Protective Equipment Gloves

- Select compatible gloves for type of chemicals being used (RMM# 321)
- Check safety supply catalogues for compatibility tables
- Inspect gloves for tears and holes prior to use





Personal Protective Equipment Lab Coat/Aprons (Handout)

- Lab coats are required and to be worn in the lab





Personal Protective Equipment Footwear

- Closed toed shoes must be worn in a chemical laboratory /studio (RMM# 312)
- Reasonable heel height should be a consideration when choosing footwear



Personal Protective Equipment Respirators

Contact EOHSS/FHSc for selection, use and care of respirators as per RMM # 311 and the CSA standard.





Handling Chemicals Safely

- Review and understand hazards **before** using a chemical (MSDS)
- Follow standard operating procedures (SOPs) developed in your lab, studio, or worksite
- Review McMaster University's Lab Safety Handbook
- Control your exposure through engineering, administrative and personal protective equipment (PPE)
- Review Risk Management Manual (RMM)




Handling Chemicals Safely, cont'd

- Chemicals falling under the Designated Substance Regulations provide specific requirements for Control Programs and may include medical monitoring
- Handling toxic, reactive, corrosive, or flammable chemicals requires wearing the appropriate Personal Protective Equipment (PPE) for the protection of eyes, face, hands, feet and body
- Annual Training and Fit testing is mandatory prior to using a respirator



Handling Chemicals Safely, cont'd


- Hazardous chemicals shall be used in a fume hood. Adequate ventilation must be maintained and use of an alarm system is mandatory
- Know the location of and how to use safety showers and eye wash stations
- Order sufficient quantities to eliminate unnecessary storage and/or disposal (i.e. smaller amounts)
- Ensure enough spill kits are available to contain all of the chemical(s) you are working with in case of a spill
- Ensure you are trained on how to use the appropriate spill kit(s)
- After handling chemicals and removing gloves, thoroughly wash hands




Toxic Chemicals

In addition to following Standard Safety Practices (Slides 31,32,33):

- Install and arrange maintenance for automatic monitors and alarms where asphyxiates are present
- Where required by law, keep chemicals locked up






Reactive Chemicals

In addition to following Standard Safety Practices (Slides 31,32,33):

- Isolate reactive chemicals from all other materials
- Provide secondary containment for all containers
- Avoid contact with combustible materials
- Date all peroxide forming materials and dispose of after a six month period



Corrosive Chemicals

In addition to following Standard Safety Practices (Slides 31,32,33):

- Use concentrated acids in fume hoods
- Transport corrosive chemicals in secondary safety container
- Provide secondary containment for all containers



Flammable Chemicals

In addition to following Standard Safety Practices (Slides 31,32,33):

- Keep away from heat, sparks and sources of ignition
- Keep containers closed, except when in use
- Ground all metal drums and transfer vessels
- Make sure your containers are labeled and stored in flammable cabinets or explosion proof refrigerator
- Know how to use a fire extinguishers and the location



Dispensing Flammables

- Pouring, dispensing, or transferring any liquid from a container labeled "Flammable" requires bonding and grounding
- Must be done in a fume hood






Compressed Gas

In addition to following Standard Safety Practices (Slides 31,32,33):


- May include an additional WHMIS class: know the full hazards of the gas you are working with
- Identify chemical contents of cylinder
- Cylinder must be chained individually
- Before moving cylinders, Remove Regulator and replace with safety cap
- Moving cylinders requires the use of a proper (3 or 4 wheeled) cart






Compressed Gas, Cont'd

- Toxic gases should to be stored in a dedicated flammable cabinet and used in a fume hood e.g. chlorine, ammonia
- Use only a regulator designated for the specific gas being used
- Gas Cylinder Training shall be taken before using compressed gases



When a Hazardous Gas Cylinder is Leaking:


- If there is a **FLAME** present, do not extinguish the flame before the cylinder is turned off, it could re-ignited explosively
- If possible move the leaking cylinder to a fume hood
- Make sure there are no incompatible chemicals nearby
- Do not take an elevator or go in an enclosed space
- Contact Security/Emergency Services



Compressed Liquids

In addition to following Standard Safety Practices (Slides 31,32,33):

- Compressed liquids may include an additional WHMIS class: know the full hazards of the gas you are working with (e.g. propane is a liquid when compressed)
- Compressed liquids present a danger of frost bite and burns



Hydrogen Fluoride (HF)

- Can cause severe burns and potentially life threatening health effects
- There is NO safe level of HF Exposure

If working with HF:

- HF Training
- HF Emergency Kit
- HF emergency protocol

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Video: Flammable and Explosives

- Definitions
- Ventilation
- Transporting
- Storage
- Compressed Gases
- Emergency Planning

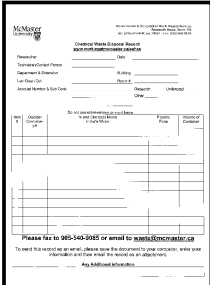


Waste Disposal: RMM # 502: Hazardous Waste Management Program

- Waste must be packaged in the appropriate containers for the chemical
- All waste containers must be labeled with the yellow Chemical Waste labels available through EOHSS or ABB Stores, Room B166
- Complete a Chemical Waste Disposal Record available at working@mcmaster.ca/eohss and fax to EOHSS at 905 540-9085
- Chemical waste will be picked up Tuesdays
- For FHSc, call 24956



Chemical Waste Disposal Record






Biological Waste Disposal

- Double bag in yellow or red bags, biomedical waste box or appropriate sharps container
- Labeled
- Cannot be stored longer than 4 days

See Lab Safety Handbook



Waste Pick Up Locations

- Ivor Wynne Centre (IWC)
- John Hodgins Engineering (JHE)
- General Science Building (GSB)
- Tandem Accelerator Building (TAB)
- Togo Salmon Hall (TSH)
- Psychology Building
- Nuclear Research Building (NRB)
- Burke Science Building (BSB)
- Life Science Building (LSB) (Biohazardous Waste)



Contaminated Broken Glassware

- For chemical contaminated glassware, pack in box lined with plastic bag
- Close bag and tape with packing tape
- Label box following disposal of chemical waste

Radioactive Broken Glassware: Call Health Physics (ext. 24226)

Biological Broken Glassware: Call Bio Safety Office (ext. 23453)



Empty Glass Disposal (Handout)


Water Soluable:

- Follow Chemical Waste procedure
- Rinse bottles, dry, deface label, place in hallway for custodial pick up (main campus only)

Toxic and Solvent:

- Follow Chemical Waste procedure
- Evaporate in fume hood
- Place in hallway for custodial pick up (main campus only)


Do Not Pour Chemicals Down the Drain!
Do Not Place Any Empty Chemical Bottles in Recycling!

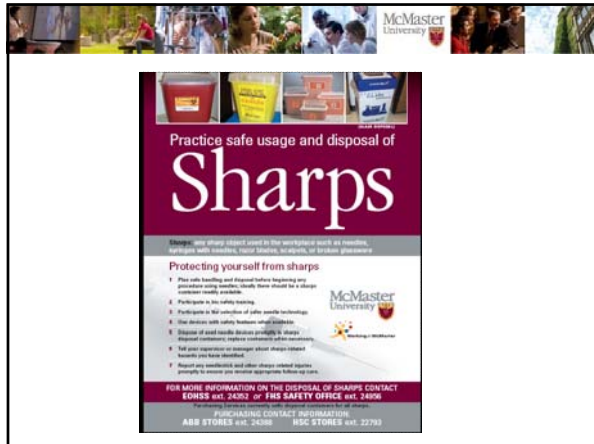


Sharps Disposal

- Needles
- Razors
- Blades


Must be in sharp containers






Chemical Spills

- Anyone using chemicals needs to plan for a spills response, including spills kits
- Each work area is unique, therefore, only the Supervisor/Principal Investigator and Workers involved can adequately plan to clean up the spill



When A Spill Occurs

- Move away from spill
- Determine type of spill: minor or complex
 - Minor spill may be cleaned up
 - Complex spill: follow Standard Operating Procedure (SOP)
- Refer to Material Safety Data Sheet (MSDS)
- Notify Supervisor/PI immediately




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Spills, cont'd

How to Identify a Minor or Complex Spill:

What is:

- The hazard(s) posed by chemical?
- The potential impact to health and environment?
- Spill size?
 - ◊ Type of chemical(s)
 - ◊ The amount
 - ◊ The location
 - ◊ Proper method for cleaning up spill
 - ◊ The Personal Protective Equipment (PPE) available
 - ◊ Training of the personnel



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Minor Spill

- Any amount that is safe to clean up
- Easily contained (away from drains, ignition sources, and incompatible chemicals)
- Not immediately dangerous to life or health (IDLH)
- No likelihood of fire or explosion
- Proper PPE is immediately available and worker has been fit tested/trained
- Appropriate spill kit is available and worker has been trained to use

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Complex Spill


- Any amount that is not safe to clean up
- Potential for release to atmosphere, discharge to sewer, leak directly into soils or surface water (environmental threat)
- Dangerous to life or health
- Likelihood of fire or explosion
- No PPE is available or worker has not been fit tested or trained
- Appropriate spill kit is not available






**Complex Spill, cont'd
Follow Site-Specific Standard Operating
Procedure (SOP)**

- Alert other staff in the area
- Pull fire alarm or call Security/Emergency Response
- Be prepared to provide details of chemical spill (location, amount, MSDS, and any other potential hazards/chemical mixtures)
- Notify Supervisor/Principal Investigator
- On Campus Security, dial 88
- Faculty of Health Science MUMC Site: 5555
- For Hospital hosted off site locations call a Code Brown
- For non hospital hosted locations, dial 911




Mercury Spill

- Isolate the area of spill (limit exposure to other personnel and prevent spread)
- As a Designated Substance, Mercury spills require specific spill clean up: Mercury Spills Kit are available
- A Mercury Vacuum is available in ABB Room 107. Access is available through ABB Room 156 or Security. In MUMC call ext. 5555; St. Joseph's call ext 7777
- Only trained workers may clean up a mercury spill
- Additional information is available in the Lab Safety Handbook




General Guidelines for Spill Cleanup

- Ventilate area if required
- Wear appropriate PPE before starting clean up; Obtain Spills Kit
- Place pads working from the outer edge of spilled liquid toward the centre of the spill
- Sprinkle absorbent from the outer edges toward the centre of the spill
- Collect and contain the clean up residues using tools to reduce contact with spilled material
- Decontaminate the area and equipment
- Decontaminate the surface where spill occurred
- Place waste including gloves into a double poly bag, label with chemical waste label
- Dispose of chemical waste as per RMM # 502
- Complete McMaster's Injury/Incident Form and fax to EOHSS (905) 540-9085 or, where applicable to FHSc Safety Office at (905) 525-8539
- Replace Spills Kit



Report and Follow Up

Complete Injury/Incident Report available on line www.workingatmcmaster.ca/ehss or pre-printed copy



Chemical Spill Kit

A Spills Kit will contain:

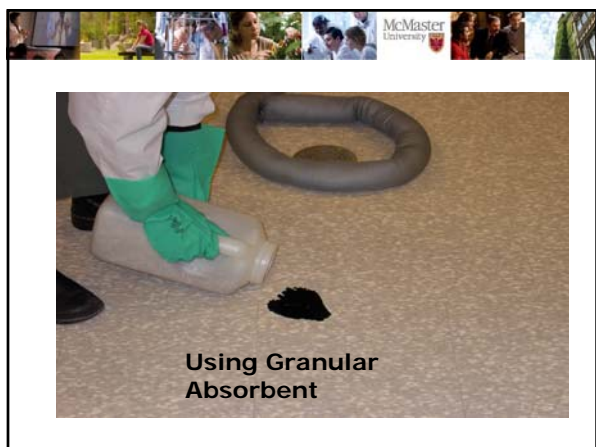
- Chemical goggles, face shield
- Gloves suitable for the chemical(s) you are working with
- Lab coat/apron
- Shoe covers

Basic equipment must be in a visible location and known to workers

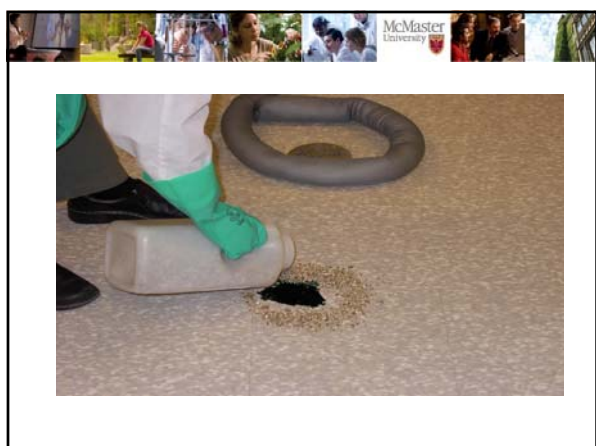
Respirators are to be stored where there is no potential for contamination

How to Clean Up a Spill Using a Spills Kit





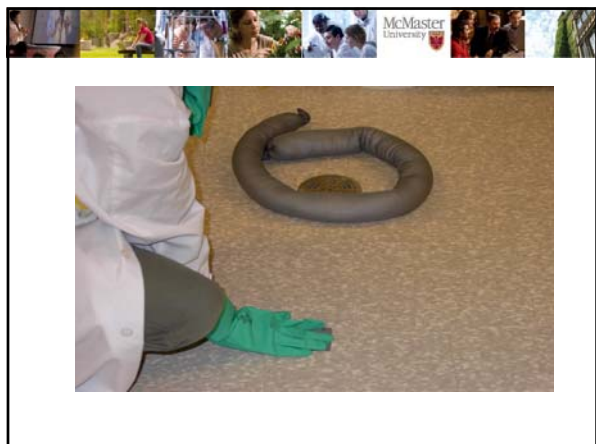
Using Granular Absorbent

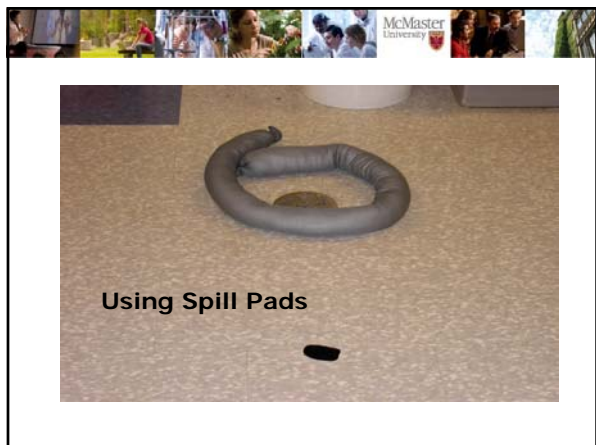


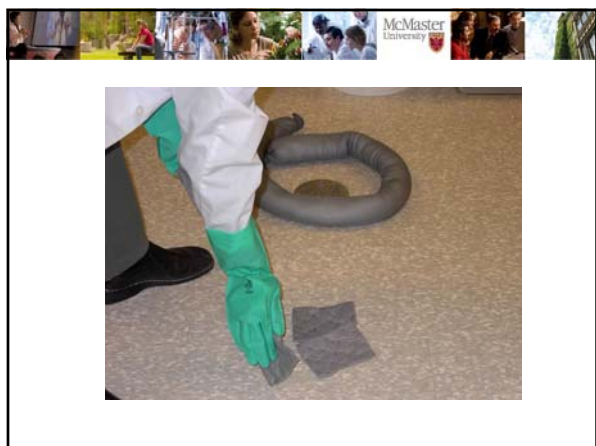


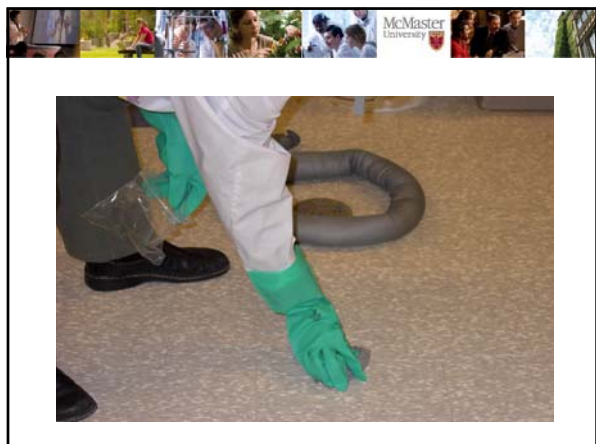


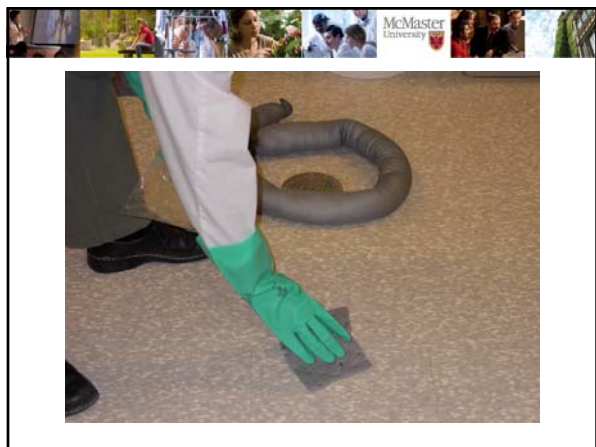


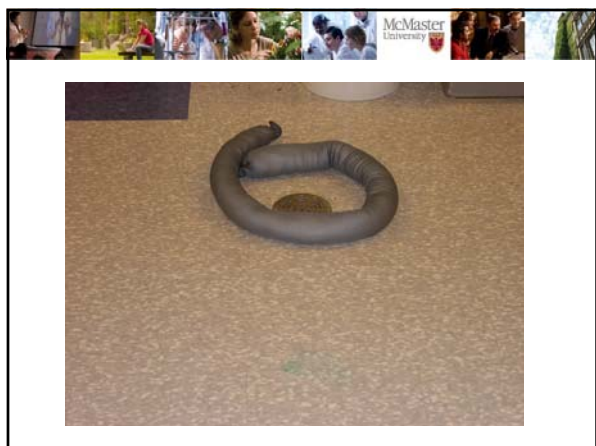














References and Resources

- www.workingatmcmaster.ca/eohss
- <http://fhs.mcmaster.ca/safetyoffice>
- www.ccohs.ca
- Laboratory Safety Handbook
- Fire Code:
<http://www.ofm.gov.on.ca/english/Legislation/firecode/Default.asp>
- Safe Disposal of Empty Chemical Bottles
- Lab Coat, Laundering / Disposal Options
- General Guidelines for Spills Clean Up
