University of Saskatchewan
Department of Mechanical Engineering
Standard Operating Procedure # Mat0001

Procedure Title: Materials Laboratory Practices

Minimum Review Requirements:	**Annually**
Creation Date:	**January, 2011**
Date of Next Review:	**January, 2012**
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1. Version History

Version #: .1
Supersedes: n/a

Handwritten amendments to the official procedures can be made by a single line through the text, along with the date, and initialed by the authorized individual making the correction. Changes are to be noted below. Formal changes to this SOP are made on the date of revision or sooner, where required.

Section	Changes made to official copy	Date	Initials

2. Introduction

Persons who do not follow this and other mechanical engineering Standard Operating Procedures will lose lab privileges (this may mean the inability to conclude research that is required for your degree).

This SOP provides general laboratory practices for the following:

1. Labeling, storing and disposing of hazardous and non-hazardous substances.
2. Collection, labeling and disposal of contaminated solid waste, such as gloves, HAZmat pads, paper towels, disposable spatulas, weigh boats or any other contaminated solid item.
3. Proper use, cleaning and storage of laboratory utensils, glassware and labware.
4. General solvent and chemical usage guidelines.

This SOP does not attempt to address the procedure, environmental controls or the PPE required for the use of any substances and the applicable MSDS's, SOP's and other relevant documentation must be considered before performing any task involving hazardous substances in the materials labs.

Relevant safety information can be found on the Department of Mechanical Engineering's Safety Webpage located at: http://www.engr.usask.ca/safety-me/. You must log in with your NSID and password.

All users of the materials labs (and their supervisors) **MUST** be familiar with the expectations listed on the safety website.

All users of the materials labs (and their supervisors) **MUST** consult the MSDS prior to working with a hazardous substance, and be familiar with the hazards, safe handling practices and PPE required to work with the substance. It is the end user's responsibility to follow laboratory rules.

Some substances, such as Hydrofluoric Acid (HF) or HF container materials are restricted and governed by their own specific SOP, it is the users responsibility to know if additional requirements exist for the substances they want to use.

ANY UNLABELLED CONTAINER (with a WHMIS or non-WHMIS substance) must be disposed of as unknown hazardous waste, and as such a service charge of up to **$250.00** is required for **EACH** container. This service charge will **be billed to the researcher's supervisor**, or in the event the supervisor cannot be identified it will be split between the most likely professors (i.e. professors who have students doing research in the particular location the substance is discovered).

3. Definition

SOP:	Standard Operating Procedure
MSDS:	Material Safety Data Sheet
WHMIS:	Workplace Hazardous Materials Information System
WHMIS Substance:	Any substance with an MSDS or that is hazardous to a person or the environment.
PPE:	Personal Protective Equipment

4. Personnel

Persons authorized to perform this SOP:

By signing this form I acknowledge that I have read and understand this SOP, as well as the applicable MSDS's and that I will conduct myself in accordance with this SOP and the general laboratory rules.

NOTE: ALL SIGNATURES MUST BE PRESENT ON THE SOP LOCATED IN THE YELLOW BINDER IN ROOM 2C26 – Mechanical Engineering Materials Lab, digital copies of SOP's are made available for reference and convenience only. Printed SOP's are valid for 24 hours only, after that time their accuracy must be verified with the **OFFICIAL HARDCOPY VERSION**.

Name (Print)	NSID	Dep't	Signature	Date
Robert Peace	Staff	ME		
Akindele Odeshi	Faculty	ME		
J.D. Johnston	Faculty	ME		
Qiaoqin Yang	Faculty	ME		
Ike Oguocha	Faculty	ME		
Jerzy Szpunar	Faculty	ME		

Name (Print)	NSID	Dep't	Signature	Date

5. Safety

- While handling hazardous products, use the appropriate environmental controls (fume hood, biosafety cabinet etc.) and wear appropriate PPE.
- See relevant MSDS and SOPs.
- All users of the materials labs **MUST** use a lab coat and appropriate gloves when working in the materials labs, glove type is material dependant and must be known prior to beginning any work.
- No Hazardous substances can be used outside of appropriate lab rooms (0C14, 2C26, 2C50).
- All hazardous chemicals including organic solvents such **as Acetone, methanol, toluene**, etc. **MUST** be used inside a fume hood.
- **Ethanol** in any quantity may be used outside of a fume hood and **Isopropyl alcohol** in small quantities can be used outside of a fume hood in a well ventilated area.
- Prior to beginning any procedure a waste container of suitable size (**maximum 10 L and have a screw lid**) must be labeled appropriately **with a NEW Chemical Waste Disposal Label**, as shown in Figure 2. **% of EACH Constituent MUST** be indicated on the label.

6. Procedure

6.1 Cleaning Glassware, Labware and Utensils

- All glassware, labware and utensils used with WHMIS substances, must be triple rinsed (with rinse water collected in an appropriately labeled waste container) immediately after their use, if after triple rinsing there still appears to be contamination, rinse an additional 3 times (collecting rinse water) and then wash the item in a sink with soap, the soapy water can be allowed to go down the drain.
- After cleaning, glassware should be placed on a sorbent pad and allowed to air dry for no more than 24 hours, after which it **MUST** be returned to its storage location.
- Any contaminated glassware, labware or utensils must be disposed of as if they contain unknown substances, and as such a **$250.00** fee will be charged to the researcher's supervisor for this disposal fee.
- All glassware, labware and utensils must be returned to their appropriate location, after they are allowed to dry, they are not to be left in a sink, fume hood or countertop for more than 24 hours after cleaning.

6.2 Labeling and Storing of WHMIS and Non-WHMIS Substances

Allowed Substances

- No substance is to be brought into the Materials laboratory without prior approval by a **faculty member AND the departmental assistant** supervising the area.

Labeling of WHMIS Substances

- Prior to re-packaging or mixing any WHMIS substance out of the original supplier labeled container the container **MUST** be labeled with a WHMIS workplace label and a storage classification sticker.
- All **Mixtures** must have their entire contents labeled with the composition in % indicated, i.e. 2% Nitric Acid in 98% Methanol, **ALL CONSTITUENTS MUST** be indicated along with their concentrations.
- **Temporary Labels** are allowable if a substance/mixture is not going to be stored, and is going to be used in less than one day. A temporary container (etching dish, beaker etc.) can be labeled with masking tape and a pen, some etching dishes will have a permanent marker label on them for a certain etchant, such as Nital (this would include 2%, 5% etc.), Potassium Permanganate and Sodium Hydroxide etc. These dishes must only be used for these etchants.
- **Waste Containers** must be appropriately labeled with either a WHIMIS label or a **Waste Disposal Label** (orange label from the University).

Figure 1 illustrates the features of a proper WHMIS workplace label.

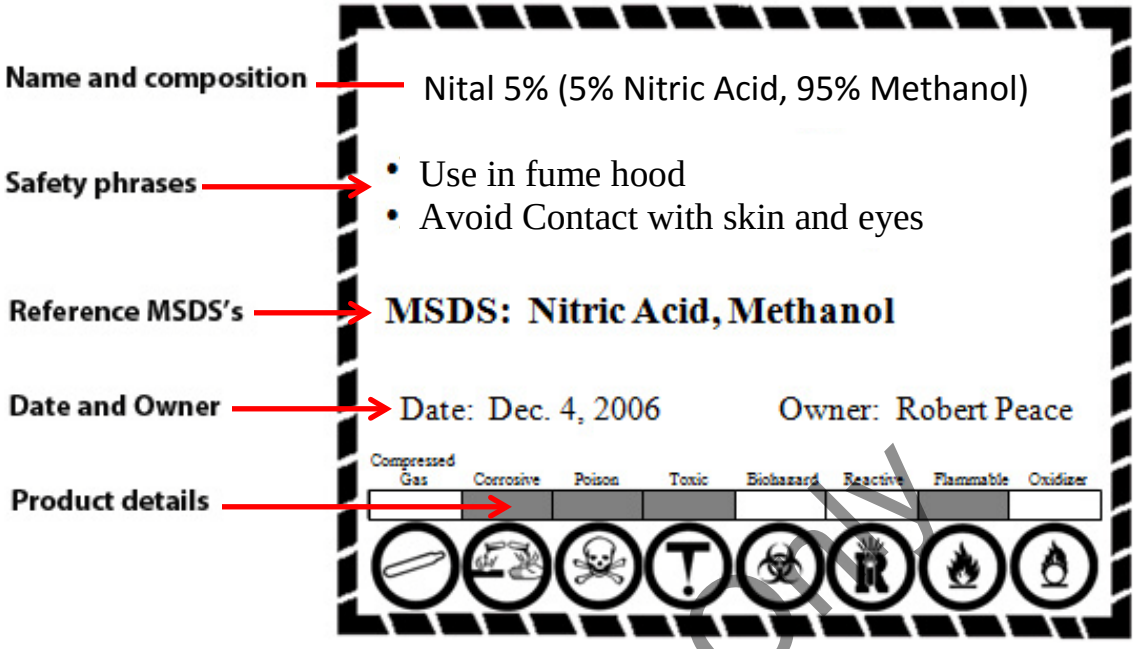

Figure 1: WHMIS workplace label.

Labeling of Non-WHMIS Substances

- Prior to re-packaging or mixing any non-WHMIS substance, the container **MUST** be labeled as described below.
- Substances such as soap, distilled water, tap water, oil samples etc. are not WHMIS regulated, however a label is still required, a WHMIS label can be used and is encouraged, however masking tape with pen or permanent marker (with masking tape or directly on the bottle) is acceptable.
- **ALL CONSTITUENTS MUST** be indicated along with their concentrations, regardless of its status as a WHMIS substance.

Storage of Substances

- All substances must be stored with compatible substances, the MSDS will have a list of incompatible substances, and the table provided below provides a general guide to chemical storage. In addition each substance will have a small colored dot on it (a sticker) indicating its storage code. **Substances with different colored stickers MUST NOT BE STORED TOGETHER**.
- NO hazardous substances can be stored under a sink.
- **Nitric Acid** must be stored separately from organic acids in secondary containment.

- **Hydrofluoric Acid must** be stored with a **Plastic** secondary containment container capable of containing the entire volume of the acid.
- **Hydrogen Peroxide must** be stored with secondary containment separate from organics.
- **Sulfuric Acid must** be stored with secondary containment.
- WHMIS substances **MUST not** be stored above eye level or where food products are used/stored.

Hazardous Storage Groups

F	Flammables	OA	Organic Acids
G	General	A	Acids
NA	Nitric Acid	O	Oxidizers
UIG	Under Inert Gas – Store in Dessicator	B	Bases

6.3 Hazardous Waste Disposal Procedures

Research groups are **required** to arrange for the disposal of their hazardous waste a minimum of every **2 months** or whenever a secondary containment bin becomes full, whichever occurs first.

6.3.1 Labeling of Liquid Hazardous Waste

- All **Mixtures** must have their entire contents labeled with the composition in % indicated, i.e. 2% Nitric Acid in 98% Methanol, **ALL CONSTITUENTS MUST** be indicated along with their concentrations.
- Labels must be of the orange type shown below for each shipping container.
- A shipping container is either a PLASTIC 10 L waste container or a cardboard box filled with smaller screw type containers or solid waste bags.

Note: It is required that the waste shipment number be filled in along with the number of containers in a shipment on the ORANGE waste disposal labels.

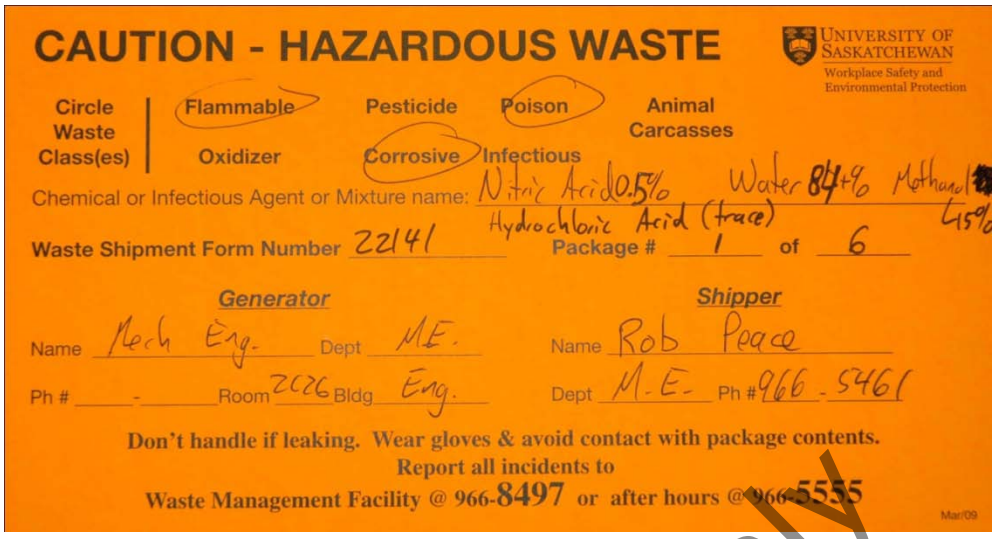

Figure 2: Sample Hazardous Waste Label for a 10L container.

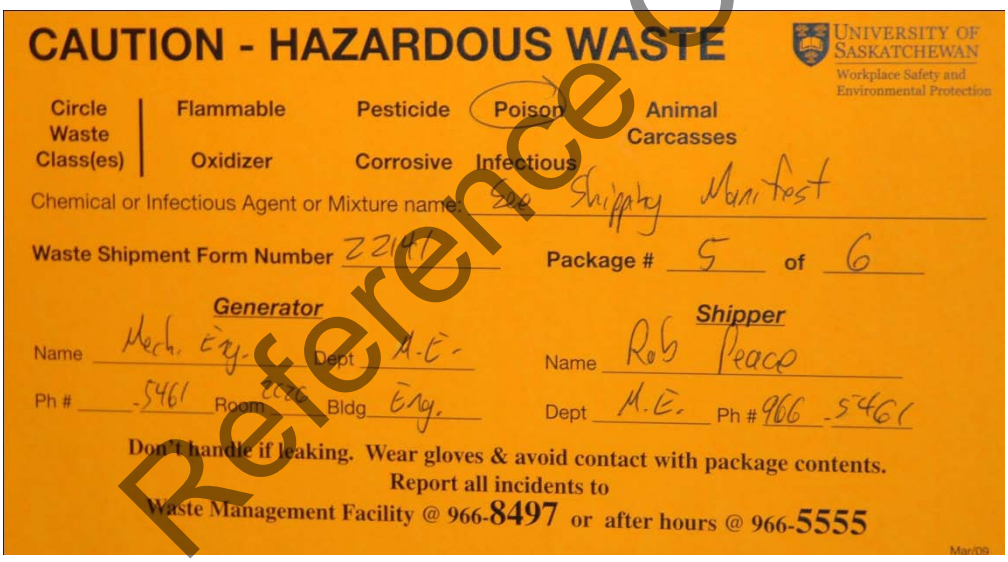

Figure 3: shows a Hazardous Waste Shipping Label for a box containing multiple labeled screw lid bottles.

NEW LABELS

Waste containers are often recycled and may have old labels on them, a NEW label must be filled in and used prior to using the waste container, it is easy to tell an old label from a new one as an old label will be at least partially crossed out and will have a Waste Shipment Number, a new label will not have a waste shipment number until I arrange for its disposal.

DO NOT COMBINE INCOMPATIBLE SUBSTANCES IN A WASTE CONTAINER, IF YOU ARE UNSURE OF COMPATIBILITY CHECK THE MSDS OR USE SEPARATE CONTAINERS.

Under **NO** circumstances can chemical waste be washed down the **sink** or contaminated waste placed in the **garbage**.

At the end of each experiment all waste must be collected, along with the rinse waste in the appropriately labeled container. All waste containers must be placed in the designated areas in the plastic secondary containment trays.

Flammable waste **must be** stored in a container of **5 L or less** (for mixtures if the volume is 40% or more flammable waste then the entire container is considered flammable).

All chemical waste must be collected in accordance with University of Saskatchewan regulations. These regulations can be found in the Hazardous Waste Disposal Manual, which is located with the MSDS binders in room 2C26, and is also available from the WSEP website.

Labeled waste can be disposed of for no fee; **unlabelled waste will result in a fee of $250.00 being charged to the researcher's (faculty) supervisor.**

Empty Containers (empty containers of HF or other highly hazardous materials must be disposed of as hazardous waste, less hazardous material containers can be disposed of as follows:

> Triple rinsed (rinse water collected in a labeled waste container) and then labeled as rinsed (original and all other labeling must be defaced). The containers should then be broken (glass) or punctured (Plastic) and disposed of through the regular garbage, glass cannot go directly into the garbage, it must be in a plastic lined cardboard box labeled as "sharps" or in a sharps container.
>
> Solvent bottles (acetone, methanol etc.) can be left open in a fume hood over night and do not need to be triple rinsed before being disposed of as indicated above.

The exterior of any waste container should be clean enough that you are comfortable touching it with a bare hand (although gloves should always be worn when handling waste disposal containers), if it is not triple wipe the exterior with a wet HAZmat or paper towel and collect the solid waste as indicated below.

6.3.2 Labeling of Contaminated Solid Waste

- **NO CONTAMINATED SUBSTANCES CAN BE PLACED IN THE GARBAGE**. Any substance that contains even trace amounts of a hazardous substance cannot be disposed of in the general garbage.
- Carefully, while wearing appropriate gloves and in a controlled safe manner collect any contaminated HAZmat pads, utensils or other disposable implements in a **labeled** re-sealable plastic bag. The bag should be labeled in permanent marker as: Trace amounts of: WHMIS substance. Such as: Trace 2% Nital, Trace 1g/1000ml NaOH solution. Etc.
- Only place **COMPATIBLE** chemical waste in the same container, if you are unsure ask for assistance or use separate containers.
- Place the **labeled sealed** plastic bag in the secondary containment chemical waste trays provided in the lab.
- If the outside of the bag becomes contaminated place it inside a non-contaminated bag and label the exterior bag.
- You should feel comfortable touching a waste disposal bag on the outside with a bare hand, if you are not then the outside is not sufficiently clean, however gloves should always be worn when touching waste disposal containers.
- Solid waste bags must be labeled individually, however for shipping purposes many bags can be placed in a cardboard box (see package 6 in the sample waste disposal form and Figure 3 for how to fill in the waste disposal label)

6.3.3 Waste Disposal Forms

Go to the website: http://www.usask.ca/dhse/includes/HWDF.php
Print the form and follow the instructions to fill it in properly, label the appropriate shipping containers and then fax the form to 6146.

A sample of a filled in waste disposal form follows, this shows the disposal of Plastic 10L containers, smaller liquid containers and solid contaminated waste.

University of Saskatchewan
Workplace Safety & Environmental Protection
Waste Management Facility
FAX : 966-6146
Disposal Questions:966-8497
wsep@usask.ca

HAZARDOUS WASTE DISPOSAL FORM

Page 1 of 4

PLEASE PRINT

Date: Jan. 18, 2011

Department: Mech. Engineering

Building & Room: 2C26 Eng.

Pick Up Location: _____
(if other than above)

WASTE SHIPMENT NO: 22141

Number of packages in this shipment: 6

Contact Name: Rob Peace

Email Address: rob.peace@usask.ca

Telephone: 966-5461

Waste Description & Container Type* *State type of container such as glass, metal, plastic, etc. Chemical Waste in Biohazardous Waste Bags Cannot Be Accepted.	Percentage Must=100%	No. Of Containers	Total Quantity L/KG	Pkg No.
Plastic - Mixture		1	10L	1
Nitric Acid	60			
Hydrochloric Acid	trace			
Methanol	15			
Water	84+			
Plastic Mixture		1	8L	2
Nitric Acid	1			
Ethanol	14			
Water	85			

MIXTURES (more than 2 components): Print **"MIXTURE"** and state **total** quantity in container.

Then list all components and their concentrations **by percentage** to equal 100%.

WARNING: DO NOT package incompatibles in the same container!

Glass bottles must be packed in sturdy containers with sufficient packing material.

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Plastic - Mixture		1	2L	3
Phosphoric Acid	5			
Water	95			
Plastic - Mixture		1	5L	4
Potassium Chloride	30g			
Cupric Sulphate	1			
Potassium Ferrocyanide	1			
Agar	20g			
Water	98			
phenolphthalein	trace			

MIXTURES (more than 2 components): Print **"MIXTURE"** and state **total** quantity in container.

Then list all components and their concentrations **by percentage** to equal 100%

WARNING: DO NOT package incompatibles in the same container!

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Waste Description & Container Type* *State type of container such as glass, metal, plastic, etc. Chemical Waste in Biohazardous Waste Bags Cannot Be Accepted.	Percentage Must=100%	No. Of Containers	Total Quantity L/KG	Pkg No.
Plastic - Mixture		1	500ml	5
Water	93			
Chloroform	5			
(FeO_3) iron III Oxide	1			
(PLGA) polylactic-co-glycolic acid	1			
Plastic - Mixture		1	300ml	5
Diapro Paint (water based) (diamond)	2			
Motor Oil	1			
Acetone	97			
Plastic - Ferrofluid (EFH1)	100	2	120ml	5

MIXTURES (more than 2 components): Print **"MIXTURE"** and state **total** quantity in container.
Then list all components and their concentrations **by percentage** to equal 100%.
WARNING: DO NOT package incompatibles in the same container!
Glass bottles must be packed in sturdy containers with sufficient packing material.

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Pick Up Location: _____
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Contact Name: Rob Peace
Email Address: rob.peace@usask.ca
Telephone: 966-5461

Waste Description & Container Type* *State type of container such as glass, metal, plastic, etc. Chemical Waste in Biohazardous Waste Bags Cannot Be Accepted.	Percentage Must=100%	No. Of Containers	Total Quantity L/KG	Pkg No.
Cardboard {Plastic bags}		5	1 kg	6
contaminated gloves, towels, stir sticks etc.				
Kevlar & Epoxy	trace			
Plastic bags				
contaminated solid waste		4	1 kg	6
N,N-Dimethyl formamide	trace			
Methanol	trace			
Plastic bag		1	0.5 kg	6
contaminated solid waste				
Chloroform	trace			
(FeO_3) iron III Oxide	trace			
(PLGA) polylactic-co-glycolic acid	trace			

MIXTURES (more than 2 components): Print **"MIXTURE"** and state **total** quantity in container.
Then list all components and their concentrations **by percentage** to equal 100%
WARNING: DO NOT package incompatibles in the same container!
Glass bottles must be packed in sturdy containers with sufficient packing material.

6.4 Storage of Hazardous Waste

- All hazardous waste must be stored with compatible substances, the MSDS will have a list of incompatible substances, and the table provided below provides a general guide to chemical storage. In addition each substance will have a small colored dot on it (a sticker) indicating its storage code. **Substances with different colored stickers MUST NOT BE STORED TOGETHER**.

7. Equipment or Materials Required

- WHMIS workplace labels
- Chemical Waste Disposal Labels
- Substance Classification Sticker (colored Dot)
- Proper containers (MUST have a **SCREW LID**) and be less than **10 Litres** in volume for liquid storage.
- Marker and/or pen.

8. Regulatory / Standards

University of Saskatchewan Hazardous Waste Disposal Manual: Hazardous Waste Disposal:http://www.usask.ca/dhse/file_view/download.php/Hazardous+Waste+Disposal+Manual+Aug+2007.pdf?id=3&view=1

9. References

University of Saskatchewan WSEP Documents:
Chemical Safety Code (Draft):
http://www.usask.ca/dhse/chemicalsafety/codes.php

Hazardous Waste Disposal:
http://www.usask.ca/dhse/file_view/download.php/Hazardous+Waste+Disposal+Manual+Aug+2007.pdf?id=3&view=1

Laboratory Safety Manual:
http://www.usask.ca/dhse/file_view/download.php/Laboratory_Safety_Manual.pdf?id=32&view=1

Canadian Centre for Occupational Health and Safety (MSDS reference):
http://ccinfoweb.ccohs.ca/msds/search.html