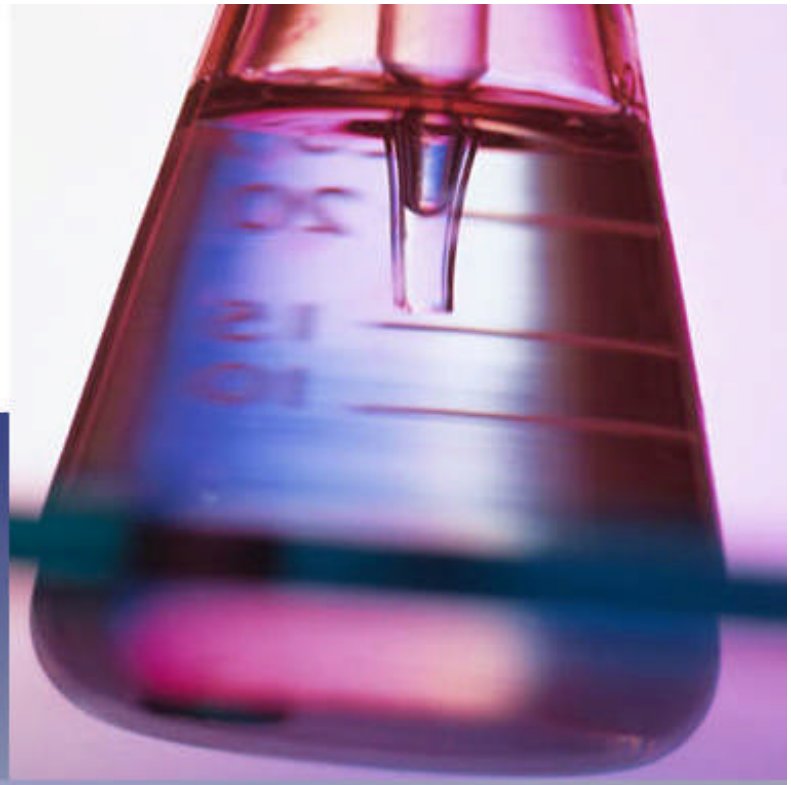
BALL STATE UNIVERSITY®

LABORATORY SAFETY

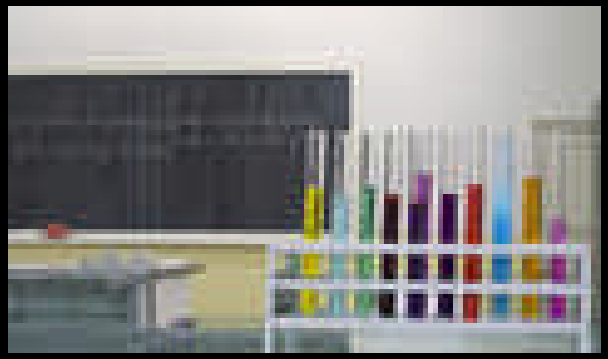


Presented by the:

Environmental Health and Safety Office

Lab/Research/Field Safety

Involves & relies on



Teaching Laboratories

Laboratory Research

Field Research

Chemical Hygiene Officer

Fire Prevention, Building Design & Maintenance, Industrial Hygienists etc.

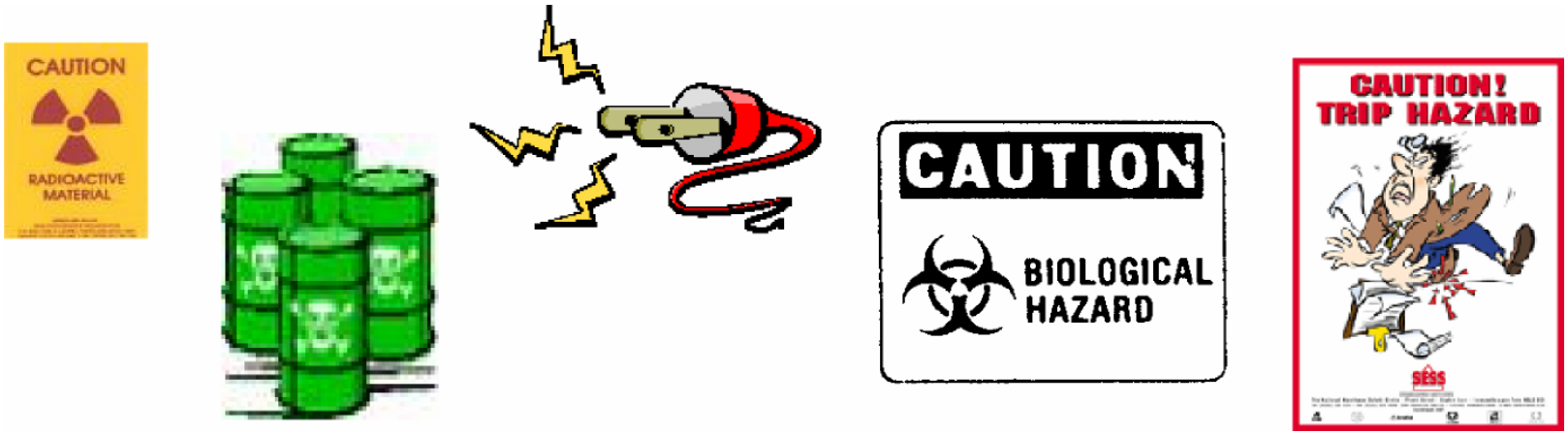
Radiation & Biological Safety Officers

OSHA Accident Investigations Findings

- Exposures to toxic or physical agents in the laboratory can have severe consequences, including death.
- These injuries can occur in any type of setting where toxic chemicals are handled.
- Most all chemical injuries and biological exposures would be preventable--
- If these people had had the *proper equipment*, if they had been using the *proper techniques* and if they had had *adequate knowledge*, such exposures probably would not have occurred.

General Laboratory Hazards

Laboratory hazards are often classified into two categories, those due to *unsafe acts by persons* and those due to *unsafe conditions in the workplace* environment. Of the two, hazards arising from unsafe acts are more prevalent than hazards related to unsafe conditions. [1]



[1] Young J.A. (1987). Improving Safety in the Chemical Laboratory. New York, John Wiley and Sons.

Occupational Exposure to Hazardous Chemicals in the Laboratories Regulation (Lab Standard)

THE KEY ELEMENTS OF THIS OSHA REGULATION ARE AS FOLLOWS:

- A written Chemical Hygiene Plan must be created and accessible to employees when hazardous chemicals or hazardous operations are involved.
- A Chemical Hygiene Officer must be appointed.
- Employees shall be protected from occupational exposure to hazardous chemicals.
- Employees shall be provided and informed of the Material Safety Data Sheets (MSDSs) and other reference material.
- Employees shall be informed of the hazardous chemicals present in the lab/field or of the hazardous operations in which they are involved.
- Employees handling hazardous chemicals must be appropriately trained before doing any work involving hazardous chemicals or hazardous operations.
- Engineering controls and personal protective equipment must be provided, maintained, and replaced when necessary.
- Employees must be informed of the procedures to follow to respond to emergencies.

Ball State University Chemical Hygiene Plan

Chemical Hygiene Plan

- The BSU Chemical Hygiene Plan applies to all BSU “employees” who work in teaching, research, field, or clinical labs where hazardous materials (chemicals or biologicals) are stored or used.
- Students are also covered by the BSU Chemical Hygiene Plan as a matter of University Policy (“Standard of Care”).

CHP Contents

***Standard Operating Procedures* (SOP's)** are written procedures explaining how to safely work with hazardous chemicals.

Requires Lab-specific SOPs for any work with *Particularly Hazardous Substances* – Select Carcinogens, Highly Toxic Chemicals, Reproductive Toxins

Other Topics:

General Laboratory Safety
Hazard Identification and Labeling
Exposure Incidents and Monitoring
Personal Protective Equipment (PPE)
Emergency Equipment
Lab Worker Training
Laboratory Ventilation
Particularly Hazardous Materials

Appendices:

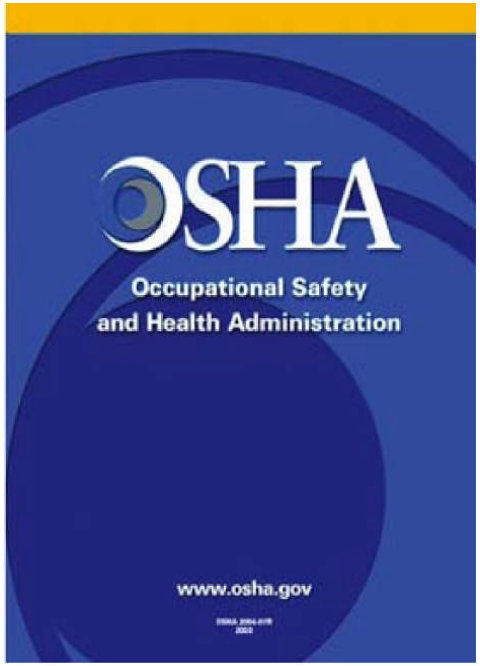
PPE Selection Charts
Chemical Information Tables
Laboratory Inspection Protocols
BSU Waste Management Guide
Fume Hood Inspection Guide
Lab Safety and Pregnancy
Standard Operation Procedures
OSHA Laboratory Standard (copy)
Spill Prevention and Control (soon)

\\ilocker.bsu.edu\users\tlrussell\WORLD_SHARED ---BSU CHP LOCATION

What are the Hazards

There are three general hazard classes that must be evaluated when assessing the safety of laboratory work:

- **Physical Hazards**
- **Health Hazards**
- **Biological / Infectious Hazards**



Physical Hazards - Chemicals

"scientifically valid evidence" it is a:

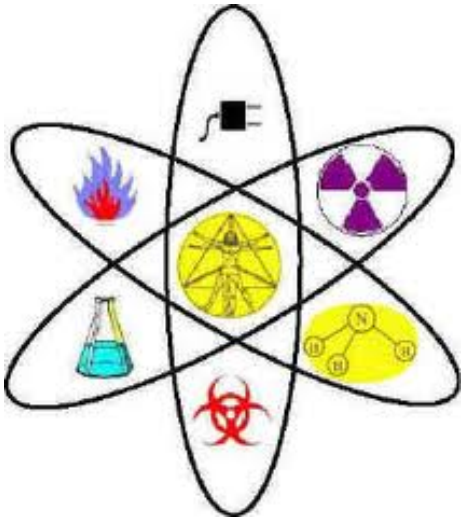
- combustible liquid
- compressed gas
- *explosive*
- flammable
- organic peroxide
- oxidizer
- *pyrophoric*
- unstable (reactive)
- water-reactive

Health Hazards - Chemicals

"**Statistically Significant Evidence**" that acute or chronic health effects may occur in exposed employees

- ***carcinogens***
- ***toxic or highly toxic agents***
- ***reproductive toxins***
- **irritants**
- **corrosives**
- **sensitizers**
- **hepatotoxins**
- **nephrotoxins**
- **neurotoxins**
- **hematopoietic damaging agents**
- **Or, anything that damages --**

  lungs, skin, eyes or mucous membranes



Biohazardous Materials

An agent of biological origin that has the capacity to produce deleterious effects on humans.

These agents may include, but are not limited to:

- **bacteria**
- **viruses**
- **fungi**
- **recombinant DNA**
- **pathogens carried by cultured cell lines**
- **toxins and allergens derived from biological organisms**
- **bloodborne pathogens**

Biological Hazards: Risk Groups

- Found in the *NIH Guidelines*
- Classified into risk groups on the basis of risk to the individual and to the community.
- Currently, 4 risk group levels designated.

  --the least risk (RG-1) to the most risk (RG-4).

Risk Group 1 (RG1)	**Agents that are not associated with disease in healthy adult humans**
Risk Group 2 (RG2)	**Agents that are associated with human disease which is rarely serious and for which preventive or therapeutic interventions are *often* available**
Risk Group 3 (RG3)	**Agents that are associated with serious or lethal human disease for which preventive or therapeutic interventions *may be* available (high individual risk but low community risk)**
Risk Group 4 (RG4)	**Agents that are likely to cause serious or lethal human disease for which preventive or therapeutic interventions are *not usually* available (high individual risk and high community risk)**

Hazard Identification / Assessment

Hazard Identification

- **What do I Need to Know about a chemical?**
  - What kind of hazard(s) does it present?
  - What are the routes of exposure?
  - What are the exposure limits?
  - Does the dose represent an acute or chronic exposure?
    - *How much am I working with and for how long?*
  - Safe handling procedures?
  - PPE requirements?
  - Disposal requirements?

Quantifying Exposure limits

MSDSs list known exposure limits for various components or means of exposure to a substance.

Inhalation Exposure limits are from several sources:

- *Permissible Exposure Limits (PELs) – OSHA*
- *Threshold Limit Values (TLVs) – ACGIH*
- *Recommended Exposure Levels (RELs)–NIOSH*
- *LC_{50} (lethal concentration)*

Ingestion hazards:

- *LD_{50} (lethal dose)*

Absorption hazards:

- *Skin Designations*
- *LD_{50} (dermal)*

Hazard Identification

Where Do I Get this Information?

- *Container label*
  - Identity, target organs, hazards, warnings
- *Material Safety Data Sheets (MSDS)*
- *Teaching Faculty / Principal Investigator*
- *Department Lab Manager or Technician*
- *BSU Environmental Health & Safety*
- *ChemTracker* (being implemented)

MSDSs (or, now, SDSs)

Material Safety Data Sheets

A *Material Safety Data Sheet* (MSDS) is a valuable reference. It is important to consult an MSDS before introducing a new chemical into a lab protocol or working with hazardous substances.

Prepared by its manufacturer, an MSDS provides information to help you understand the intrinsic hazards of the chemical including:

- *Physical and chemical properties*
- *Reactivity and stability information*
- *Physical and Health Hazards*
- *Acute and chronic toxicity information*
- *Permissible exposure limits*
- *Exposure control measures*
- *Handling and storage information*
- *Waste disposal*

Must be kept for 30 years after use discontinued

MSDS Example

SIGMA-ALDRICH sigma-aldrich.com

Material Safety Data Sheet

Version 4.4
Revision Date 04/21/2012
Print Date 08/06/2012

1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	Ethanol
Product Number	:	E7023
Brand	:	Sigma-Aldrich
Supplier	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone	:	+1 800-325-5832
Fax	:	+1 800-325-5052
Emergency Phone # (For both supplier and manufacturer)	:	(314) 776-6555
Preparation Information	:	Sigma-Aldrich Corporation Product Safety - Americas Region 1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards
Flammable liquid, Target Organ Effect, Irritant, Carcinogen

Target Organs
Nerves., Liver, Heart

GHS Classification
Flammable liquids (Category 2)
Skin irritation (Category 2)
Eye irritation (Category 2B)
Specific target organ toxicity - single exposure (Category 3)

GHS Label elements, including precautionary statements

Pictogram

Signal word: Danger

Hazard statement(s)

H225	Highly flammable liquid and vapour.
H315 + H320	Causes skin and eye irritation.
H335	May cause respiratory irritation.

Precautionary statement(s)

P210	Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

HMIS Classification

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	3
Physical hazards:	0

NFPA Rating

Health hazard:	2
Fire:	3
Reactivity Hazard:	0

Potential Health Effects

Inhalation	May be harmful if inhaled. Causes respiratory tract irritation.
Skin	May be harmful if absorbed through skin. Causes skin irritation.
Eyes	Causes eye irritation.
Ingestion	May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms	:	Ethyl alcohol
Formula	:	C2H6O
Molecular Weight	:	46.07 g/mol

Component		Concentration
Ethanol		
CAS-No.	64-17-5	-
EC-No.	200-578-6	
Index-No.	603-002-00-5	

4. FIRST AID MEASURES

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability
Flammable in the presence of a source of ignition when the temperature is above the flash point. Keep away from heat/sparks/open flame/hot surface. No smoking.

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products
Hazardous decomposition products formed under fire conditions. - Carbon oxides

Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions
Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

MSDS Example

Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

7. HANDLING AND STORAGE

Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Use explosion-proof equipment. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

Conditions for safe storage
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Hygroscopic.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Basis
Ethanol	64-17-5	TWA	1,000 ppm	USA. ACGIH Threshold Limit Values (TLV)
Remarks	Upper Respiratory Tract irritation Confirmed animal carcinogen with unknown relevance to humans			
		TWA	1,000 ppm 1,900 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	1,000 ppm 1,900 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
	The value in mg/m3 is approximate.			
		TWA	1,000 ppm 1,900 mg/m3	USA. NIOSH Recommended Exposure Limits

Personal protective equipment

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Immersion protection
Material: butyl-rubber
Minimum layer thickness: 0.3 mm
Break through time: > 480 min
Material tested:Butoject® (Aldrich Z677647, Size M)

Splash protection
Material: Nitrile rubber
Minimum layer thickness: 0.2 mm
Break through time: > 30 min
Material tested:Dermatril® P (Aldrich Z677388, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 873000, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an Industrial Hygienist familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Eye protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection
impervious clothing, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	liquid, clear
Colour	colourless

Safety data

pH	no data available
Melting point/freezing point	-144.0 °C (-227.2 °F)
Boiling point	78.0 - 80.0 °C (172.4 - 176.0 °F)
Flash point	14.0 °C (57.2 °F) - closed cup
Ignition temperature	363 °C (685 °F)
Autoignition temperature	363.0 °C (685.4 °F)
Lower explosion limit	3.3 %(V)
Upper explosion limit	19 %(V)
Vapour pressure	59.5 hPa (44.6 mmHg) at 20.0 °C (68.0 °F)
Density	0.79 g/cm3
Water solubility	completely soluble
Partition coefficient: n-octanol/water	no data available
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability
Stable under recommended storage conditions.

Possibility of hazardous reactions

Vapours may form explosive mixture with air.

MSDS Example

Conditions to avoid
Heat, flames and sparks. Extremes of temperature and direct sunlight.

Materials to avoid
Alkali metals, Ammonia, Oxidizing agents, Peroxides

Hazardous decomposition products
Other decomposition products - no data available
Hazardous decomposition products formed under fire conditions. - Carbon oxides

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50
LD50 Oral - rat - 7,060 mg/kg
Remarks: Lungs, Thorax, or Respiration:Other changes.

Inhalation LC50
LC50 Inhalation - rat - 10 h - 20000 ppm

Dermal LD50
no data available

Other information on acute toxicity
no data available

Skin corrosion/irritation
Skin - rabbit - Irritating to skin. - 24 h

Serious eye damage/eye irritation
Eyes - rabbit - Mild eye irritation - 24 h - Draize Test

Respiratory or skin sensitization
no data available

Germ cell mutagenicity
no data available

Carcinogenicity

Carcinogenicity - mouse - Oral
Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Liver:Tumors. Blood:Lymphomas including Hodgkin's disease.

IARC:	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
Reproductive toxicity - Human - female - Oral
Effects on Newborn: Apgar score (human only). Effects on Newborn: Other neonatal measures or effects. Effects on Newborn: Drug dependence.

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)
Inhalation - May cause respiratory irritation.

Specific target organ toxicity - repeated exposure (Globally Harmonized System)
no data available

Aspiration hazard
no data available

Potential health effects

Inhalation	May be harmful if inhaled. Causes respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. Causes skin irritation.
Eyes	Causes eye irritation.

Signs and Symptoms of Exposure
Central nervous system depression, narcosis, Damage to the heart., To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects
no data available

Additional Information
RTECS: KQ6300000

12. ECOLOGICAL INFORMATION

Toxicity

no data available

Persistence and degradability
no data available

Bioaccumulative potential
no data available

Mobility in soil
no data available

PBT and vPvB assessment
no data available

Other adverse effects

13. DISPOSAL CONSIDERATIONS

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

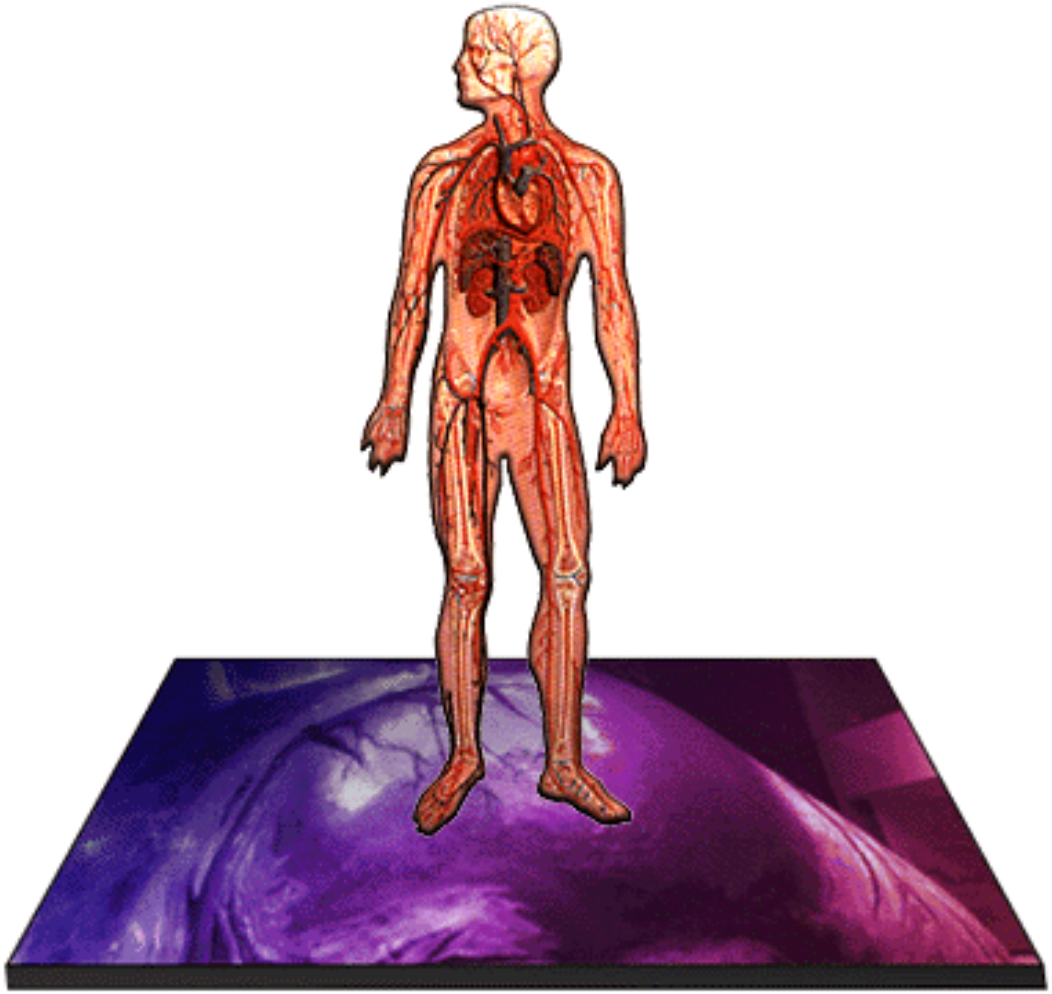
14. TRANSPORT INFORMATION

DOT (US)
UN number: 1170 Class: 3 Packing group: II
Proper shipping name: Ethanol
Reportable Quantity (RQ):
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG
UN number: 1170 Class: 3 Packing group: II EMS-No: F-E, S-D
Proper shipping name: ETHANOL
Marine pollutant: No

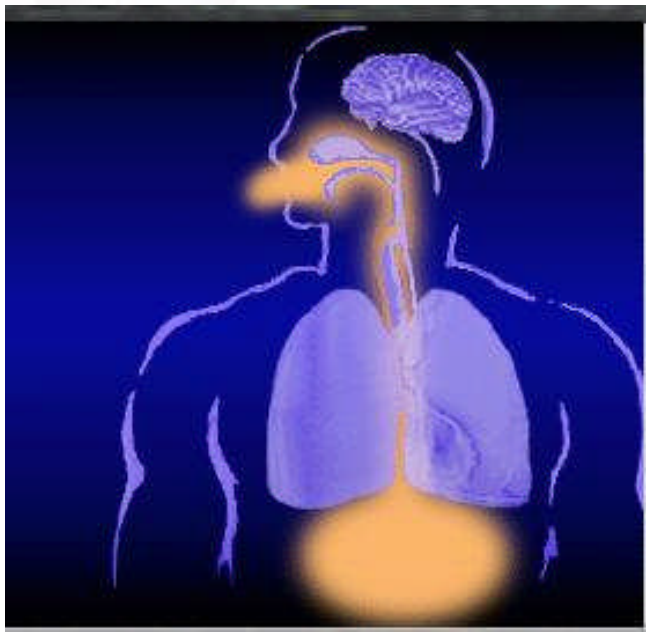
IATA

Routes of Exposure



Ingestion
Absorption
Inhalation
Injection

Ingestion

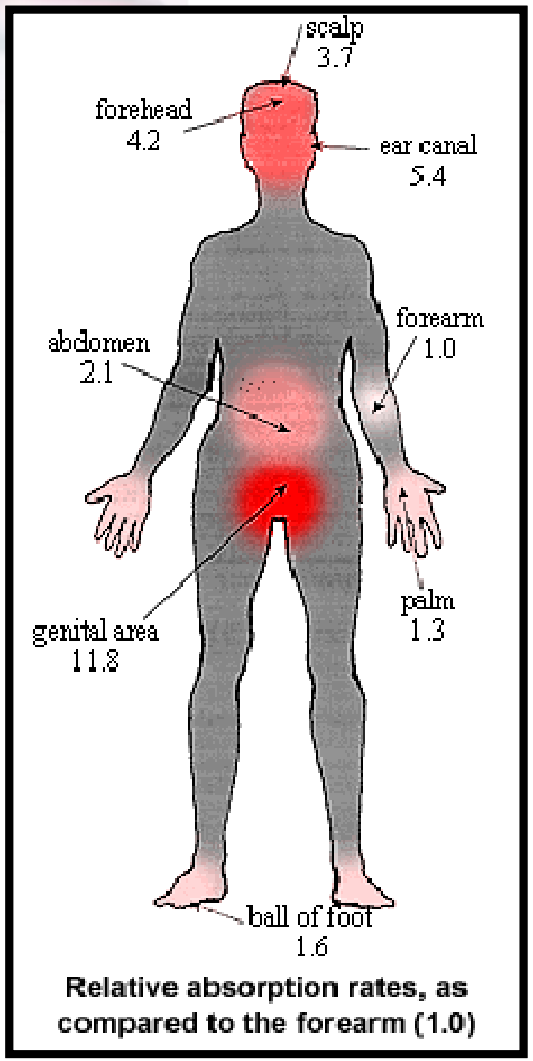


Ingestion rarely happens intentionally

- No food and no drinks
- No applying makeup
- No mouth pipetting
- Don’t wear gloves outside of laboratory
- Don’t wear gloves while typing
- Don’t chew on pens or other objects

Personal hygiene, labeling, and housekeeping are important to ingestion prevention

Absorption

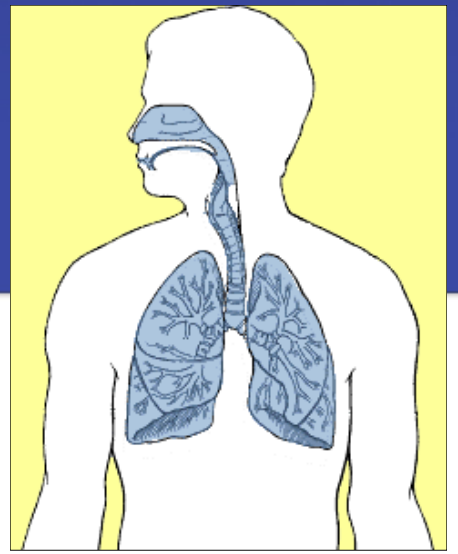


Relative absorption rates, as compared to the forearm (1.0)

- Chemicals enter the body through skin layer or through the eyes or mucous membranes
- Can occur very quickly through cuts or abrasions on the skin
- Depending on the characteristics of the contaminant, absorption may occur through intact skin
(examples: phenol, DMSO, hydrofluoric acid)

Barrier protection (such as gloves) and personal hygiene are the primary control measures.

Inhalation



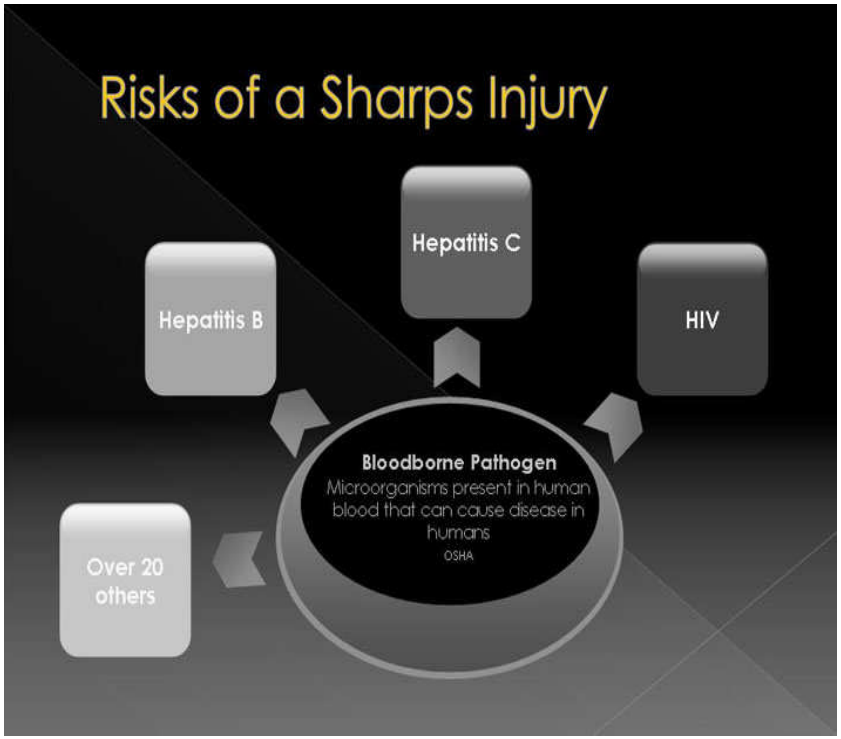
- Primary Route of Entry
- Airborne contaminants such as gases, vapors and particulate matter that enter directly into lungs.

Chemical fume hood / biosafety cabinets are the primary controls available. Respiratory protection or specialized exhaust may be necessary where hoods or cabinets cannot be used.

Injection

- Accidental Route of Entry
- Normally biological, but may be chemical contaminant.

Proper handling and disposal of sharps and pneumatic injection are primary controls



Hazard Controls

Chemical Storage
Chemical Transportation

Chemical Storage

Chemical Storage-Requirements

- There must be an inventory list of hazardous chemicals as defined in the BSU Chemical Hygiene Plan (ChemTracker).
- Chemical containers must be labeled with a minimum of chemical name and hazard warnings.
- Containers should be dated when received and opened.
- Accompanying Material Safety Data Sheets must be kept.
- Containers must be compatible with the substance and kept closed when not filling or emptying.
- Never use food or beverage containers to store chemicals, biologicals, or waste materials

Chemical Storage

- Do not store liquid chemicals above eye level.
- Do not store chemicals in aisle ways or on floors.
- Avoid over stocking shelves.
- Do not store heavy containers above shoulder level.
- Do not store chemicals in fume hoods or on counters
- Do not store chemicals near sources of heat or in direct sunshine.
- Provide secondary containment for incompatibles –or liquids if near sinks or drains

Chemical Handling

Avoid overhead storage of hazardous chemicals!

Do not store liquids near sink drains

Storage: Segregate Incompatibles

Mix these and flaming acid (oxidizer + organic) will result.

Chemical Storage – Hazard Class

At a minimum, chemicals should be segregated as:

Corrosives

Oxidizers

Flammable Liquids

Poisons or Toxic Chemicals

Reactive (water or time sensitive)

Chemical Compatibility

Chemical Category	Storage Consideration
Corrosives: Inorganic Acids	In an Acids or Corrosive Cabinet. Use secondary containment to separate from other acids and bases (for example: organic acids, inorganic bases, oxidizing acids)
Corrosives: Organic Acids	In an Acids or Corrosive Cabinet. Use secondary containment to separate from other acids and bases. If oxidizing acids are present move them to the flammables cabinet in secondary containment to separate from flammables.
Corrosives: Oxidizing Acids	In an Acids or Corrosive Cabinet. Use secondary containment to separate from other acids and bases (for example: inorganic acids, inorganic bases). Remove ALL organic material from this cabinet.
Inorganic Bases	In a Bases or Corrosive Cabinet. Use secondary containment to separate from other acids and bases (for example: inorganic acids, oxidizing acids)
Flammable & Combustible Liquids	In a Flammables Cabinet (preferably a metal, commercially manufactured cabinet designed for storage of flammables)
Compressed Gases	Secure by a chain or strap half to three quarters of the way up the cylinder to prevent them from falling.
Organic Peroxides	This material is an organic oxidizer. Store by itself in secondary containment to separate from other organic and inorganic chemicals.
Oxidizers	In secondary containment to separate from other organic and inorganic chemicals.
Reactives (Water, Pyrophoric & Explosive Materials)	Due to the varying characteristics of these materials contact Safety and Health for guidance.
Toxic & Environmentally Hazardous Chemicals	Store in separate Toxics storage area OR in separate secondary containment in a Flammables Storage Cabinet.

Chemical Compatibility - Stanford

Stanford University Compatible Storage Group Classification System
Should be used in conjunction with specific storage conditions taken from the manufacturer's label and MSDS.

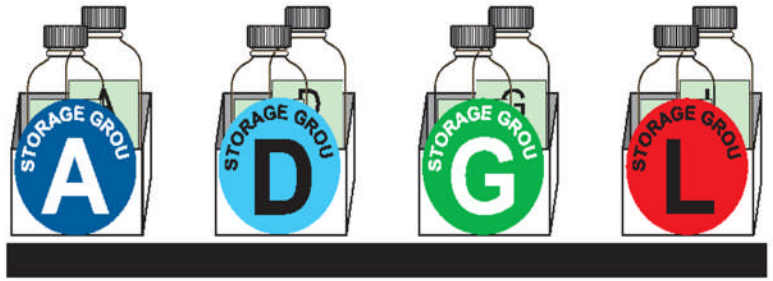
STORAGE GROUPS

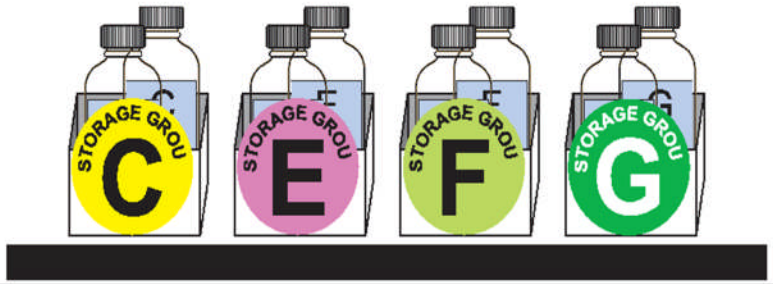
Store chemicals in separate secondary containment and cabinets
Find Storage Group information in Chemtracker:
https://chemtracker.stanford.edu/chemsafety

A	Compatible Organic Bases
B	Compatible Pyrophoric & Water Reactive Materials
C	Compatible Inorganic Bases
D	Compatible Organic Acids
E	Compatible Oxidizers including Peroxides
F	Compatible Inorganic Acids not including Oxidizers or Combustible
G	Not Intrinsically Reactive or Flammable or Combustible
J*	Poison Compressed Gases
K*	Compatible Explosive or other highly Unstable Material
L	Non-Reactive Flammable and Combustible, including solvents
X*	Incompatible with ALL other storage groups

***Storage Groups J, K and X: Contact EH&S @ 3-0448**
For specific storage - consult manufacturer's MSDS

If space does not allow Storage Groups to be kept in separate cabinets the following scheme can be used with extra care taken to provide stable, uncrowded, and carefully monitored conditions.





Storage Group X must be segregated from all other chemicals.

Storage Group B is not compatible with any other storage group.

Last updated 04/17/09

Chemical Storage Guidelines

The laboratory room, storage area, and cabinets should be labeled to identify the hazardous nature of the products stored within.

Not marked

Storage (Peroxide formers)

Never store highly reactive chemicals longer than 3-18 months. Examples:

- Picric acid
- Ethyl ether (diethyl ether)
- Isopropyl ether
- Phosphorus
- Sodium metal
- Potassium metal

THESE CONTAINERS MUST BE DATED WHEN OPENED

Gas Cylinder Safety

Storage and Handling

- Gas cylinders should not be stored in exits or egress routes or blocking any safety equipment
- Gas cylinders (excluding lecture bottles) should be stored in an upright position and with safety caps in place unless in use.
- The correct valve must be used and closed except when the gas is in use
- Gas cylinders must be secured with a chain or appropriate belt above the midpoint but below the shoulder of the cylinder

Container Labels

All chemicals (including solutions and chemicals transferred from their original containers) should be labeled with their common names, concentrations, and hazards.

Label may also include: Proper handling, Storage, Emergency response

Hazard Information Labels

NFPA Label

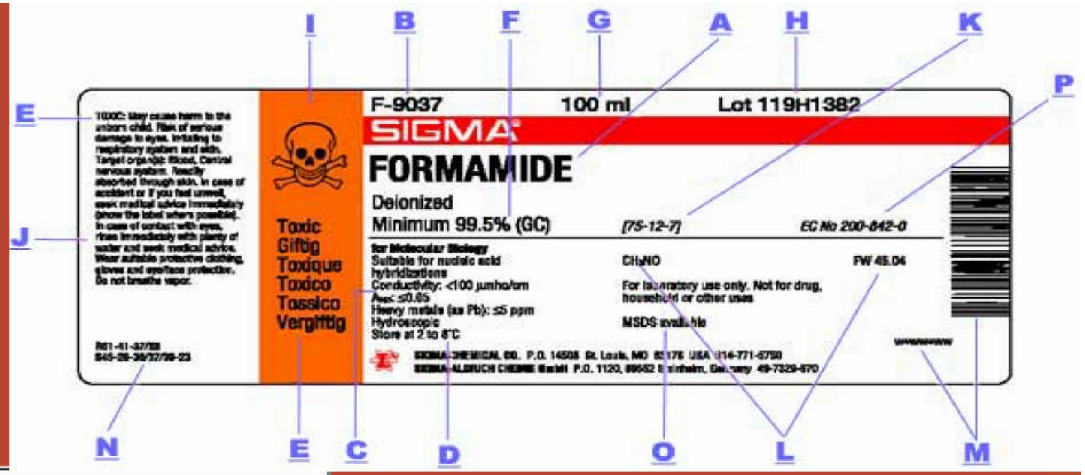
Chem. name

Health (blue)
4 – deadly
3 – extreme danger
2 – hazardous
1 – slightly hazardous
0 – normal material

Fire Hazard (red)
Flash Point Temp.
4 – below 73F - v.flam.
3 – 73 to 100F – flam.
2 – 101 to 200F- comb.
1 – over 200F –slightly combustible
0 – will not burn

Reactivity (yellow)
4 – may detonate
3 – shock or heat may detonate
2 – violent chem. reaction
1 – unstable if heated
0 – stable

Specific Hazard
OXY - oxidizer
ACID – acid
ALK – Alkali
COR – corrosive
~~W~~ – use no water
RAD - radiation haz.



METHANOL

CAS #67561

CAUTION

HAZARD RATINGS
4 — Severe
3 — Serious
2 — Moderate
1 — Slight
0 — Minimal

HEALTH HAZARDS: Combustible, Do not sewer, Flammable, Poison, Store below 212 F.
ORGANS HAZARDS : Blood, Eyes, Intestines, Stomach.

FLAMMABLE! No smoking, matches or open flames!
FIRST AID: Immediately flush eyes w/ water for 15 minutes. Ingestion: Do not induce vomiting - give warm milk or water - call 911.

CONSULT MATERIAL SAFETY DATA SHEET FOR FURTHER INFORMATION ON HAZARDS

ACETONE

1	Health
3	Flammability
0	Reactivity
c	Protective Equipment

HAZARD RATING

4 EXTREME
3 SERIOUS
2 MODERATE
1 SLIGHT
0 MINIMAL

GHS Label Example

ToxiFlam (Contains: XYZ)

Danger! Toxic If Swallowed, Flammable Liquid and Vapor

Do not eat, drink or use tobacco when using this product. Wash hands thoroughly after handling. Keep container tightly closed. Keep away from heat/sparks/open flame. – No smoking. Wear protective gloves and eye/face protection. Ground container and receiving equipment. Use explosion-proof electrical equipment. Take precautionary measures against static discharge. Use only non-sparking tools. Store in cool/well-ventilated place.

IF SWALLOWED: Immediately call a POISON CONTROL CENTER or doctor/physician. Rinse mouth.

In case of fire, use water fog, dry chemical, CO_2 , or "alcohol" foam.

See Material Safety Data Sheet for further details regarding safe use of this product

MyCompany, MyStreet, MyTown, NJ 00000, Tel: 444 999 9999

GHS Hazard Labeling

- Flammables
- Self Reactives
- Pyrophorics
- Self-Heating
- Emits Flammable Gas

- Acute toxicity (severe)

- Explosives
- Self Reactives
- Organic Peroxides

- Carcinogen
- Respiratory Sensitizer
- Reproductive Toxicity
- Target Organ Toxicity
- Germ Cell Mutagens

- Corrosive (Eye, Skin, Me[illegible])

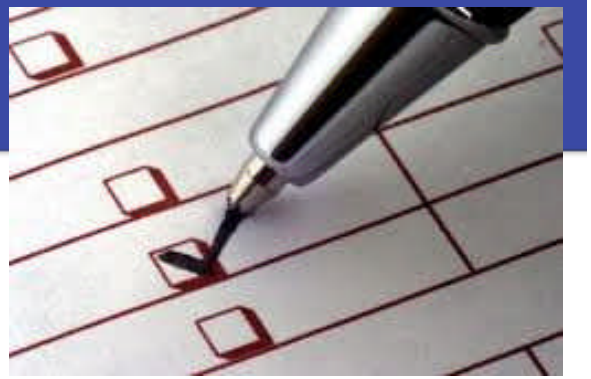
- Oxidizers
- Organic Peroxides

- Acute toxicity
- Skin Irritation
- Eye Irritation
- Skin Sensitizers
- Ozone depleting

- Gases Under Pressure

- Aquatic Toxicity

Container Storage Inspections



Chemical storage areas should be frequently monitored.

- Inspect for broken, deteriorating, or leaking containers.
- Ensure that all containers are clearly labeled with the name and hazard of the chemical (e.g. “Hydrochloric acid, corrosive” or “Ethanol, flammable”).
- Store liquid hazardous chemicals and wastes in secondary containment whenever possible.
- Chemicals must be put back into their proper storage location at the end of your experiment or demonstration.
- At the end of a work day, any chemical in an unlabeled container should be noted and inquiries made as to its contents and hazards.

Chemical Transportation

Transporting Chemicals

- Cap all containers
- If transferred to a new container- make sure properly labeled
- Tightly sealed, inside secondary containment whenever possible
- Use freight elevator
- Do not remove chemical containers from University buildings
- Ground and bond metal containers when dispensing flammable liquids

Transporting Chemicals

Make sure the pathway is clear of obstructions and tripping hazards.

Plan ahead for spills.

Transport only the quantity needed to complete the experiment or task.

Use sturdy carts when transporting heavy containers or transporting over long distances.

Have spill cleanup equipment available or on-board

Decanting Chemicals

- ✓ When transferring chemicals between containers: pay careful attention to the size of the receiving container to prevent overfilling it.
- ✓ Use funnels and spill containment trays to catch leaks and spills when transferring liquids.
- ✓ Use approved safety containers when transferring flammable and combustible liquids.
- ✓ Ensure that the materials are compatible prior to mixing.
- ✓ Remember to label the secondary container with the material name, hazards, and manufacturer.

Transferring Chemicals

- ✓ When transferring liquids from large containers, use pumps, siphoning (not initiated by mouth) or other mechanical means instead of pouring.
- ✓ Use approved safety containers when transferring flammable and combustible liquids.
- ✓ When transferring flammable liquid from drums, ensure that both the drum and receptacle are grounded and bonded together to avoid an explosion initiated by a static electric spark.
- ✓ Perform the material transfers only in locations with containment to capture or retard the escape of any spillage to the environment or drains.

Compressed Gas Handling

- Do not move a cylinder more than a foot without a cart
- Firmly secured
- Never move cylinder without having a valve cap

Hazard Control Methods

Hazard Control Methods

Hazard control methods must be implemented by the lab manager or principal investigator to reduce employee exposure to hazardous chemicals in the laboratory.

This section covers the three types of hazard control methods to reduce employee exposure to workplace hazards:

- *Administrative controls*
- *Engineering controls*
- *Personal protective equipment*

Administrative Controls (Work Practices)

Administrative Controls

One way to control worker exposure to workplace hazards is through policies and procedures. Some examples of the administrative controls used in labs are:

- The BSU CHP and References
- Standard Operating Procedures
- Lab-Specific SOP Training
- Required Work Practices
- Chemical Labeling
- Material Safety Data Sheets
- Required Safety Training
- Security Training

Security – All Labs, Prep, and Stock Rooms

Lab Security

Some points to consider are:

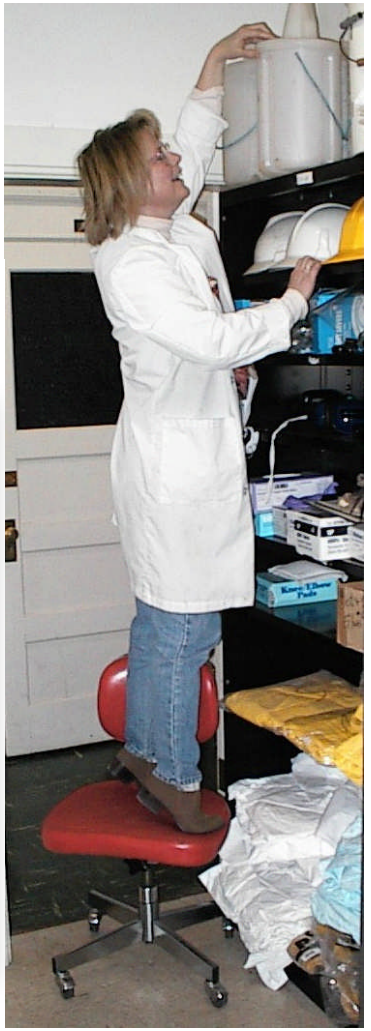
- Recognize that laboratory security is related to - but different from laboratory safety - and follow a site-specific security policy.
- Control access to areas where hazardous materials are used and stored.
- Know who is in your laboratory area.
- Know what materials are being brought into your lab.
- Know what materials are being removed from your lab.
- Have a protocol for reporting security incidents.

Laboratory Access

- Public access is prohibited to visitors and non-university personnel.
- Access controls are for, as well as for protection of research protocols.
- Lock lab and stock room doors when unoccupied.
- Lab staff who are or might be pregnant should consult their personal physician and provide them with a copy of their lab's chemical inventory and lab safety plans.
- Administrative, clerical, and other non-lab personnel may not maintain workstations in a lab.

Physical Hazards

- Most common accidents
  - Slips, trips, falls
  - Splashes



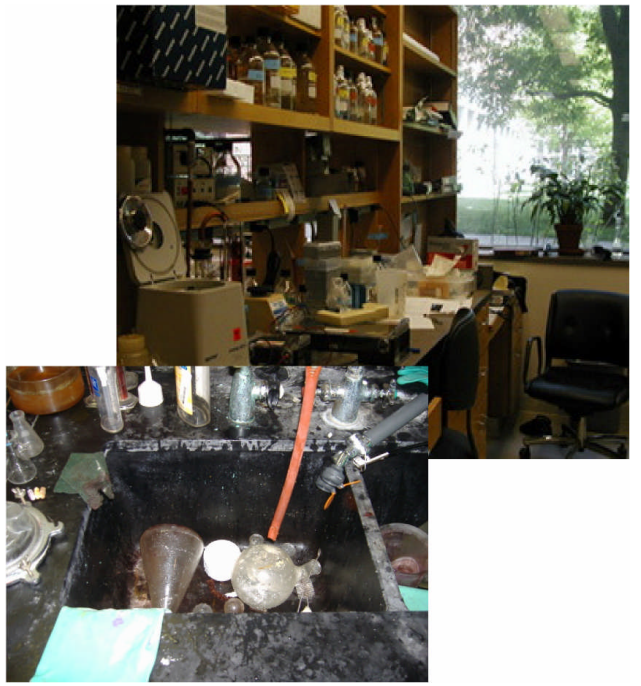
General Lab Rules: Awareness

For the chemicals you are working with, you should be familiar with:

- The standard operating procedure for using that chemical in your lab (a.k.a. the protocol)
- The hazards associated with that chemical
- The PPE required for using that chemical
- Storage requirements
- Waste disposal procedures
- Procedures to be followed in the event of an emergency

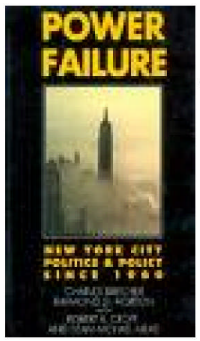
Lab Safety Guidelines

- Housekeeping - keep benches organized and free of clutter
- Proper waste containment
- Students should never work alone
- Unattended operations require permission and emergency plan



Personal Safety

- Employees should avoid working alone in the lab
- If you must work alone, after hours, or on weekends:
  - Make arrangements with others in the building to check in with you periodically.
  - Let someone know you are working alone, and make arrangements to call and check in periodically.
  - Avoid conducting hazardous experiments during this time.
  - Do the hazardous aspects of your work during regular work hours when there are others present.



Personal Hygiene

- No Food or Beverages – includes gum, candy
- No Smoking
- Do Not Apply Cosmetics
- Do Not Consume Lab Ice or Deionized Water

- Never Pipette by Mouth
- Do Not Smell or Taste Chemicals
- Constrain Long Hair/Loose Clothing

Personal hygiene

- Always remove gloves and lab coat before leaving the lab.
- Wash well before leaving the lab, even if it's only for a short break.
  - Use soap and water, not solvents (which may enhance absorption of the chemical by the skin).
  - Wash immediately whenever any chemical comes in contact with your skin. Flush for at least 15 minutes.
- Avoid inhalation of chemicals: Do not sniff a chemical in order to identify it – once you smell it - it's already in you.

Housekeeping

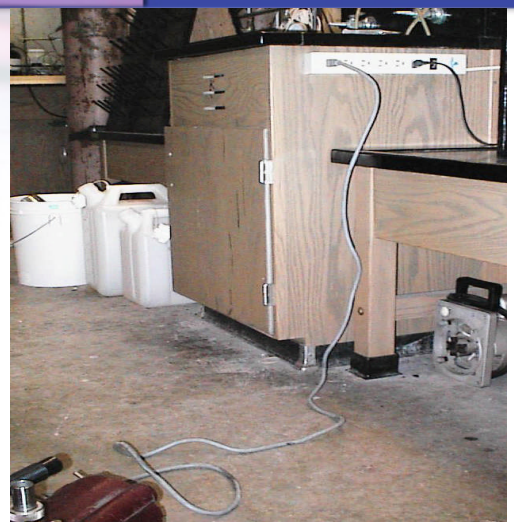
Do not block access to safety equipment, sinks, or exits!!

Aisles must be kept clear

Housekeeping

- Do not store chemicals on the lab floor
- Minimize tripping hazards
- Sinks should be kept clear of glassware.
- Soap and paper towels supplied.

Housekeeping



- Do not have electric cords or hoses across aisle floors
- Eliminate chances of cross-contamination of water supply (submerged inlets, etc.)
- Do not store items closer than 24-inches to the ceiling (18-inches if sprinklered)

Housekeeping

- Clean up spills as soon as possible
- If needed, contact Work Control (5-5081) for cleanup
- Notify lab workers of slip hazards
- Clean up your work area
- Clean up your equipment (scales, hot plates, etc.)

Housekeeping

- Put all chemicals and wastes in their proper place after the work is done.
- Test emergency shower and eye wash monthly to make sure they deliver continuous, contaminant-free water.
- **Do not store unnecessary combustibles in the lab**

Housekeeping - Poor

- Bench top too cluttered
- Chemical spill on bench top
- Containers on sides
- Containers not labeled
- Containers not closed

Housekeeping

- Keep chemical use areas (countertops) free from contamination
- Close/cap all containers not in use
- Clean drips and spillage off of container exterior
- Maintain the minimum on the work surface.

- Keep working aisles clear
- Label any doors that are blocked
- Keep storage out of the halls
- Inspect labs and stockrooms

Chemical Handling

Use chemical fume hoods to control exposure as chemicals are transferred or during the experiment.

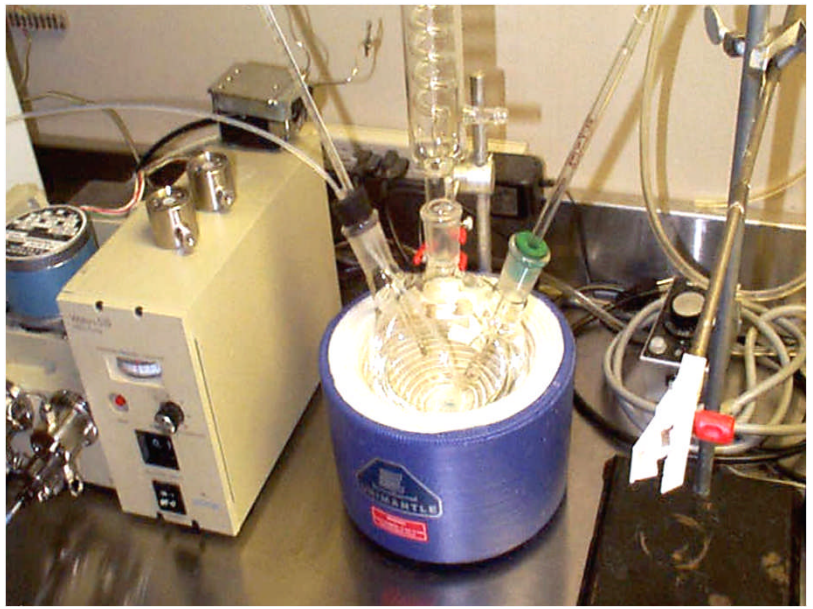
Use safety cabinets to control biological exposure during the experiment or during transfers.

Wear the appropriate personal protective equipment (chemical splash goggles, gloves, etc.).

Have disposal containers ready ahead of time.

Chemical Handling

- Do not force a rubber stopper onto glass tubing or thermometers.
- Lubricate the tubing and the stopper with glycerol or water.
- Use paper or cloth toweling to protect your hands.
- Grasp the glass close to the stopper.



Chemical Handling

Take special precautions when handling contaminated glassware

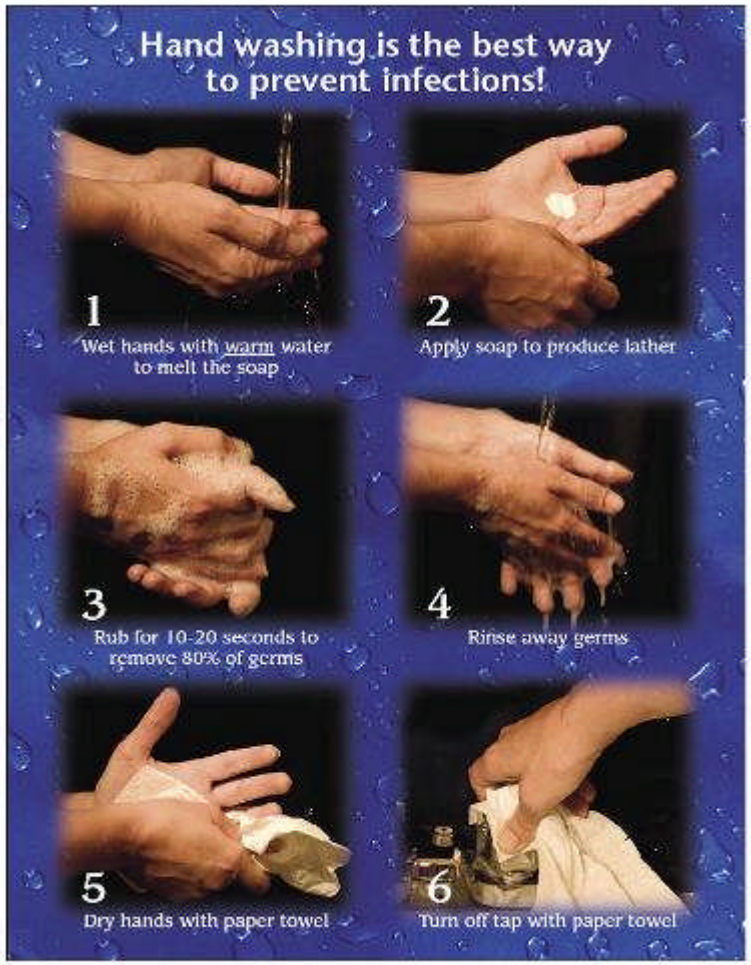
- Broken, contaminated glassware can cause chemical exposure
- Do not use broken, chipped, starred or cracked glassware.
- Clean up spills and broken glass immediately.

Chemical Handling

Don’t leave work or equipment unattended:

- Never leave a burning flame or heated hot plate unattended.
- Make sure gas is turned off when finished.
- Do not leave running water on.
- Report malfunctioning equipment

Biological Safety Practices



Leave Biologicals in the laboratory:

- Wash hands after removing gloves and before leaving
- Verify decontamination completed
- Confirm inward air flow
- Don’t wear lab coat and gloves outside of the lab

Biological Safety Practices

Reduce Aerosols

- Gently expel fluids against the walls of tubes or flasks
- Use contaminated container in the BSC to reduce drips to a biohazard bag or container outside the cabinet.
- Monitor aspiration flasks-do not overfill.

Minimize Aerosol Formation

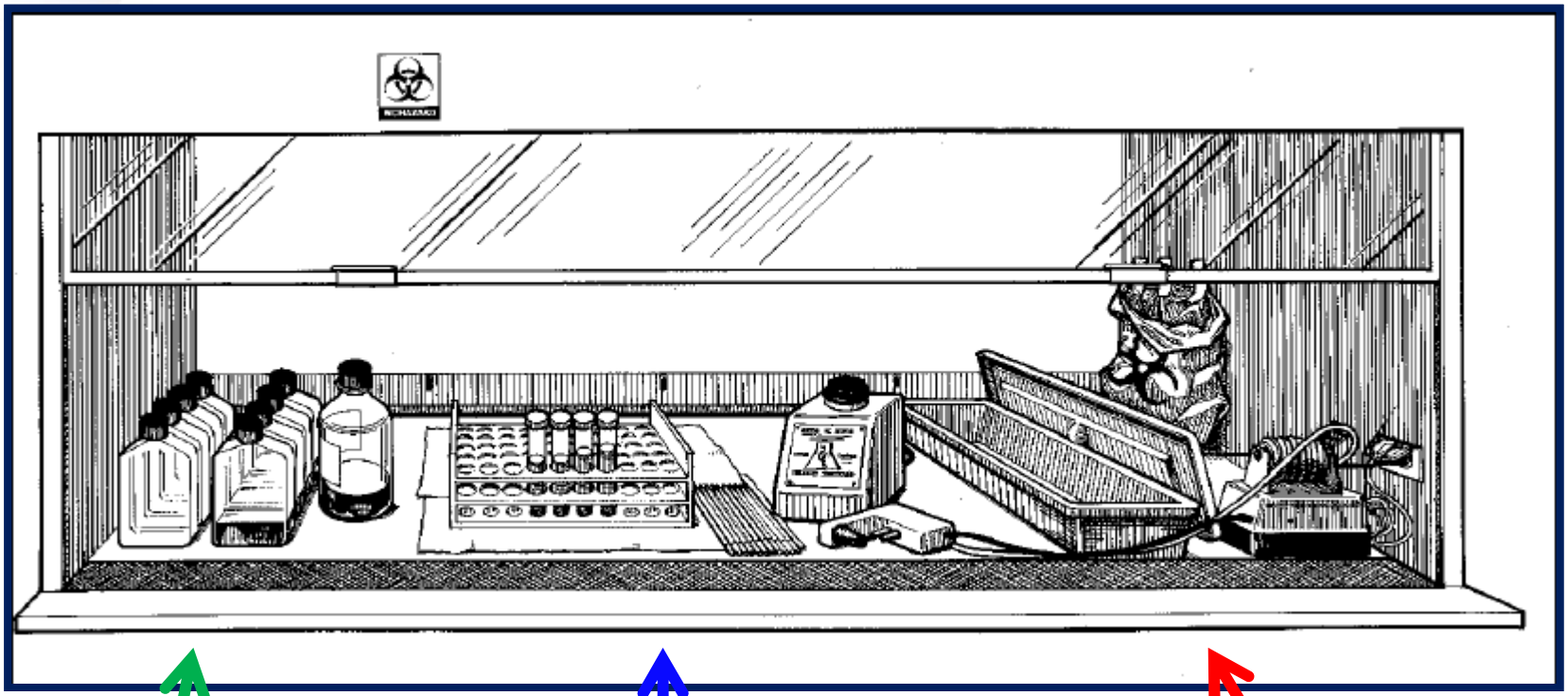
Common operations that produce aerosols

- Pipetting
- Centrifuging
- Grinding
- Blending
- Shaking
- Mixing
- Sonicating
- Opening containers of hazardous materials or microorganisms

Aerosol forming experiments should be performed in a Biological Safety Cabinet

Biological Safety Cabinet Operation

Prevent Cross Contamination



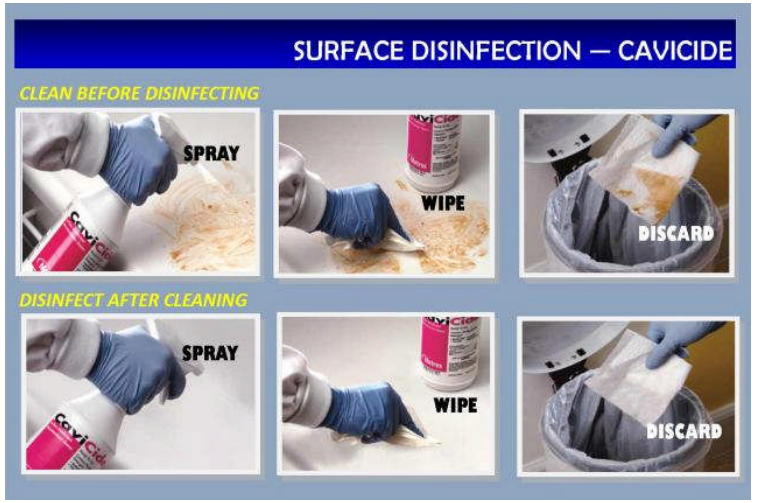
Clean Area

Working Area

Contaminated Area

Decontamination of Infectious Material Work Spaces

- Liquid Disinfectants (or other EPA registered)
  - 70% Isopropyl alcohol or ethyl alcohol
    - Volatile and flammable
    - Acts quickly with no residue
  - 10% bleach solution
    - Must be prepared daily
    - Effective against wide range of agents
    - Requires contact time to deactivate agent
    - Leaves residue

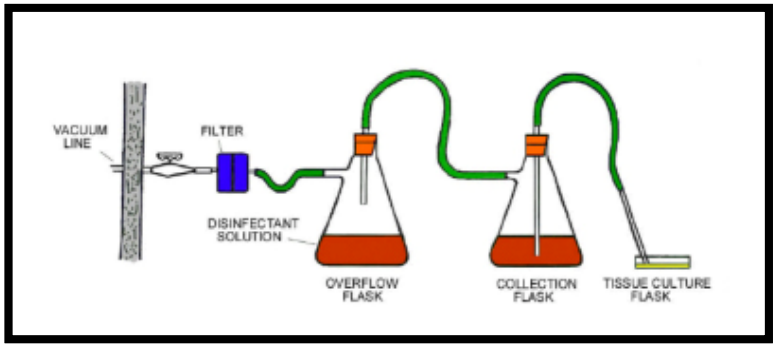


- Clean and Disinfect work surfaces daily and after spills

Decontamination of Equipment and Lab Ware

- Spills or splashes involving infectious materials must be contained, decontaminated, and cleaned up with an appropriate disinfectant by trained staff.
- Equipment must be decontaminated before repair, maintenance, or removal from the laboratory.
- All consumable solid supplies must be autoclaved prior to disposal.
- All reusable supplies (i.e.- glassware) must be decontaminated with an appropriate disinfectant prior to re-use.
- Significant volumes of contaminated liquids must be autoclaved or treated with an appropriate disinfectant.

Aspirating Contaminated Liquids Safely



Autoclave Wastes

Cultures and stocks of **infectious agents** and associated biologicals including:

- Laboratory waste, biological production wastes, discarded live and attenuated vaccines, culture dishes, and related devices.
- Liquid human and animal waste, including blood and blood products and body fluids, but not including urine or materials stained with blood or body fluids.
- Pathological waste.
- Contaminated wastes from animals that have been exposed to agents infectious to humans, these being primarily research animals.

Shall be placed in biohazard bags and decontaminated by autoclaving.

Decontamination of Waste

- Autoclave liquid waste
- Solid waste can go directly into a biohazard box
- Autoclave safety
  - Follow SOP for sterilization
  - Wear heat resistant gloves, lab coat, goggles
  - Do not autoclave chemicals
  - Do not overload autoclave bags
  - Wait until autoclave is cool to clean any spills
  - Performance testing – schedule and document

Hazardous Chemicals in Biological Work

- Biological Safety Cabinets are not suitable for work with highly flammable or toxic material
  - Material is recycled into cabinet and not removed by HEPA filter
  - Material is recycled into the room
- Use chemical fume hood instead
- Keep chemical and biohazard wastes separate – they are different with different handling and disposal methods.

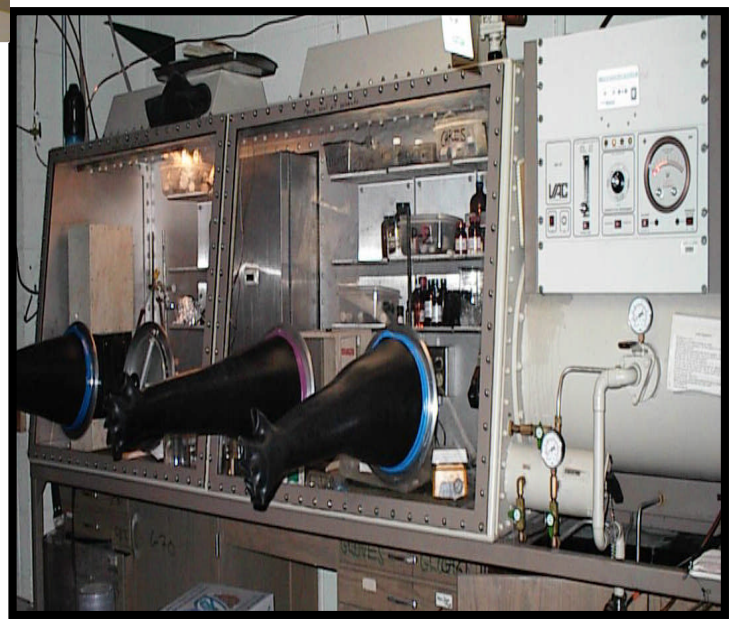
Biosafety Conclusions

- Know hazards of agents
- Correctly use biological safety cabinet to reduce laboratory aerosols
- Correctly manage sharps

- Dispose of material promptly and properly
- Clean up spills and disinfect when they occur
- Treat and report any exposures immediately

Engineering Controls (Equipment)

Engineering Controls



General Lab Ventilation

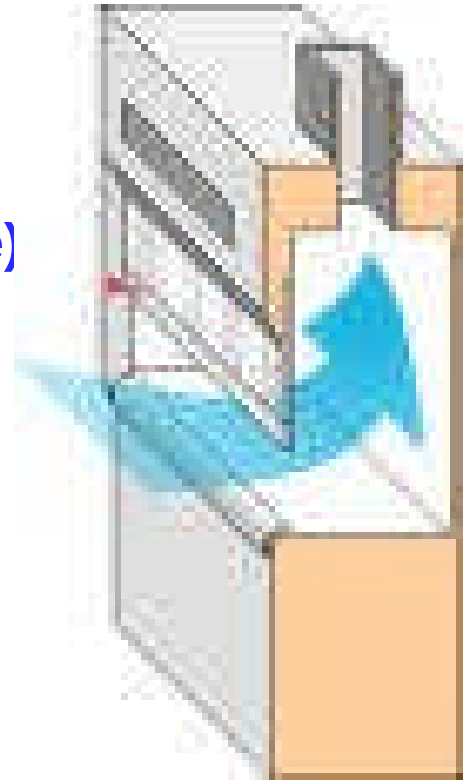
- Do not block air supply or return grills
- Do not remove ceiling tiles
- Use toxic or odorous chemicals only in fume hoods
- Keep lab doors shut – open doors defeat the design negative pressure and the conditions under which fume hoods/safety cabinets are certified.

Equipment: Fume Hoods

Fume hoods work by moving air from the lab, into the hood, and exhausting to the outside atmosphere.

Use a chemical fume hood anytime your work involves:

- **Toxic volatile materials (chloroform, formaldehyde) with a PEL <50 mg/kg.**
- **Carcinogens or other Particularly Hazardous Substances**
- **A procedure that may create an aerosol of a toxic substance**
- **Reactive or explosive materials or chemicals that may spatter**
- **Toxic gases (H_2S, CO, F)**



Safety Equipment:
Chemical Fume Hood

Airflow into the hood prevents chemicals inside from migrating out into your breathing zone.

If air velocity into the hood is impeded or slowed, the hoods ability to capture chemicals is compromised.

Factors that affect airflow:

- Sash Height
- Drafts
- Bulky objects inside

Fume Hoods

Safe Operation of Chemical Fume Hoods

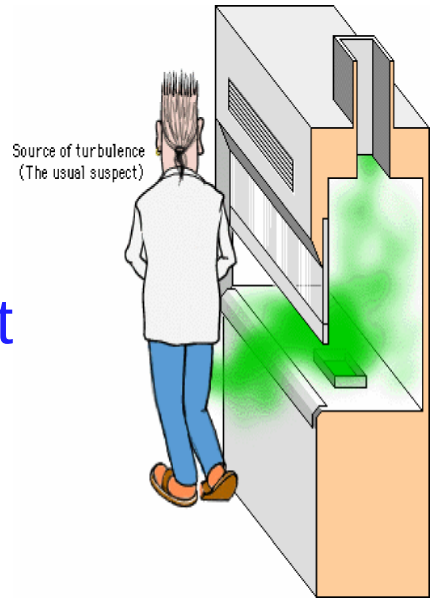
To ensure that airflow is not interrupted, and that the fume hood offers as much protection as possible:

- Minimize storage of chemicals in the hood
- Avoid blocking off baffle exhausts.
- Ensure that blower is working – use KimWipe, ribbon, or tissue
- Work with sash at proper operating level (between your face and materials in the fume hood).

EHS inspects fume hood performance regularly, and puts “Sash height arrows for proper ventilation" stickers on the hood. Use the hood sash at or lower than the sticker to assure that air speed is adequate.

Fume Hood Protocols

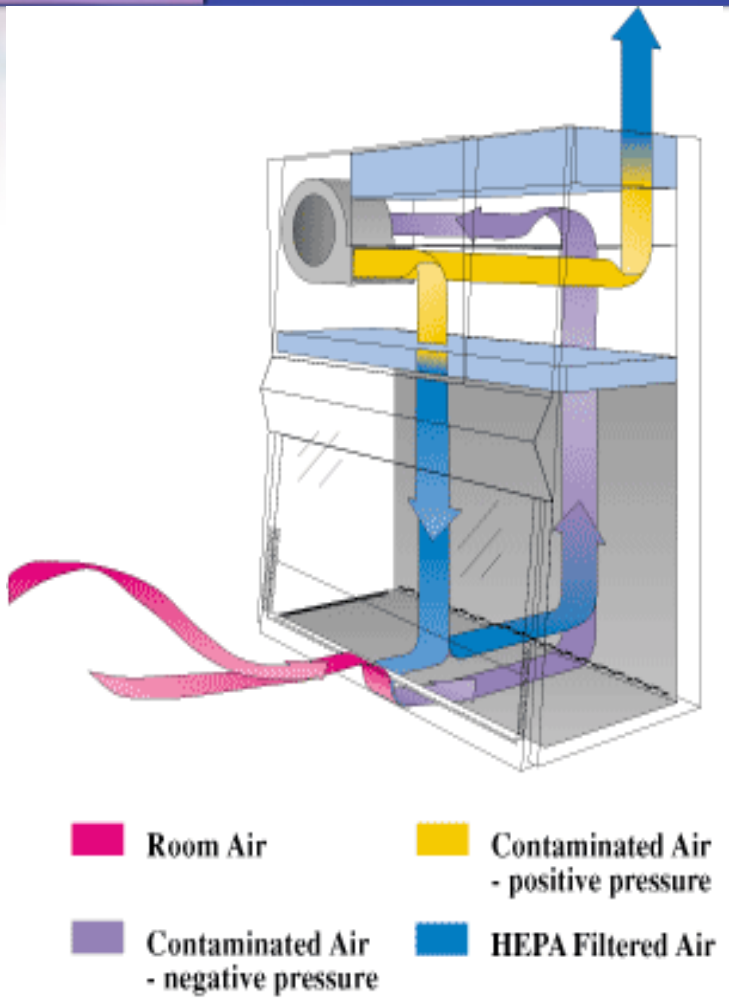
- Minimize turbulence--foot traffic – door openings
- Keep head out of the hood
- Large equipment should be elevated 2-inches
- Keep sources of emission at least 6 inches inside the fume hood (behind sash).
- Design air flows are 70-120 fpm (only about 1 mph) – and easily disrupted by cross currents or other turbulence.



Biological Safety Cabinets

- Used for BSL 2,3,4 work
- Air is pulled from the room, passed through a HEPA filter and normally recycled to the room – not exhausted.

Biological Safety Cabinet Operation



- Room air flows into cabinet
- Air is passed through HEPA filter
- Filtered stream often split between room and cabinet
- **Not for use with flammable, reactive, or toxic chemicals**

Biological Safety Cabinet

- Prevent turbulent air flow within the cabinet
  - Keep sash pulled down
  - Do not block grill
  - Keep materials towards the back of the cabinet
  - Move arms slowly in the cabinet
  - Turn on 5 minutes before starting work to purge the air and any particulates
  - Unlike chemical fume hoods, user should work well into the cabinet (~4-inches).

Biological Safety Cabinet Explosion

No flammables in safety cabinets!

Personal Protective Equipment (PPE)

Important:

Always inspect your PPE prior to use. Look for cracks, holes, weak spots, or obvious signs of degradation.

Personal Protective Equipment (PPE)

Personal protective equipment includes any devices or clothing worn by the worker to protect against the hazards in the environment.

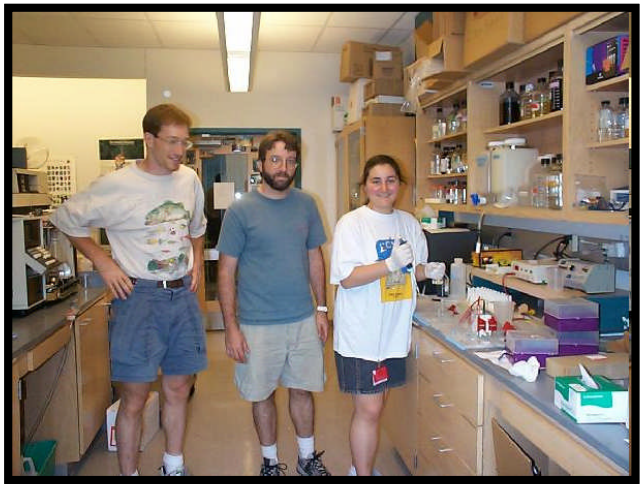
Examples are:

- **Lab coats**
- **Protective gloves**
- **Safety glasses**
- **Chemical goggles**
- **and Face shields**

Before Entering the Lab

- Make sure that you minimize exposed skin at all times by wearing the appropriate clothing (long sleeves/pants, close-toed shoes).
- You should wear PPE when in the lab even if not working with hazardous material-because you can be injured or exposed by someone else's accident!

Laboratory Attire - “No”



Lower Body Protection

Shoes or Leg and Foot Coverings

- NEVER wear sandals or open-toed shoes in the lab.
- Non-permeable shoes (no open mesh) are preferable.
- Wear low-heeled shoes with non-slip soles.
- If handling large volumes of hazardous chemicals (corrosives, solvents), wear rubber boots or Tyvek® foot coverings.
- Long pants are always advisable and may be required – natural rather than synthetic fabric.

Absorption through the feet

Gloves

- Gloves
  - Use gloves that are appropriate for the material you are working with
    - Heat-resistant for handling hot items, cryoprotective for handling liquid nitrogen – Nomex or Zetex
    - Chemical resistant—material depends on type of chemical being used
  - Understand the limitations of gloves
    - Chemicals do break through the glove materials over time—do not reuse disposable gloves
  - Change gloves often
    - You are still transferring chemicals or microorganisms (cross-contamination

PPE: Gloves

- **Select the right size**
- **Select the correct material:** ***latex, nitrile, neoprene, viton, butyl rubber, PVC, etc.***
- **Correct thickness (mils)**

Select gloves based on permeability charts

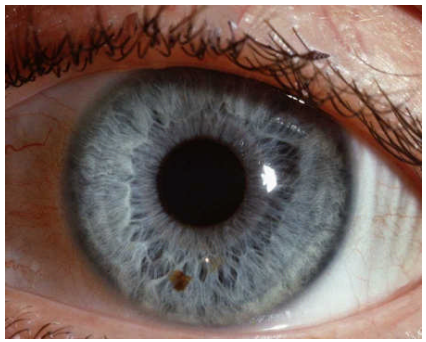
Eye Protection

Wear **safety glasses** when chemicals are present and when handling glassware

Wear **goggles** when using acids or whenever there is potential for a splash hazard

Face Protection

- Face shields are needed with significant splash hazard to the face
- Splash goggles can still be worn beneath the face shield



Absorption in the eyes

- Don’t rub eyes in the laboratory
- Wear safety glasses over eye glasses

Cryogenic Work

Boiling / splashing occurs when charging or filling a warm container

Wear face shields during transfers, loose fitting, dry leather or cryogenic gloves and long pants

Requires:

- Insulated gloves
- Face shield
- Goggles

Liquid Nitrogen boils at -196°C
Liquid Helium boils at – 269°C

Emergencies and Exposures

Emergency Response

- Fires/accidents 911 or 5-1111
  (From a cell phone 765-285-1111)
- Spills 5-2807 or
  5-5081 (Work Control)
  (Environmental Health and Safety)
- After Hours Spills 5-1111
  State the type of emergency and the exact location of emergency.
  If a chemical is involved spell the chemical name to the dispatcher—identify any biological hazards.

FIRE

EXPOSURE

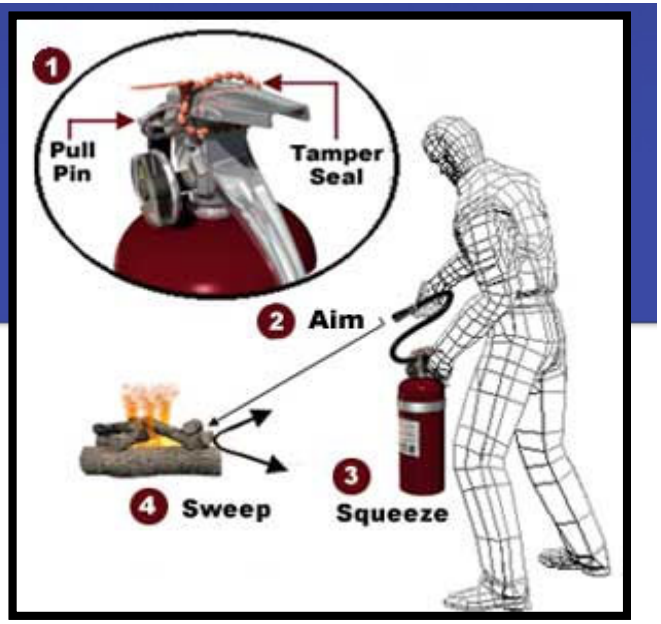
Fire Safety

- Alert persons in area of fire
- Close doors to confine fire
- Activate fire alarm
- Evacuate through nearest exit
- Do not use elevators
- Move away from the building
- Know the exit routes and rally locations

Fire Extinguishers

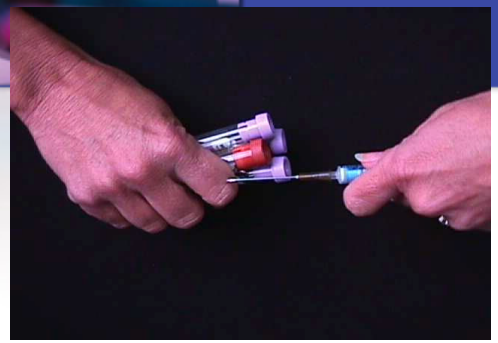
- Extinguishers are graded by type of fire
- **Intended only for escape at BSU**
- Only use if you know what you are doing, are trained, and can safely fight the fire

Fire Safety



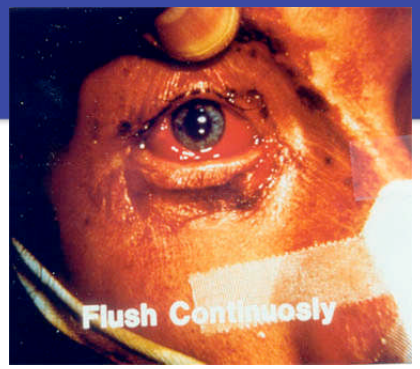
- Remember the acronym **PASS**:
  - **P**ull the pin
  - **A**im the extinguisher nozzle at the base of the fire
  - **S**queeze the handle
  - **S**weep the nozzle from side to side
- Only have media enough for about 10 seconds of operation!
- Should be 8-10 feet from fire, moving closer as flames go out--or away if not!
- Stay with an extinguished fire to ensure it does not restart!

Biological/Chemical Exposures



Needle Sticks:

- Wash thoroughly with soap and water
- Identify source



Ocular Exposures:

- Remove contacts
- Rinse at eyewash for 15 minutes
- Hold eye open to ensure effective wash

Dermal Exposures:

- Rinse under drench shower at least 15 minutes
- Remove all contaminated clothing

Seek Medical Treatment

Take MSDS or name of chemical or identity of agent with you

Exposure to Biohazards

1. Remove contaminated clothing
2. Wash area with soap and water (decontaminate)
3. Call Biosafety officer or EHS and tell them nature of exposure
    - Route of Entry
    - Agent or substance
    - Concentration
    - Amount
4. Notify lab supervisor or PI
5. Call 5-1111, or go to Health Center, Occupational Health Clinic, or ER after hours

Chemical Burns (Eyes)

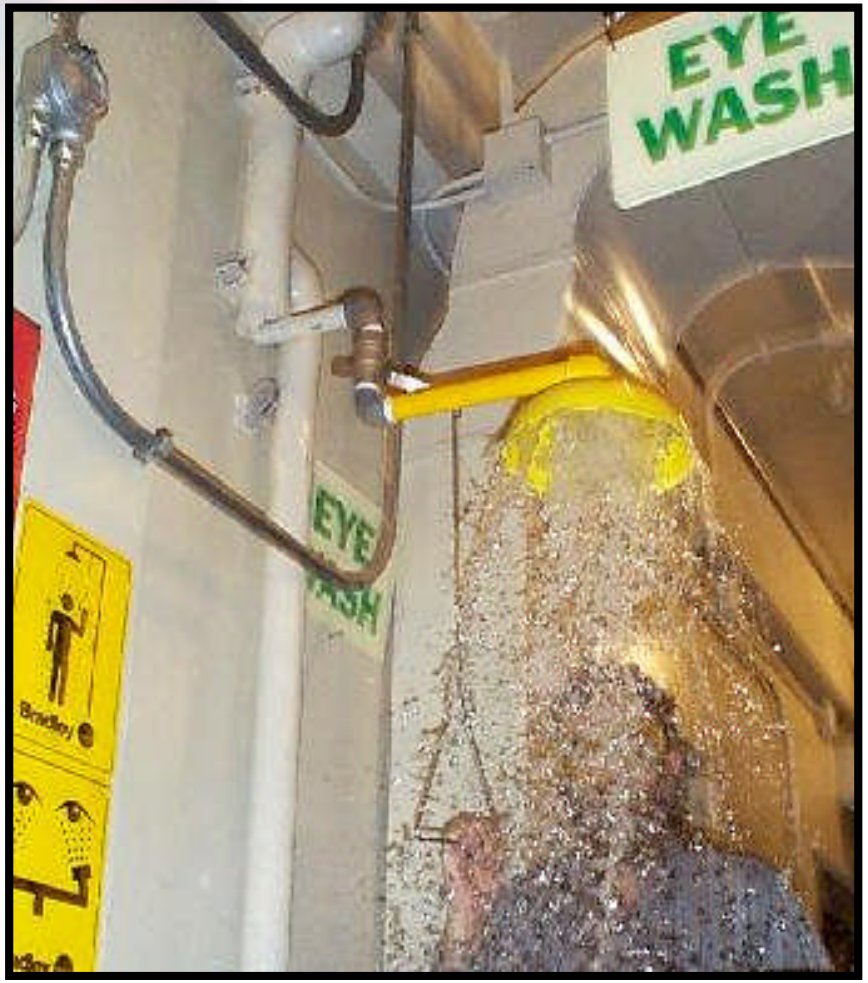
Make sure you know the location of the nearest eyewash station and that it is unobstructed.

Can you find your way to it with your eyes closed?

Chemical Burns (Eyes)

- Forcibly open eyelids to ensure effective washing behind eyelid
- Remove contact lenses
- Wash from nose out to ear to avoid washing chemicals back into eye or into an unaffected eye
- Flood eyes and eyelids with water/eye solution for minimum of 15 minutes

Emergency Shower



- Know nearest location of emergency shower
- Stay under shower for 15 minutes
- Remove contaminated clothing
- Have someone read MSDS
- Call 911(or 5-1111)

Eye Wash Maintenance

- Eyewashes and showers are periodically checked and flushed by BSU Facilities Management. Lab personnel should test eyewashes monthly.
- Designate someone to test/flush eye washes monthly. Let run for at least one (1) minute.
- Remember to keep access open to these units.
- Many do not have closed or nearby floor drains, so be careful of wet floors or standing water.

Spills and Response

Spill Response

Be prepared for emergencies!

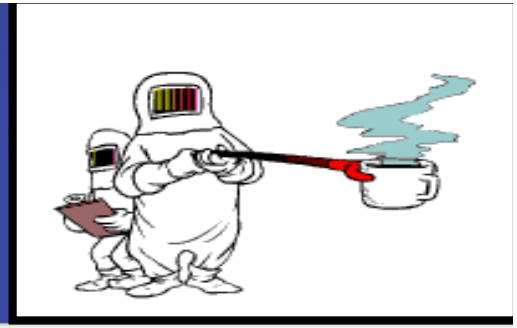
Refer to the BSU Spill Response Manual

Spill Kits (chemical or biological)

- Contains absorbent material
- Personal Protective Equipment
- Disposal bags

Chemical Spills

Identify the chemical



Assess your ability to **safely** contain and clean up the spill:
(spill size, chemical identification, PPE availability)

I CAN safely clean it up

Notify coworkers and secure the area

Use spill kit to contain and clean up the spill (MSDS helps)

Call EHS Office to confirm clean up

I CANNOT safely clean it up

Notify coworkers and vacate/secure the area

Call 5-1111
On cell call
765-285-5111

Major Spill Response

In the event of any hazardous chemical spill:

- Remain Calm
- Warn others in the area to leave
- Avoid breathing vapors or fumes, close doors
- Activate fire alarm to evacuate building if chemical is a respiratory hazard or flammable
- Notify Police at 5-1111 then EHS at 5-2807
  - Provide chemical name or biological identity and quantity if possible
- Secure the spill location to prevent others from entering until Police or EHS personnel arrive

Non-Hazardous or Minor Chemical Spills

No warning labels or only low hazard statements on container:

- Can be cleaned up by lab personnel
- Contact EHS for assistance if necessary

Steps for Clean Up:

- Use personal protective equipment, as appropriate
- Stop source of release
- Confine the spill to the smallest area possible
- Contain spill with paper towels, kitty litter, absorbents, etc.
- Contact EHS to report incident and for waste disposal

Chemical Spills -- Absorbent

Absorb free liquid with an appropriate absorbent:

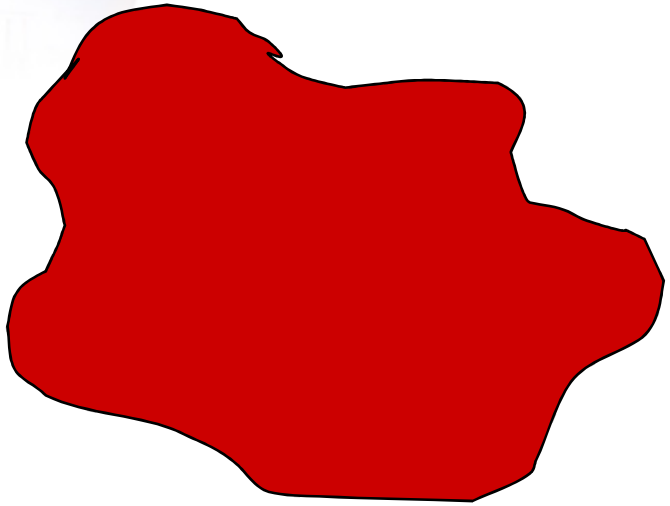
- Caustic - use polypropylene pads or diatomaceous earth.
- Oxidizing acid - use diatomaceous earth.
- Mineral acid - use baking soda or polypropylene pads.
- Flammable liquids - use polypropylene pads.

Neutralize residues and decontaminate the area.

Containerize the waste and residue, label, and call EHS

Biological Spills/Decontamination

- Cover spill with paper towels
- Soak towels with disinfectant (10% Bleach is effective)
- Wait 10 minutes
- While wearing PPE, clean up the spill using paper towels
- Wipe spill area with disinfectant
- Dispose of all clean-up materials as biological waste (red bag)



Notify EHS
5-2807 or Work Control (5-5081) if you need assistance

Waste Management

BALL STATE UNIVERSITY

WASTE MANAGEMENT GUIDE

September 2011 version

Environmental Health and Safety Office
Ball State University

BSU Laboratory Waste Management Plan

BALL STATE UNIVERSITY

Prepared by the:

Environmental Health and Safety Office
North Service Building
3401 North Tillotson Avenue
Muncie, Indiana 47306
765-285-2807 or tlrussell@bsu.edu

August 2013

Waste Separation

Clearly label all wastes!

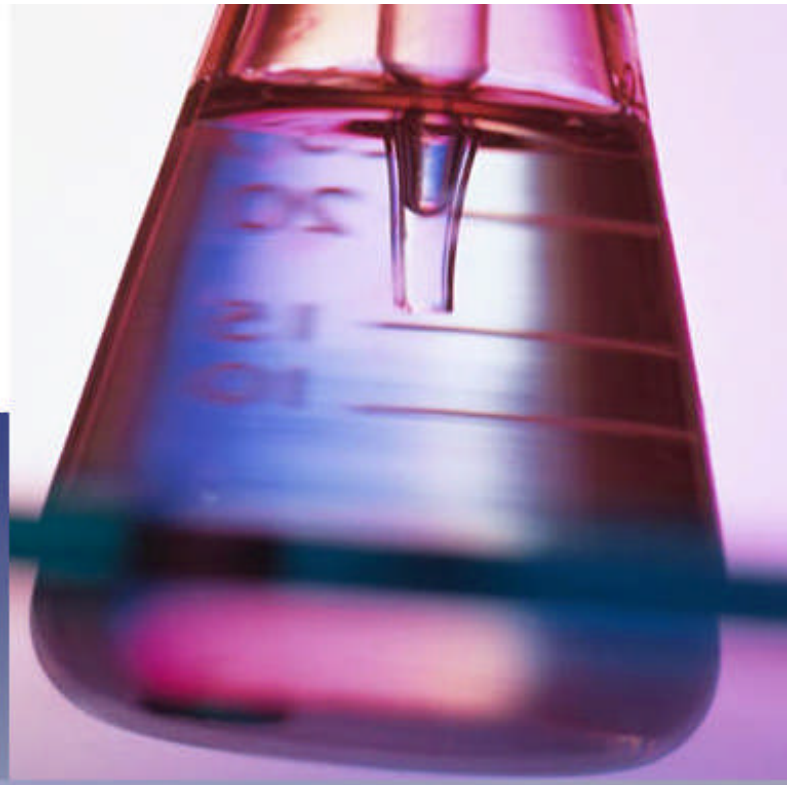
Wastes must be separated by type:

Lab Wastes:

- Non-hazardous chemical wastes
- Hazardous chemical wastes

Other Wastes:

- Autoclave Wastes
- Sharps
- Biohazard Wastes
- Broken Glass
- General refuse

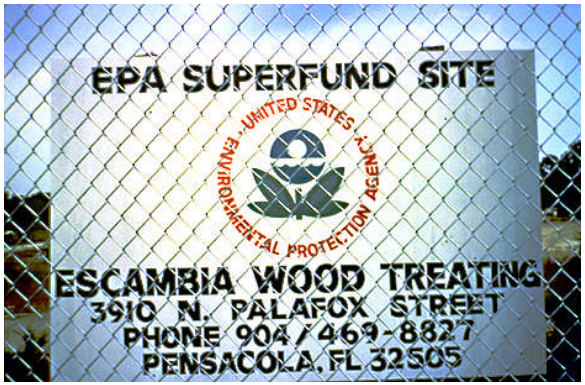


What is Hazardous Waste?

Hazardous Waste

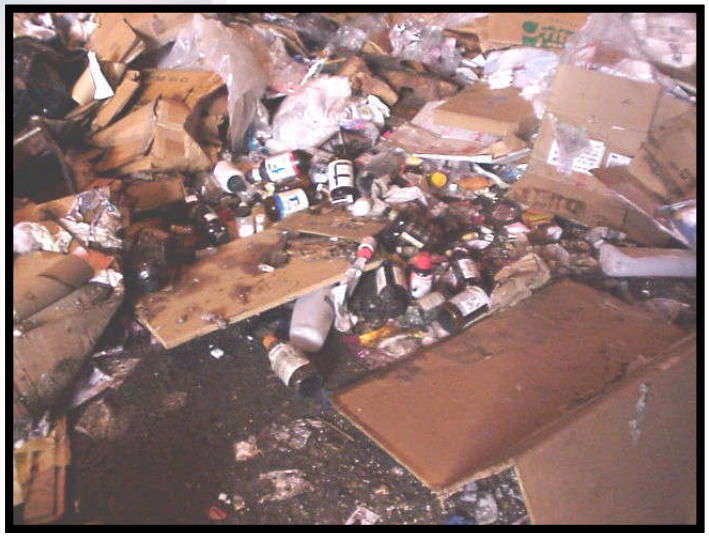
What is the Resource Conservation & Recovery Act (RCRA)?

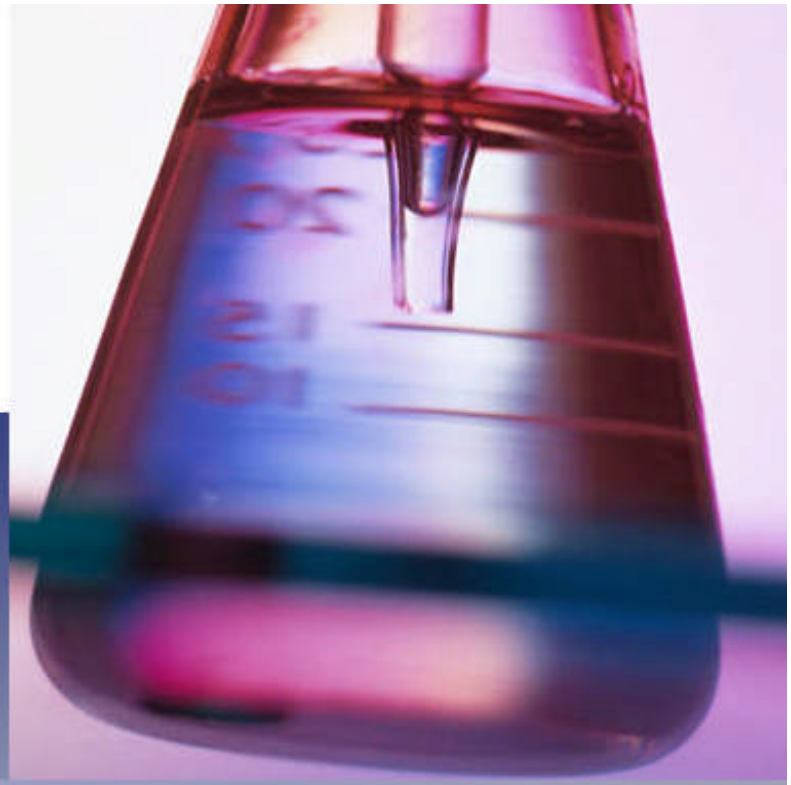
Resource Conservation & Recovery Act (RCRA)



- Enacted in 1976 by EPA as an amendment to the Solid Waste Disposal Act (SWDA)
- Main objectives:
  - Protect human health & the environment
  - conserve valuable material & energy resources
- Established "Cradle-to-grave" management and tracking of hazardous waste
- EPA inspectors have same authority as FBI/ATF

HAZARDOUS Wastes





So… is <u>your</u> waste a hazardous waste?

You Might Have A Hazardous Waste If ….

The compound or solution is:

- Ignitable
- Corrosive
- Reactive
- Toxic

Or, if it is a “Listed” waste.

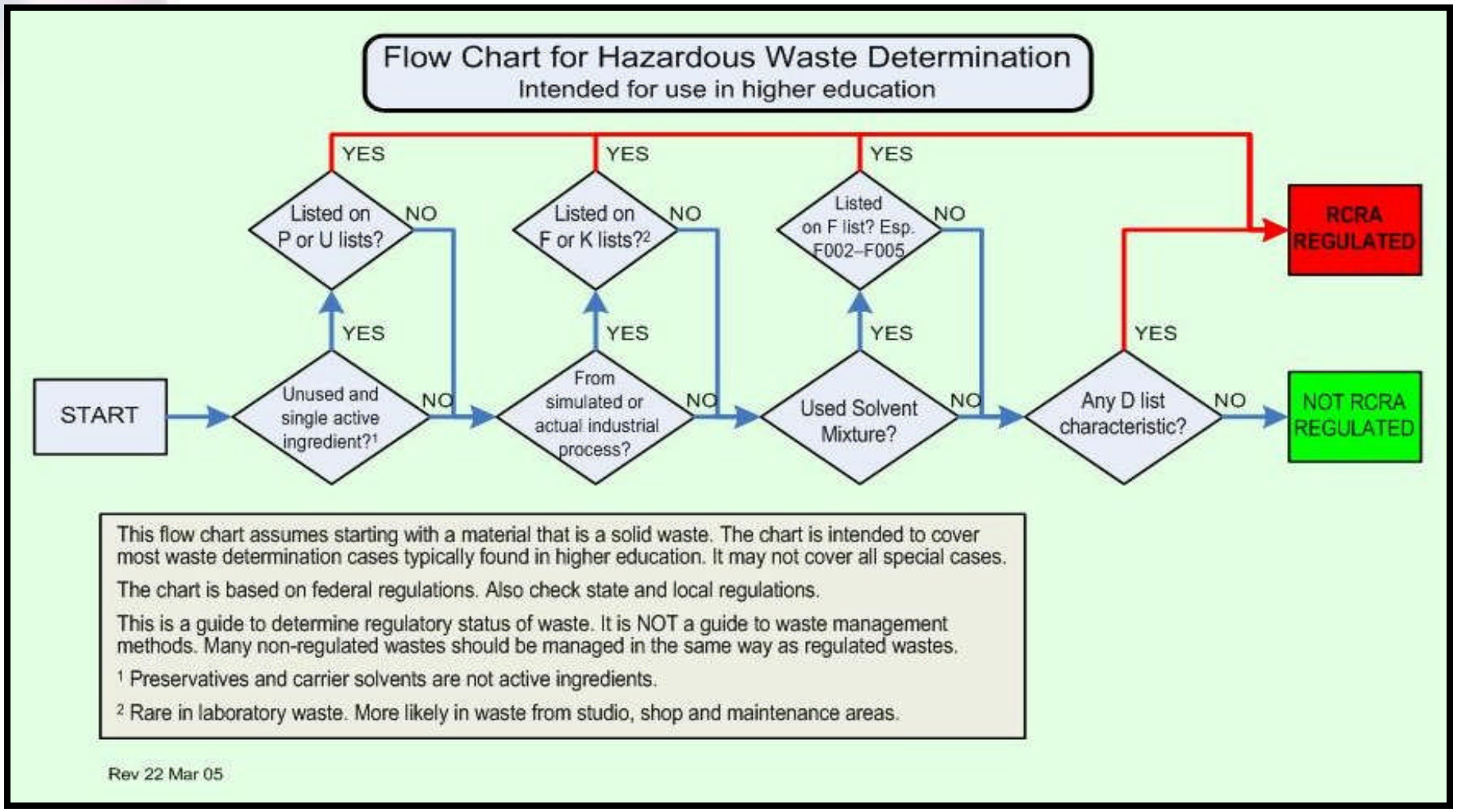
EPA definition of a solid waste

- EPA begins by defining everything as a “solid” waste (including solids, liquids, gases, and semi-solids)
- 40 CFR 261.2 provides the definition of “solid waste”:
  - (a)(1) A *solid waste* is any discarded material that is not excluded by § 261.4(a) or that is not excluded by variance granted under §§ 260.30 and 260.31.
  - (2) A *discarded material* is any material which is:
  - (i) *Abandoned,* as explained in paragraph (b) of this section; or
  - (ii) *Recycled,* as explained in paragraph (c) of this section; or
  - (iii) Considered *inherently waste-like,* as explained in paragraph (d) of this section; or
  - (iv) *A military munition* identified as a solid waste in 40 CFR 266.202.
- (Again, no need to memorize that!)

EPA definition of a hazardous waste

- If the waste material meets certain criteria, and is not somehow exempted or excluded from the regulations, it may be a RCRA-regulated hazardous waste.
- 40 CFR 261.3: definition of a hazardous waste:
  - (a) A solid waste, as defined in § 261.2, is a hazardous waste if:
  - (1) It is not excluded from regulation as a hazardous waste under § 261.4(b); and
  - (2) It meets any of the following criteria:
  - (i) It exhibits any of the characteristics of hazardous waste identified in subpart C of this part. However, any mixture of a waste from the extraction, beneficiation, and processing of ores and minerals excluded under § 261.4(b)(7) and any other solid waste exhibiting a characteristic of hazardous waste under subpart C is a hazardous waste only if it exhibits a characteristic that would not have been exhibited by the excluded waste alone if such mixture had not occurred, or if it continues to exhibit any of the characteristics exhibited by the non-excluded wastes prior to mixture. Further, for the purposes of applying the Toxicity Characteristic to such mixtures, the mixture is also a hazardous waste if it exceeds the maximum concentration for any contaminant listed in table I to § 261.24 that would not have been exceeded by the excluded waste alone if the mixture had not occurred or if it continues to exceed the maximum concentration for any contaminant exceeded by the nonexempt waste prior to mixture.
  - (ii) It is listed in subpart D of this part and has not been excluded from the lists in subpart D of this part under §§ 260.20 and 260.22 of this chapter.

Hazardous Waste Determinations



Categories of Hazardous Waste

Hazardous wastes are regulated because they present special hazards to man or to the environment if they are improperly disposed of or discarded.

Hazardous waste determinations are based upon whether the material is a:

- **Characteristic waste**
  - *Listed on the D-list or TCLP*
- **Listed waste**
  - *Materials specifically identified on one of the following lists: F, K, U or P lists*
- **Universal waste** (batteries; lamps; pesticides; mercury from thermometers)

Characteristic Wastes

- D001 – Ignitable Wastes (flashpoint is less than 140^0 F) includes oxidizers…
- D002 – Corrosive Wastes (pH less than or equal to 2 or greater than or equal to 12.5)
- D003 – Reactive Wastes (water reactives, normally unstable materials, cyanides & sulfides…)
- D004 - TCLP Wastes

(Toxicity Characteristic Leaching Procedure)

What Is An Ignitable Waste?

- It is a liquid and is capable of burning or causing a fire. This material will have a flash point **<u>below 140º F</u>.**
- It is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture, or spontaneous chemical changes.
- It is an ignitable compressed gas.
- It is an oxidizer or explosive

D001 Waste

Examples include *acetone, gasoline, organic peroxides, industrial alcohols, chlorates, permanganates*.

What Is A Corrosive Waste?

- The material is a liquid or solid and is capable of eroding materials and human tissue.
- These materials have a pH of **2** or less **or 12.5** or **greater**
- It is a liquid and corrodes steel at a rate greater than 0.250 inch per year
- Examples: *Alkaline cleaners, some chlorides, fluorides, and acids & bases*.

D002 Waste

What Is A Reactive Waste?

Waste that is:

- Capable of reacting dangerously with air and water
- When mixed with water could cause an explosion
- Could release poisonous fumes,
- Capable of detonation or explosive reaction at STP
- Forbidden explosives
- Is shock sensitive.

Examples include *peroxides, picric* **D003 Waste** *s, cyanides, sulfides, and chlorine.*

What Is A Toxic Waste?

- Material is capable of poisoning humans.
- Contains concentrations of arsenic, barium, cadmium, chromium, lead, mercury, selenium, or silver
- Contains a pesticide or other organic toxin – cresols, chloroform, benzene, TCE
- Wastes are determined to be "**Toxic**" if they fail the **TCLP Test (a leachate test)**.

D004-D043 Wastes

Listed Wastes

- *F-listed wastes* are from non-specific sources
  - Example: halogenated solvents used to degrease equipment; or, discarded chlorophenol formulations
- *K-listed wastes* are from specific industrial sources
  - Example: Product washwaters from the production of dinitrotoluene via nitration of toluene
- *U-listed wastes* are toxic wastes
- *P-listed wastes* are acutely hazardous wastes

What Is A Listed Waste?

- **The F-list** (non-specific source wastes). Solvents that have been used in cleaning or degreasing operations. The F-listed wastes are known as wastes from non-specific sources. These include halogenated and non-halogenated solvents such as methylene chloride, TCA, TCE, MEK, ethyl ether, xylene, acetone, benzene, chlorinated fluorocarbons, and many others.

- **The P-list and the U-list** (discarded commercial chemical products). These lists include specific commercial chemical products in an unused form. Some pesticides and many pharmaceutical products become hazardous waste when discarded. Hundreds of chemicals are included on both the P- and U-lists. (*contact the EHS Office for guidance on these waste identifications*).

Examples of P-Listed Wastes

Allyl alcohol	Osmium tetroxide
Ammonium vanadate	Phenylthiourea
Arsenic acid	Potassium cyanide
Arsenic trioxide	Sodium azide
Carbon disulfide	Sodium cyanide
2,4-Dinitrophenol	Thiosemicarbazide
Fluorine	Vanadium oxide
Nitric oxide	Vanadium pentoxide

P-listed chemicals (acutely hazardous wastes) are also fairly common in BSU labs – but should be avoided whenever possible.

Examples of U-Listed Wastes

Acetaldehyde	1,4-Dioxane
Acetone	Ethyl acetate
Acetonitrile	Ethyl ether
Aniline	Formaldehyde
Benzene	Methyl alcohol
Bromoform	Methylene chloride
1-Butanol	Phenol
Chloroform	Toluene

U-listed (toxic) chemicals are commonly found in BSU labs.

Notes on P and U Wastes

- Commercial chemical product listings do not apply to spent materials or manufacturing process wastes containing listed chemicals.
- Listings apply only to technical grade chemicals or formulations where the listed chemical is the sole active ingredient.
- The commercial chemical products listings do apply if and when such chemicals are spilled, discarded or intended to be discarded.
- Listings should be consulted prior to disposal of virgin chemical spill residues, off-specification chemical products, manufacturing chemical intermediates, obsolete chemical inventory, excess or surplus inventory, or expired chemical products.

The good news…

The good news is:

- The BSU Hazmat “team” will now decide whether your waste is a RCRA-regulated hazardous waste, a non-regulated hazardous waste, a non-hazardous waste, or a non-regulated waste.

- Even though you don’t have to decide what to call your waste, it was necessary to review that process so that you are aware of the interim handling procedures for those wastes that may be hazardous wastes.

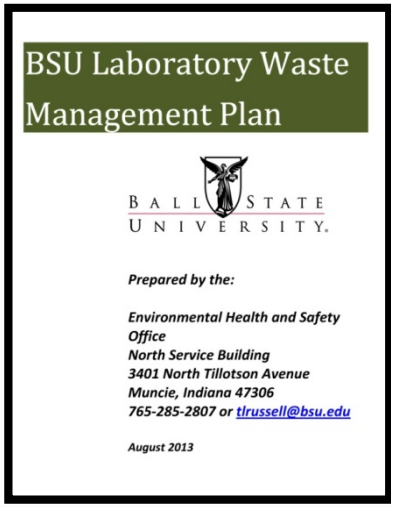
Rationale for the Academic Labs Rule (Subpart K)

- Teaching and research labs differ from industry in the following ways:
  - Hazardous waste generation pattern is different
    - Hundreds of different hazardous wastes that vary over time
    - Small amounts of each hazardous waste
    - Many individuals generating hazardous waste in many labs (i.e., many points of generation)
  - Individuals generating the hazardous waste are often students, who
    - Have inherently high turnover (thus difficult to train)
    - Lack the expertise or interest mandated in industry

Lab Wastes

The provisions of Subpart K will bring about safer management of hazardous waste in academic laboratories by:

- Requiring hazardous waste determinations to be made by “trained professionals”, rather than students, faculty, or researchers
- Requiring hazardous waste to be removed from the laboratory every six months
- Allowing eligible academic entities the flexibility to decide when and where on-site hazardous waste determinations are made
- Offering incentives for removing from the laboratories old and expired chemicals that may pose risks
- Requiring the development of a Laboratory Management Plan, in which entities specify best waste management practices


BSU Laboratory Waste Management Plan

BALL STATE UNIVERSITY

Prepared by the:

Environmental Health and Safety Office
North Service Building
3401 North Tillotson Avenue
Muncie, Indiana 47306
765-285-2807 or tlrussell@bsu.edu

August 2013

Lab Wastes

Lab Wastes Can be Either:

- Non-hazardous chemical wastes

  or,

- Hazardous chemical wastes

This determination will be made Later by a "trained professional" Based on the completed label.

LAB WASTE

Accumulation Start Date: _____

Dept:_____Bldg/Rm:_____

Contact:_____Phone:_____

Waste Name: _____

Chemical Composition: %

_____ ____

_____ ____

_____ ____

_____ ____

_____ ____

_____ ____

_____ ____

Hazard properties (check any applicable):

☐ Poison ☐ Heavy Metal: __ __ ppm

☐ Flammable ☐ Oxidizer

☐ Corrosive: pH? ____ ☐ Shock-sensitive

☐ Reactive to: ☐ Air ☐ Water

☐ Cyanides: ___ ppm ☐ Sulfides: ____ ppm

☐ Carcinogen ☐ Irritant ☐ Sensitizer

☐ Solvents ☐ Chlorinated solvents

☐ Toxic ☐ Peroxide former

☐ Biohazard ☐ Non-Hazardous?

Other: _____

Wastes must be removed within 6 months of Start of Accumulation in the Container!!

Contact EHS Office (tlrussell@bsu.edu, or 5-2807) with questions or for pickup.

Lab Wastes

All containers of Lab Waste ("unwanted materials") must be labeled with:

Affixed or Attached to the Container:

1. The words **"Lab Waste"**; and,

2. Information to alert emergency responders to the contents of the container (e.g., name or list of chemicals or hazard classes)

All waste containers must also have the following information either directly on the container, or associated with the container label:

Associated With Container Label – May be Affixed or Attached if Desired:

3. Information sufficient to make a Hazardous Waste determination; and,
4. Accumulation start date (of the waste in the container)

Lab Wastes

Identifies container as *Unwanted Material* – BSU term: *LAB WASTE*

Needed to make a HW determination and alerts emergency responders to container contents

LAB WASTE

Accumulation Start Date: _____

Dept:_____Bldg/Rm:_____

Contact:_____Phone:_____

Waste Name: _____

Chemical Composition: %

_____ ____

_____ ____

_____ ____

_____ ____

_____ ____

_____ ____

_____ ____

Hazard properties (check any applicable):

☐ Poison ☐ Heavy Metal: __ __ ppm

☐ Flammable ☐ Oxidizer

☐ Corrosive: pH? ____ ☐ Shock-sensitive

☐ Reactive to: ☐ Air ☐ Water

☐ Cyanides: ___ ppm ☐ Sulfides: ____ ppm

☐ Carcinogen ☐ Irritant ☐ Sensitizer

☐ Solvents ☐ Chlorinated solvents

☐ Toxic ☐ Peroxide former

☐ Biohazard ☐ Non-Hazardous?

Other: _____

Wastes must be removed within 6 months of Start of Accumulation in the Container!!

Contact EHS Office (tlrussell@bsu.edu, or 5-2807) with questions or for pickup.

States *Start of Accumulation* Date

Alerts emergency responders to the container contents

Alerts emergency responders to container contents and assists in making a HW determination

Lab Wastes

1. Start Date – date when waste is first added to container (if combining containers – the earliest date prevails);
2. Contact person – who generated or knows the waste?
3. Give common waste name;
4. Provide contents and estimated percentage
5. Check known/likely hazards

LAB WASTE

Accumulation Start Date: 9-12-13

Dept: CHEM Bldg/Rm: CP441

Contact: C. Cardinal Phone: 5-1241

Waste Name: Spent Solvent/Cleaner

Chemical Composition:	%
Acetone	30
Methanol	25
Acetic Acid	10
Water	35

Hazard properties (check any applicable):

☐ Poison ☐ Heavy Metal: __ __ ppm

✓ Flammable ☐ Oxidizer

✓ Corrosive: pH? 3.8 ☐ Shock-sensitive

☐ Reactive to: ☐ Air ☐ Water

☐ Cyanides: ___ ppm ☐ Sulfides: ____ ppm

☐ Carcinogen ☐ Irritant ☐ Sensitizer

✓ Solvents ☐ Chlorinated solvents

✓ Toxic ☐ Peroxide former

☐ Biohazard ☐ Non-Hazardous?

Other: _____

Wastes must be removed within 6 months of Start of Accumulation in the Container!!

Contact EHS Office (tlrussell@bsu.edu, or 5-2807) with questions or for pickup.

Lab Wastes - Referenced

LAB WASTE

Accumulation Start Date: 9-12-13

Dept: CHEM Bldg/Rm: CP441

Contact: C. Cardinal Phone: 5-1241

Waste Name: Container #103

Chemical Composition:	%
Chlorinated Solvents	100

Hazard properties (check any applicable):

- ☐ Poison ☐ Heavy Metal: __ __ ppm
- ☐ Flammable ☐ Oxidizer
- ☐ Corrosive: pH? ____ ☐ Shock-sensitive
- ☐ Reactive to: ☐ Air ☐ Water
- ☐ Cyanides: ___ ppm ☐ Sulfides: ____ ppm
- ☐ Carcinogen ☐ Irritant ☐ Sensitizer
- ☐ Solvents ✓ Chlorinated solvents
- ✓ Toxic ☐ Peroxide former
- ☐ Biohazard ☐ Non-Hazardous?

Other: _____

Wastes must be removed within 6 months of Start of Accumulation in the Container!!

Contact EHS Office (tlrussell@bsu.edu, or 5-2807) with questions or for pickup.

Must still have at least LAB WASTE identity and hazard information for emergency responders on the container itself – start of accumulation date and HazWaste information may be "associated" or "referenced"

Lab Wastes

+

BALL STATE UNIVERSITY

LAB WASTE

Accumulation Start Date: *9-5-13*

Dept: *Sculpture* Bldg/Rm: *AJ 102*

Contact: *Charlie C.* Phone: *5-1241*

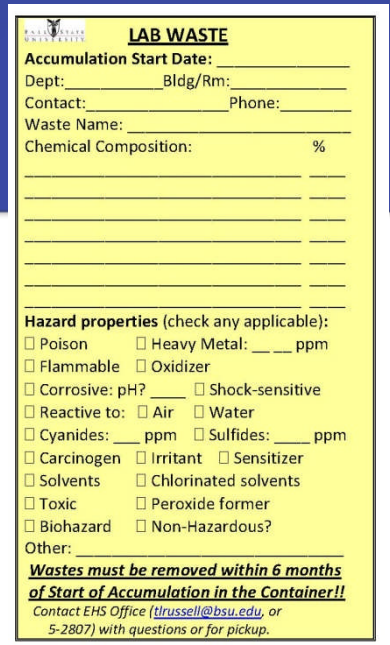
Waste Name: **Unused Linseed Oil**

Wastes must be removed within 6 months of Start of Accumulation in the Container!!

Contact EHS Office (tlrussell@bsu.edu, or 5-2807) with questions or for pickup.

Here you can cut off part of the LAB WASTE label if you like –still need to show that and the Accumulation Start Date, etc. The material hazards (flammability, etc.) and contents should already be on the original container label.

Lab Wastes



LAB WASTE

Accumulation Start Date: _____

Dept:_____Bldg/Rm:_____

Contact:_____Phone:_____

Waste Name: _____

Chemical Composition: %

_____ ___

_____ ___

_____ ___

_____ ___

_____ ___

_____ ___

_____ ___

Hazard properties (check any applicable):

☐ Poison ☐ Heavy Metal: __ __ ppm

☐ Flammable ☐ Oxidizer

☐ Corrosive: pH? ____ ☐ Shock-sensitive

☐ Reactive to: ☐ Air ☐ Water

☐ Cyanides: ___ ppm ☐ Sulfides: ____ ppm

☐ Carcinogen ☐ Irritant ☐ Sensitizer

☐ Solvents ☐ Chlorinated solvents

☐ Toxic ☐ Peroxide former

☐ Biohazard ☐ Non-Hazardous?

Other: _____

Wastes must be removed within 6 months of Start of Accumulation in the Container!!

Contact EHS Office (tlrussell@bsu.edu, or 5-2807) with questions or for pickup.

Poison: A waste that either exhibits ***Toxic*** hazards as defined below, or is otherwise designated a ***Poison*** based on shipping labels on the constituent containers, on Safety Data Sheets, or container labels related to the contents of the waste container.

Heavy Metal: This refers to the 8 RCRA metals – Arsenic (As), Barium (Ba), Cadmium (Cd), Chromium (Cr), Mercury (Hg), Lead (Pb), and Selenium (Se), and Silver (Ag). If present in the waste in appreciable amounts, name the metal and its approximate concentration.

Flammable: Liquids having a flashpoint of less than 140°F. For solids--may cause a fire through friction; show a burning rate faster than 2.2 mm (0.087 inches) per second; or any metal powders that can be ignited and react over the whole length of a sample in 10 minutes or less. Naphthalene, matches, aluminum powder, and magnesium are examples of flammable solids.

Lab Wastes

Oxidizer: Any compound that spontaneously evolves oxygen at room temperature or under slight heating. The term includes such chemicals as chlorates, perchlorates, nitrates, and permanganates. Peroxide-formers should be checked separately where indicated.

Corrosives: Acids and bases or mixtures having a pH less than or equal to 2 or greater than or equal to 12.5, and materials that burn the skin or dissolve metals. Examples are strong mineral acids (chromic, sulfuric, hydrochloric, or nitric) strong alkalis (potassium hydroxide, sodium hydroxide), rust removers, and acid or alkaline cleaning fluids. Specify the pH of the waste where indicated if known or a potential hazard. The presence of perchloric or hydrofluoric acid should also be noted in the *Waste Name* or *Other* category.

LAB WASTE

Accumulation Start Date: _____

Dept:_____Bldg/Rm:_____

Contact:_____Phone:_____

Waste Name: _____

Chemical Composition: %

_____ ___

_____ ___

_____ ___

_____ ___

_____ ___

_____ ___

_____ ___

Hazard properties (check any applicable):

☐ Poison ☐ Heavy Metal: __ __ ppm

☐ Flammable ☐ Oxidizer

☐ Corrosive: pH? ____ ☐ Shock-sensitive

☐ Reactive to: ☐ Air ☐ Water

☐ Cyanides: ___ ppm ☐ Sulfides: ____ ppm

☐ Carcinogen ☐ Irritant ☐ Sensitizer

☐ Solvents ☐ Chlorinated solvents

☐ Toxic ☐ Peroxide former

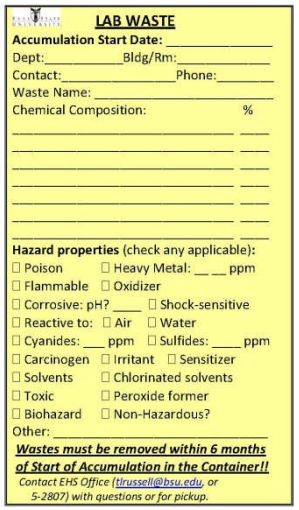
☐ Biohazard ☐ Non-Hazardous?

Other: _____

Wastes must be removed within 6 months of Start of Accumulation in the Container!!

Contact EHS Office (tlrussell@bsu.edu, or 5-2807) with questions or for pickup.

Lab Wastes



LAB WASTE
Accumulation Start Date: _____
Dept:_____Bldg/Rm:_____
Contact:_____Phone:_____
Waste Name: _____
Chemical Composition: %
_____ ___
_____ ___
_____ ___
_____ ___
_____ ___
_____ ___
_____ ___
Hazard properties (check any applicable):
☐ Poison ☐ Heavy Metal: __ __ ppm
☐ Flammable ☐ Oxidizer
☐ Corrosive: pH? ____ ☐ Shock-sensitive
☐ Reactive to: ☐ Air ☐ Water
☐ Cyanides: ___ ppm ☐ Sulfides: ____ ppm
☐ Carcinogen ☐ Irritant ☐ Sensitizer
☐ Solvents ☐ Chlorinated solvents
☐ Toxic ☐ Peroxide former
☐ Biohazard ☐ Non-Hazardous?
Other: _____
Wastes must be removed within 6 months of Start of Accumulation in the Container!!
Contact EHS Office (tlrussell@bsu.edu, or 5-2807) with questions or for pickup.

Reactivity: A waste material, other than an explosive, which will vigorously polymerize, decompose, condense, or become self-reactive and undergo other violent chemical changes, including explosion, when exposed to heat, friction or shock, or in the absence of an inhibitor, or in the presence of contaminants or in contact with incompatible material. Check if the material is air or water reactive. Also, check and provide the concentration of any **cyanides** or **sulfides** in the waste. a waste is hazardous if it is a cyanide- or sulfide-bearing waste which generates toxic gases or vapors at a quantity sufficient to present a health or physical danger.

Carcinogen: Any substance or agent capable of causing or producing cancer in mammals, including humans. A chemical is considered to be a carcinogen if it has been listed as such by the International Agency for Research on Cancer (IARC), by the National Toxicology Program (NTP) (latest edition), or if it is regulated by OSHA as a carcinogen.

Lab Wastes

Irritant: A chemical/material that causes a reversible inflammatory effect on living tissue, and may cause soreness, redness or discomfort.

Sensitizer: A chemical that causes a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemical.

Solvents: Identify if the waste contains materials that were used as a solvent or extraction fluid – either **halogenated** (methylene chloride, chloroform, trichloroethylene, dichloroethylene, Tetrachloroethylene, 1,1,1-trichloroethane, carbon tetrachloride, chlorinated fluorocarbons, etc.); **or non-halogenated** (Xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol, etc.)

LAB WASTE

Accumulation Start Date: _____

Dept:_____Bldg/Rm:_____

Contact:_____Phone:_____

Waste Name: _____

Chemical Composition: %

_____ ____

_____ ____

_____ ____

_____ ____

_____ ____

_____ ____

_____ ____

Hazard properties (check any applicable):

☐ Poison ☐ Heavy Metal: __ __ ppm

☐ Flammable ☐ Oxidizer

☐ Corrosive: pH? ____ ☐ Shock-sensitive

☐ Reactive to: ☐ Air ☐ Water

☐ Cyanides: ___ ppm ☐ Sulfides: ____ ppm

☐ Carcinogen ☐ Irritant ☐ Sensitizer

☐ Solvents ☐ Chlorinated solvents

☐ Toxic ☐ Peroxide former

☐ Biohazard ☐ Non-Hazardous?

Other: _____

Wastes must be removed within 6 months of Start of Accumulation in the Container!!

Contact EHS Office (tlrussell@bsu.edu, or 5-2807) with questions or for pickup.

Lab Wastes

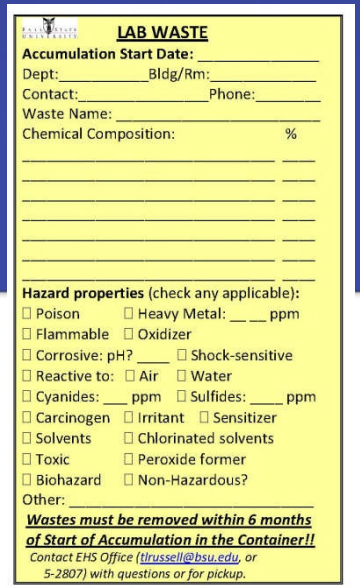
LAB WASTE
Accumulation Start Date: _____
Dept:_____Bldg/Rm:_____
Contact:_____Phone:_____
Waste Name: _____
Chemical Composition: %
_____ ___
_____ ___
_____ ___
_____ ___
_____ ___
_____ ___
_____ ___
Hazard properties (check any applicable):
☐ Poison ☐ Heavy Metal: __ __ ppm
☐ Flammable ☐ Oxidizer
☐ Corrosive: pH? ____ ☐ Shock-sensitive
☐ Reactive to: ☐ Air ☐ Water
☐ Cyanides: ___ ppm ☐ Sulfides: ____ ppm
☐ Carcinogen ☐ Irritant ☐ Sensitizer
☐ Solvents ☐ Chlorinated solvents
☐ Toxic ☐ Peroxide former
☐ Biohazard ☐ Non-Hazardous?
Other: _____
Wastes must be removed within 6 months of Start of Accumulation in the Container!!
Contact EHS Office (tlrussell@bsu.edu, or 5-2807) with questions or for pickup.

Toxic: A waste having the capacity to cause death, illness, or diminished function. A material that meets one or more of the following criteria should be considered toxic:

- Has a published LD_{50} equal to or less than 0.5 g/kg of body weight.
- Has a published LC_{50} equal to or less than 1000 ppm.
- Has an OSHA permissible exposure limit (PEL) or ACGIH Threshold Limit Value (TLV) equal to or less than 5000 ppm.
- Has an OSHA PEL or ACGIH TLV equal to or less than 10 mg/m^3.

Peroxide Formers: Organic peroxides are very unstable carbon-based chemicals that contain the characteristic peroxide (-O-O-) bond. Peroxides can be formed when commonly used laboratory chemicals with the potential to form peroxides react with air, moisture, or impurities. Organic peroxides are extremely sensitive to shock, sparks, heat, friction, impact, and light. These include acrylonitrile, butadiene, cyclohexene,, ethylene glycol diethyl ether, furan, isopropyl ether, methyl isobutyl ketone, vinyl acetate, vinyl chloride, and vinyl ethers.

Lab Wastes



LAB WASTE

Accumulation Start Date: _____

Dept:_____Bldg/Rm:_____

Contact:_____Phone:_____

Waste Name: _____

Chemical Composition: %

_____ ____

_____ ____

_____ ____

_____ ____

_____ ____

_____ ____

_____ ____

Hazard properties (check any applicable):

☐ Poison ☐ Heavy Metal: __ __ ppm

☐ Flammable ☐ Oxidizer

☐ Corrosive: pH? ____ ☐ Shock-sensitive

☐ Reactive to: ☐ Air ☐ Water

☐ Cyanides: ___ ppm ☐ Sulfides: ____ ppm

☐ Carcinogen ☐ Irritant ☐ Sensitizer

☐ Solvents ☐ Chlorinated solvents

☐ Toxic ☐ Peroxide former

☐ Biohazard ☐ Non-Hazardous?

Other: _____

Wastes must be removed within 6 months of Start of Accumulation in the Container!!

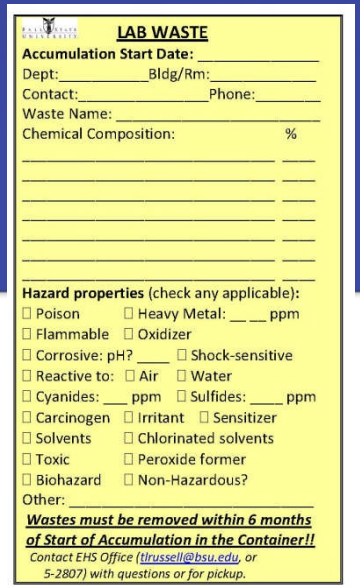
Contact EHS Office (tlrussell@bsu.edu, or 5-2807) with questions or for pickup.

Biohazard: An agent of biological origin (e.g., all infectious organisms, their toxins, allergens of biological origin, and genetic fragments) that has the capacity to cause ill-effects in humans.

Explosive: The term "explosive" or "explosives" includes any chemical compound or mechanical mixture which, when subjected to heat, impact, friction, shock, detonation or other suitable initiation, undergoes a very rapid chemical change with the evolution of large volumes of highly heated gases which exert pressures in the surrounding medium. The term applies to materials that either detonate or deflagrate. Explosive wastes do not appear as a label hazard as such materials should be immediately brought to the attention of the BSU EHS Office for proper handling.

Other: Can include any other hazard not listed.

Lab Wastes



LAB WASTE

Accumulation Start Date: _____

Dept:_____Bldg/Rm:_____

Contact:_____Phone:_____

Waste Name: _____

Chemical Composition: %

_____ ____

_____ ____

_____ ____

_____ ____

_____ ____

_____ ____

_____ ____

Hazard properties (check any applicable):

☐ Poison ☐ Heavy Metal: __ __ ppm

☐ Flammable ☐ Oxidizer

☐ Corrosive: pH? ____ ☐ Shock-sensitive

☐ Reactive to: ☐ Air ☐ Water

☐ Cyanides: ___ ppm ☐ Sulfides: ____ ppm

☐ Carcinogen ☐ Irritant ☐ Sensitizer

☐ Solvents ☐ Chlorinated solvents

☐ Toxic ☐ Peroxide former

☐ Biohazard ☐ Non-Hazardous?

Other: _____

Wastes must be removed within 6 months of Start of Accumulation in the Container!!

Contact EHS Office (tlrussell@bsu.edu, or 5-2807) with questions or for pickup.

Non-Hazardous: Many chemicals and compounds would not constitute hazardous wastes, only a very few examples include neutralized caustics (pH between 5 and 10), collagen, cytosine, nutrients, starches, cellulase, many biologicals and media, salines, potassium thiosulfate, plasmin, calcium citrate, pectrin, and many others. If a trained individual, based on knowledge of the waste contents and characteristics can determine that the waste is not a RCRA Hazardous Waste, this class may be checked. Normally, this determination will be made following removal of the waste by the Chemical Hygiene Officer or field chemists employed by BSU's waste vendor personnel. However, if you are sure the waste is innocuous it may be checked as Non-Hazardous here--or separately disposed as solid waste or to the sewer as described in the *BSU Waste Management Guide*.

Lab Waste Pick-Ups

The EHS Office schedules quarterly waste pickups across the campus on the following academic calendar schedule:

Mid-August (after the 2nd Summer Session-before Fall Term)
December (during Winter Break)
March (during Spring Break)
May (after Spring term-before 1st Summer Session)

However, BSU maintains Central Accumulation Area for the temporary storage and staging of Lab Wastes between the quarterly scheduled pickups for off-site treatment and disposal.

Lab Wastes

Remember:

It is the responsibility of the student, laboratory worker, instructor, Principal Investigator, or manager within the laboratory to prepare the label(s) completely and verify that labels are placed on all containers of lab wastes stored in the laboratory, or associated storage or preparation room. In order for the container to be removed from a laboratory or studio it must be identified with the required information.

LAB WASTE

Accumulation Start Date: _____

Dept:_____Bldg/Rm:_____

Contact:_____Phone:_____

Waste Name: _____

Chemical Composition: %

_____ ____

_____ ____

_____ ____

_____ ____

_____ ____

_____ ____

_____ ____

Hazard properties (check any applicable):

☐ Poison ☐ Heavy Metal: __ __ ppm

☐ Flammable ☐ Oxidizer

☐ Corrosive: pH? ____ ☐ Shock-sensitive

☐ Reactive to: ☐ Air ☐ Water

☐ Cyanides: ___ ppm ☐ Sulfides: ____ ppm

☐ Carcinogen ☐ Irritant ☐ Sensitizer

☐ Solvents ☐ Chlorinated solvents

☐ Toxic ☐ Peroxide former

☐ Biohazard ☐ Non-Hazardous?

Other: _____

Wastes must be removed within 6 months of Start of Accumulation in the Container!!

Contact EHS Office (tlrussell@bsu.edu, or 5-2807) with questions or for pickup.

Lab Wastes

1. Label properly!

2. Use compatible containers in good condition;

3. Do not exceed 55 gallons (220 lbs) of waste in particular lab (1 qt. of P-lists);

4. Do not exceed 6 months beyond the *start of accumulation date;*

***5.* All personnel and students in labs must have this basic training;**

6. Only fully "trained persons" may remove the wastes or make hazardous waste determinations

7. EHS has ten (10) days to remove the wastes after container is full or 6 months.

BALL STATE UNIVERSITY

Environmental Health and Safety Office
North Service Building

Contact: Tom Russell, CHMM
765-285-2807
tlrussell@bsu.edu

Chemical Waste / Lab Waste Management in Laboratories and Art Studios/Workshops

This checklist is for managing *Lab Wastes* (Chemical Wastes) in science education and research laboratories, and art studios and workshops, on the main campus of Ball State University. Other generators of chemical wastes (maintenance shops, housing, dining, etc.) must follow the general chemical and hazardous waste handling procedures for waste generators under U.S.EPA/IDEM hazardous waste regulations.

- ☐ Determine that the material is unwanted and is not going to be reused at any time.
- ☐ Determine the container the Lab Waste will be stored in – contact the EHS with questions or if acceptable containers are needed:
  - This container must be in good condition and compatible with the waste.
  - Large volumes of waste should be stored in U.S. DOT approved Hazardous Material shipping containers.
- ☐ Apply a BSU *Lab Waste* label (yellow) to the container at the time of first filling and complete the label fully and accurately:
  - Ensure a descriptive chemical name is printed on the label (no acronyms).
  - Ensure location and contact name is printed on the label.
  - Ensure the *accumulation start date* is printed on the label.
  - Ensure the waste components and hazards are recorded on the label.
- ☐ Use secondary containment (trays or cabinets) to segregate containers according to hazard class and compatibility.
- ☐ Ensure each container is closed at all times (except when adding Lab Wastes). See *working container* and *inline system policies* for more information.
- ☐ Ensure you do not exceed 1 kg. (2.2 lbs) of any of the following acutely hazardous materials: *Aluminum phosphide, Ammonium picrate, Mercury fulminate, Nitroglycerein, Tetranitromethane, or Zinc phosphide >10%.*
- ☐ Ensure that you do not exceed the smaller of 55-gallons or 220 lbs of Lab Waste.
- ☐ Ensure that any Lab Wastes are removed by EHS within 6 months of the *start of accumulation date* on any container – contact the EHS for pickup.
- ☐ Ensure that all personnel and students who manage Lab Wastes have training.
- ☐ Ensure all personnel and students working in the Lab Waste generation and storage areas know emergency and spill procedures:
  - Post emergency/spill/injury procedures near the lab/studio door.
  - Ensure everyone working in the area is familiar with the location and operation of emergency eye washes, showers, fire extinguishers, spill control equipment.
- ☐ Contact the EHS Office to request removal of any Lab Waste containers that are nearly full or upon approaching 6 months of storage, whichever comes first.
- ☐ **Do not dilute or dispose of Lab Wastes via drain/sewer, in trash, dumping on The ground, or by evaporation.**

Lab Wastes

8. Be sure all waste containers are always kept closed; EXCEPT:

- **When adding, removing, or bulking Lab Wastes; or,**
- **A *Working Container* may be open until the end of the procedure or work shift (must then be closed); or,**
- **When venting of a container is necessary;**
- **For the proper operation of lab equipment – in-line collection of waste from HPLC; or,**
- **To prevent dangerous situations, such as build-up of pressure; and,**
- **Must be 2 gallon or less capacity.**

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- ☐ Ensure all personnel and students working in the Lab Waste generation and storage areas know emergency and spill procedures:
  - Post emergency/spill/injury procedures near the lab/studio door.
  - Ensure everyone working in the area is familiar with the location and operation of emergency eye washes, showers, fire extinguishers, spill control equipment.
- ☐ Contact the EHS Office to request removal of any Lab Waste containers that are nearly full or upon approaching 6 months of storage, whichever comes first.
- ☐ **Do not dilute or dispose of Lab Wastes via drain/sewer, in trash, dumping on The ground, or by evaporation.**

Lab Wastes

P- Listed Materials

Now, under Subpart K, there are only six (6) acutely hazardous (P-listed) wastes limited to < 1 quart.

Acutely hazardous waste (P-listed material) must be removed from lab within 6 months or when a 1-quart limit is reached.

The 6 are:

1. P006 – Aluminum Phosphide
2. P009 – Ammonium Picrate
3. P065 – Mercury Fulminate
4. P081 – Nitroglycerin
5. P112 – Tetranitromethane
6. P122 – Zinc Phosphide >10%

Lab Wastes

Laboratory Cleanouts

- Control your inventory- Reduce where possible;
- Subpart K allows a particular laboratory a “once per year” Laboratory Cleanout;
- Best to keep chemicals in their original manufacturer containers;
- Only allowed one per rolling 12-month period;
- EH&S has 30 days (rather than 10 days) from the time the cleanout begins to remove the chemicals from the laboratory;
- The laboratory department can perform the cleanout--or schedule it for EHS and our waste vendor to perform

Lab Wastes

Laboratory Cleanouts Documentation

- Identify the lab/room being cleaned out;
- An inventory of the chemicals must be provided;
- The date(s) the laboratory clean-out begins and ends;
- The total volume of hazardous waste generated;
- Records must be kept for at least 3 years.
- If done properly, the increased waste volume will not affect our hazardous waste generator status.

Field Work Safety (guideline only)

The Ball State University ***Field Safety Plan*** procedure applies to all BSU employees, students, and volunteers performing research or work at all BSU campuses, properties, or in the field. At present, the following form(s) and procedure(s) are only suggested guidelines.

The variety of research and education-oriented field work performed, the differing geographic and geologic hazards and climates to which persons may be exposed, the flora and fauna encountered, and myriad other potential hazards with travel and field work would render a comprehensive safety plan—hoping to encompass all possible risks—both too cumbersome and, most likely, ineffective. Accordingly, the BSU field work safety program involves completion of a site-specific ***Field Work Safety Plan*** requiring the identification, evaluation, and control of any risks that may be encountered.

Field Research Safety Plan

To be completed and reviewed by all field personnel prior to departure

BALL STATE UNIVERSITY

FIELD RESEARCH SAFETY PLAN (Template)

This template may be used by the Faculty Member, Instructor, Principal Investigator (PI), or Project Manager, to **assist** with the development of a Field Safety Plan. **The completed Safety Plan should be shared with all the members of the field research team and a copy left with the Department.** Multiple trips to the same location can be covered by a single Safety Plan. The Safety Plan should be revised whenever a significant change to the location or scope of fieldwork occurs.

Section I.

Faculty Member, Principal Investigator/Project Manager:		Department:	
Phone:		Email:	
Project Duration:			

Location of Field Research (Attach map and transportation safety precautions – road hazards, vehicles, etc.)

Country:		Geographical Site:	
State or County:		Nearest City:	
Nearest Hospital or Emergency Health Facility:		Phone Number:	

Attach map with driving directions from field site to nearest hospital or health care facility

BSU Dept. Contact Person:		Phone:	
Local (Field) Contact Person:		Phone:	

Field Work Personnel (Attach separate sheet of paper if necessary)

Name	Affiliation (i.e. BSU, Other)	Category (check all that apply)			
		Team Leader	Team Member	Other (specify)	Trained First Aider
		☐	☐		☐
		☐	☐		☐

Field Research Safety Plan

To be completed and reviewed by all field personnel prior to departure

		☐	☐		☐
		☐	☐		☐
		☐	☐		☐
First Aid Trained Person:			Phone:		
CPR Trained Person:			Phone:		

Section II.

Field Research Study/Project: Describe scope of field work or activity. (Attach separate sheet of paper if necessary)

Hazards Inherent to the Project (Check all that Apply)

Environment

- ☐ High Altitude
- ☐ Extreme Temperature
- ☐ Excessive/Extreme Exposure to sun, wind, blowing sand, etc.
- ☐ Work Over/Under Water
- ☐ Diving

Accessibility

- ☐ Remote Location
- ☐ Long Distance to Medical Services
- ☐ Difficult Communications with the outside world

Terrain

- ☐ Rough/Unusual Terrain

Work Tasks

- ☐ Work in Confined Space (natural or man-made)
- ☐ Trenching/Excavating
- ☐ Work at Night/Poor Lighting
- ☐ Noise Generated > 85 dBA
- ☐ Dusts/Other Particulate Hazards
- ☐ Potential for Oxygen Deficiency or Other Atmospheric Hazard (i.e. gas, vapor)
- ☐ Hazardous Waste Generation
- ☐ Transportation of Hazardous Materials
- ☐ Handling Hazardous Materials
- ☐ Storage of Hazardous Materials on site
- ☐ Lack of Potable Water

Field Research Safety Plan

To be completed and reviewed by all field personnel prior to departure

☐ Flash Flood Potential	☐ Lack of Sanitary Facilities
☐ Falling Objects (avalanches, rock falls, etc.)	☐ Flying Debris or Impact
☐ Work along roadway shoulders (Attach traffic control plan and permit, if required)	☐ Electrical Hazard
☐ Heights (trees, cliffs, etc)	☐ Fire Hazards (welding, cutting)
☐ Disaster Area	☐ Diving
☐ Violence (political, military, etc)	☐ Climbing/Strenuous Hiking Required
Flora/Fauna	**Equipment Used in Field Area**
☐ Wild Animal Hazards	☐ Snowmobile/ATV
☐ Venomous/Poisonous Animals:_____	☐ Boat/Canoe/Kayak
☐ Insects as Known Disease Carriers	☐ Forklift
☐ Trapping/Handling Animals:_____	**Materials Brought to Field Area**
☐ Toxic/Poisonous Plants:_____	☐ Chemicals
☐ Other:_____	☐ Biological
	☐ Radiological
	☐ Other:_____
	☐ No Known Hazards

Section III.

Safety Plan: Describe the risks, and associated safety provisions or procedures for the hazard(s) identified in the field research activities as noted above. (Attach separate sheet of paper if necessary)

Personal Protective Equipment or Clothing Required: All field activities require basic protection including appropriate field clothing, hand protection, safety shoes/boots, and eye protection. Any additional PPE requirements based on the hazards identified as part of minimizing risk of exposure, injury or illness. (Check all that Apply)

☐ Face Shields/Safety Glasses	☐ Respirator	☐ Fall Protection
☐ Hearing Protection	Type:_____	☐ Extraction Equipment

Field Research Safety Plan

To be completed and reviewed by all field personnel prior to departure

☐ Hard Hat/Bump Cap	Cartridge/Filter Type: _____	(Confined Space)
☐ Rain Gear	☐ Portable Eye Wash	☐ Flashlights
☐ Gloves	☐ Emergency Shower	☐ Other: _____

Travel Immunizations: List any required immunizations/prophylaxis required for this field study

Preparedness (Check all that Apply)

- ☐ Medications (Taken on a Regular Basis)
- ☐ Allergy Treatments (as needed)
- ☐ Adequate Food and Water Supplies
- ☐ Water Purification Tablets or Filter Devices
- ☐ Other:_____

Safety Training Required

☐ First Aid/CPR	☐ Biosafety
☐ Emergency Action and Preparedness	☐ Radiation Safety
☐ Project Specific Hazard Communication	☐ Laser Safety
☐ OSHA Carcinogens	☐ Respiratory Protections
☐ Compressed Gasses and Cryogenic Liquids	☐ Forklift/Other Heavy Equipment
☐ HotWorks	☐ Confined Space Entrant/Attendant/Supervisor
☐ Dangerous Good/Hazardous Materials Shipping	☐ Heat Illness Prevention
☐ Certified SCUBA Diver	☐ Other:_____

Section IV.

Emergency Plan/Procedure: Describe emergency response procedures in an event of an injury, exposure, accident, or other emergency situation. Include emergency communication, evacuation plans, etc. (Attach separate sheet of paper if necessary)

Field Research Safety Plan

To be completed and reviewed by all field personnel prior to departure

By signing below, I certify that I have read the Field Research Safety Plan and agree that I and all listed participants will abide by the Safety Plan and adhere to all SDSU policies and procedures as well as any local policies, procedures or guidelines.

Signature: _____ Date: _____

Participants: _____ Date: _____
_____ Date: _____
_____ Date: _____
_____ Date: _____
Participants _____ Date: _____
_____ Date: _____

A number of References from other Universities are available for the preparation of this field safety plan – here are several:

Northern University of Arizona Field Safety Plan:
http://nau.edu/uploadedFiles/Administrative/Research/Compliance/_Forms/Field-Safety-Manual.pdf

University of California, Berkeley, Safety Guidelines for Field Researchers:
http://ehs.berkeley.edu/images/ehs/pubs/fieldresearchsfty.pdf

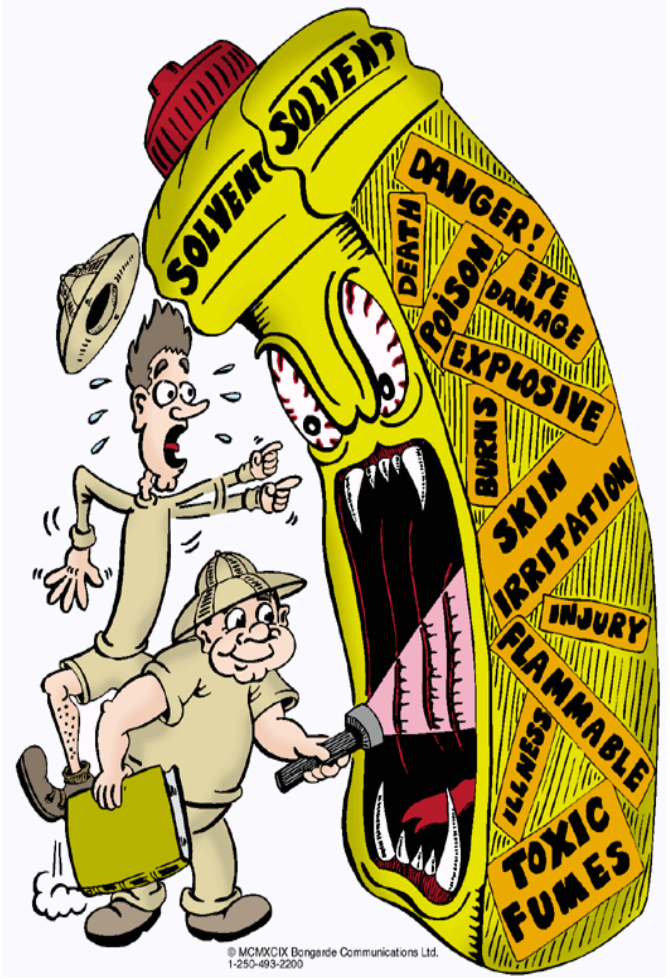
Arizona State University, Safety Guidelines for Field Researchers
http://www.asu.edu/ehs/documents/field_researchers_manual.pdf

Cornell University, Agriculture and Life Sciences, Field Safety Guidelines
http://oeh.cals.cornell.edu/pdf/FieldSafetyGuide.pdf

Concluding Remarks

Compliance / Inspections

- EHS and the BSU Lab Safety and Security Committee will soon conduct random compliance inspections and will generate a written report for each lab that addresses areas of concern.
- Each lab should first conduct a self-audit. The form is available in the BSU Chemical Hygiene Plan.



Areas of Regulatory Oversight for Laboratory Safety

- **Radiation Safety**

  Radiation Safety Committee

  Saiful Islam RSO: 285-8066

- **Biological Safety**

  Institutional Biosafety Committee

  Chris Mangelli, Research Integrity: 285-5070

  John McKillip, Biology Department: 285-8830

- **Chemical and General Safety**

  Laboratory Safety and Security Committee

  TomRussell,Chemical Hygiene Officer/Environmental Specialist: 285-2807
  Anthony Rench, Industrial Hygienist, EHS Office: 285-2832

  Tim Kirby, Life Safety Specialist, EHS Office: 285-2815

“What Not To Do” Laboratory