Laboratory Safety and GHS Self-Study Module

For Science Department Faculty

Revised May 25, 2016

Self-study Module Outline

- The Basics: PI Responsibilities
  - Lab-Specific Training and Procedures
  - Regulatory Review
- Chemical Health and Safety
  - Chemical Fume Hood Basics
  - Globally Harmonized System – Right to Know More
  - Chemical Health Hazards
  - Physical Hazards of Chemicals
- General Laboratory Safety
- Emergency Procedures
- Additional training Requirements
- Quiz

Environmental Health & Safety

Let me know how I can help you support safety and environmental compliance in your laboratory!

Lindsey Kayman, CIH, LEED AP (CM)
Director, Environmental Health and Safety
524 W 59th St., Room L2.61
NY, NY 10019
Office: 212.818.4151
Cell: 917.682.6298
Kayman@jjay.cuny.edu

http://www.jjay.cuny.edu/environmental-health-and-safety

Instructions

- Review this self study module and then complete the quiz on the last slide with a score of 90% or higher to fulfill your laboratory safety training requirement.

The Basics: PI Responsibilities

Ensure that all personnel working in your lab are:

- Up-to-date on annual lab safety and hazardous waste training provided by EHS, as well as other training, if applicable.
- Made aware of any chemicals or equipment that require training and/or prior authorization from you before use.
- Provided with and required to wear appropriate personal protective equipment.
- Made aware of the college’s Chemical Hygiene Plan and CUNY’s Laboratory Safety Manual. These and other resources are available on the EHS Website.
- Aware of the safety hazards and safe work practices of chemicals, materials and equipment they are using.
The Basics: PI Responsibilities

- Use the lab audit checklist to identify and correct safety deficiencies and regulatory violations in your laboratory.
- Notify Facilities right away of any hood that is alarming or not working properly by phoning x8541 and completing a Facilities Work Order, which can be found in Inside John Jay on the Resources Center page. Indicate the face velocity reading and if the alarm sounds when the sash is at the sash stop, lowered and closed.
- Post a warning sign on the hood describing the problem, whether it safe to use and when Facilities was notified.

Inform Natalya if you are considering bringing onsite or using...

- new equipment such as lasers, equipment needing local exhaust, etc.
- Ordering highly hazardous chemicals – GHS rating of 1
- Bringing on-site or using biohazardous materials that you haven’t worked with before (BL2 or higher)
- Radionuclides

Approval from EHS and Science Dept is required for use/storage of the following:

- Radionuclides, recombinant nucleic acids, yeast, and other select agents and toxins
- Select agents and toxins that are highly toxic or lethal to humans, animals, or plants
- Select agents and toxins that have a demonstrated capacity to cause severe illness or injury to humans, animals, or plants
- Select agents and toxins that can generate these materials, highly lethalfor reactions
- Select agents and toxins that can generate these materials, highly lethal for reactions
- Select agents and toxins that can generate these materials, highly lethal for reactions

The Basics: PI Responsibilities

- Approval from EHS and Science Dept is required for use/storage of the following:
- Radionuclides, recombinant nucleic acids, yeast, and other select agents and toxins
- Select agents and toxins that are highly toxic or lethal to humans, animals, or plants
- Select agents and toxins that have a demonstrated capacity to cause severe illness or injury to humans, animals, or plants
- Select agents and toxins that can generate these materials, highly lethal for reactions
- Select agents and toxins that can generate these materials, highly lethal for reactions
- Select agents and toxins that can generate these materials, highly lethal for reactions

Keep documentation that you reviewed the following with persons in your laboratory:

- Location and use of eyewash, safety showers, spill clean-up supplies, etc.
- Hazards and safety procedures for chemicals and/or other hazardous materials being used.
- Safe use of equipment they may use such as autoclaves, centrifuges, electrophoresis
- Emergency procedures
- Any prior approvals for use of equipment, chemicals, or working alone, specific to your lab.

Video: https://www.youtube.com/watch?v=MS6X6AhVz3Q

In 2008, a laboratory fire led to the death of a 23-year-old technician, Sangji Sheharbano. Her sweater caught on fire while she was using a pyrophoric chemical.

In addition to the University, the PI was charged as the "employer" because he was the hiring/firing authority for the position.

Charges:
- Lack of training/failure to document training
- Failing to correct unsafe laboratory conditions and work practices identified in EHS audit
- Failing to ensure that employees wore appropriate personal protective equipment
Extremely Hazardous Materials

- The PI or the PI’s designee should be in the room with and provide training and supervision for procedures requiring skill/knowledge until the person being trained has demonstrated understanding and competency. If appropriate, have the person practice doing a dry run.
- Ensure that appropriate personal protective equipment is used and the chemical hood is working properly.
- Try to replace extremely hazardous materials or procedures with safer substitutes.

NYC Fire Code, Enforced by FDNY

Certificate of Fitness C-14

- A FDNY Certificate of Fitness (CoF) C-14 holder is required to be present to supervise the area whenever the laboratory is in operation. An up-to-date permit must be posted in each lab.
- Renewed every 3 years

Lab Specific Training

- Training can be incorporated into group meetings
- Keep documentation of both formal and informal sessions including what was covered. You can email yourself the topics you covered and who attended.
- Ensure that lab personnel are informed which chemicals and equipment they are authorized to use by the PI and which they are not authorized to use.
- Discuss the procedure that group members should follow for specific spills.
- Review Safety data sheets with lab personnel or have them complete a chemical-specific training exercise for chemicals they work with.

Occupational Safety and Health Administration (OSHA)

Major OSHA standards affecting John Jay laboratories:

- Occupational Exposure to Hazardous Chemicals in Laboratories, “Lab Standard”
- Standards for Inhalation Exposure to Specific Chemicals
- Hazard Communication
- Formaldehyde
- Dichloromethane

REGULATORY REVIEW

Agencies that have standards for tasks commonly performed in John Jay laboratories:

- FDNY – NYC Fire Dept.
- OSHA – Occupational Safety & Health Administration
- NY PESH – NY Public Employees Safety & Health
- EPA - Environmental Protection Agency

Are CUNY employees covered by OSHA?

No. OSHA does not cover public sector employees

- CUNY employees are covered under the NY Public Employees Safety and Health (PESH) Bureau in the NY Department of Labor Division of Safety and Health
  - PESH enforces OSHA standards for NY Public Employees
  - Promulgates and enforces some state health and safety standards:
    - Workplace Violence
    - Hazard Communication/Right to Know
OSHA “Lab Standard”
Particularly Hazardous Substances (PHS)

Occupational Exposure to Hazardous Chemicals in Laboratories, 29 CFR 1910.1450

The “Lab Standard” focuses on chemical exposure prevention and requires signs to be posted where PHS are used and stored, as well as additional precautions which are listed in a Chemical Hygiene Plan.

PHS is defined as chemicals which are:

- **Select Carcinogens** – As identified by the OSHA-Regulated carcinogen list, the National Toxicology Program, or the International Agency for Research on Cancer.
- **Reproductive Toxins** – Mutagens, Teratogens, Fertility Impairment
- **Acutely Toxic Substances** – Small exposures that can kill or cause serious harm

OSHA Lab Standard Considerations
Must be described in a Chemical Hygiene Plan

Formaldehyde and Dichloromethane Standards

- Engineering and work practice controls to prevent exposure
- Labeling of Containers
- Training of personnel
- Air monitoring to determine employee exposure
- Keeping exposures within OSHA’s Permissible Exposure Limit and Action Level
- Medical Surveillance (monitoring by a health care professional at specified exposure levels)
(Note: When these chemicals are used in a chemical fume hood, air monitoring and medical surveillance are not required).

OSHA Inhalation Standards for Individual Chemicals

Permissible Exposure Limits (PEL)
Maximum air contaminant concentrations that workers may be exposed to on the job

- 8 hour Time Weighted Average (TWA)
- Short term exposure limit – usually 15 minutes. 4x/day (STEL)
- Ceiling (C) – exposure may never exceed the Ceiling concentration
  - Units are parts per million (ppm) or mg/m³
  - Geared towards industrial workplaces, not laboratories

NY PUBLIC EMPLOYEES SAFETY AND HEALTH (PESH)

Public Employee Safety and Health (PESH) in the NY Worker Protection Bureau, Division of Safety and Health (DOSH), Public Employee Safety and Health

- Enforces OSHA standards and NY Right to Know
Chemical Safety Information and Training
• For employees, provide similar info as OSHA Hazard Communication Standard
• For NY residents, Right-to-Know provides access to information on chemicals used in nearby businesses

Why do we need the Right to Know?
• In the past, chemical producers did not list the chemical ingredients, so workers did not know of potential health effects.
• Cities and states passed “Right to Know” laws before federal OSHA enacted "Hazard Communication Standard" which requires employee training, safety data sheets and container labeling.
• NYC Community Right to Know – Local Law 26 Businesses provide information concerning the amount, location and nature of hazardous substance to emergency responders

Chemical Fume Hood Basics
- Use for all operations where odoriferous, volatile, toxic or harmful release is possible
- Check monitor to ensure working order
- Reduce Turbulence:
  - Work at least 6 inches into the hood
  - Elevate Large Apparatus
- Work with sash at or below sash stop
- Do not use the hood for storage
Chemical Fume Hood Basics

Normal Operation

- The face velocity indicator is not just a monitor, it adjusts the airflow – face velocity is controlled by a sash tracking cable.
- When the sash is moved it takes a few minutes for the face velocity to stabilize – it should read between 90-100 FPM.
- The green light should be on. Notify Facilities if the red or yellow light is lit.

Cluttered Hood – a common safety deficiency in the lab

Maintenance a space to work that is clear from front to back

It is not safe to work with hazardous chemicals when there is not an area that is clear from front to back. Turbulence can allow contaminated air to leak out when a person is working in the hood.

Chemical Fume Hood Basics

Inspection Sticker

- Each hood has an inspection sticker which indicates the face velocity when the hood was last tested.
- You can compare the current face velocity reading with the reading when the hood was last tested.
- When the glass sash is moved it takes a few minutes for the face velocity to stabilize.

Chemical Fume Hood Basics

Sash Closed Sash Open

- When the sash is closed, the controller should read “FLO” to indicate that the hood is in reduced flow mode.
- When the sash is opened, the controller indicates the face velocity. It should be between 90-100 fpm.

Chemical Fume Hood Basics

Controller will indicate EEE when in purge mode, the red light will be lit and there will be a high-pitched whistling noise. Contact Facilities to turn off the purge mode.

Monitor or Red Button Purge – Used to increase exhaust if there is a chemical spill

Variable Air Volume Hoods

NB Hoods are Variable Air Volume

- Flow = Face Velocity x Hood Opening
- $F_{\text{min}} = F_{\text{min}} \times F^2$
- Face velocity is the speed of the air at the plane of the sash opening. It is kept constant by sash tracking technology which varies the flow rate as the sash is moved using a cable on the side of the glass sash. It should be 90-100 feet per minute.
- Face Velocity is kept constant. Flow rate varies and is the lowest when the glass sash is CLOSED.
Chemical Fume Hood Basics

1. Use the hood with the glass sash lowered as much as possible. This provides:
   • Protection to the eyes and face from splashes
   • Better containment of contaminants
   • Reduces the amount of heated and cooled air that is exhausted, which saves money and reduces environmental footprint.

Work with the Sash Lowered

- Eyes & Face Protected
- Optimal Containment of Chemicals

Its hard to believe, but people do this… especially if they sit at the hood.

Chemical Fume Hood Basics

- Save money and reduce greenhouse gas emissions by keeping sash closed when the hood is not in use.
- Flow of air through the hood:
  - Sash closed: 200 ft³/min
  - Sash open to sash stop: 750 ft³/min

Chemical Fume Hood Basics

- Flow of air through the hood: almost 4 times more heated or cooled air is exhausted from the building when the sash is open!

Globally Harmonized System of Classification and Labeling of Chemicals (GHS)


- Resource – detailed info on every chemical tracked, with all the codes, along with hazard phrases and required pictograms.

GHS: Right to (More) Information

- A system used internationally for
  - Classification of chemicals
  - Communicating hazards of chemicals
  - Labeling of chemicals
  - Safety Data Sheets (SDS) - no longer called Material Safety Data Sheets (MSDS)
- Much more detailed hazard information than what had been provided on chemical container labels and Material Safety Data Sheets

GHS Classes and Categories

- Hazard Class – type of hazard, such as acute toxicity, carcinogenicity, reproductive hazard, etc
- Hazard Categories – degree of severity – 1= Most Severe 4= Least Severe

Sections of Safety Data Sheet-SDS

1. Identification
2. Hazard identification, includes pictograms, signal word, precautionary & hazard statement
3. Composition/info on ingredients
4. First-aid measures
5. Fire-fighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure controls and personal protective equip
9. Physical & chemical Properties
10. Stability and reactivity
11. Toxicological information
12. Ecological information
13. Disposal considerations
14. Transport information
15. Regulatory information
16. Other info including date of preparation or last revision

Chemical Container Labels & Safety Data Sheets

Now container labels and Safety Data Sheets provide the following information:
- Chemical name
- Signal word: Danger or Warning or no Signal Word
- Pictogram
- Hazard statements
- Precautionary statements

GHS – Major Changes to Hazard Communication Standard

- Material Safety Data Sheets (MSDS) will be replaced with a Safety Data Sheet (SDS) which is similar, but has 16 sections in a new format

GHS: 1= most hazardous

In old rating systems, 1 was the least hazardous
GHS Health Hazard Statements

- Name of chemical. The chemical name must be fully spelled out and is the only accepted format on labels. Do not include abbreviations or formulas with the chemical name spelled out. Examples:
  - NaOH – Incorrect!
  - Sodium Hydroxide (NaOH) – INCORRECT!
  - Sodium Hydroxide - Correct and only accepted format.
- Specific information regarding the hazards of the contents (name, signal word, and pictogram).
- An easy way to do this is to print out and tape GHS info from an SDS onto the container.

Temporary Chemical Containers

If chemicals in a container (other than the original) will be used longer than one day, label the container with following information:

- Name of chemical.
- Specific information regarding the hazards of the contents (name, signal word, and pictogram).
- An easy way to do this is to print out and tape GHS info from an SDS onto the container.
Toxicity: Acute vs Chronic

- **Acute Exposure vs. Chronic Exposure**
  - **Acute**: Harmful effects through a single or short term exposure
  - **Chronic**: Harmful effects over an extended period, usually upon repeated or continuous exposure.

  Paracelsus (~1567): “All substances are poisons, there is none which is not a poison; the right dose differentiates a poison from a remedy”

Possible Routes of Entry

- Ingestion
- Absorption
- Inhalation
- Injection

Weighing toxic solids

- Toxic powders – bench wipe samples at other institutions show chemical contamination of lab surfaces from weighing toxic solids. This could lead to ingestion
  - Buy in solution
  - How to weigh toxic powders safely?

How to weigh a toxic solid?

- Tare a container.
- Add the solid in a hood. Try not to take more than necessary. Do not put extra material back into original container.
- Weigh the container.

INGESTION

- Occurs when contaminated items are placed in the mouth.
- The reason for banning food, drink, tobacco, and cosmetics in the lab.
- Personal hygiene and housekeeping are very important to ingestion hazard control.
**Personal Hygiene**
- No Food or Beverages
- No Smoking
- Do Not Apply Cosmetics
- Do Not Consume Lab Ice

**SKIN ABSORPTION**
- Can occur very quickly through cuts or abrasions on the skin.
- Depending on the characteristics of the contaminant, absorption may occur through intact skin (example: phenol, DMSO, solvents)
- Solvents act as a carrier for other chemicals
- Mucous membranes and eye tissue are particularly vulnerable
- Barrier protection (gloves) and personal hygiene are the primary control measures.

**INJECTION**
- Includes all puncture wounds.
- Examples: needle sticks, glass shards or capillary tubes puncturing skin
- Difficult to protect against
- Use carefully planned procedures and personal diligence, including sharps containers.
- Do not clip the needles!

**INHALATION**
- Most common route of entry in labs
- Chemical fume hood is the primary control available, not room ventilation.
- Respiratory protection may be necessary where a fume hood is inadequate or unavailable. Must get permission from EH&S to use.

Which property of a chemical determines how likely it is to evaporate?

**Vapor Pressure: Measure of How Easily a Liquid will Evaporate**

VP at room temperature:
- Water = 1
- Acetone = 180
- Ethidium Bromide (negligible)

- Volatile chemicals must be used in a hood!

**OSHA Lab Standard Particularly Hazardous Substances and GHS**
- OSHA Lab Standard has not yet incorporated GHS into definition of Particularly Hazardous Substances, which must be used & stored in "designated areas" that have a warning sign posted

General Guidance – if a chemical has a GHS category of 1 or 2 in these classifications, assume it is an OSHA Particularly Hazardous Substance:
- Carcinogens
- Reproductive Toxicity/Germ Cell Mutagenicity
- Acutely Toxic
GHS Health Hazard Classes Cont.

- Carcinogenicity
- Reproductive toxicity - Effects on fertility, development of offspring, effects on or via lactation
- Specific target organ toxicity - Single and repeated exposure
- Aspiration hazard - Low viscosity hydrocarbons that cause lung damage when ingested

GHS Health Hazard Classes

- Acute toxicity
- Skin corrosion
- Skin Irritation
- Eye Effects
- Respiratory Sensitization
- Skin Sensitization
- Reproductive Toxicity/Germ cell mutagenicity
- Target Organ System Toxicity
- Aspiration Toxicity

GHS Health Hazard Class & Categories

GHS Acute Toxicity Categories

<table>
<thead>
<tr>
<th>Acute Toxicity</th>
<th>Category 1</th>
<th>Category 2</th>
<th>Category 3</th>
<th>Category 4</th>
<th>Category 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral (mg/kg)</td>
<td>≤5</td>
<td>≤50</td>
<td>≤300</td>
<td>≤2000</td>
<td>Criteria:</td>
</tr>
<tr>
<td>Dermal (mg/kg)</td>
<td>≤50</td>
<td>≤200</td>
<td>≤1000</td>
<td>≤2000</td>
<td>- ≤5000</td>
</tr>
<tr>
<td>Gases (ppm)</td>
<td>≤100</td>
<td>≤500</td>
<td>≤2500</td>
<td>≤20000</td>
<td>Anticipated</td>
</tr>
<tr>
<td>Vapours (mg/l)</td>
<td>≤0,5</td>
<td>≤2,0</td>
<td>≤10</td>
<td>≤20</td>
<td>significant</td>
</tr>
<tr>
<td>Dust and mists (mg/l)</td>
<td>≤0,05</td>
<td>≤0,5</td>
<td>≤1,0</td>
<td>≤5</td>
<td>effects in human</td>
</tr>
</tbody>
</table>

GHS Carcinogen Category Criteria

- Category 1: Known or Presumed Human Carcinogen
  - Category 1A: Known to have carcinogenic potential for humans, largely based on human evidence
  - Category 1B: Presumed to have carcinogenic potential for humans, largely based on animal evidence
- Category 2: Suspected human carcinogens (based on human or animal evidence but less convincing)

GHS Health Hazards

Skull and Crossbones Pictogram

- Acute Toxicity – Categories 1-3 (oral, inhalation or dermal routes)
**GHS Health Hazards**

**Exclamation Mark Pictogram**
- Acute Toxicity – Category 4 (oral, inhalation or dermal routes)
- Skin Irritation/Corrosion – Category 2
- Serious Eye damage/irritation – Category 2A
- Skin Sensitive
- STOT (single exposure) – Category 3 (respiratory tract irritation, narcotic effects)

**GHS Health Hazards**

**Health Hazard Pictogram**
- Respiratory Sensitive
- Germ Cell Mutagenicity
- Carcinogenicity
- Toxic to Reproduction
- STOT (single exposure) – Categories 1-2
- STOT (repeated exposure) – Categories 1-2
- Aspiration Hazard

**GHS Hazards**

**Corrosion Pictogram**
- Corrosive to Metals (steel or aluminum >6.25 mm/year at 55°C)
- Skin corrosion/irritation – Category 1 (A, B and C)
- Serious eye damage/irritation – Category 1

**GHS Health Hazards**

**Toluene – GHS Information**

**Toluene**
- CAS#: 108-88-3
- Health Hazard Information:
  - Flammable
  - Acute Toxicity
  - Skin Irritation
  - Eye Irritation
  - Respiratory Irritation
  - Sensitive Skin
  - STOT (Single Exposure)
  - STOT (Repeated Exposure)
  - Aspiration

**Calomel – Mercury I Chloride**

**GHS Example: Hg₂Cl₂**

**Mercuric Chloride (Mercury II chloride)**

**Mercuric Chloride**
- CAS#: 7447-16-4
- Health Hazard Information:
  - Corrosive
  - Skin Irritation
  - Eye Irritation
  - Respiratory Irritation
  - Sensitive Skin
  - STOT (Single Exposure)
  - STOT (Repeated Exposure)
  - Aspiration
Physical Hazards of Chemicals
GHS Physical Hazard Classes

- Explosives
- Flammable gases
- Flammable aerosols
- Oxidizing gases
- Gases under pressure
- Flammable liquids
- Flammable solids
- Self-reactive substances and mixtures
- Pyrophoric liquids

Flash point

The lower the flashpoint, the more flammable a chemical is!

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Flashpoint</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol</td>
<td>61°F</td>
<td>2</td>
</tr>
<tr>
<td>Ethyl Ether</td>
<td>-49°F</td>
<td>1</td>
</tr>
<tr>
<td>Hexane</td>
<td>-7°F</td>
<td>2</td>
</tr>
<tr>
<td>Xylenes</td>
<td>77°F</td>
<td>3</td>
</tr>
<tr>
<td>Dichloromethane</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

GHS Hazards

Flammability

- It is the vapor that evaporates from a flammable chemical that catches on fire. If you have a flammable spill and an ignition source in the room it could cause a fire.
- Letter from a post-doc burned in a lab fire
- Liquids evaporate faster when the temperature is raised.

Flashpoint

- The temperature at which a particular organic compound gives off sufficient vapor to ignite in air if there is an ignition source.
- Which are more flammable – chemicals with Low or High Flashpoint?
Oxidizers may ignite on contact with flammable liquids. Concentrated category 1 oxidizers can ignite combustibles.

**Examples of Oxidizers**

- Bleach
- Chlorine
- Chlorates
- Chromates
- Chronic Acid
- Halogens
- Hydrogen
- Peroxide
- Perchlorates
- Nitric Acid
- Nitrate
- Oxygen
- Peroxide
- Persulfate
- Sulfate
- Sulfuric Acid
- Perchloric Acid

**Safe Use and Storage: Oxidizers**

- Agents which are known to readily give up oxygen and gain hydrogen. They increase the flammability of other materials.
- Store away from flammables, organics, and reducers.
- Ensure there are no extraneous materials in the area that could react.
- If the reaction is anticipated to be violent or explosive, use shields or other methods for isolating the materials or the process.

**FIRE Prevention**

- Segregate oxidizers and combustibles/flammables
- Segregate acids and bases
- Do not store oxidizers on wooden shelves
- Use spill clean up materials and not paper towels for flammable liquid spills
- Use flammable storage cabinet for flammables

**INCIDENT**

Inadvertent Mixing of Ethanol and Nitric Acid

An explosion occurred when a few drops of ethanol was accidentally poured into a nitric acid waste container.

**Flammable Cabinets: Prevent Contents From Igniting When There is a Fire**

When the adjacent refrigerator caught on fire, the flammable solvents in this flammable storage cabinet did not ignite, giving personnel time to evacuate safely.
**Safe Use and Storage: Flammables**

- Flammable materials have flash points < 100°F (37.8°C).
- Store in NFPA approved flammable liquid containers ("safety cans") or flammable liquid storage cabinets.
- Do not store in refrigerators not designed for flammable liquid storage (having internal ignition sources).
- Flammable liquids must be stored away from ignition sources and strong oxidizers.

**Safe Use and Storage: Corrosives**

- Never add water to acid.
- Store below eye level.
- Containers and equipment used for storage and processing of corrosive materials should be corrosion resistant.
- For all chemicals: Wear proper personal protective equipment and know the location of eyewash and safety shower.

**Water Reactives and Pyrophorics**

- Water Reactive materials include alkali metals such as lithium, sodium, potassium, acid anhydrides, and acid chlorides. Remember air contains water!
- Pyrophoric materials can ignite spontaneously upon contact with air.
- Store in inert environments.
- Have written procedures and appropriate extinguisher available.
- Notify EHS to evaluate safety before you use!

**PEROXIDE FORMERS**

- Chemicals which undergo auto-oxidation to form peroxides which may explode.
- Common examples: ethyl ether, tetrahydrofuran, dioxane, butadiene, cyclohexene.
- Date container when received.
- Date container when opened.
- Test for peroxides every 6 months after opening.

**Keep Segregated**

- Acids
- Bases
- Oxidizers
- Flammables

Avoid exothermic reactions which causes spattering and possibility of explosions.

**GHS Environmental Hazards**

- Aquatic Toxicity
  - Acute aquatic toxicity
  - Chronic aquatic toxicity
- Hazardous to the Ozone Layer
GHS Exercise

Sigma Aldrich Safety Data Sheets or European Chemical Agency Database [link]

Leads to: [link]

Personal Protective Equipment

Laboratory Coats

- Lab coats are required whenever employees handle hazardous materials
- Lab coat should not be worn outside the lab
- A rubber apron should be used when handling large amounts of corrosives
- A flame resistant coat may be required if a pyrophoric will be used. Consult EHS.

Minimum personal protective equipment requirements when hazardous chemicals or BL2 or higher biological materials are being used:

- Laboratory Coat
- Safety Glasses
- Nitrile, Vinyl or Latex Gloves

BSL2 – Microorganisms are moderate potential hazard to personnel and the environment. They cause only mild disease to humans, or are difficult to contract via aerosol in a lab setting. More info

Personal Protective Equipment

RESPIRATORY PROTECTION

Rubber or Disposable Respirator

- You need permission from EHS if you plan to use a respirator.
- A lot of OSHA Requirements
- Should not be necessary if you are working in a chemical fume hood.

These are respirators. Disposable respirators have 2 straps and a NIOSH approval number. Use is not allowed without permission from EHS.

Nuisance masks - used to remind you not to touch your face.

Safety Glasses

- Minimum eye protection in the laboratories
- The fume hood sash also protects eyes when lowered.
- Goggles with a face shield, rather than safety glasses, are needed when pouring large amounts of highly corrosive chemicals or other high risk activities or using liquid nitrogen
Gloves

- Wear gloves whenever chemicals or other hazardous materials are used.
- In general, gloves provide only short term protection. They should be changed frequently and should be immediately removed and discarded whenever contaminated or torn. They should not be worn outside the lab unless you one hand is ungloved hand to open doors, etc.
- For very hazardous chemicals, or when more than incidental contact is anticipated, additional research on glove selection is required. Ask for help from EHS.

Etiquette for Non-research workers in laboratories

Facilities, custodial, outside contractors

- Clear work areas of hazardous materials and contamination prior to work starting
  - Wipe down equipment / surfaces
- Secure experiments
- Be available for questions

General Lab Safety

- Use the lab audit checklist, posted on the EHS Website to review safety requirements and perform a self-inspection of your laboratory.
  [Link to lab audit checklist]

Emergency Procedures

Incident Response

John Jay Emergency Number

- Notify Public Safety at x 8888 (212-237-8888) for all types of emergencies
- Inform the Public Safety dispatcher that you are reporting an emergency
- Call from a safe place (not when standing next to a chemical spill)
Chemical Spill Supplies

Each lab with chemicals must have the following spill clean-up supplies:
• Solvent spills, acid spills, base spills, spatulas and related supplies
• Hazardous waste bags
• Gloves, goggles, lab coat

There is a large spill cart with supplies in room 4.70.05
Ask Public Safety if you need a key.

Complicated Spills: Must be Reported to Public Safety

Any of the following spill characteristics requires a call to Public Safety x8888 or 212-237-8888, who will then contact EHS. EHS will provide instructions on how to handle clean-up and may call in a cleanup vendor.
• Reactive, Strong Oxidizer, Other Physical Hazard
• Health – GHS 1 or 2 for Acute Toxicity, Carcinogen, Reproductive Toxicity, STOT - (Single Exposure), Respiratory Sensitizer - Category of 1 or 2 or 3
• Respiratory Protection may be needed
• More than 1 liter
• Lab personnel not comfortable with handling
• N. Timmer, D. Warunek, F. Sheehan, or Certificate of Fitness holder unavailable

A Complicated Spill will usually involve wearing a respirator

Purge Button

Activate either purge button when there is a spill to increase air being exhausted from the lab

Incident Response: Chemical Spills

Incident Response: Splash to Eye/Face

Uncomplicated spills that can be handled by lab personnel

Lab employees can clean up the following uncomplicated spills, without getting help from Public Safety:
1) the ingredients in the spill are known,
2) Personnel are sure that the material is low toxicity (check safety data sheet)
3) a respirator is not needed, and
4) no one needs medical attention

Procedure to Follow:
• Alert people in the immediate area
• If the spill involves a flammable liquid, turn off all ignition and heat sources immediately
• Activate the purge button – on hood controller or red button on the wall
• Notify N. Timmer, D. Warunek, F. Sheehan or the Certificate of Fitness holder
• Don appropriate protective equipment (goggles, gloves, long sleeve lab coat)
• Confine spill to small area. Create a dam around the perimeter and then absorb and neutralize spill with appropriate material. Use appropriate spill kit or sodium bicarbonate for acids; citric acids for caustics; and solvent spill kit for solvents, dry sand, or diatomaceous earth for other chemicals. Collect residue, place in a container, and dispose as hazardous waste through EHS.
• Clean spill area with soap and water.

Procedure for Complicated Spills

• Notify people in the area to evacuate. Activate the purge button as you exit.
• Call Public Safety from a safe location and provide details about the spill as well as a phone number where you can be reached.
• Post a sign on the door warning others not to go in the room until approved by EHS or Public Safety.
• Wait for a call-back from Lindsey Kayman or another safety representative.

• Use the eyewash locking clip for hands-free operation
• Flush eyes as long as possible, at least 15 minutes, until Fastcare responds
• Call Public Safety from lab phone or by calling 212-237-8888
**Incident Response: Splash to Eye/Face**

Use the locking clip to be able to hold eyes open with hands free operation.

Flush eyes for 15 minutes or until medical help arrives.

**Incident Response: Clothing Fires and Spills on Clothing/Body**

- Remove affected clothing
- Call from lab phone or dial 212-237-8888 to summon help

**Incident Response- Fire**

For all fires:
- Activate the Alarm using the pull station, located near exits.
- Evacuate. Close the door behind you to prevent spread of smoke.
- Notify responders or public safety of the nature of the fire. You can call 212-237-8888 or speak to responders on your way out.

**Incident Response- Fire**

Individuals are neither required nor encouraged to fight fires. However, it is critical to notify responders when a fire occurs!

**Incident Response- Clothing Fires and Spills on Clothing/Body**

Pull handle out to use as a drench hose.

Help a panicking student or colleague get under the safety shower!
Water – for Combustibles

CO₂ – for Electrical
If you have expensive electrical equipment, consider getting one of these. It won’t damage equipment, like dry powder.

Dry Powder – for solvents, combustibles and electrical

Type A
Type BC
Type ABC

This is what we have in the labs

Incident Response - Fire

Additional Training Requirements

- All personnel who handle, label or manage hazardous waste containers must complete Hazardous Waste training. Classroom style training or a self-study module and quiz is available from the Resources Center in Inside John Jay.
- The following training must also be completed where applicable:
  - Bloodborne Pathogens/Biosafety Training – where human or primate cells or tissues or human, plant or animal pathogens are stored or used.
  - Recombinant DNA Training – Required in addition to Bloodborne Pathogens/Biosafety training for personnel working with Recombinant or Synthetic Nucleic Acid Molecules
  - Shipping Training – Required for personnel shipping dry ice, infectious materials or other dangerous goods
  - Radiation Training Use of radionuclides or radioactive sealed sources or lasers

Contact EHS to schedule these.

Incident Response - Fire

Combustible Metals such as Sodium, Potassium, and Magnesium
- Class D type fire extinguisher must be available in areas where combustible metals are used.
- Materials such as dry sand, should also be available to help smother a potential combustible metal fire.
- DO NOT use (ABC) type fire extinguishers on combustible metal fires.

Incident Response - Fire

The End

Thank you for reviewing this Science Faculty Laboratory Safety self-study module.

Click here to take the 20 question quiz. You must get 90% correct to fulfill your training requirement.