Laboratory Safety Training

Presented By
University Department of Safety and Health
Safety Information Sources

- University Department of Safety and Health website address:

  www.drexelsafetyandhealth.com
Safety Information Sources

- **Department of Chemistry Website**
  - Address - www.chemistry.drexel.edu/
  - Provides information on:
    - Safety Personnel – contact information
    - Departmental Chemical Hygiene Plan (CHP)
    - Chemical Fume Hood Information
    - Laboratory Broken Glass/ Waste Disposal
    - Hazardous/ Chemical Waste Disposal
    - Incident Reports
    - Recent Safety Notices
    - Safety/ Hazard Labels
Safety Information Sources

- **Other Sources of Information**
  - The University Department of Safety and Health library
  - Any question concerns contact the Department Chemical Hygiene Officer or the University Department of Safety and Health.
  - For Radiation safety question contact the Radiation Safety office at 215-762-4050.
Chemical Storage
Chemical Storage Requirements

- All hazardous and non-hazardous chemicals must be stored in clearly defined designated areas in accordance with the CHP and OSHA Regulation 29 CFR 1910.1450 also known as the “Laboratory Standard”. These storage guidelines must be followed when storing hazardous chemicals:

  - The chemical inventory should be kept as small as possible.
  - Do not store chemicals on top of high cabinets or shelves.
  - Keep exits, passageways, areas under tables, and emergency equipment areas free of stored chemicals.
  - Provide a definite storage place for each chemical and return the chemical to that location after each use.
  - Avoid storing chemicals on bench tops and in fume hoods, except for those chemicals being used currently.
Chemical Storage Requirements

- Do not store chemicals on the floor.

- Do not store chemicals in the cabinets under the sink, except for household cleaning agents (i.e. Windex, bleach, soaps, detergents, etc.).

- Store chemicals in a cool dry place avoiding direct sunlight

- Ventilated storage cabinets shall be used to store extremely hazardous chemicals.

- Use chemical storage refrigerators only for chemical storage. Label these refrigerators with the following signage: “No Food or Drink - Chemical Storage Only”

- Do not store flammable liquids in a refrigerator unless it is an approved explosion-proof refrigerator.

- Safety containers must be used when transporting chemicals (i.e. carts, rubber totes, secondary containers etc).
Chemical Storage Requirements

- Observe all precautions regarding the storage of incompatible chemicals.
  - Oxidizing reagents / Reducing reagents
  - Acids / Bases

- Dry chemicals (solid materials) shall not be stored with liquid chemicals.

- Separate chemicals according to the recommendation of the Flinn Scientific Catalog

- Store all flammable liquids in a grounded flammable storage cabinet with self-closing doors.

- Organic Acids can be stored in the flammable storage cabinet; however, overspill containers must be used to contain any spills.
Chemical Storage Requirements

- Acids must be stored separate from bases. Storage in the same cabinet is possible ONLY IF OVERSPILL CONTAINERS ARE USED TO CONTAIN ANY SPILLS.

- Separate inorganic and organic bases. These can be stored in the same cabinet. Shelves or overspill containers can be used as a means of separation.

- Oxidizers must be stored in a cabinet separate from all other chemicals.

- Reactive chemicals must be segregated and stored appropriately i.e. flammable cabinet, explosion proof refrigerator, dedicated container etc.

- Toxic chemicals, including carcinogens, must be properly labeled and stored in ventilated storage areas; small containers should be stored together in unbreakable chemical-resistant secondary containers. These containers must be labeled either “Caution: High Chronic Toxicity,” or “Cancer Suspect Agent.”
Chemical Storage Requirements

- Alphabetical storage of all dry chemicals is not allowed. This may result in incompatibles appearing together on a shelf. Dry chemicals should first be segregated appropriately then stored alphabetically within each hazard class.

- Cylinders of compressed gases, empty or full, must be labeled, strapped or chained at all times to a wall or bench top, and must be capped when not in use.

- Oxygen and other oxidizing gases must not be stored adjacent to flammable gases (except when in use).
Chemical Storage Requirements

- Do not store flammable gases near sources of heat or ignition.

- **Peroxides** or peroxide forming chemicals must be date upon recite and upon opening.

- If unable to determine the best possible storage options consult the MSDS for the chemical. If further assistance is need contact the University Department of Safety and Health.
Chemical Storage Requirements

- New storage requirements for Flammable Chemicals in High Rise Buildings:

  - Current Requirements as per Philadelphia Building and Fire Code:
    - The code limits the amount of flammable material that can be stored in a control zone. The first floor according to the code can have a maximum of four control zones.
    - The maximum allowable amount of flammable materials that can be stored on the first floor is sixty gallons.
    - As the number of floor increase the number of control zones and the allowable amount of flammable materials that can be stored decreases.
    - For example, only 4 gallons of flammable materials can be stored on or above the 7th floor of the building.
Chemical Storage Requirements

- New storage requirements for Flammable Chemicals in High Rise Buildings:
  - New Requirements as per acquired variance:
    - The amount of flammable materials handled on bench top at any given time during the day must be less than 1.5 gallons or 6 liters.
    - The allowable amount of flammable materials stored in the laboratory must be less than or equal to 60 gallons or 240 liters.
    - All materials in excess of 6 liters must be stored in flammable storage cabinets equipped with over spill containers.
Labeling
Labeling Requirements

Chemical Container Labeling

- OSHA requirements for labeling under the Chemical Hygiene Plan will be the same as those defined in the hazard communication standard 1910.1200. Therefore, all containers in the workplace must contain the following information:
  
  - Complete chemical name. Identify the solvent (if not water).
    - Abbreviation or chemical symbols are not acceptable
  
  - Appropriate hazard warnings.
    - For example - irritant; flammable; corrosive; oxidizers etc.
  
  - Name and address of chemical manufacturer, importer, distributor, or other responsible party.
Labeling

- All labels must be prominently displayed and legibly written (printed) in English and other language as appropriate for employees and/or students.

- Small containers can be labeled with numerical values that reference information in a note book. The note book must list all the essential information pertaining to the material.

- Secondary containers (i.e. beakers; erlenmeyer flask; cap bottles etc.) used for purposes of transferring hazardous material from a primary labeled container for immediate and complete use by an investigator or his / her technicians or research staff or student do not require labeling.

- However, if the transferred hazardous material is to be used by other research personnel/ student, or is not immediately used, it is the responsibility of the investigator/ lab supervisor/ faculty member/ student/ lab technician for whom the chemical material was first intended, to properly label the secondary container.

- For chemicals prepared for use in a research lab a research notebook and page number should replace the Course Number line in the information above.
Labeling

- Laboratory Labeling

- The laboratory entrance door shall be labeled as follows:
  - NFPA diamond. Laboratory personnel shall fill in the diamond with the highest hazard number pertaining to their laboratory.
  - Biohazard label and appropriate Biosafety Level (if applicable).
  - Radiation Hazard Label (if applicable).
  - Emergency contact information. The information should include a name and number to contact in the event of an emergency. It must be clearly visible and placed on the laboratory entrance door.
  - Additional warning labels as applicable, i.e. “carcinogen in use”, “water reactive materials”, “inhalation hazard, respiratory protection required in this area”, “high noise, hearing protection required in this area”, etc.
Labeling

Chemical Storage Labeling

- All cabinets, shelves and refrigerators containing chemical storage (including the cleaning supplies) must be labeled with the appropriate warning label (i.e. Flammable, Acids, Bases, Oxidizers etc).
- Refrigerators used for chemical storage must be labeled, with appropriate hazard warnings and with the signage: “NO Food or Drink – Chemicals Storage Only.”
- Any refrigerator used of food or drink storage must be label as such.
- Microwaves and centrifuges that could be contaminated with chemicals must be labeled with the appropriate warning labels.
Hazardous Waste Management
Hazardous Waste Procedures

- **Hazardous Waste**
  - Hazardous waste includes substances that are solids, liquids and gases. The EPA definition of hazardous waste includes substances that possess a hazardous characteristic (e.g. toxic, ignitable, corrosive or reactive with other substances), or substances that are listed as hazardous waste by the EPA on the basis of their usage or chemical constituents.

- **Hazardous Waste Identification**
  - The University Safety and Health Department will perform identification of hazardous wastes. Since the majority of chemicals used in our facility are reagent grade the identification will be performed using Material Safety Data Sheets, bottle labels, and 40 CFR Part 261 Subpart B, C, and D. A third party contractor will test for the ignitability, corrosivity, reactivity, and toxicity of unknown hazardous wastes.
Hazardous Waste Procedures

**Mixed Chemical Waste**
- The University Safety and Health Department shall require that only compatible chemical waste be combined into one waste container. Refer to the Laboratory Safety Manual and MSDS for chemical compatibilities.

**Multi-Hazardous Waste**
- Multi-Hazardous waste is waste that contains any combination of chemical, radioactive, or biological hazards. Any waste stream that presents more than one type of hazard will require special management consideration because the selected treatment technology appropriate for one type of waste may not be appropriate for the other types. Multi-hazardous waste will be evaluated on an individual basis and the constituent that poses the greatest hazard will be given priority.
Hazardous Waste Procedures

**Drain Disposal**

- The University Safety and Health Department will permit drain disposal of elementary neutralized (pH adjustment of waste that are hazardous only because they exhibit the corrosivity characteristic) acidic and caustic aqueous solutions. The elementary neutralized aqueous solution must have a final pH value between 6 and 9. The limit of material that may be neutralized is 1 liter.

- The Department of Safety and Health will also permit drain disposal of common salts, sugars and agars in both liquid and solid forms. For solids, the material must be dissolved in tap water. The limit of material that may be disposed is 1kg of solid or 1 liter of liquid.

- All drain discharges will be documented on a log sheet located near the point of discharge. The log sheet shall contain the date of discharge, the chemical name, the volume discharged and the pH value. The University Safety and Health Department will collect the log sheet bimonthly. Each log sheet will be kept in a room specific file for one year.
Hazardous Waste Procedures

The University Safety and Health Department shall prohibit the drain disposal of the following:

- Flammable or explosive pollutants
- Pollutants that will cause corrosive structural damage to the Publicly Owned Treatment Works (POTW), but in no case discharges with pH lower than 5.0.
- Solid or viscous pollutants that may cause an obstruction of flow in the POTW
- Pollutants capable of releasing fumes or vapors
- Pollutants, including oxygen-demanding pollutants (high biological oxygen demand), which may cause interference with the POTW
- Wastewater with sufficient heat to inhibit biological activity in the POTW (must not exceed 104 F at the POTW)
- Petroleum, oil, non-biodegradable cutting oil or products of mineral oil origin in amounts that will cause interference or pass through
- No organic chemicals
- No heavy metal solutions
Hazardous Waste Procedures

Satellite Accumulation Areas

A satellite accumulation area is an area at or near a process that generates chemical wastes. The area must be under the control of the operator of that process.

The University Safety and Health Department designates each laboratory as a satellite accumulation area. The laboratory Principal Investigator, Moderator, Chemical Hygiene Officer, is responsible for following the policies of the safety and health department regarding satellite accumulation areas.

Each laboratory shall designate the satellite accumulation area. The storage of hazardous waste shall follow in accordance with the Chemical storage guidelines outlined in the Chemical Hygiene Plan.
Hazardous Waste Procedures

■ Allowable Amount Accumulated

- Laboratories may accumulate as much as 5 gallons of hazardous waste or one quart of acutely hazardous waste (immediately hazardous to life and health) in compatible containers at or near any point of generation.

■ Accumulation Time

- There will be no limit on accumulation time, however, once a container is full or more than 5 gallons of hazardous waste or 1 quart of acutely hazardous waste is accumulated, the full container or excess waste must be moved to the accumulation area within 72 hours.
Hazardous Waste Procedures

Labeling

- Hazardous Material Labels (orange label) shall be completed for each waste container. Contact the University Department of Safety and Health for labels.

- All containers must be labeled with the complete chemical name of each primary component. Formulas, acronyms and abbreviations are not acceptable.

- If possible, the label should include the approximate percentage of each chemical.

- Do not place the date or the words “Hazardous Waste” on the container. University Safety and Health will re-label the container during pick-up as either a recyclable/re-distributable material or as hazardous waste at which time the container will be dated and moved to the temporary storage vault.
Hazardous Waste Procedures

**Container Types**

- All containers must be kept closed except when it is necessary to add or remove material. Evaporation of waste in the chemical fume hood is **STRICTLY PROHIBITED**.

- All containers must be maintained in good condition (i.e. no rust, dents, or leaks, etc.)

- All containers must be compatible with the hazardous wastes they contain. Refer to Material Safety Data Sheets (MSDS) for container compatibility. If the MSDS is not available contact the University Department of Safety and Health.
Hazardous Waste Procedures

- Inspection of Satellite Accumulation Area
  
  - Inspection of each satellite accumulation area shall be the responsibility of the principle investigator.
  
  - University Safety and Health Department shall distribute an inspection checklist to each Principle Investigator, Moderator, Chemical Hygiene Officer, at the beginning of each month.
  
  - This checklist shall be completed and returned to University Safety and Health Department by the end of each month.
Hazardous Waste Procedures

- **Chemical Pick-up Request**

  - The Safety and Health Department shall provide chemical pick-up request forms for each laboratory. Chemical pick-up request forms should be immediately filled out when:
    - Unwanted and old chemical reagents need to be removed.
    - The satellite accumulation waste container is full.
    - There is more than 5 gallons of hazardous waste or one quart of acutely hazardous waste accumulated.

  - Laboratory personnel shall immediately fax the forms to the University Safety Department.

  - University Safety and Health Department shall respond to chemical pick-up request within 48 hours of receipt of request.
Hazardous Waste Procedures

- Chemical Pick-up

  - The chemical request form should list all the materials that need to be removed. Any materials not listed will not be removed until a chemical request form is filled out.

  - If the material is improperly labeled it will not be removed until proper labeling is present.

  - Open containers will not be removed from the laboratory. Only closed containers will be removed.
Emergency Spill Response
Hazardous Chemical Spills 
Procedures 

Hazardous Chemical Spill Identification 

The University Safety and Health Department separates hazardous chemical spills into two categories: 

- Major Spills 
- University Safety and Health Department defines major spill as a large spill that is greater than 500 gm or 500 ml or any amount of an acutely hazardous material. An acutely hazardous material is any material that is imminently dangerous to life and health. 

- Minor Spills 
- University Safety and Health Department defines minor spill as a small spill that is less than 500 gm or 500 ml of non-acutely hazardous materials.
Hazardous Chemical Spill Procedures

- Hazardous Chemical Spill Identification
  
  - The safety and health department shall provide a list of some acutely hazardous chemicals. This list shall be referenced prior to any clean up.

  - All spills that occur in vacant laboratories shall initially be identified as a major spill. The University Safety and Health Department shall assess the situation and determine the appropriate course of action.

  - Report all minor spills involving the release of materials in quantities greater than 100 milliliters to the University Department of Safety & Health at 215-762-3632.
Hazardous Chemical Spill Procedures

- **Major Spill Procedures**
  - Notify persons in the immediate area that a spill has occurred.
  - If contaminated with hazardous material, immediately implement [Personal Decontamination Procedures](#).
  - Avoid breathing vapors, mists or dust of the spilled material.
  - Turn off all ignition sources.
  - Evacuate room and close the door
  - Contact the Drexel Security - x 2222
Hazardous Chemical Spill Procedures

- Major Spill Procedures (continued)

- In order to assess the situation be prepared to provide the following information:
  
  - Name and call back number
  - The location of the spill (building and room number)
  - Type of material spilled
  - The amount of material that spilled

- Remain on or near the telephone until you have received instructions from the emergency operator or security or University Safety & Health.
Hazardous Chemical Spill Procedures

Minor Spill Procedures

- If contaminated with Hazardous material, immediately implement personal decontamination procedures prior to cleaning up the spill.

- Review MSDS and acutely hazardous material list prior to clean-up.

- Proper personnel protection equipment will be donned during clean up of all hazardous materials. Personnel protection equipment selection charts will be referenced prior to cleaning up any spilled material(s). If the laboratory personnel does not have the proper personal protective equipment then contact University Safety and Health for assistance.

- Contain spilled material(s) using absorbent pads and/or socks. Paper towels will not be used for containment of spill nor will they be used for clean up.

- Neutralize spilled material(s) using the appropriate neutralizing agent.
Hazardous Chemical Spill Procedures

Minor Spill Procedures (continued)

- Clean up neutralized material using dustpan and/or plastic scoop.
- Place neutralized material in hazardous waste bags. Dispose of as hazardous waste.
- Wash area where spill has occurred with distilled water several times making sure no residue was left behind. Dispose of any towels used as hazardous waste.
- All emergency equipment shall be decontaminated and stored.
- All non-disposable personal protective equipment shall be decontaminated and stored.
- All disposable personal protective equipment and clean up materials shall be disposed of as hazardous waste.
- Always use extreme caution when cleaning up hazardous substances.
Teaching Laboratory Incident

Incident Occurs

Injury

Major Health Danger
- Call 9-911
- Call x2222
- Assist Student
- Curtail Class
- Request other students to seek assistance
- Obtain MSDS if chemical contamination involved
- Assist Rescue Workers
- File ChemWeb Report
- TA signs

Minor Discomfort
- Call Drexel Security x2222
- Assist Student
- Ask Security Officer to Accompany Student to Hospital/Clinic
- Advise Student of Right of Refusal
- File ChemWeb Report
- Student signs

Chemical Spill

Major
- >500mL or Acute
- Evacuate Lab
- Close Doors
- Call Drexel Security x2222
- File ChemWeb Report
- TA signs

Minor
- <500 mL
- Advise others in Lab
- Clean up using Spill Kit
- Call University Health & Safety for Disposal 215-762-3632
- File ChemWeb Report
- TA signs

Drexel Chemistry Dept. Safety Committee, 10/03
Research Laboratory Incident

**Incident Occurs**

- **Injury**
  - Major Health Danger
    - Call 9-911
    - Call 2222
    - Assist Injured Person
    - Halt laboratory operations
    - Request other workers to seek assistance
    - Obtain MSDS if chemical contamination involved
    - Assist Rescue Workers
    - File ChemWeb Report Involved persons sign
  - Minor Discomfort
    - Call Drexel Security x2222
    - Assist Injured Person
    - Ask Security Officer to Accompany Injured Person to Hospital/Clinic
    - Advise injured person of Right of Refusal
    - File ChemWeb Report Involved persons sign

- **Chemical Spill**
  - Major
    - >500mL or Acute
      - Evacuate Lab
      - Close Doors
    - Minor <500 mL
      - Advise others in Lab
  - Minor
    - <500 mL
      - Call Drexel Security x2222
      - Clean up using Spill Kit
    - Call University Health & Safety for Disposal 215-762-3632
      - Inform Laboratory Supervisor
      - File ChemWeb Report Involved persons sign

Drexel Chemistry Dept. Safety Committee, 10/03
Personal Protection Equipment
Personal Protection Equipment

- Appropriate eye protection is worn by all persons in laboratories and areas where chemicals are used or stored.
  - Eye protection consists of safety glasses with side shields, goggles or face shield, or full-face respirator.

- Employees/students are required to wear appropriate gloves when an employee has the potential for direct contact with blood, hazardous chemicals, infectious agents, or other hazardous materials.

- Select gloves appropriate for the task. Gloves protect differently for each chemical. For more information concerning glove selection contact University Department of Safety & Health.

- Lab coats and gloves must be worn only in the laboratory area and are to be removed upon exiting the laboratory. Lab coats are worn to protect street clothes from hazardous materials.
Personal Protection Equipment

- If respirator protection is needed then contact the University Department of Safety and Health.

- Use any other protective apparel and equipment as appropriate. Know the locations of personal protection equipment (PPE) and how to obtain additional materials when necessary. If appropriate PPE is not readily available do not initiate experiments involving hazardous chemicals.

- The Principle Investigator shall provide proper personal protection equipment for all personal in the research laboratory.

- Faculty Members/Laboratory Supervisors shall require students to obtain the appropriate PPE prior to commencing any laboratory activities. For proper PPE selection contact the University Department of Safety and Health.
Chemical Inventory

- An inventory of all chemicals (all hazardous chemicals, non-hazardous chemicals, chemical cleaning agents, samples, etc.) must be conducted in each laboratory.

- One copy of this inventory will be maintained by the P.I./Faculty Member, a second copy will be maintained in each lab as the first page of the MSDS book and a third copy will be sent to the University Department of Safety & Health.

- Additional inventories must be prepared annually. As new chemicals are obtained, chemical inventory sheets must be updated accordingly.

- In development – Online Chemical Inventory System
Material Safety Data Sheet

- Product Information
- Composition
- Hazard Identification
- First Aid Measures
- Fire Fighting Measures
- Accidental Release Measures
- Handling and Storage
- Exposure control and personal protection
- Physical and Chemical properties
- Stability and Reactivity
- Toxicology Information
- Ecological Information
- Disposal Consideration
- Transportation Information
- Regulatory Information
- Other Information

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3. Hazards Identification

Emergency Overview

RANGELY EXTREMELY FLAMMABLE LIQUID AND VAPOR. MAY CAUSE SEVERE BURNS AND CAVITIES ON CONTACT WITH SKIN OR EYES. GASES IF INHALED CAUSE RESPIRATORY TRACT INJURIES AND PNEUMONIA. CONTACT CENTRAL NERVOUS SYSTEM.

Acute: 1AF (F) (Data for immediate effects)
Material Safety Data Sheet

- MSDS must be kept in each laboratory in a labeled binder. The MSDS should be filed in alphabetical order along with the chemical inventory for that particular laboratory.

- If MSDS are missing from a particular chemical inventory, request letters should be sent to the applicable manufacturer or vendor. Vendors and manufacturers are required by federal law to provide MSDS upon request, free of charge, within a reasonable time frame.


- MSDS must be updated annually. As new chemicals are obtained, chemical inventory sheets must be updated accordingly.

- The PI/Laboratory Supervisor/Faculty Member is responsible for reviewing the MSDS and recording which materials are carcinogenic, mutagenic or teratogenic. This information must be conveyed to all students and/or employees engaged in research in his/her laboratories, including locations used and stored within the lab. This information must be posted at the entrance to each lab in an effort to inform any individual who may need to enter that space. If material safety data sheets are located in hallway then signage must be placed in laboratory detailing location.
Chemical Fume Hoods

- Annually Certified
  - Performed by:
    - Jennifer Welsh, Industrial Hygienist
    - Contact Number: 215-762-7624
- Required Airflow – 80 lpfm to 120 lpfm
- Repaired chemical fume hoods need to be certified/checked prior to use.
- Refer to safe practices section in the laboratory safety manual.
Quarterly Laboratory Audit

- The University Department of Safety and Health performs laboratory safety audits on a quarterly basis. The purpose of the audits is to assist the investigators in meeting their obligation to become compliant with federal, state and local regulations.

- New online auditing system.
End of Show!

Any Questions??