Wake Forest University

CHEMICAL HYGIENE PLAN

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Wake Forest University Office of Environmental Health and Safety

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I. INTRODUCTION

The Chemical Hygiene Plan (CHP) is in place to protect laboratory workers from harm due to hazardous chemicals. This CHP will review policies, procedures and responsibilities that protect faculty, staff and students from the health hazards associated with the hazardous chemicals within their particular lab. The CHP is required under OSHA's Occupational Exposure to Hazardous Chemicals in Laboratories standard (29 CFR 1910.1450), henceforth referred to as the "Lab Standard", and is therefore mandatory reading for individuals *prior to* working in the lab.

An electronic copy or hardcopy of this Chemical Hygiene Plan and Safety Manual will be kept in each laboratory for your reference. View the online Chemical Hygiene Plan and Safety Manual from the University web site at http://www.wfu.edu/chem/cheminventory/index.html.

National Research Council's (NRC) 2011 edition of Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards, henceforth referred to as "Prudent Practices," is available from the National Academies Press, 500 Fifth Street NW., Washington DC 20001 (www.nap.edu). "Prudent Practices" is cited because of its wide distribution and acceptance and because of its preparation by recognized authorities in the laboratory community through the sponsorship of the NRC. Each laboratory should ensure an electronic or hardcopy is available within the lab.

II. COMPONENTS OF A CHEMICAL HYGIENE PLAN

OSHA lists eight elements of the Chemical Hygiene Plan to ensure compliance with the Lab Standard. These elements may be found at 29 CFR 1910.1450(e)(3). Summarized briefly, these eight elements are as follows:

1. Standard Operating Procedures when using hazardous chemicals
2. Control measures to reduce exposure (engineering or administrative controls, PPE)
3. Proper fume hood performance and maintenance
4. Information and training for employees on the CHP
5. Prior approval requirements for certain lab activities
6. Medical consultation and examinations
7. Responsibilities within the CHP
8. Working with Particularly Hazardous Substances.

The following sections will cover the eight elements in a generalized form. Not all information will be pertinent to each laboratory. Likewise, the PI may need to provide additional information for specific hazards within the individual lab. Contact your DCHO or EHS if you have questions or need to make adaptations to the plan.

III. RESPONSIBILITIES UNDER THE CHEMICAL HYGIENE PLAN

A. Department Chair

a. Ensure compliance with the Lab Standard within the department.
b. Working with the Provost, Office of Research and Facilities and Campus Services, ensure appropriate resources are allocated to provide proper and adequate administrative and engineering controls to protect faculty, staff and students from the health hazards associated with the hazardous chemicals within the department.
c. Designate a Departmental Chemical Hygiene Officer (DCHO).
d. Notify the University Chemical Hygiene Officer when any new hazards are introduced into the department.
e. Ensure Principal Investigators have completed required training.
f. Notify Office of Environmental Health and Safety upon hiring or employment termination of Principal Investigators within the department.

B. Principal Investigators (PI)

a. Ensure compliance with the Lab Standard within their respective laboratories.
b. Designate a Laboratory Chemical Hygiene Officer (LCHO).
c. Develop, review and update Standard Operating Procedures (SOP's) for laboratory specific hazards, as required.
d. Ensure all personnel working within the lab have completed required and annual training.
e. Notify the Department Chair and DCHO when any new hazards are introduced into the laboratory.
f. Provide adequate Personal Protective Equipment for all personnel working within the lab.
g. Report all accidents, injuries, and illnesses to the Department Chair.

C. Departmental Chemical Hygiene Officer (DCHO)

a. Assist Department Chair in ensuring compliance with the Lab Standard within the department.
b. Read and be familiar with departmental SOP's and individual Laboratory Hygiene Plans.
c. Be the point of contact for LCHO's within the department and liaison with the Office of Environmental Health and Safety.
d. Maintain and update departmental roster of faculty, staff, principal investigators, graduate students working in laboratory research and any other individuals working within the lab.
e. Review training records for all laboratory personnel to ensure requirements have been met.
f. Oversee departmental chemical inventory and be aware of Particularly Hazardous Substances.
g. Report all accidents, injuries, and illnesses to the Department Chair, EHS, and Human Resources, as required.

D. Laboratory Chemical Hygiene Officer (LCHO)

a. Assist PI in ensuring compliance with the Lab Standard within the lab.

b. Read and be familiar with lab specific SOP's and the Laboratory Hygiene Plan.
c. Be the point of contact for lab within the department and liaison with the DCHO.
d. Maintain and update laboratory roster, and provide to DCHO.
e. Maintain chemical inventory within the lab and be aware of location of Particularly Hazardous Substances within the lab.
f. Report all accidents, injuries, and illnesses to the PI and DCHO.

E. Laboratory Personnel

a. Apply good chemical hygiene practices as outlined in the CHP.
b. Participate in required training at least annually.
c. Always use the appropriate personal protective equipment provided.
d. Report all accidents, injuries, and illnesses to the LCHO and PI.

F. Office of Environmental Health and Safety (EHS)

a. Ensure overall University compliance with the Lab Standard.
b. Assign University Chemical Hygiene Officer as liaison to departments.
c. Review general and lab specific SOP's.
d. Provide training, as required, to laboratory personnel and Principal Investigators.
e. Conduct laboratory inspections on a regular basis for all appropriate environmental, health and safety requirements for compliance with federal, state and local regulations.
f. Collect and dispose of waste chemicals generated within labs.
g. Provide appropriate signs for identification of laboratory hazards.
h. Provide chemical spill clean-up.

G. University Chemical Hygiene Officer

a. Maintain and update the University Chemical Hygiene Plan, as required.
b. Review general and lab specific SOP's.
c. Point of contact for DCHO's and PI's regarding compliance with federal, state and local regulations and assistance with laboratory chemical and occupational health related issues.
d. Investigate accidents, injuries, and illnesses and any potential environmental, health or safety hazards identified by laboratory personnel.
e. Maintain University chemical inventory system.

H. University Administration

a. Ultimate responsibility within the University, and along with the University President, the Provost and other administrators, provides continuing support for the CHP.

IV. CONTROL MEASURES

Control measures are in place to prevent exposure to harmful chemicals. These can include administrative or engineering controls.

A. Administrative Controls

Administrative controls are also known as work practice controls. These are changes in work procedures such as written SOPs, general safety rules, or training that will result in reducing or eliminating the duration, frequency and severity of exposure to hazardous materials or hazardous situations.

1. Standard Operating Procedures

Standard Operating Procedures (SOPs) are the main method used to ensure uniformity when working within the laboratory. This uniformity is important from a safety standpoint in that procedures that have been reviewed and documented are less likely to result in unintended and potentially harmful consequences. The SOPs are written instructions that provide detailed information on performing a laboratory process or working with a chemical effectively and safely.

SOPs can be specific or generic depending on the application. These may range from "working with inorganic acids" to "working with hydrofluoric acid", for example. Wake Forest University has developed a number of SOPs for common laboratory work. These are located in Appendix I.

In addition, a template SOP has been developed to allow individual laboratories to develop their own SOP's for laboratory specific situations.

It is the PI's responsibility to provide written SOPs specific to potential safety and health risks arising from use of hazardous chemicals or procedures within the lab. These SOPs should include, but are not limited to, work with:

- *Particularly Hazardous Chemicals*, as defined by OSHA, and includes carcinogens (Appendix II), reproductive toxins (Appendix II), and substances with a high acute toxicity.
- *Highly Reactive Chemicals*, including highly reactive or unstable chemicals that may polymerize or decompose violently, are shock sensitive, or may react violently when exposed to pressure, temperature, light, water, or another material . Examples are pyrophorics, explosives, azides, and organic peroxides.
- *Select Agents and Toxins*, as defined by the Center for Disease Control (CDC) (Appendix II).

2. General Safety Rules

In order to promote a culture of safety at Wake Forest University, it is vital that basic safety rules and policies are consistently followed and enforced. Communication is essential in this process. If basic safety rules are not being followed, do not hesitate to make this known. Concerns that are not addressed quickly will often lead to an incident or injury.

Prudent Practices (pgs. 15-17) describes a number of General Safety Rules for working in the lab. Below are listed ten basic safety procedures that must always be followed:

1. Do not work alone when using hazardous materials. If an incident occurs, help will not be available.
2. Always follow Standard Operating Procedures, and never perform unauthorized experiments.
3. Read the Safety Data Sheet (SDS) and label prior to using a chemical.
4. Always wear appropriate PPE. Eye protection and closed toed shoes are mandatory for anyone entering a laboratory. At no time may sandals or other open toed shoes be worn in the lab.
5. Use a fume hood whenever working with hazardous chemicals.

6. Know the location of, and how to use, emergency equipment (i.e. safety shower, eyewash, fire-extinguisher).
7. Make sure other lab workers are aware of any special hazards associated with your work, and be aware of hazards posed by the work of others within the lab.
8. Never ingest anything in the lab. No eating, drinking, chewing gum, etc. This is only to be done in approved break areas.
9. Immediately report any injuries, accidents or near-misses to the PI and LCHO.
10. Report any unsafe conditions to the PI, LCHO or DCHO.
11. Properly dispose of all chemical waste, following directions found in this CHP.

3. Housekeeping

Good housekeeping must be practiced when working in the lab. There is a direct correlation between good housekeeping and safety within the lab. Good housekeeping reduces the chance of chemical exposure and reduces the risks associated with hazardous chemicals. A clean and orderly lab allows for easier identification of items while working and also reduces the chance of scientific error due to contamination. Referring to Prudent Practices (pgs. 113-114), the following are some essentials to good housekeeping:

1. Don't block exits and leave aisles open. Keep clearance around emergency equipment (eyewashes, fire-extinguishers) and make sure electrical panels are not blocked.
2. Close drawers and cabinets when not in use. This especially applies to the doors on fire cabinets.
3. Properly label all chemical containers. This includes transfer vessels, which must be labeled with the chemical name and hazard class. Store all chemicals with the label outward for easy identification.
4. Do not store incompatible material together.
5. Never store glass bottles on the floor, where they may be inadvertently knocked over.
6. Close all chemical containers unless you are adding or removing contents.
7. Secure cylinders to walls or benchtops with chains or straps.
8. Keep all containers at least 2 inches from the edge of benchtops to avoid knocking them onto the floor.
9. Clean up spills, even minor spills, immediately. This applies to liquids and solids.
10. Don't pile up dirty glassware in the sink. "Clean as you go". Piles of dirty glassware can hide potentially dangerous broken glass and sharp edges. Place a rubber mat at the bottom of the sink to prevent glassware from breaking.
11. Dispose of broken glass in clearly labeled and lined Broken Glass boxes.
12. Sharps and needles are not to be re-used, and must be placed in an authorized Sharps Disposal container.

4. Chemical Substitution

One very useful Administrative Control is the policy of substituting a hazardous chemical with a less hazardous chemical whenever possible when working within the laboratory. One example currently in practice is the elimination of mercury thermometers with alcohol thermometers whenever possible. This practice eliminates potential mercury exposure in the event of a thermometer break, as well as the time and expense of cleaning a mercury spill.

5. Chemical Inventory

All locations on campus where chemicals are used and stored must be inventoried. An accurate inventory is important as both a regulatory and sustainability measure.

a. Chemical Inventory System

Chemical inventory will be maintained in the University designated program. All chemicals received are to be bar-coded in the system prior to use or storage. Empty chemical bottles are to be scanned out of the system. It is the responsibility of the PI and LCHO to ensure the laboratory chemical inventory is accurate and up-to-date.

b. City of Winston-Salem Fire Marshal

The Winston-Salem Fire Marshal's Office conducts annual inspections of all campus buildings to ensure compliance with the NC Fire Prevention Code. The Fire Prevention Code regulates the maximum quantity of flammable liquids that may be stored, per floor, per building. Accurate chemical inventory is essential to ensure compliance with this regulation.

B. ENGINEERING CONTROLS

Engineering controls provide a physical barrier between the hazardous chemical and the individual working in the lab. These include ventilation, fume hoods, bio-safety cabinets and personal protection equipment. A fume hood vents chemical fumes and vapors out of a work area to the outside of the building. A biological safety cabinet circulates air so a laminar flow forms that prevents cultures or other materials inside the work area from being contaminated by the outside air. Laminar flow of air also prevents aerosols or microbes inside the hood from escaping. A biosafety cabinet is not tied into the central ventilation system.

1. Ventilation

Laboratory ventilation standards have been established by a number of organizations, including the American National Standards Institute (ANSI), the American Conference of Industrial Hygienists (ACGIH), and the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE). Standard building or room ventilation does not suffice as protection from airborne hazards. The use of fume hoods or bio-safety cabinets in addition to ventilation is necessary to provide adequate protection.

The purpose of room ventilation is two-fold:

1. Provide adequate heating and cooling to make a comfortable working environment, and
2. Provide a pressure differential between the lab and non-lab adjacent spaces to prevent uncontrolled chemical emissions from leaving the lab.

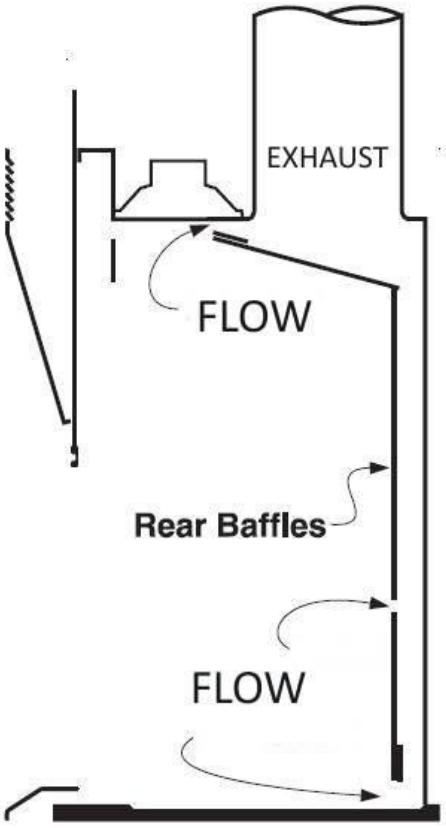
2. Fume Hoods

As stated in Prudent Practices, page 221, "Laboratory chemical (fume) hoods are the most important components used to protect laboratory personnel from exposure to hazardous chemicals and agents." This is only the case if the hood is functioning properly and the user is knowledgeable in its proper use and limitations.

a. Fume Hood Design and Function

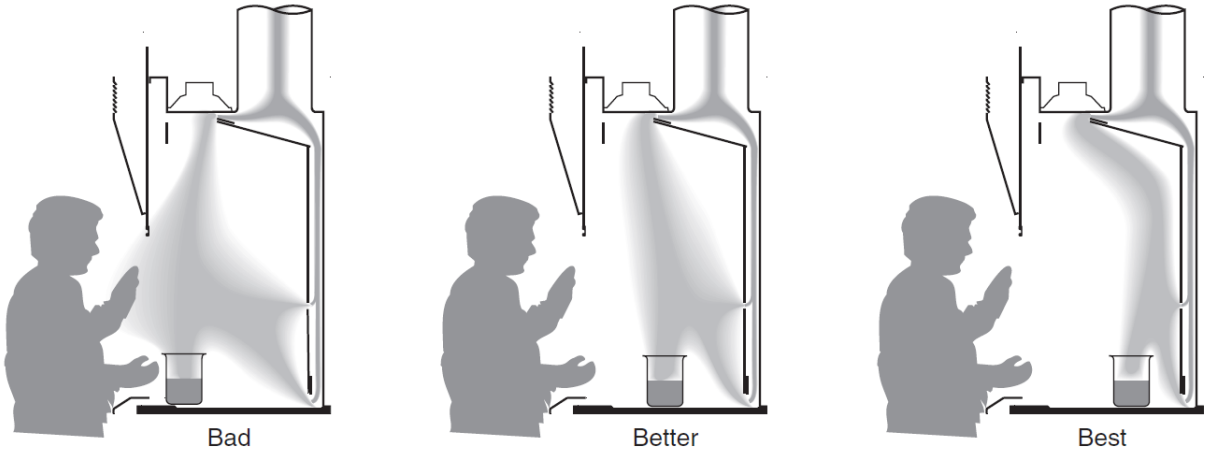
The fume hood is designed to protect the lab worker by providing an enclosed barrier between the worker and airborne dust, powders and vapors within the hood. The hoods directional flow will carry

the harmful contaminants toward the baffles at the rear of the hood and into the exhaust, where large volumes of air dilute the contaminant prior to discharge through the stack on the building roof.

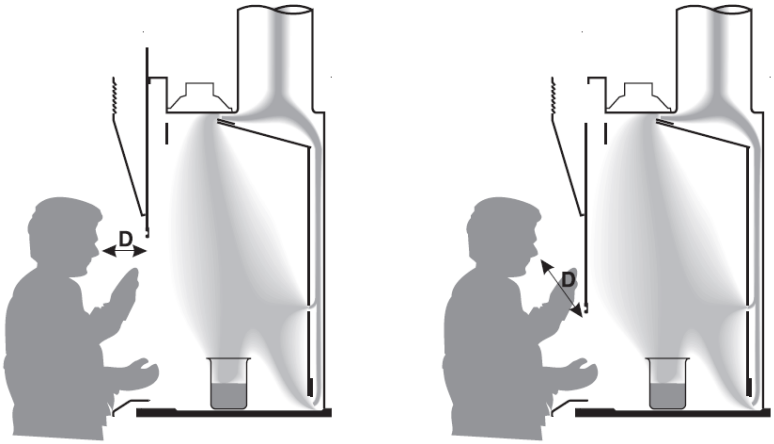


Side view of typical chemical fume hood showing air flow.

Placement of the source of hazardous material will influence potential exposure. It is noted in Prudent Practices, page 223, "chemical (fume) hood containment tests reveal that the concentration of contaminant in the breathing zone can be 300 times higher from a source at the front of the face than from a source placed at least 6 in. back." See diagrams below (Kewaunee Scientific Corporation, *Operating and Maintenance Procedures, page 5*.)



Lowering of the sash will also help eliminate exposure by increasing the distance between the breathing zone and the area where contaminants may escape from the hood (see D, below). Additionally, lowering the sash also limits the external effects of room disturbances on flow. (Kewaunee Scientific Corporation, *Operating and Maintenance Procedures, page 7*.)



Be aware that room air flow disturbances include foot traffic. Prudent Practices, page 222, indicates the vortices formed behind an individual walking can exceed 250 fpm. This is enough to overcome the draw into the hood, thus pulling contaminant fume from the hood into the laboratory. Foot traffic near fume hoods should be limited when the hood is being used.

b. Fume Hood Air Flow

The face velocity of a fume hood is an average air velocity across the front, or face, of the hood at the sash. The velocity is measured in feet per minute (fpm). Recommendations by several organizations suggest face velocity should be maintained between 80 and 120 fpm. Most fume hoods on campus are automatically calibrated to the proper face velocity through a Phoenix Control Valve.
The Phoenix Control Valve is located above the hood (usually above the ceiling tiles in the lab), and operates on sash movement, generating a corresponding voltage command to the Phoenix Controls fume hood valve. The pressure-independent air valves maintain proper flow through the hood. The sash opening determines flow requirements through the hood while the room make-up air adjusts to maintain pressure.

c. *Fume Hood Use*

Prior to using a fume hood:

1. Know how the hood works.
2. Know the hazards of the chemicals to be used. Consult the SDS.
3. Ensure hood is on.
4. Make sure sash is open to proper operating level, as indicated by the marks on the frame.
5. Make sure the air flow gauge is reading between 80 and 120 feet per minute.

When using the fume hood:

1. Keep your head out of the hood at all times.
2. Use proper eye protection, gloves, and lab coat.
3. Be sure nothing is blocking the airflow through the airfoil at the front of the hood and the baffles in the rear of the hood.
4. Elevate equipment at least two inches off the base of the hood.
5. Keep all materials at least six inches from the sash opening.
6. Do not open and close the sash rapidly, as this will cause turbulence and disturb flow.
7. Close the sash when work is complete.

Fume Hood Housekeeping:

1. Keep the hood and adjacent areas free of clutter.
2. Keep airfoil and baffles clear to allow proper air flow.
3. Minimize the amount of equipment in the hood to prevent blockage of air flow.
4. Do not permanently store any chemicals in the hood.
5. Remove any unnecessary items from the hood.
6. Do not use the hood as a means of intentionally disposing of compressed gases or to let solvents evaporate.

d. *Fume Hood Maintenance*

In order to function properly and provide maximum protection, the fume hood must be maintained according to the manufacturer's specifications. Additionally, periodic assessments of the hoods are required to measure flow rate is within appropriate range.

Facilities and Campus Services (F&CS) maintain all fume hoods on campus. If a fume hood alarm sounds, it is indicating that the air flow is not within intended range. Closing the sash will often recalibrate the flow and silence the alarm. However, if the alarm continues, it is no longer safe to use the hood. Close the sash fully and place a note on the sash stating:

DANGER. DO NOT USE. HOOD OUT OF ORDER.

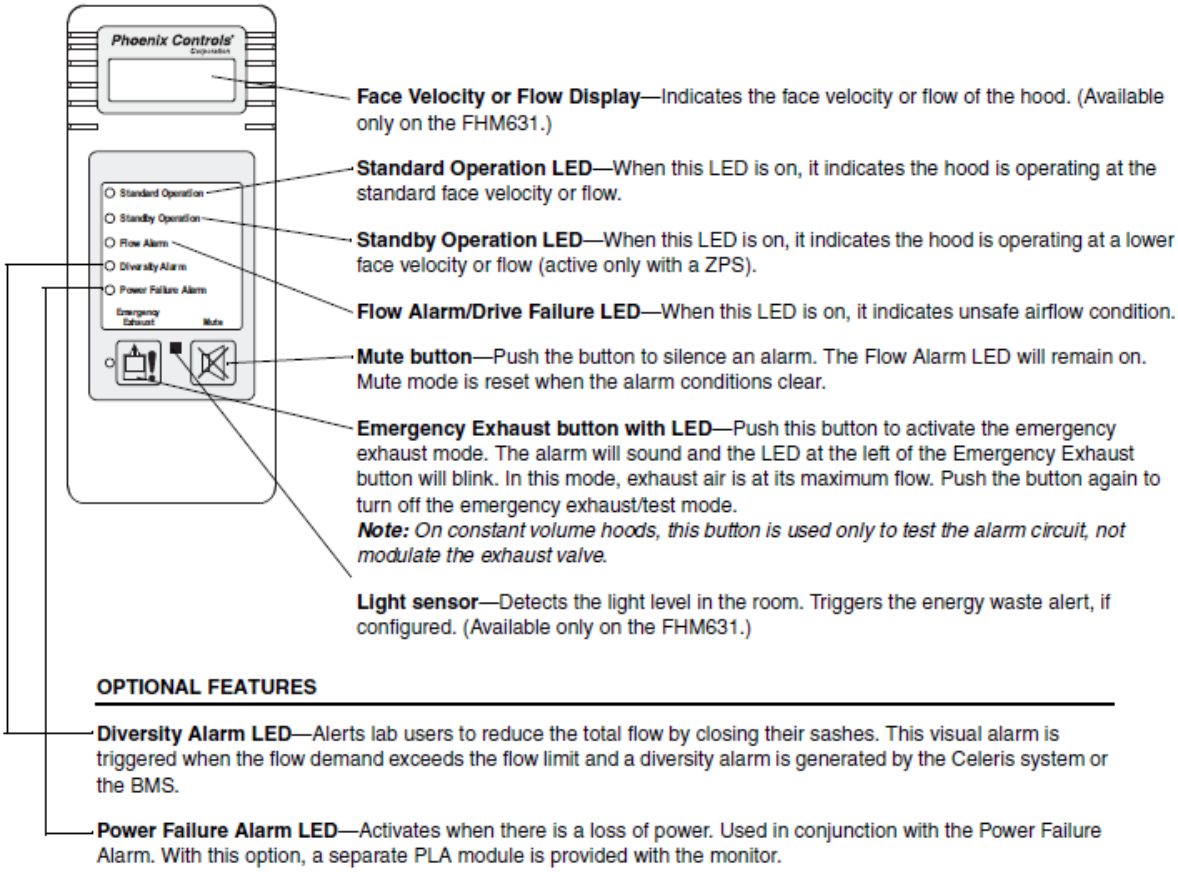
Next, call F&CS Customer Service at x4255 and place an Emergency Work Order to have the hood repaired. Do not use the hood until F&CS has responded to the Work Order, and has made appropriate repairs.

At Wake Downtown B60, call Building Services at (336) 245-4960 and place an Emergency Work Order to have the hood repaired. Do not use the hood until F&CS has responded to the Work Order, and has made appropriate repairs.

The Department of Environmental Health and Safety (EHS) conducts periodic air flow tests on all campus fume hoods. Any conditions out of norm are reported immediately for repair. Signs will be posted in those instances when the fume hood must be taken out of service.

Many fume hoods on campus are wired to a digital fume hood monitor, which shows a display of the current face velocity reading. As stated previously, this reading should always be between 80 and 120

fpm. If the reading falls outside this range, and does not re-set after closing the sash, follow the instructions outlined above to take the hood out of service and call F&CS for repair. Below is a diagram of the typical unit found on the hood face.



3. Constant Volume Hoods

Several fume hoods in campus laboratories are “constant volume hoods”, meaning there is no associated Phoenix Control Valve to modulate air flow. Constant volume hoods will continue to pull air at the same rate with the sash open or closed. However, since the fan rate is not equivalent to the velocity, the feet per minute of air flow will decrease as the sash is opened. (Air is being drawn through a larger surface area, reducing velocity). Be aware that the higher the sash is open, the lower the fpm will be and will increase the chance of fugitive emissions. Constant volume hoods are typically operated by a switch. Make sure the switch is on and the fan is running prior to using this type of hood.

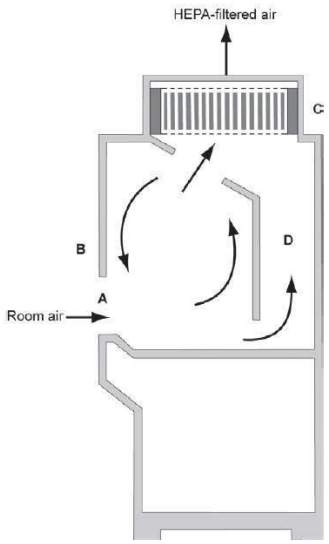
4. Biosafety Cabinets

Biosafety cabinets (BSC) are located in laboratories that typically work with biological organisms. The BSC is designed to protect both the worker and the material within the cabinet. They are the main means by which protection is offered lab personnel from potentially infectious microorganisms. There are three types of BSCs, designated Class I, II and III. The information and all figures for this section are from Center for Disease Control and Prevention (CDC) publication, *Biosafety in Microbiological and Biomedical Laboratories, 5th Edition (BMBL).* This publication should be read by all lab personnel prior to working with a BSC.

a. Class I

Class I BSC will provide protection to lab personnel and the environment, but will not protect the material (organism) within the cabinet. Air is drawn inward across the opening at the front of the BSC and then filtered, usually through a High Efficiency Particulate Air (HEPA) filter. Often, the BSC I will be used to enclose equipment, such as centrifuges or fermenters, where the possibility of aerosolization of product may occur.

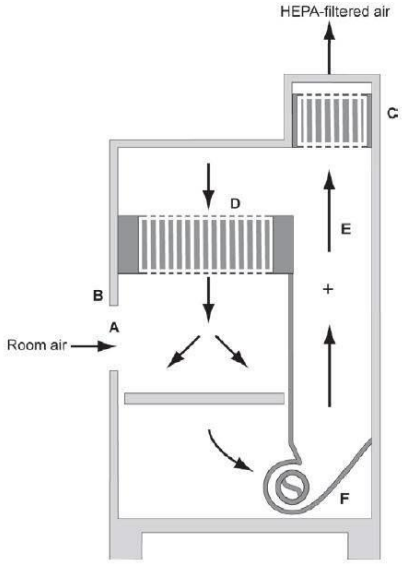
The Class I BSC (A) front opening; (B) sash; (C) exhaust HEPA filter; (D) exhaust plenum. *Note:* The cabinet needs to be hard connected to the building exhaust system if toxic vapors are to be used.



b. Class II

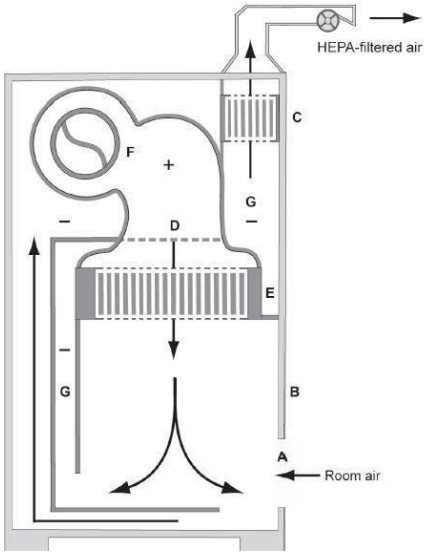
Class II BSCs provide protection for lab personnel, the environment and the material within the cabinet. Class II BSCs are further divided in four types: A1, A2, B1 and B2. Airflow enters through the front grille of the cabinet, where it is HEPA filtered prior to passing into the cabinet work area (Types A1, A2 and B1 only). This air is re-circulated through an additional HEPA filter prior to exhaust from the BSC. See the chart at the end of this section for specific capabilities and limits of the four types of Class II BSCs.

The Class II, Type A1 BSC (A) front opening; (B) sash; (C) exhaust HEPA filter; (D) supply HEPA filter; (E) common plenum; (F) blower.



The Class II, Type B1 BSC (bench top design) (A) front opening; (B) sash; (C) exhaust HEPA filter; (D) supply plenum; (E) supply HEPA filter; (F) blower; (G) negative pressure exhaust plenum. *Note:* The cabinet exhaust needs to be hard connected to the building exhaust system.

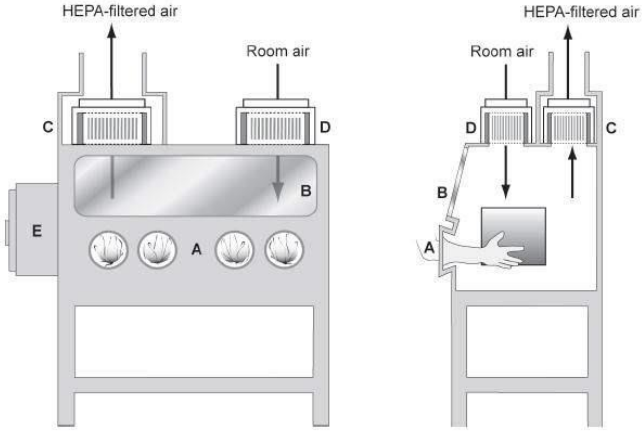
Connection to the building exhaust system is required.



c. Class III

The Class III BSC is designed for use with highly infectious microbiological agents. This BSC provides maximum protection to the lab personnel and the environment. The outward appearance is similar to that of a glove box. Material may be added or removed from the Class III BSC only through a double-pass door. The cabinet is kept under constant negative pressure through an exhaust system.

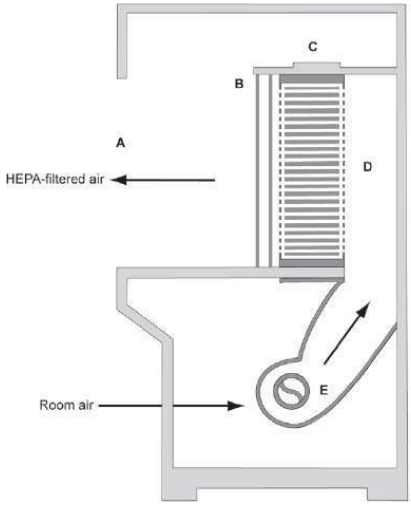
The Class III BSC (A) glove ports with O-ring for attaching arm-length gloves to cabinet; (B) sash; (C) exhaust HEPA filter; (D) supply HEPA filter; (E) double-ended autoclave or pass-through box. *Note:* A chemical dunk tank may be installed which would be located beneath the work surface of the BSC with access from above. The cabinet exhaust needs to be hard connected to an exhaust system where the fan is generally separate from the exhaust fans of the facility ventilation system. The exhaust air must be double HEPA-filtered or HEPA-filtered and incinerated.



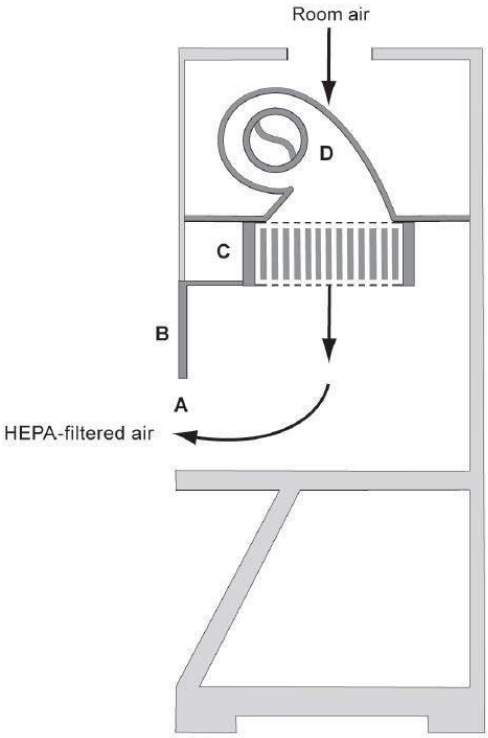
d. Laminar Flow and Vertical Flow "Clean Bench"

It is very important to note that both standard Laminar flow and Vertical flow cabinets are not Biosafety Cabinets. These two items do not provide protection to the worker, and should never be used when dealing with potentially infectious or harmful material.

The horizontal laminar flow "clean bench" (A) front opening; (B) supply grille; (C) supply HEPA filter; (D) supply plenum; (E) blower.



The vertical laminar flow "clean bench" (A) front opening; (B) sash; (C) supply HEPA filter; (D) blower. *Note:* Some vertical flow clean benches have recirculated air through front and/or rear perforated grilles.



e. Selection and Comparison of BSCs

The tables below are from BMBL and describe the type of BSC to be used with each biological risk and a comparison of BSC characteristics. The CDC has categorized biological risks into four Biosafety Levels (BSL). Detailed information on BSLs is addressed in *BMBL Edition 5*. The table below is from BMBL, page 59. It is important to note that Wake Forest University currently is not equipped for any work requiring BSL-3 or BSL-4. No agents are to be introduced to campus requiring these levels of protection.

Summary of Recommended Biosafety Levels for Infectious Agents

BSL	Agents	Practices	Primary Barriers and Safety Equipment	Facilities (Secondary Barriers)
1	Not known to consistently cause diseases in healthy adults	Standard microbiological practices	■ No primary barriers required. ■ PPE: laboratory coats and gloves; eye, face protection, as needed	Laboratory bench and sink required
2	■ Agents associated with human disease ■ Routes of transmission include percutaneous injury, ingestion, mucous membrane exposure	BSL-1 practice plus: ■ Limited access ■ Biohazard warning signs ■ "Sharps" precautions ■ Biosafety manual defining any needed waste decontamination or medical surveillance policies	Primary barriers: ■ BSCs or other physical containment devices used for all manipulations of agents that cause splashes or aerosols of infectious materials ■ PPE: Laboratory coats, gloves, face and eye protection, as needed	BSL-1 plus: ■ Autoclave available
3	Indigenous or exotic agents that may cause serious or potentially lethal disease through the inhalation route of exposure	BSL-2 practice plus: ■ Controlled access ■ Decontamination of all waste ■ Decontamination of laboratory clothing before laundering	Primary barriers: ■ BSCs or other physical containment devices used for all open manipulations of agents ■ PPE: Protective laboratory clothing, gloves, face, eye and respiratory protection, as needed	BSL-2 plus: ■ Physical separation from access corridors ■ Self-closing, double-door access ■ Exhausted air not recirculated ■ Negative airflow into laboratory ■ Entry through airlock or anteroom ■ Hand washing sink near laboratory exit
4	■ Dangerous/exotic agents which post high individual risk of aerosol-transmitted laboratory infections that are frequently fatal, for which there are no vaccines or treatments ■ Agents with a close or identical antigenic relationship to an agent requiring BSL-4 until data are available to redesignate the level ■ Related agents with unknown risk of transmission	BSL-3 practices plus: ■ Clothing change before entering ■ Shower on exit ■ All material decontaminated on exit from facility	Primary barriers: ■ All procedures conducted in Class III BSCs or Class I or II BSCs in combination with full-body, air-supplied, positive pressure suit	BSL-3 plus: ■ Separate building or isolated zone ■ Dedicated supply and exhaust, vacuum, and decontamination systems ■ Other requirements outlined in the text

Selection of a Safety Cabinet through Risk Assessment

Biological Risk Assessed	Protection Provided			
	Personnel	Product	Environmental	BSC Class
BSL 1 – 3	Yes	No	Yes	I
BSL 1 – 3	Yes	Yes	Yes	II (A1, A2, B1, B2)
BSL – 4	Yes	Yes	Yes	III; II—When used in suit room with suit

Comparison of Biosafety Cabinet Characteristics

BSC Class	Face Velocity	Airflow Pattern	Applications	
			Nonvolatile Toxic Chemicals and Radionuclides	Volatile Toxic Chemicals and Radionuclides
I	75	In at front through HEPA to the outside or into the room through HEPA (Figure 2)	Yes	When exhausted outdoors[1,2]
II, A1	75	70% recirculated to the cabinet work area through HEPA; 30% balance can be exhausted through HEPA back into the room or to outside through a canopy unit (Figure 3)	Yes (minute amounts)	No
II, B1	100	30% recirculated, 70% exhausted. Exhaust cabinet air must pass through a dedicated duct to the outside through a HEPA filter (Figures 5A, 5B)	Yes	Yes (minute amounts)[1,2]
I, B2	100	No recirculation; total exhaust to the outside through a HEPA filter (Figure 6)	Yes	Yes (small amounts)[1,2]
II, A2	100	Similar to II, A1, but has 100 lfm intake air velocity and plenums are under negative pressure to room; exhaust air can be ducted to the outside through a canopy unit (Figure 7)	Yes	When exhausted outdoors (FORMALLY "B3") (minute amounts)[1,2]
III	N/A	Supply air is HELP filtered. Exhaust air passes through two HEPA filters in series and is exhausted to the outside via a hard connection (Figure 8)	Yes	Yes (small amounts)[1,2]

[1] Installation requires a special duct to the outside, an in-line charcoal filter, and a spark proof (explosion proof) motor and other electrical components in the cabinet. Discharge of a Class I or Class II, Type A2 cabinet into a room should not occur if volatile chemicals are used.
[2] In no instance should the chemical concentration approach the lower explosion limits of the compounds.

C. Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) provides a physical barrier between a chemical or physical hazard and the wearer. In the laboratory, the main types of protective equipment are eyewear, gloves, and the lab coat. Since any work conducted that may result in vapors, fumes or dust is performed in the fume

hood, respiratory protection would only be required on a case-by-case basis, and requires prior approval by the Department Chair and EHS.

1. Principal Investigator Responsibilities

It is the responsibility of the PI or designee to conduct a complete assessment to determine PPE requirements within the lab. To this end, a full review must be made of hazards that may require protection from both chemical and physical hazards. This review should be task specific, so that the requirements are known prior to beginning work. Proper PPE is to be provided to laboratory personnel at no cost to those personnel.

The PI or designee is also responsible for training those under their direction on the proper use and function of PPE. This includes identification of proper PPE for the hazard, donning and doffing PPE, decontamination (if applicable), and disposal.

The PI must ensure that lab personnel follow all PPE rules, and conduct an annual assessment to confirm the requirements are still applicable to hazards.

2. Lab Personnel Responsibilities

It is the responsibility of lab personnel to fully understand the hazards that require the use of PPE, both chemical and physical. Training must be completed prior to working in the lab. It is the responsibility of the lab personnel to use the proper PPE in a proper manner whenever working in the lab.

3. Eye Protection

Eye protection is required at all times in the laboratory and where hazards to the eye may exist. This includes splashes, sprays, aerosols, dust, powder, fumes and vapor. Safety glasses with side shields are appropriate for situations where there is no risk of fumes or vapors. In cases where fumes or vapors may be present, safety goggles must be worn, as these provide much better protection against these hazards.

Contact lenses may not be worn in any laboratory environment where chemicals are in use. Many chemical vapors will penetrate the porous surface of contact lenses and become trapped between the lens and cornea, creating an intensified exposure. Several chemicals, halogenated solvents in particular, have the ability to melt the contact lens to the cornea, requiring an emergency procedure to remove the lens, with the likelihood of permanent eye damage.

a. Chemical Splash Goggles

Chemical splash goggles provide excellent overall eye protection against splashes, vapors and flying debris. Goggles must be worn when there is a significant chemical or debris hazard, and are recommended for use over safety glasses in all laboratories. Be sure the goggles are indirectly vented, as this will inhibit fumes and vapors from entering the goggles.

b. Safety Glasses

Safety glasses with side shields afford the minimum protection for use in the lab. Safety glasses are available that will fit over prescription glasses. Standard prescription glasses are not a substitute for safety glasses. Prescription glasses with safety lenses must also have side shields.

c. Full Face Shield and Blast Shield

The full face shield is worn in addition to safety glasses or goggles when the chance for exposure to splashes or debris is great. The full face shield is designed to provide protection to the entire face and neck.
The blast shield is also used in addition to safety glasses or goggles. The blast shield is to be used in situations where there is the chance of implosion or explosion (i.e. working with azides). The shield is intended for protection of only that part of the body behind the shield. Peering over the top of the blast shield will not afford protection to the head. It must be behind the shield at all times.

d. Eye Protection from UV radiation

Ultraviolet (UV) radiation can damage skin and eyes. In the lab, common sources of UV radiation are UV light boxes or UV Transilluminator, UV Crosslinkers, and Germicidal Lamps. Eye exposure to UV radiation can damage the cornea and cause lesions. Standard prescription eyewear, standard safety glasses, and goggles do not protect against UV radiation.
Protective eyewear must be ANSI-Z87 rated to provide proper UV protection. This marking will be stamped onto the eyewear, typically on the side shield. Contact the safety glass manufacturer before you use the protective eyewear if you are unsure.

e. Eye Protection from Lasers

The focused energy of lasers has the ability to cause corneal, lens and retinal damage to the eye. It is important to note that no single safety lens material is effective against all wavelengths or for all radiation. Protective eyewear should provide maximum attenuation of the laser and transmit the maximum amount of ambient light. When choosing protective eyewear consider the parameters of the operation, the wavelength and the Maximum Permissible Exposure (MPE). The MPE has been set by ANSI Z136.1.

4. Skin and Hand Protection

Proper attire in the laboratory is essential to prevent skin exposure from chemical or physical hazards. In addition, the proper type of glove must be used for the appropriate hazard.

a. Proper clothing

Always wear clothing that adequately covers the torso and legs. Shorts are not permitted in the lab. Loose clothing should not be worn as it could easily become caught on equipment, come in contact with chemicals or catch fire. Natural fiber clothing is recommended over synthetic fiber, as synthetic fiber will melt to the body in the event it catches fire. Open toe and open top shoes are prohibited in the lab. Always wear shoes that cover the entire foot, and preferably have a rubber non-slip sole.

i. Lab Coats

A lab coat should be worn as an additional layer of protection. In the event of a spill or fire, the lab coat can be removed much more quickly than any other article of clothing, and will offer a degree of protection to the clothing beneath. Disposable lab coats are available at the Bookstore, as are cotton fiber standard lab coats. Be aware that unless specifically marked, lab coats are not protected against fire. Individuals working with pyrophoric and flammable liquids on a regular basis should consider using a lab coat that is flame resistant.

b. Gloves

Since skin exposure is most likely to occur at the hand, it is imperative that the correct glove be used whenever encountering a chemical or physical hazard. Gloves should never be worn outside of the laboratory unless required for safety reasons (i.e. transporting autoclaved material). Never touch items with gloves that will be touched with ungloved hands. This includes light switches, elevator buttons, computers, and phones.

All approved disposable glove manufacturers have tested glove "breakthrough" time for their respective products. The breakthrough time indicates the time, usually in minutes, the glove can be exposed to a specific chemical before the glove begins to break down and become porous. Charts with breakthrough times are available from each manufacturer and are usually located on their website. An example is located in Appendix III. Be sure you have the correct chart for the glove manufacturer, as each will be unique to its own products.

i. Nitrile Gloves

Nitrile gloves generally provide the best overall protection for the widest range of chemicals. Be sure to blow into the glove before use to check for pinhole leaks. When removing disposable Nitrile gloves, be sure not to touch exposed skin with the gloved fingertips. Turn gloves inside out when removing. Disposable nitrile gloves are never to be re-used, and should be replaced on a regular basis even if there is no obvious deterioration.

ii. Neoprene Gloves

Neoprene gloves offer greater protection than Nitrile gloves, and should be used when working with concentrated, highly corrosive or toxic materials. Neoprene is not as pliable as Nitrile, and extra care should be taken when used, as dexterity will be lessened.

iii. Temperature Resistant Gloves

When working with extremes of heat and cold it is important to protect hands from burns. This would include when working with boiling or superheated liquids (as from an autoclave) or when working with cryogenics (liquid Nitrogen or Dry Ice). Heat-resistant Neoprene gloves are a good choice when handling hot glassware and boiling liquids. Specific cryogenic gloves are to be used whenever using liquid nitrogen. This includes when disbursing from large cylinders into dewars. Cryogenic gloves should also be used when adding or removing material from sub-zero freezers.

5. Respiratory Protection

Engineering controls are in place to protect lab personnel for contaminants that may exceed Permissible Exposure Limits (PELs) or other applicable standards. If conditions exist where effective engineering controls are not possible, proper respiratory protection must be provided. These conditions should be very rare, and prior to working under such conditions notification must be made to the Department Chair and EHS so an analysis can be made to determine if additional engineering controls may be put in place to avoid the use of respiratory protection.

It should be noted that N-95 Face Masks are considered respirators under OSHA. Required use of a Face Mask to protect from airborne particulates will necessitate notification to the Department Chair and EHS.

a. Permissible Exposure Limits (PELs)

OSHA sets PELs to protect workers against exposure to airborne hazardous substances. In some cases PELs may also be set for skin exposure. The OSHA PEL is based on an 8-hour time weighted

average (TWA) exposure, above which lab personnel may not exceed. The list of chemicals with a specific PEL may be found at:
https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9992
This list is published in 29 CFR 1910.1000 Table Z-1.

b. Medical Evaluation and Respiratory Protection Program

Prior to wearing a respirator, the lab worker must complete a medical evaluation questionnaire to determine fitness to wear the respirator. Any individual required to wear a respirator must be enrolled in the University Respiratory Protection Program. This program is administered by EHS. All medical evaluations and program training must be completed prior to using a respirator.

V. GUIDELINES FOR WORKING WITH HAZARDOUS MATERIALS

Understanding the chemical and physical properties of the materials being worked with in the lab is critical to limiting exposure and preventing accidents. Global standards have been established so identification of hazards will be uniform.
Under the CDC, the National Institute of Occupational Safety and Health (NIOSH) has published the NIOSH Pocket Guide to Chemical Hazards. This is an excellent reference for physical and health hazards of 677 distinct chemicals. This guide also lists OSHA Permissible Exposure Limits.

A. Globally Harmonized System of Classification and Labeling of Chemicals

The Globally Harmonized System of Classification and Labeling (GHS) includes criteria for classifying health, physical and environmental hazards. GHS specifies information that must be included on hazardous chemical labels and on Safety Data Sheets (SDS).

1. Physical Hazards

Physical hazards described in GHS are typically quantitative with a distinct endpoint. Below is a listing of the physical hazards, followed by a brief description of each. Note that some hazards (e.g. flammable liquids, pyrophorics) have multiple categories based on severity of the hazard. Familiarization with these hazards is required to work safely in the lab.

Hazard	Category	Criteria
Explosives		solid or liquid which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. Pyrotechnic substances are included even when they do not evolve gases.
Flammable Gases		a gas having a flammable range in air at 20°C and a standard pressure of 101.3 kPa.
Flammable Aerosols		any gas compressed, liquefied or dissolved under pressure within a non-refillable container.
Oxidizing Gases		any gas which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does.
Gases under Pressure		gases that are contained in a receptacle at a pressure not less than 280 Pa at 20°C or as a refrigerated liquid.
Flammable Liquids		Flammable liquid means a liquid having a flash point of not more than 93°C.
	1	Flash point < 23°C and initial boiling point ≤ 35°C (95°F)
	2	Flash point < 23°C and initial boiling point > 35°C (95°F)
	3	Flash point ≥ 23°C and ≤ 60°C (140°F)
	4	Flash point ≥ 60°C (140°F) and ≤ 93°C (200°F)
Flammable Solids		solids that are readily combustible, or may cause or contribute to fire through friction.
	1	Metal Powders: burning time ≤ 5 minutes: Others: wetted zone does not stop fire & burning time < 45 seconds or burning > 2.2 mm/second
	2	Metal Powders: burning time > 5 and ≤ 10 minutes; Others: wetted zone stop fire for at least 4 minutes & burning time < 45 seconds or burning rat > 2.2mm/second
Self-Reactive Substances		thermally unstable liquids or solids liable to undergo a strongly exothermic thermal decomposition even without participation of oxygen (air).
	A	Can detonate or deflagrate rapidly, as packaged.
	B	Possess explosive properties and which, as packaged, neither detonates nor deflagrates, but is liable to undergo a thermal explosion in that package.
	C	Possess explosive properties when the substance or mixture as package cannot detonate or deflagrate rapidly or undergo a thermal explosion.
	D	Detonates partially, does not deflagrate rapidly and shows no violent effect when heated under confinement; or Does not detonate at all, deflagrates slowly and shows no violent effect when heated under confinement; or Does not detonate or deflagrate at all and shows a medium effect when heated under confinement.
	E	Neither detonates nor deflagrates at all and shows low or no effect when heated under confinement.
	F	Neither detonates in the cavitated bubble state nor deflagrates at all and shows only a low or no effect when heated under confinement as well as low or no explosive power.
	G	Neither detonates in the cavitated state nor deflagrates at all and shows non effect when heated under confinement nor any explosive power, provided that it is thermally stable (self-accelerating decomposition temperature is 60°C to 75°C for a 50 kg package), and, for liquid mixtures, a diluent having a boiling point not less than 150°C is used for desensitization.
Pyrophoric Liquids		a liquid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air.
Pyrophoric Solids		a solid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air.
Self-Heating Substances		a solid or liquid, other than a pyrophoric substance, which, by reaction with air and without energy supply, is liable to self-heat.
Substances which on Contact with Water Emit Flammable Gases		Substances that, in contact with water, emit flammable gases are solids or liquids which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.
	1	≥10 L/kg/1 minute gas evolution
	2	≥20 L/kg/ 1 hour + < 10 L/kg/1 min gas evolution
	3	≥1 L/kg/1 hour + < 20 L/kg/1 hour gas evolution
	No Class	< 1 L/kg/1 hour gas evolution
Oxidizing Liquids		a liquid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause or contribute to the combustion of other material.
Oxidizing Solids		a solid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause or contribute to the combustion of other material.
Organic Peroxides		organic liquid or solid which contains the bivalent -0-0- structure and may be considered a derivative of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals.
	A	Can detonate or deflagrate rapidly, as packaged.
	B	Possess explosive properties and which, as packaged, neither detonates nor deflagrates, but is liable to undergo a thermal explosion in that package.
	C	Possess explosive properties when the substance or mixture as package cannot detonate or deflagrate rapidly or undergo a thermal explosion.
	D	Detonates partially, does not deflagrate rapidly and shows no violent effect when heated under confinement; or Does not detonate at all, deflagrates slowly and shows no violent effect when heated under confinement; or Does not detonate or deflagrate at all and shows a medium effect when heated under confinement.
	E	Neither detonates nor deflagrates at all and shows low or no effect when heated under confinement.
	F	Neither detonates in the cavitated bubble state nor deflagrates at all and shows only a low or no effect when heated under confinement as well as low or no explosive power.
	G	Neither detonates in the cavitated state nor deflagrates at all and shows non effect when heated under confinement nor any explosive power, provided that it is thermally stable (self-accelerating decomposition temperature is 60°C to 75°C for a 50 kg package), and, for liquid mixtures, a diluent having a boiling point not less than 150°C is used for desensitization.
Substances Corrosive to Metal		A substance or a mixture that by chemical action will materially damage, or even destroy, metals is termed 'corrosive to metal'.

2. Health Hazards and Toxicity

The following tables describe health and toxicity information that will be found on chemical labels and SDS.

a. Acute Toxicity

For purposes of GHS, acute toxicity is based on lethal dose - LD_{50} (oral, dermal) or lethal concentration - LC_{50} (inhalation), indicating the amount of the substance required (usually per body weight) to kill 50% of the test population.

Acute Toxicity

Acute toxicity	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Category 5
Oral (mg/kg)	≤ 5	> 5 ≤ 50	> 50 ≤ 300	> 300 ≤ 2000	Criteria: ▪ Anticipated oral LD50 between 2000 and 5000 mg/kg; ▪ Indication of significant effect in humans;* ▪ Any mortality at class 4;* ▪ Significant clinical signs at class 4;* ▪ Indications from other studies.* *If assignment to more hazardous class is not warranted.
Dermal (mg/kg)	≤ 50	> 50 ≤ 200	> 200 ≤ 1000	> 1000 ≤ 2000	
Gases (ppm)	≤ 100	> 100 ≤ 500	> 500 ≤ 2500	> 2500 ≤ 5000	
Vapors (mg/l)	≤ 0.5	> 0.5 ≤ 2.0	> 2.0 ≤ 10	> 10 ≤ 20	
Dust & mists (mg/l)	≤ 0.05	> 0.05 ≤ 0.5	> 0.5 ≤ 1.0	> 1.0 ≤ 5	

b. Skin Corrosion

Skin corrosion indicates irreversible damage to the skin following the application of a test substance for up to 4 hours.

Skin Corrosion / Irritation

Skin Corrosion Category 1			**Skin Irritation Category 2**	**Mild Skin Irritation Category 3**
Destruction of dermal tissue: visible necrosis in at least one animal			Reversible adverse effects in dermal tissue Draize score: ≥ 2.3 < 4.0 or persistent inflammation	Reversible adverse effects in dermal tissue Draize score: ≥ 1.5 < 2.3
Subcategory 1A Exposure < 3 min. Observation < 1hr,	Subcategory 1B Exposure < 1hr. Observation < 14 days	Subcategory 1C Exposure < 4 hrs. Observation < 14 days		

c. Eye Effects

Serious eye damage includes tissue damage or deterioration of vision after exposure to the substance, which is not fully reversible in 21 days.

Eye Effects

Category 1 Serious eye damage	**Category 2 Eye Irritation**	
Irreversible damage 21 days after exposure Draize score: Corneal opacity ≥ 3 Iritis > 1.5	Reversible adverse effects on cornea, iris, conjunctiva Draize score: Corneal opacity ≥ 1 Iritis > 1 Redness ≥ 2 Chemosis ≥ 2	
	Irritant Subcategory 2A Reversible in 21 days	**Mild Irritant** Subcategory 2B Reversible in 7 days

d. Mutagenicity and Carcinogenicity

Mutagens are agents that may increase the occurrence of cellular mutation. Carcinogens are substances which will induce, or increase the incidence, of cancer. The listing of known carcinogens is located in Appendix II.

Germ Cell Mutagenicity

<table>
<tr><th colspan="2">Category 1
Known/Presumed</th><th>Category 2
Suspected/Possible</th></tr>
<tr><td colspan="2">Known to produce heritable mutations in human germ cells</td><td rowspan="2">May include heritable mutations in human germ cells
Positive evidence from tests in mammals and somatic cell tests
In vivo somatic genotoxicity supported by in vitro mutagenicity</td></tr>
<tr><td>Subcategory 1A
Positive evidence from epidemiological studies</td><td>Subcategory 1B
Positive results in:
In vivo heritable germ cell tests in mammals
Human germ cell tests
In vivo somatic mutagenicity tests, combined with some evidence of germ cell mutagenicity</td></tr>
</table>

Carcinogenicity

<table>
<tr><th colspan="2">Category 1
Known or Presumed Carcinogen</th><th>Category 2
Suspected Carcinogen</th></tr>
<tr><td>Subcategory 1A
Known Human Carcinogen Based on human evidence</td><td>Subcategory 1B
Presumed Human Carcinogen
Based on demonstrated animal carcinogenicity</td><td>Limited evidence of human or animal carcinogenicity</td></tr>
</table>

e. Reproductive Toxicity

Reproductive toxins cause adverse effects on fertility and sexual function in males and females, as well as in offspring. A list of some known reproductive toxins is listed in Appendix II.

Reproductive Toxicity

<table>
<tr><th colspan="2">Category 1</th><th>Category 2
Suspected</th><th>Additional
Category</th></tr>
<tr><td colspan="2">Known or presumed to cause effects on human reproduction or on development</td><td rowspan="2">Human or animal evidence possibly with other information</td><td rowspan="2">Effects on or via lactation</td></tr>
<tr><td>Category 1A
Known
Based on human evidence</td><td>Category 1B
Presumed
Based on experimental animals</td></tr>
</table>

3. Pictograms and Signal Words

GHS hazard symbols will appear on chemical labels and on SDS. In addition, hazard statements describe the hazard by hazard classification. Signal words will indicate the severity of a hazard, where:

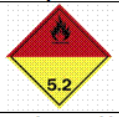
"Danger" indicates more severe hazards, and

"Warning" indicates less severe hazards.

Below are the GHS pictograms that will appear on chemical labels with designated signal words beneath. Lab personnel need to be familiar with the pictograms and associated hazards.

GHS Pictograms and Hazard Classes		
		
▪ Oxidizers	▪ Flammables ▪ Self Reactives ▪ Pyrophorics ▪ Self-Heating ▪ Emits Flammable Gas ▪ Organic Peroxides	▪ Explosives ▪ Self Reactives ▪ Organic Peroxides
		
▪ Acute toxicity (severe)	▪ Corrosives	▪ Gases Under Pressure
		
▪ Carcinogen ▪ Respiratory Sensitizer ▪ Reproductive Toxicity ▪ Target Organ Toxicity ▪ Mutagenicity ▪ Aspiration Toxicity	▪ Environmental Toxicity	▪ Irritant ▪ Dermal Sensitizer ▪ Acute toxicity (harmful) ▪ Narcotic Effects ▪ Respiratory Tract ▪ Irritation

Packages arriving on campus may bear GHS transportation pictograms. The outer packing of the box may contain one or more of these to indicate hazard(s). Below are the pictograms used in transporting hazardous material.

Transport "Pictograms"		
		
Flammable Liquid Flammable Gas Flammable Aerosol	Flammable solid Self-Reactive Substances	Pyrophorics (Spontaneously Combustible) Self-Heating Substances
		
Substances, which in contact with water, emit flammable gases (Dangerous When Wet)	Oxidizing Gases Oxidizing Liquids Oxidizing Solids	Explosive Divisions 1.1, 1.2, 1.3
		
Explosive Division 1.4	Explosive Division 1.5	Explosive Division 1.6
		
Compressed Gases	Acute Toxicity (Poison): Oral, Dermal, Inhalation	Corrosive
		
Marine Pollutant	Organic Peroxides	

Acute Oral Toxicity is divided into five categories dependent on the LD (Lethal Dose)$_{50}$. The LD_{50} is the amount of the substance required (usually per body weight) to kill 50% of the test population.

ACUTE ORAL TOXICITY - Annex 1					
	Category 1	**Category 2**	**Category 3**	**Category 4**	**Category 5**
LD_{50}	£ 5 mg/kg	> 5 < 50 mg/kg	³ 50 < 300 mg/kg	³ 300 < 2000 mg/kg	³ 2000 < 5000 mg/kg
Pictogram					No symbol
Signal word	Danger	Danger	Danger	Warning	Warning
Hazard statement	Fatal if swallowed	Fatal if swallowed	Toxic if swallowed	Harmful if swallowed	May be harmful if swallowed

4. Safety Data Sheets

In the GHS, the Safety Data Sheet (SDS) will replace the Material Safety Data Sheet (MSDS). The SDS provides detailed information for chemical management. The SDS is to be used by lab personnel as a source of information regarding hazards and safety precautions for the particular chemical. The SDS will contain 16 headings, as shown in the chart below. These headings will be the same on every SDS.

Minimum information for an SDS

1.	**Identification of the substance or mixture and of the supplier**	▪ GHS product identifier. ▪ Other means of identification. ▪ Recommended use of the chemical and restrictions on use. ▪ Supplier's details (including name, address, phone number, etc.). ▪ Emergency phone number.
2.	**Hazards identification**	▪ GHS classification of the substance/mixture and any national or regional information. ▪ GHS label elements, including precautionary statements. (Hazard symbols may be provided as a graphical reproduction of the symbols in black and white or the name of the symbol, e.g., flame, skull and crossbones.) ▪ Other hazards which do not result in classification (e.g., dust explosion hazard) or are not covered by the GHS.
3.	**Composition/information on ingredients**	**Substance** ▪ Chemical identity. ▪ Common name, synonyms, etc. ▪ CAS number, EC number, etc. ▪ Impurities and stabilizing additives which are themselves classified and which contribute to the classification of the substance. **Mixture** ▪ The chemical identity and concentration or concentration ranges of all ingredients which are hazardous within the meaning of the GHS and are present above their cutoff levels. ***NOTE**: For information on ingredients, the competent authority rules for CBI take priority over the rules for product identification.*
4.	**First aid measures**	▪ Description of necessary measures, subdivided according to the different routes of exposure, i.e., inhalation, skin and eye contact, and ingestion. ▪ Most important symptoms/effects, acute and delayed. ▪ Indication of immediate medical attention and special treatment needed, if necessary.
5.	**Firefighting measures**	▪ Suitable (and unsuitable) extinguishing media. ▪ Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products). ▪ Special protective equipment and precautions for firefighters.
6.	**Accidental release measures**	▪ Personal precautions, protective equipment and emergency procedures. ▪ Environmental precautions. ▪ Methods and materials for containment and cleaning up.

7.	**Handling and storage**	▪ Precautions for safe handling. ▪ Conditions for safe storage, including any incompatibilities.
8.	**Exposure controls/personal protection.**	▪ Control parameters, e.g., occupational exposure limit values or biological limit values. ▪ Appropriate engineering controls. ▪ Individual protection measures, such as personal protective equipment.
9.	**Physical and chemical properties**	▪ Appearance (physical state, color, etc.). ▪ Odor. ▪ Odor threshold. ▪ pH. ▪ melting point/freezing point. ▪ initial boiling point and boiling range. ▪ flash point. ▪ evaporation rate. ▪ flammability (solid, gas). ▪ upper/lower flammability or explosive limits. ▪ vapor pressure. ▪ vapor density. ▪ relative density. ▪ solubility(ies). ▪ partition coefficient: n-octanol/water. ▪ autoignition temperature. ▪ decomposition temperature.
10.	**Stability and reactivity**	▪ Chemical stability. ▪ Possibility of hazardous reactions. ▪ Conditions to avoid (e.g., static discharge, shock or vibration). ▪ Incompatible materials. ▪ Hazardous decomposition products.
11.	**Toxicological information**	Concise but complete and comprehensible description of the various toxicological (health) effects and the available data used to identify those effects, including: ▪ information on the likely routes of exposure (inhalation, ingestion, skin and eye contact); ▪ Symptoms related to the physical, chemical and toxicological characteristics; ▪ Delayed and immediate effects and also chronic effects from short- and long-term exposure; ▪ Numerical measures of toxicity (such as acute toxicity estimates).
12.	**Ecological information**	▪ Ecotoxicity (aquatic and terrestrial, where available). ▪ Persistence and degradability. ▪ Bioaccumulative potential. ▪ Mobility in soil. ▪ Other adverse effects.
13.	**Disposal considerations**	▪ Description of waste residues and information on their safe handling and methods of disposal, including the disposal of any contaminated packaging.

14.	**Transport information**	▪ UN Number. ▪ UN Proper shipping name. ▪ Transport Hazard class(es). ▪ Packing group, if applicable. ▪ Marine pollutant (Yes/No). ▪ Special precautions which a user needs to be aware of or needs to comply with in connection with transport or conveyance either within or outside their premises.
15.	**Regulatory information**	▪ Safety, health and environmental regulations specific for the product in question.
16.	**Other information including information on preparation and revision of the SDS**	

B. Chemical Labeling

Chemical labeling is a vital component of laboratory safety. Unlabeled, mislabeled, and poorly labeled containers can lead to unintended and often dangerous consequences. From a scientific standpoint, it leads to poor results and displays a lack of discipline.

The preamble to 29 CFR 1910.1945 states the following regarding labeling of received chemicals as the means of hazard identification:

- *"Employers are to ensure that labels on incoming containers of hazardous chemicals are not removed or defaced."*
- *"If a chemical substance whose chemical composition is known is produced in the laboratory for its own exclusive use, OSHA requires that available hazard information be provided to employees who may be exposed to the substance. MSDS and label preparations as required under the Hazard Communication Standard do not apply since, still qualifying under the laboratory use and laboratory scale definitions…"*
- Laboratories that *"produce a chemical byproduct whose composition is unknown shall make the assumption that the substance is hazardous and require that it be handled according to the Chemical Hygiene Plan…"*
- *"Finally, the standard clarifies the employer's responsibility where a chemical is produced in the laboratory and shipped to another user outside of the laboratory. With respect to the substance produced, the employer has become a manufacturer and therefore is subject to all the relevant provisions of the Hazard Communication Standard including requirements for the development of a material safety data sheet and labeling. However, if manufacturing is not the laboratory's principal concern, the laboratory standard remains in effect for those activities unrelated to the manufacturing operations."*

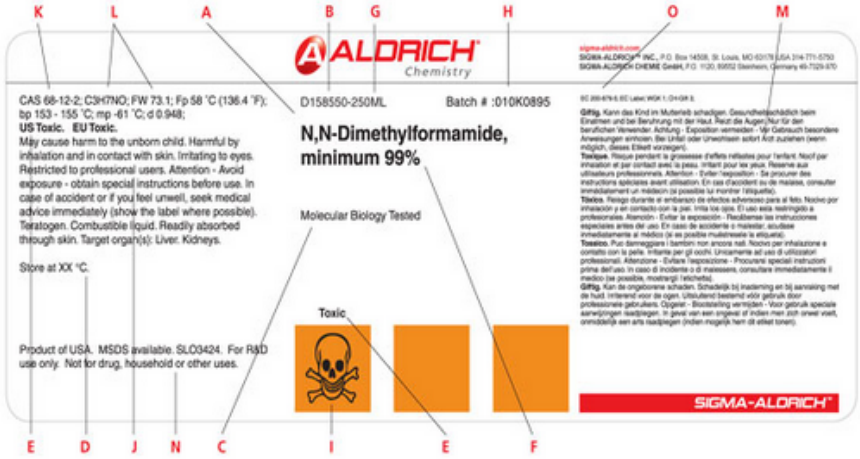
1. Chemicals in Original Containers

Chemicals in their original containers will be labeled by the manufacturer prior to shipment. Manufacturer label must remain visible and is not to be removed from the bottle while product still remains. If a label becomes defaced or otherwise illegible it is to be replaced. The replacement label must at a minimum contain the following:

- Chemical name
- Hazard(s)
- Manufacturer
- Manufacturer address and phone number

Below is an example of manufacturer product label, with identification of each component.

Key to Aldrich Product Labels:



A Product Name and Description

B Product Number

C Further Descriptive Information

D Recommendations on Handling and Storage
Storage temperatures indicated are for long-term storage of products. Products may be shipped under different conditions to reduce shipping costs, while still ensuring product quality.

E Hazard Statement
Indication of danger.

F Lot Analysis
Data on activity, purity, degree of hydration, etc., for this lot.

G Package Size
Unless the material is described as pre-weighed, the package will normally contain at least the indicated quantity, and usually somewhat more. For some products, the actual quantity at time of packaging is also shown. The user should always measure the amount needed from the container.

H Lot Number

I Hazard Pictogram
Lets you know at a glance what safety hazards are involved in the use of this product.

J Further Hazard Information
More complete description of actual hazards, handling precautions, and emergency management procedures.

K CAS Number
Chemical Abstract Service number shown wherever available. CAS numbers vary in how specifically they define the material. We make every effort to provide the most specific CAS number which applies. Where a CAS number is provided for a mixture or solution, it is usually the CAS number of the solute or component referred to in the main label name.

L Chemical Formula and Formula Weight
Unless water of hydration is indicated in the formula, the formula weight is for the anhydrous material.

M Risk and Safety Statements:
Information is provided in multiple languages.

N Material Safety Data Sheet Available:
A Material Safety Data Sheet is available for this product.

O EC Number:
EC Number (EINECS or ELINCS), products without an EINECS number will carry the warning statement, "Caution: Substance Not Yet Fully Tested."

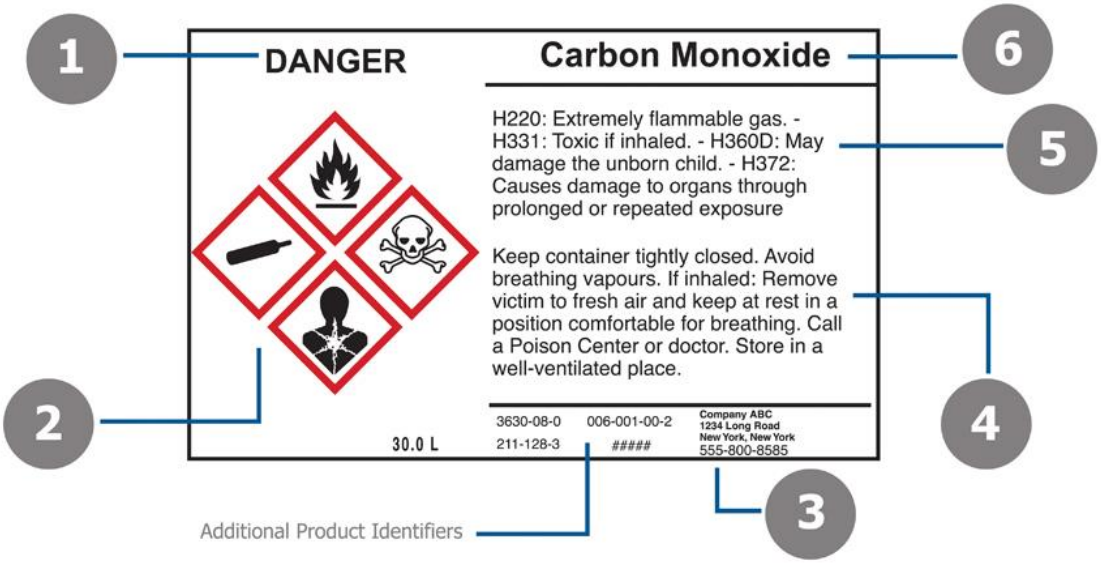
2. Chemicals Transferred from Original Container

Chemicals transferred from their original container must be labeled with:

- THE IDENTITY OF THE CHEMICAL AND APPROPRIATE HAZARD WARNINGS MUST BE SHOWN ON THE LABEL.
- HAZARD PICTOGRAM
- THE NAME AND ADDRESS OF THE MANUFACTURER OR OTHER RESPONSIBLE PARTY MUST BE INCLUDED ON THE LABEL.

- THE HAZARD LABEL MESSAGE MUST BE LEGIBLE, PERMANENTLY DISPLAYED AND WRITTEN IN ENGLISH.

Make sure that labels and ink are not soluble with the contents of the container. An example of this type of label is shown below.



3. Stock Solutions

Stock solutions must be labeled in a manner similar to that of chemicals transferred from their original container. In this case, the chemical name will be the name of the stock solution (e.g. 1XPBS, 2N HCl, 1M NaOH.) Abbreviations may only be used if the stock solution abbreviation is known to all lab personnel. Otherwise, the full chemical name must be displayed. Please note: a list of common acceptable abbreviations is listed in Appendix IV.
It is of benefit if the hazard(s) also be identified on the label. Appropriate identification would be to add the signal word, or pictogram label with matching signal word to the container, as in the example below.

4. Samples and Prepared Chemical Substances

Samples and other prepared substances should be identifiable by lab personnel. This is especially true if:

- The material is not used within the work shift of the individual who prepares the sample or substance.
- The worker who made the sample or substance leaves the work area.

- The container with the sample or substance is moved to another work area and is no longer in the possession of the preparer.

The use of a laboratory notebook is acceptable as means of identification as long as individual samples or compounds can be identified through a numbering or other marking system that will allow the user or other lab personnel to match the sample with the information in the notebook identifying the contents of said sample or compound. The lab notebook must be accessible when the preparer is not present in the lab to allow other lab personnel to identify contents.

C. Laboratory Signs

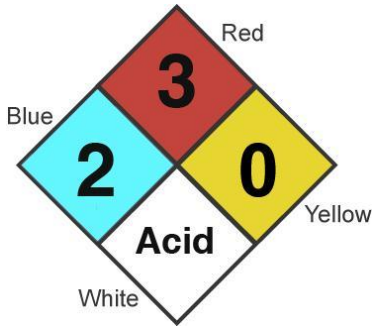
Signs in and around laboratories are in place as a means of quick identification of potential hazards, means of egress, and location of safety equipment. It is the responsibility of the PI to ensure that all appropriate signs are posted within the lab, and that these are visible and legible. EHS can assist with obtaining and placement of signs.

1. National Fire Protection Agency (NFPA)

The NFPA 704 Diamond Label system is used to inform building occupants and first responders of potential chemical and physical hazards within a building. The system uses three specific categories to identify flammability, health and reactivity hazard levels. A fourth category identifies special hazards that are present.

The label is color coded red, blue, yellow and white to highlight different hazards, making it easier to identify specific risks. NFPA 704 uses a numerical value of between "0" and "4" to indicate the relative level of hazard for that particular chemical. In this system, a rating of "0" indicates little or no risk, while a rating of "4" indicates the highest or most severe risk. An example is shown below.

Color	Category
Blue	Health
Red	Flammability
Yellow	Reactivity
White	Special Hazard



Number	Flammability	Health Hazard	Reactivity
0	Material will not burn	No Hazard	Not Reactive
1	Material must be exposed to high heat before ignition occurs; flash point >200 ^{o} F	Minor irritation	Normally stable but can become unstable w/ heat
2	Moderate heat required before ignition occurs; flash point 100-200 ^{o} F	Intense or chronic exposure may cause temporary incapacitation	Violent reaction when exposed to heat or w/ water
3	Liquids or solids that ignite under ambient temperatures; flash point <100 ^{o} F	Short exposure could cause serious injury	May detonate w/ initiating source or reacts w/ water
4	Vaporizes and burns at normal temp/pressure; flash point <73 ^{o} F (rm. temp.)	Short exposure could cause death	May detonate at normal temp/pressure

The white diamond on the bottom lists special properties.

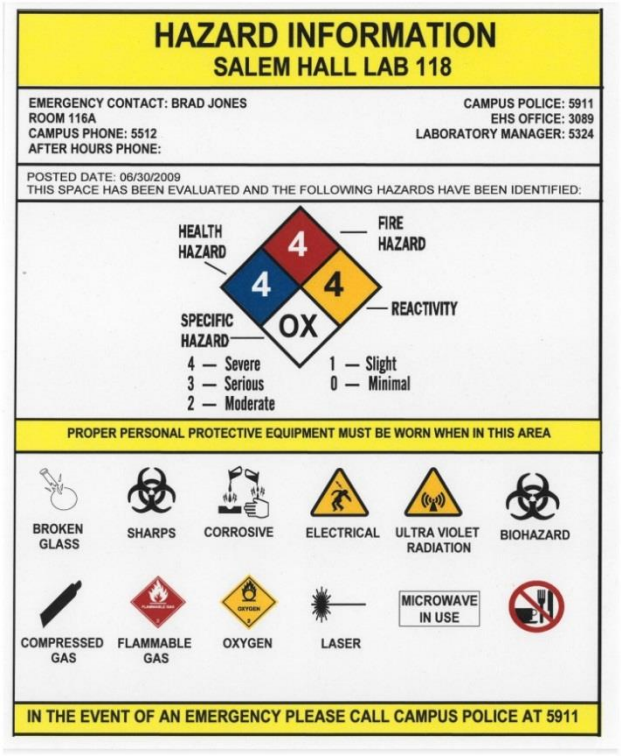
- ACID (strong acid, usually a mineral acid)
- ALK (strong alkali)
- COR (strong corrosive)
- OXY (strong oxidizer)
- P (can polymerize spontaneously and release energy)
- ~~W~~ (use no water)

2. NFPA vs. GHS

It is very important to note that NFPA and GHS hazard category number systems do not align. As shown in section A. 1 above, the GHS numerical system of hazard severity uses the number "1" as most severe. In most cases, the GHS numerical system will only be seen on the SDS. Signs posted in the lab will use the NFPA 704 system, since this will support not only lab personnel, but first responders in the event of an emergency.

3. Space Hazard Signs

Each laboratory door is marked with a Space Hazard Sign. The Space Hazard Sign indicates the chemical and physical hazards present within the space, and includes emergency contact information. These signs were developed by EHS with the assistance of each PI. It is the PI's responsibility to ensure the information on the Space Hazard Sign is correct. Any changes to chemical or physical hazards in the lab will be provided to EHS so an updated sign can be created. An example of the Space Hazard Sign is shown below:



The top section includes Emergency Contact information, including the PI after hours phone.

The center section uses the NFPA 704 identification system to list fire, health, and reactivity information.

The bottom section lists specific chemical or physical hazards that are present within the laboratory.

4. Exit Signs, Emergency Equipment Signs, Evacuation Signs

Exit signs are posted throughout each building. Exit signs are backlit to provide visibility in the event of a power outage. Always know the location of at least two exits from a building. This allows for a safe evacuation from a building in the event the primary exit is blocked.
Emergency equipment signs are posted to identify the location of safety showers, eyewash stations, and fire extinguishers. If a sign is missing or has become illegible, notify F&CS Customer Service at x4255 for replacement.
Building evacuation signs are posted in the hallways of each building. When entering any building, take note of the evacuation signs to locate the nearest exit and the evacuation route. This information is an essential life-saving tool in the event of an emergency requiring building evacuation.

D. Chemical Storage

Chemical storage considerations are dependent on a number of factors. Several federal, state and local regulations affect handling and storage of chemicals in laboratories. These include restrictions on storage of consumable alcohol, flammable material, and controlled substances.

1. Incompatibles

The most important storage consideration is chemical compatibility. Incompatible and mutually exclusive materials must never be stored together. There must be at least a separation of distance that will prohibit unintentional mixing in the event of release. Preferably, incompatibles are to be separated within different storage areas or separated by means of secondary containment.

2. Flammable Liquids

The Winston-Salem Fire Department defines strict limitations to the amount of flammable liquids that may be stored on each building level. With each increase in building floor there is a corresponding decrease in the quantity of flammables that may be stored. The Wake Forest University Fire and Life Safety Specialist in F&CS will provide each building the information on maximum storage quantities per floor of flammable liquids.

3. Controlled Substances

Controlled substances are regulated by the US Department of Justice Drug Enforcement Agency (USDOJ DEA). Information regarding storage requirements for controlled substances is located in the Wake Forest University *Guidelines: Use of Controlled Substances in Research*. This document provides detailed information on the registration process, procurement, storage, and use of controlled substances at the University. Security of controlled substances is essential in preventing illegal diversion.

4. Consumable Alcohol used in Research

Wake Forest University maintains a single license from the Department of Justice Bureau of Alcohol, Tobacco, Firearms and Explosives (DOJ ATF) for the purchase of consumable alcohol used in research. The license is necessary for purchase of alcohol, and therefore is controlled by the University Administration.

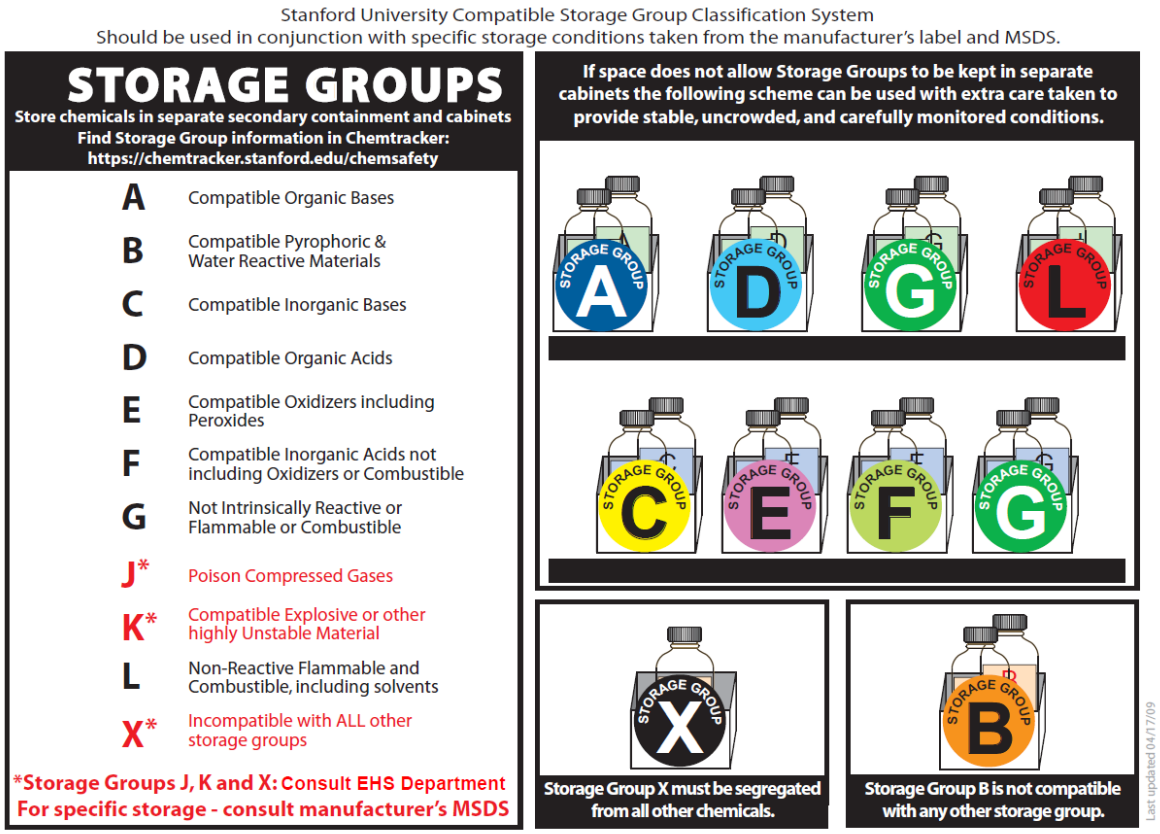
5. Storage Guidelines

Prudent Practices provides detailed information on chemical storage within laboratories and stockrooms. The information is located in Chapter 5, Section E, and should be reviewed to ensure proper storage methods are being employed in the lab. General considerations for storage include:

- Avoiding chemical storage above eye-level,

- Storing frequently used chemicals within easy reach,
- Storing heavy materials on lower shelves, and
- Prohibiting storage on floors or in areas that block egress or where chemicals may be inadvertently knocked over.

The following list is from Prudent Practices (page 97) and lists examples of compatible storage groups:



E. Waste Collection, Labeling and Disposal of Chemical Waste

The Environmental Protection Agency (EPA) governs the regulations regarding collection and disposal of chemical waste. A substance in the lab is considered a waste when it will no longer be used for its original purpose and / or is no longer needed in the laboratory.

1. Hazardous Waste Descriptions

Hazardous waste is dangerous or potentially harmful to health and the environment. Hazardous wastes may be liquid, sludges, solids, or gases. Four main classifications of hazardous waste have been developed by the EPA: flammable, corrosive, reactive and toxic. Full descriptions and examples are listed in Appendix VI.

a. Flammable Waste

Flammable wastes include liquids with a flash point of less than 140 ^{o}F, oxidizers (liquid or solid), solids that may ignite due to friction, water-reactive materials, and spontaneously combustible materials. Flammable compressed gases also fall under this category. Some examples of common flammable waste include:

- Unused or spent organic solvents or alcohols (acetone, THF, ethanol, isopropyl alcohol)
- Peroxides, perchlorates, permanganates, hypochlorites
- Full, partial full or empty lecture cylinders of propane or hydrogen

b. Corrosive Waste

Corrosive wastes are liquids with a pH of less than 2 (acidic) or greater than 12.5 (caustic). Examples of common corrosive wastes include:

- Mineral acids (hydrochloric or phosphoric acid)
- Nitric acid, chromic acid, chromerge
- Sodium or potassium hydroxide

c. Reactive Waste

Reactive wastes include water-reactive and air reactive materials. Cyanide and sulfide bearing wastes are also considered reactive due to toxic gas release when exposed to corrosives. Common lab reactive waste includes:

- Sodium metal, magnesium flake
- Sodium or potassium cyanide
- Hydrogen sulfide

d. Toxic Waste

Toxic wastes are a list of forty distinct chemicals or compounds that have been designated by the EPA to cause damage to human health. A waste will be considered toxic if the concentration of the toxin in the waste is above the cited concentration. These are listed below.

Maximum Concentration of Contaminants for Toxicity Characteristic

EPA HW No. [1]	Contaminant	CAS No. [2]	Regulatory Level (mg/L)
D004	Arsenic	7440-38-2	5.0
D005	Barium	7440-39-3	100.0
D018	Benzene	71-43-2	0.5
D006	Cadmium	7440-43-9	1.0
D019	Carbon tetrachloride	56-23-5	0.5
D020	Chlordane	57-74-9	0.03
D021	Chlorobenzene	108-90-7	100.0
D022	Chloroform	67-66-3	6.0
D007	Chromium	7440-47-3	5.0
D023	o-Cresol	95-48-7	[4] 200.0
D024	m-Cresol	108-39-4	[4] 200.0
D025	p-Cresol	106-44-5	[4] 200.0
D026	Cresol		[4] 200.0
D016	2,4-D	94-75-7	10.0
D027	1,4-Dichlorobenzene	106-46-7	7.5
D028	1,2-Dichloroethane	107-06-2	0.5
D029	1,1-Dichloroethylene	75-35-4	0.7
D030	2,4-Dinitrotoluene	121-14-2	[3] 0.13
D012	Endrin	72-20-8	0.02
D031	Heptachlor (and its epoxide)	76-44-8	0.008
D032	Hexachlorobenzene	118-74-1	[3] 0.13
D033	Hexachlorobutadiene	87-68-3	0.5
D034	Hexachloroethane	67-72-1	3.0
D008	Lead	7439-92-1	5.0
D013	Lindane	58-89-9	0.4
D009	Mercury	7439-97-6	0.2
D014	Methoxychlor	72-43-5	10.0
D035	Methyl ethyl ketone	78-93-3	200.0
D036	Nitrobenzene	98-95-3	2.0
D037	Pentrachlorophenol	87-86-5	100.0
D038	Pyridine	110-86-1	[3] 5.0
D010	Selenium	7782-49-2	1.0
D011	Silver	7440-22-4	5.0
D039	Tetrachloroethylene	127-18-4	0.7
D015	Toxaphene	8001-35-2	0.5
D040	Trichloroethylene	79-01-6	0.5
D041	2,4,5-Trichlorophenol	95-95-4	400.0
D042	2,4,6-Trichlorophenol	88-06-2	2.0
D017	2,4,5-TP (Silvex)	93-72-1	1.0
D043	Vinyl chloride	75-01-4	0.2

[1] Hazardous waste number.

[2] Chemical abstracts service number.

[3] Quantitation limit is greater than the calculated regulatory level. The quantitation limit therefore becomes the regulatory level.

[4] If o-, m-, and p-Cresol concentrations cannot be differentiated, the total cresol (D026) concentration is used. The regulatory level of total cresol is 200 mg/l.

e. Listed Waste

Listed wastes are unused chemical products (usually in the original container) that are either out of date or will no longer be used in the laboratory. The EPA has developed two sets of listed wastes:

- U-Listed – a list of over 480 chemicals or chemical compounds.
- P-List – a list of 240 chemicals or chemical compounds considered acutely toxic by EPA.

These chemicals are listed in Appendix VI.

2. Collection and Labeling of Hazardous Waste

Hazardous waste must be collected and labeled appropriately in the laboratory. Hazardous waste may never be disposed in the sink or in the regular trash. Incompatible or mutually exclusive materials may never be collected for disposal in the same container.

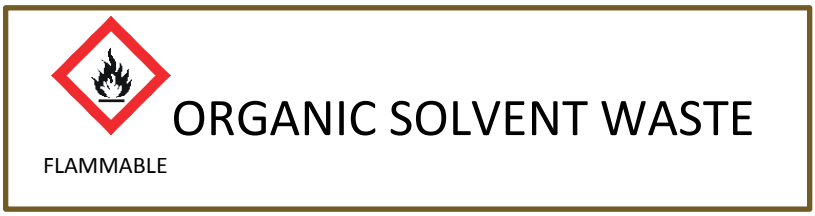
a. Hazardous Waste Collection Containers

Hazardous waste is to be collected in a container that is compatible with the waste. Do not collect corrosive materials in metal containers, as the metal will corrode, releasing the contents. Laboratories should have prepared containers for waste collection prior to beginning experiments. Compatible material of the same hazard may be collected in a single container. As an example, a laboratory may use a 5-gallon carboy to collect all compatible flammable solvents and alcohols. Another container may be used to collect compatible acidic waste, while a third may be used to collect compatible caustic wastes. If a container that will be used to collect waste previously held a chemical product, be sure the original chemical from the container is compatible with the waste that will be added. For example, an empty container of acetone may be used to collect flammable solvents and alcohols, however, a container that previously held hydrochloric acid must not be used to hold cyanide waste.
Regulations require that all waste containers must be closed completely unless waste is being added. This means bottle caps must be screwed on, and lidded funnels must be closed and latched.

b. Labeling Hazardous Waste Containers

Hazardous waste collection containers must be labeled with either the full chemical name of the waste (abbreviations are not acceptable on hazardous waste labels), or a description of the type of waste in the container (Waste Flammable Solvent, Waste Acid Solution). See examples below.

Example 1.



Example 2.

Prior to labeling a hazardous waste container, be sure that all previous labels or markings are defaced or removed. This will prevent confusion as to the contents of the container.

c. Disposal of Hazardous Waste

EHS handles removal and disposal of all hazardous waste on campus. Laboratories with higher generation rates of waste will have waste removed on a weekly basis. Labs with lower waste generation rates should call or e-mail the EHS office for waste removal. Be sure to provide the following information:

- Your name, phone number and e-mail address

- Department, building and lab number
- Type and quantity of waste, and the location of the waste in the lab.

EHS will then schedule pick up for the next weekly waste collection day.

F. Working with Biohazards

Some toxic chemical compounds are not synthesized, but purified from biological sources. Examples include mushroom or spider toxins, or plant poisons. Live biological materials (viruses, bacteria, parasites, etc.) that could infect humans, other animals, or crop plants are used in some laboratories. These materials are labeled as **"**biohazards**".** Biohazards must be indicated with the following marking:

Each biohazard has its own unique properties, handling requirements, and proper technique for disposal. It is important that you know these requirements, as well as signs and symptoms of exposure. The best source for information will be the SDS and technical sheets for the material.

1. Institutional Biosafety Committee

No highly communicable disease or infectious agent may be brought on campus prior to review by the WFU Institutional Biosafety Committee. The committee reviews the proposal and either approves the proposal or sends it back to the investigator with recommendations to increase safety. Prior to the outset of research, the committee must endorse the proposal. The Office of Research Development maintains the rules of safety that serve as guidelines for the committee.

2. Biohazard Protocols

If a particular laboratory will be handling large quantities of biohazard materials, a "BIOHAZARD" sign must be placed on the door. If the lab you work in has been posted for biohazard materials:

- Familiarize yourself with the properties of the hazard, even if you are not working with it.
- Wear proper PPE.
- All procedures involving blood or other potentially infectious materials shall be performed in such a manner as to minimize splashing, spraying, spattering, and generation of droplets of these substances.
- Mouth pipetting/suctioning of blood or other potentially infectious materials is prohibited.
- Specimens of blood or other potentially infectious materials shall be placed in a container which prevents leakage during collection, handling, processing, storage, transport, or shipping.
- Wash your hands thoroughly before leaving the laboratory.
- Federal law prohibits anyone from having their office desk in a lab space where biohazard materials are in use.

3. Working with Human Blood and Bodily Fluids

Prior to working with human blood or bodily fluids, lab personnel must be trained in the WFU Exposure Control Plan (ECP). The Plan is located on the EHS website. The ECP is designed to eliminate or minimize occupational exposure to Hepatitis B Virus (HBV), Human Immunodeficiency Virus (HIV), and other bloodborne pathogens. The OSHA Bloodborne standard should be referenced for a complete understanding of compliance issues. As part of the ECP, lab personnel are offered the Hepatitis B vaccine at no cost. This program is handled through EHS. After ECP training, contact the PI or EHS to enroll in the vaccination program.

4. Biohazard Collection and Disposal

Prior to working with biohazards, lab personnel must read and understand the Wake Forest University Biohazard Waste Management Plan. The plan is available on-line at the EHS website and several departmental websites. The Plan covers proper decontamination and disposal techniques for biohazards, blood and bodily fluids, and sharps.

G. Broken Glass and Sharps

Broken glass and sharps must both be handled with extreme care in the laboratory to prevent accidental puncture wounds.

1. Broken Glass

Broken glass and empty glass bottles are to be collected in designated glass waste boxes in each laboratory. The box may be purchased prefabricated, although standard heavy duty cardboard boxes may be used as long as all original markings on the box are defaced or removed. The box must be marked with the words “BROKEN GLASS” on at least opposite sides. The box must be lined with a heavy mil (9mil minimum) plastic bag.

Do not place bottles or glass in the box that is clearly heavily contaminated with chemical residue or potentially biohazardous substances. Free liquids or sharps (needles, razors) may not be placed in the box.

Do not overfill the box. Do not use a large box that will become overly heavy or awkward to lift. It is the responsibility of lab personnel to close and tape shut the broken glass box when it is full. Be sure no glass or sharp edges are protruding from the box. Once taped shut, place the box in the hall outside the lab door for removal by Custodial Services. It is not the responsibility of Custodial Services to tape boxes closed or to remove boxes from laboratories.

2. Sharps Disposal

Sharps include needles, razors, scalpels, and any other laboratory instruments that may cause punctures or cuts to human skin. The following rules must be followed when disposing of sharps.

- Contaminated needles and other contaminated sharps shall not be bent, recapped, or removed from syringes.
- Immediately or as soon as possible after use, contaminated sharps shall be placed in appropriate Sharps containers
- Sharps must be disposed of in a container that is rigid, leak-proof when in an upright position and puncture resistant.
- The container must be labeled with the biohazard symbol and the words “Sharps” and "Biohazard."
- Do not overfill the sharps container. Once full, close the container lid and replace with an empty sharps container.

- Contact the DCHO for information on removal of full sharps containers.

VI. Activities Requiring Prior Approval

Due to the inherent nature of their hazard, some activities will require prior approval from the PI before lab personnel begin the activity.
Before beginning any work in the laboratory, personnel must be trained in the following:

- General Lab Safety
- CHP and the Laboratory Standard
- Emergency Procedures
- Read and understand the SOP's developed for the work in which they will be engaging.

The PI or designee will ensure that these steps have been completed and that the individual understands the information, prior to beginning laboratory work.

In addition, PI approval is necessary before any individual begins work with any of the following:

- Particularly Hazardous Substances – including carcinogens, reproductive toxins, and acutely toxic material.
- Radiological Material
- Select Agents
- Controlled Substances
- Lasers
- Pyrophoric or Explosive Material
- Compressed Gas Cylinders

These materials require review of the SOP, and confirmation from the PI that the individual is competent to work with the material, is aware of the hazards and methods of protection, and understands emergency procedures should an accident or exposure occur with the material.

A. Particularly Hazardous Substances

OSHA requires provisions be made for lab personnel protection when working with Particularly Hazardous Substances. This is cited under 29 CFR 1910.1450 (e)(3)(viii). These materials include carcinogens, reproductive toxins, and acutely toxic substances.
The provisions for working with these substances may include, but is not limited to:

- Establishing a designated area for work
- Use of containment devices such as a fume hood or glove box
- Procedures for safe removal of waste contaminated with the substance
- Decontamination procedures

These provisions are to be listed in the SOP for the substance, and are to be reviewed by lab personnel prior to working with the substance.

1. Carcinogens

Carcinogens are substances capable of causing cancer. Carcinogens cause damage after repeated exposure or after exposure for long-durations. Effects of carcinogens are typically not evident until after a long latency period. Following guidelines set by OSHA, the National Toxicology Program (NTP) and the

International Agency for Research on Cancer (IARC), Wake Forest University considers any of the following materials to be carcinogens:

a. OSHA Subpart Z Regulated Carcinogens

Below is the current list of OSHA regulated carcinogens found in 29 CFR 1910 Subpart Z.

- 1,2-dibromo-3-chloropropane
- 1,3-Butadiene
- 2-Acetylaminofluorene
- 3,3'-Dichlorobenzidine (and its salts)
- 4-Aminodiphenyl
- 4-Dimethylaminoazobenzene
- 4-Nitrobiphenyl
- Acrylonitrile
- alpha-Naphthylamine
- asbestos
- Benzene
- Benzidine
- beta-Naphthylamine
- beta-Propiolactone
- bis-Chloromethyl ether
- Cadmium
- Coke oven emissions
- Ethylene oxide
- Ethyleneimine
- Formaldehyde
- Inorganic arsenic
- Methyl chloromethyl ether
- Methylene Chloride
- Methylenedianiline
- N-Nitrosodimethylamine
- Vinyl chloride

b. NTP and IARC carcinogens

NTP carcinogens are categorized into several classes. For this CHP, those listed as "known to be human carcinogens" and those listed as "reasonably anticipated to be human carcinogens" in the NTP's *Report on Carcinogens* (RoC) are applicable to this section.

2. Reproductive toxins

Reproductive toxins are defined by OSHA as "chemicals that affect the reproductive capabilities including adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on the development of the offspring." These chemicals are classified by OSHA under 29 CFR 1910.1200. The list of substances known to cause reproductive toxicity is listed in Appendix II.

3. Acutely Toxic Substances

The preamble to OSHA Lab Standard states, substances with high acute toxicity "may be fatal or cause damage to target organs as a result of a single exposure or exposure of short duration". Examples given are substances such as hydrogen cyanide, hydrogen sulfide, and nitrogen dioxide. Follow the GHS standard for acute toxicity, where compounds falling under Category 1 or 2 meet the criteria for this section.

Acute Toxicity

Acute toxicity	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Category 5
Oral (mg/kg)	≤ 5	> 5 ≤ 50	> 50 ≤ 300	> 300 ≤ 2000	Criteria: ▪ Anticipated oral LD50 between 2000 and 5000 mg/kg; ▪ Indication of significant effect in humans;* ▪ Any mortality at class 4;* ▪ Significant clinical signs at class 4;* ▪ Indications from other studies.* *If assignment to more hazardous class is not warranted.
Dermal (mg/kg)	≤ 50	> 50 ≤ 200	> 200 ≤ 1000	> 1000 ≤ 2000	
Gases (ppm)	≤ 100	> 100 ≤ 500	> 500 ≤ 2500	> 2500 ≤ 5000	
Vapors (mg/l)	≤ 0.5	> 0.5 ≤ 2.0	> 2.0 ≤ 10	> 10 ≤ 20	
Dust & mists (mg/l)	≤ 0.05	> 0.05 ≤ 0.5	> 0.5 ≤ 1.0	> 1.0 ≤ 5	

Other sources of information include the SDS, the Registry of Toxic Effects of Chemical Substances (RTECS) http://www.cdc.gov/niosh/rtecs/, TOXNET (located at http://toxnet.nlm.nih.gov/) and the Poison Control Center.

B. Radiological Materials

Specific information on the use of radiological material may be found in the Wake Forest University Radiation Safety Manual. This manual is issued to all faculty members that have approval to use radioisotopes and work with radiological material. A copy of the Radiation Safety Manual must be kept in the laboratory where this work is performed at all times. For more information, contact the Radiation Safety Office within the WFUBMC EHS Department at 336-716-9375.
PI's must ensure all personnel working with radiological material are properly trained prior to the beginning of their work. This must include, at a minimum:

- Relative health risks, and targeted organs/tissues
- Exposure limits, especially for women of child-bearing age
- Half-life, relative energy, and types of particles emitted
- Proper shielding
- Proper security measures and storage conditions
- Proper disposal methods
- Proper methods for detecting radioactive contamination and spills
- Proper methods for cleaning up spilled materials

In addition, clearly visible signs must be posted at the entrance of each laboratory where radioactive materials are used or stored.

C. Select Agents and Toxins

Select Agents and Toxins are biological agents or substances that have the potential to pose a severe threat to human, animal, and / or plant health, or to animal and plant products. These agents are regulated through a joint federal program administered by CDC and the Animal and Plant Health Inspection Services/Agricultural Select Agent Program (APHIS).

Possession, transfer and use of select agents and toxins is regulated under 7 CFR 331, 9 CFR 121 and 42 CFR 73. An Application for Registration must be completed through the National Select Agent Registry prior to possession, transfer or use. This must be reviewed by EHS prior to submission. Due to potential hazard of these substances, a full review of the laboratory requesting the application, personnel involved, and all procedures must take place prior to submittal.

D. Controlled Substances

The Office of Diversion Control of the Drug Enforcement Agency (DEA) regulates the possession and use of controlled substances. Controlled substances are drugs or other substances, or immediate precursor, included in schedule I, II, III, IV, or V of 21 CFR 1308. The term does not include alcoholic beverages or tobacco.

The PI must register with the DEA and obtain a DEA license prior to accepting possession of a controlled substance. Detailed storage and use records must be maintained, and special controlled substance disposal procedures must be followed. The summary of information and requirements is detailed in *Guidelines: Use of Controlled Substances in Research* available on the EHS website. The list of controlled substances is located in Appendix VII.

E. Lasers

From OSHA, "LASER is an acronym which stands for Light Amplification by Stimulated Emission of Radiation. The laser produces an intense, highly directional beam of light. The most common cause of laser-induced tissue damage is thermal in nature, where the tissue proteins are denatured due to the temperature rise following absorption of laser energy. "

Prior to working with lasers, lab personnel must read the WFU Laser Safety Manual, located on the Physics Department web-site, http://physics.wfu.edu/safety/LaserSafetyManual.html.

1. Laser Beam Hazards

Improperly used laser devices are potentially dangerous. Effects can range from mild skin burns to irreversible injury to the skin and eye. The major danger of laser light is hazards from beams entering the eye. The eye is the organ most sensitive to light. NEVER point a laser at someone's eyes no matter how low the power of the laser.

2. Non-Beam Hazards

In addition to the hazards directly associated with exposure to the beam, hazards can be produced by compressed gas cylinders, cryogenic and toxic materials, ionizing radiation and electrical shock. Install equipment to Electrical Code requirements. All electrical equipment should be treated as if it were "live".

F. Pyrophoric and Explosive Substances

Pyrophoric materials are substances that will ignite spontaneously in air, while explosives are reactive materials that detonate with a corresponding shock wave. Working with either material requires great care to prevent accidental ignition or detonation.

1. Pyrophoric Reagents

Pyrophoric materials are used routinely in some laboratories, especially within the Chemistry Department. Common pyrophoric compounds include:

- Organolithium compounds (t-Butyllithium)

- Organozinc compounds (Diethylzinc)
- Organomagnesiums (Grignard reagent)
- Aluminum alkyls
- Metallic hydrides (sodium or potassium hydride)
- Metal powders and fines (Aluminum, Lithium, Sodium, Magnesium)

Pyrophoric reagents are typically stored in highly flammable solvent such as Ethyl ether, Hexanes, or Tetrahydrofuran (THF). This adds to potential hazard of the pyrophoric material in that it is mixed with a flammable liquid.

a. Pyrophoric Engineering Controls

Prior to working with pyrophorics, the Aldrich Technical Bulletins AL-134, Handling Air-Sensitive Reagents and AL-164 Handling Pyrophoric Reagents must be read and all safety precautions followed. Columbia University has developed a set of engineering controls to prevent accidental ignition of pyrophorics (http://www.ehs.columbia.edu/pyrophorics.pdf). These controls are summarized below, and have been adopted by Wake Forest University for the handling of pyrophorics.

- Pyrophoric liquids are to be stored in PTFE septa bottles to prevent exposure to air.
- Pyrophoric liquids may only be transferred using syringe with needle locking mechanisms to prevent inadvertent release.
- Mineral oil bubblers must be used to release pressure from reaction vessels. Balloons are unacceptable.
- Handling of pyrophoric liquids must take place in an operational fume hood with the sash lowered as much as practicable. Pyrophoric solids may only be handled in an inert atmosphere glove box.

b. Pyrophoric Administrative Controls

Lab personnel must be trained by the PI or designee prior to using pyrophoric materials, and show competency before working individually. The training will include understanding of the hazards and emergency procedures.

Personnel using pyrophorics must wear a fire resistant lab coat (Nomex coated). Kevlar or leather gloves should be worn beneath nitrile gloves to provide greater fire protection.

2. Explosive Substances

Explosive reactions cause immediate release of pressure, gas, and shock. Aside from these hazards, flying debris as a by-product of the explosion can cause injury or death. Appendix VIII lists explosive families and chemicals that have the potential to explode due to over pressurization of the storage container.

a. Explosives Engineering Controls

- A rated blast shield must be used whenever working with explosives.
- All work with explosives must be performed in the fume hood. Any unnecessary material in the hood must be removed prior to work with explosives.
- Do not rely on the fume hood sash alone as protection. The sash will not protect from flying debris.

b. Explosives Administrative Controls

As with pyrophorics, lab personnel must be trained by the PI or designee prior to using explosive materials, and show competency before working individually. The training will include understanding of the hazards and emergency procedures. All other personnel in the area are to be alerted that explosives will be used prior to beginning work.

G. Compressed Gas Cylinders

Compressed gas cylinders are hazardous not only from release of contents (if a toxic or physical hazard), but also from the fact the vessels are under pressure. Instantaneous loss of pressure will propel the cylinder with enough force that it will be capable of penetrating concrete block walls.
By Fire Code, cylinders must always be secured either by chain or strap to a wall or laboratory bench.

Mike Thompson from the WFU Chemistry Department has developed the following rules for compressed gas cylinders, which have been adopted for the entire University:

- Identifying labels must be kept in place on cylinders.
- Keep lecture bottles in ventilated lower hood cabinets when not in use.
- Store flammable gases away from oxidizers and corrosives.
- Do not use inappropriate hose material as dispensing tubes from gas cylinder regulators. Corrosive gases may destroy rubber or latex tubing. Tygon tubing should perhaps be used instead, or copper or stainless steel.
- When cylinders are no longer in use, take off their regulators, cap them with valve caps, and return them to storage. Do not allow unused cylinders to accumulate in your laboratory.
- Corroded cylinder valve stems, gas line fittings, or regulators are a source of danger and should be exchanged for better quality equipment.
- Handle gas cylinders with extreme care. They are, of course, under a great deal of pressure and would transform themselves into fairly powerful missiles if the valve stem on top were to be sheared off. This could conceivably happen if they were dropped, especially if the valve stem falls against something on the way down. This will only be prevented if you endeavor to keep the valve cap on when moving the cylinder.
- Take the regulator off the cylinder before moving. Move the cylinder on a two-wheeled chain cylinder dolly or similar device made specifically for cylinders. Chain the cylinder and push the cart slowly. Never move a cylinder without a threaded valve cap cover attached.
- Never leave cylinders unstrapped in the lab. Secure them against a wall or a lab bench.
- Keep track of where you store cylinder caps for cylinders being in use.
- Do not grease or oil the regulator thread of a cylinder valve. Oil on a gas cylinder thread will soon be under very high pressure. If the gas reacts at all with organic material, this could lead to an explosion. This is especially true for Oxygen gas cylinders. Teflon tape can be used on the outlet side of the regulator, but not on the primary fitting connection between the regulator and the cylinder.
- Never use a cylinder without an attached regulator.
- Add flashback arresters to oxygen and hydrogen cylinders when used for torches for glassblowing or glass working. Flashback occurs when flames actually traverse through the gas line back to the cylinder outlet.
- Do not completely empty a cylinder before returning it to the loading dock area. Slight positive pressure (between 5 and 15 psi) will keep atmospheric oxygen from contaminating the cylinder contents, so that the cylinder can be safely refilled by the gas cylinder supplier.
- Do not over-tighten a hand-valve on a gas cylinder. If hand tightening will not completely close the valve, call the gas cylinder company for remove.

VII. Medical Assistance, Consultations and Evaluations

A. First Aid

First aid kits are available in each department. Contact the DCHO for the location. Be sure you alert the DCHO if the first aid kit needs to be restocked.
The first aid kit is for minor, non-life threatening injuries. However, it is still required that a First Report of Injury form be completed by the injured person and PI, and submitted to Human Resources.

B. Injuries Requiring Medical Attention

For any life-threatening injury, immediately call 911, or x5911 on a campus phone. Describe the victim's injury, your location (building, floor, room), and a phone number the 911 operator can call if the line becomes disconnected. Never leave the victim alone. Direct another individual to call 911 if you are not near a phone, and have an individual meet arriving medical personnel and bring them to the victim.
Be sure to protect yourself before administering any assistance. Don gloves, eye protection, and lab coat, if necessary, to avoid potential chemical contact and to avoid blood contact.

For non-life threatening injuries that require medical attention, undergraduate and graduate students should proceed to the Student Health Center in Lot Q. Be sure to inform the PI that an injury has occurred, and at the earliest opportunity complete the First Report of Incident form (above).
Employees injured in the lab should alert their supervisor and proceed to the Wake Forest University medical provider:

Novant Health Urgent Care and Occupational Medicine
7811 North Point Blvd
Winston-Salem, NC 27106
336-759-0700

Be sure to complete the First Report of Incident form with your supervisor as soon as possible, and send a copy to human resources. This will expedite payment of services.

C. Hepatitis B Vaccination

As part of the Wake Forest University Exposure Control Plan, employees are provided the Hepatitis B vaccination series if they work in an environment where the potential for blood or bodily fluid exposure exists. This includes laboratories working with human blood, bodily fluids, and tissue. To receive the vaccination series, contact EHS.

D. Monitoring and Evaluations

Monitoring of laboratory conditions will occur whenever there is the likelihood that published action levels or PEL may be exceeding in a laboratory. EHS will oversee monitoring events, and provide guidance and instructions to lab personnel. Results of monitoring are made available to individuals monitored and the PI, DCHO and Department Chair within 15 days of receipt of the analytical results.
Medical consultation and examinations will be provided to employees when:

- An employee develops signs or symptoms associated with exposure to a hazardous chemical in the lab.
- If exposure monitoring reveals an exposure level routinely above OSHA or NIOSH limits.
- A spill or release of a hazardous chemical(s) likely results in an exposure to personnel in the lab.

EHS, in conjunction with Human Resources, will provide the employee the name and address of a physician's office or care center where the examination can take place. Information to be provided to the physician will include:

- "The identity of the hazardous chemical(s) to which the employee may have been exposed;
- A description of the conditions under which the exposure occurred including quantitative exposure data, if available; and
- A description of the signs and symptoms of exposure that the employee is experiencing, if any (29 CFR 1910.1450 (g))."

The physician's written opinion will include:

- "Any recommendation for further medical follow-up;
- The results of the medical examination and any associated tests;
- Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace; and
- A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment (29 CFR 1910.1450 (g))."

VIII. Information and Training

Upon employment with the University, all employees are required to attend a general safety session (either in person or through video). This provides basic fire and life safety information along with safety "do's and don'ts" applicable to Wake Forest University.

A. Laboratory Research Checklist

Individuals working in research laboratories are required to complete the Research Laboratory Training Checklist (Appendix IX) prior to beginning work in the lab. PI's are required to review the information on the checklist with each individual under their supervision. The PI should review the information on the checklist annually with each lab member. As part of initial lab training it is mandatory to read the Chemical Hygiene Plan. It is required that any time a new hazard is introduced to the lab, the PI will review the hazard with lab personnel and all precautionary measures that should be taken.

B. Specialized Training

Certain operations performed in laboratories will require additional information and training. Most of the additional requirements can be found at the Wake Forest University Environmental Health and Safety web-site. Personnel working with lasers must read the Laser Safety Manual.
Those working with radioactive isotopes or other forms of radiation are required to read the Radiation Safety Manual. The Radiation Safety Program is administered through Wake Forest Baptist Medical Center. Labs that will work with biohazards, including human blood and tissue, should read BMBL, Edition5. In addition, the Biohazard Waste Management Plan must be read. For those working directly with human blood, fluid or tissue, personnel must be enrolled in the Wake Forest University Exposure Control Plan. The Bloodborne Pathogen Training video must be viewed. After viewing the video, the Bloodborne Pathogen quiz must be taken. Additional specialized training may be required. It is the responsibility of the PI to ensure all lab personnel are properly trained in all potential hazards that may be encountered in the lab. Records of training must be maintained in the laboratory.

C. Lab Compliance Kit

Each laboratory should have Lab Compliance Kit. This binder is the central repository for hard copy documentation required in the lab (aside from SDS), as well as a point of reference on laboratory safety.

The kit should always have an updated copy of the Chemical Hygiene Plan along with all SOP's appropriate to the lab. Specialized documentation such as the Laser Safety Manual or Exposure Control Plan should also be maintained in the kit. In addition, the kit should hold copies of all signed training checklists for personnel currently working in the laboratory.
Each kit has a number of quick information sheets on hazards common to many labs. These include sheets on fume hoods and BSC's, fire extinguishers and fire safety, PPE, and other information.
The kit should also contain glove permeation charts for the gloves used in the lab. This allows for quick access to the charts before working with chemicals.
Finally, each kit should contain the contact information (at a minimum name and phone number) of the PI and each individual working in the lab in case of an emergency. A list of emergency numbers including University Police, EHS, and Poison Control should be included on the contact information sheet.

IX. Emergencies

Medical emergencies were discussed previously in Section VII. Spills or releases of hazardous materials, fires, and weather related events also constitute emergencies that will require proper action to minimize potential consequences.

A. Spills and Releases

Spills and releases of hazardous materials have the potential to cause physical damage to persons and property as well as toxicological exposure. Prompt response to spills is essential in minimizing hazards.

1. Minor Spills and Releases

Minor spills in the laboratory can be cleaned using chemical spill kits available in each department. Ask the DCHO for the location of the nearest spill kit to the lab. A minor spill is one that would require no more than one person and no more effort than general housecleaning to clean. Refer to the SDS for proper spill clean-up procedure. Report minor spills to the LCHO and DCHO so spill kit materials used during clean-up can be replenished if necessary. Collected spill material must be containerized and labeled as waste, and include the proper chemical name. Contact EHS to have the spill container removed from the lab.

2. Non-Minor Spills and Releases

Due to the size of the spill or the nature of the hazard involved, some spills may not be cleaned by laboratory personnel. These cases include:

1. Fire or explosion related to hazardous material.
2. Sudden or non-sudden release involving a ***Poison by Inhalation*** hazard.
3. Sudden or non-sudden release involving ***Hydrofluoric Acid***.
4. Sudden or non-sudden release that would require use of a respirator during response (i.e. due to dust, fumes, or other exposure).
5. Sudden or non-sudden release of hazardous material of greater volume than listed below (other than Poison by Inhalation or Hydrofluoric Acid)
    - Flammable Liquids, >500mL
    - Flammable Solid/Dangerous When Wet/ Spontaneously Combustible, >1 pound
    - Oxidizer, >1 pound
    - Toxic Liquid / Toxic Solid (Other than Poison By Inhalation), >1 pound
    - Corrosive (other than Hydrofluoric Acid), >500 mL

In these cases, laboratory personnel are instructed to do the following:

- Immediately notify all lab occupants of the spill and that they should evacuate.
- Extinguish open flames (if it is safe to do so).
- Evacuate the lab and close the door.
- Notify PI if present.
- Call University Police at x5911 and ask them to send an officer to assist in evacuation and call EHS at x3427.
- If the hazard has to potential to spread outside of the lab, pull the fire alarm to evacuate the building. Contact University Police once outside the building.

When speaking with University Police or EHS regarding the spill, have the following information available:

- Chemical released.

- Estimated quantity.
- Location of release – Building, floor, room.
- Injuries to occupants, if any.
- Phone number to contact if further information is required.

All non-minor spills must be reported to the PI, and a Spill / Incident Report must be completed and sent to EHS. EHS conducts all investigations related to hazardous material releases on campus.

B. Fire

Uncontrolled fire in the laboratory is life threatening due to the storage of potential sources of fuel and oxygen located in many labs that may add to a conflagration. Use a fire extinguisher only if you know the type of fire that has occurred (chemical, electrical, paper, etc.), you have the correct extinguisher for the fire, and the fire is not an immediate threat to life or health.

1. Types of Fire

There are five classes of fire. These are categorized based on the material (fuel) that is burning. Most laboratories are susceptible to at least three, if not four of these categories. The information below is from the Fire Equipment Manufacturers' Association (FEMA, not to be confused with the Federal Emergency Management Agency, having the same acronym).

a. Class A fire

Class A fires are fires in ordinary combustibles such as wood, paper, cloth, trash, and plastics.

b. Class B Fires

Class B fires are fires in flammable liquids such as gasoline, petroleum oil and paint. Class B fires also include flammable gases such as propane and butane. Class B fires do not include fires involving cooking oils and grease.

c. Class C Fires

Class C fires are fires involving energized electrical equipment such as motors, transformers, and appliances. Remove the power and the Class C fire becomes one of the other classes of fire.

d. Class D Fires

Class D fires are fires in combustible metals such as potassium, sodium, aluminum, and magnesium.

e. Class K Fires

Class K fires are fires in cooking oils and greases such as animals fats and vegetable fats.

Laboratories on campus are equipped with at least one ABC fire extinguisher. This refers to the three classes of fire for which the extinguisher is suitable. Labs that work often with, or with large quantities of, combustible metals should have a Class D extinguisher available. Ask the DCHO for the location of the Class D extinguishers in the building.

2. Fire Extinguisher Use

To operate a fire extinguisher, remember the word PASS:

- **P**ull the pin. Remove the fire extinguisher pin by pulling firmly.
- **A**im low. Point the extinguisher nozzle at the base of the fire.
- **S**queeze. Slowly and evenly squeeze the handle.
- **S**weep. Sweep the nozzle back and forth at the base of the fire.

Before using a fire extinguisher, notify all lab occupants to evacuate. Pull the fire alarm. The building must be evacuated in the event it becomes too large to be extinguished with the fire extinguisher. Always keep your back to a clear exit when using the fire extinguisher. This will ensure an unimpeded escape route should the fire continue to grow. If you feel that your life is in danger, do not use the fire extinguisher. Instead, pull the fire alarm and evacuate the building.

C. Weather Related Emergencies

Due to the unpredictability of weather, weather related emergencies can develop slowly or very rapidly. It is important to always be prepared in the event of a sudden emergency to lessen potential hazards.

1. Tornados and Severe Thunderstorms

Both tornados and severe thunderstorms exhibit high velocity winds that are capable of throwing objects hundreds of yards, with the potential for broken windows, flying glass, and downed trees and power lines. Wind speeds for tornados are generally higher that of the straight line winds associated with severe thunderstorms. Be alert to changing weather conditions, especially in spring and summer months, when tornados and severe thunderstorms are most prevalent.

If a tornado alert is issued for the campus, the University Wake Alert System will notify all faculty, staff and students via e-mail and text message. Immediately shut off any open flames and turn off all non-

essential electrical items. Evacuate the lab into the hallway and close the lab door as you leave. If time permits, go the lowest floor and innermost part of the building and wait for instructions.

2. Winter Weather

Winter weather ice or snow storms generally provide advanced warning prior to arrival. Winter storms have the ability to cause power outages and make roads impassable for periods of time. Prepare the laboratory prior to arrival of a winter storm. The lab should be secured as if it were to be unoccupied for at least three to four days. This means that only absolutely essential items may be powered on, and must be able to operate safely without attention for at least three to four days. No experiments or operations should be left that will require attention by lab personnel, as travel may be impossible.

Appendix I: Standard Operating Procedures

Standard Operating Procedure (SOP) information sources include the following:

- Columbia University in the City of New York, Environmental Health and Safety, http://ehs.columbia.edu/
- Duke University and Duke Medicine Occupational & Environmental Safety Office, http://www.safety.duke.edu/LabSafety/ChemHyg.htm
- National Research Council of the National Academies. (2011). *Prudent practices in the laboratory: Handling and management of chemical hazards*. (Updated ed.). Washington, DC: The National Academies Press.
- State University of New York at Stony Brook, Environmental Health and Safety, http://www.stonybrook.edu/ehs/
- Texas A&M University, Environmental Health and Safety, http://ehsd.tamu.edu/
- The MSDS HyperGlossary, http://www.ilpi.com/msds/ref/index.html
- University of California, Berkeley Office of Environment, Health and Safety, http://ehs.berkeley.edu/
- Wake Forest School of Medicine, Environmental Health and Safety, http://www.wakehealth.edu/EHS/
- Washington University of St. Louis, Environmental Health and Safety, http://ehs.wustl.edu/Pages/default.aspx

The following SOP's have been developed by the WFU Office of Environment, Health and Safety. Additional SOP's may be required for individual labs. It is the responsibility of the PI to determine the SOP's necessary and to develop those not listed.

- Benzene
- Blood and Bodily Fluids
- Carcinogens, Reproductive Toxins and Acutely Toxic Compounds
- Chloroform
- Compressed Gases and Cryogenic Liquids
- Corrosives
- Diethyl ether
- Distillation at Atmospheric Pressure
- Ethidium bromide
- Flammables
- Formaldehyde
- Human Gross Anatomy
- Hydrofluoric acid
- Liquid Nitrogen
- Nitric acid
- Osmium tetroxide
- Oxidizers
- Peroxide forming chemicals
- Phenol
- Pyrophorics
- Sodium azide
- Sodium hypochlorite (Bleach)
- Water Reactive

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

BENZENE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

- This SOP applies to BENZENE.
- Benzene is a known carcinogen.

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.

Additional Lab Specific Rules Here

POTENTIAL HAZARDS

- Flammable.
- Incompatibilities: strong oxidizers or strong acids.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

BENZENE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

HEALTH HAZARDS

- Carcinogen.
- Chronic exposure by inhalation may result in various blood disorders (anemia, leukemia).
- Symptoms of acute exposure can lead to headaches, dizziness, nausea or intoxication.
- May irritate eyes, nose respiratory tract.
- Benzene can be absorbed through the skin and may cause dermatitis.

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn during operations in which BENZENE might contact the eyes (e.g., through vapors or splashes of solution).
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use disposable nitrile gloves when working with Benzene. Check chemical compatibility chart for breakthrough time when Benzene.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling BENZENE. Protective clothing shall be worn to prevent any possibility of skin contact with BENZENE.

WORK PRACTICES

- All BENZENE work shall be done in the laboratory fume hood.
- Laboratory must be marked as follows:

Danger
BENZENE
CANCER HAZARD
FLAMMABLE – NO SMOKING
AUTHORIZED PERSONNEL ONLY

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

BENZENE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Do not store with incompatible material.
- Store BENZENE in a flammable storage cabinet.
- Keep away from ignition sources.

Additional Lab Specific Special Handling/Storage Procedures

WASTE DISPOSAL

- Chemicals shall not be drain disposed unless prior approval is given by EH&S.
- Excess BENZENE and all waste material containing BENZENE must be placed in a container labeled with the following **"HAZARDOUS WASTE BENZENE"**, AND THE FULL CHEMICAL NAME.
- Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

BENZENE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

FIRST AID

- If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
- In case of skin contact: Take off contaminated clothing and shoes immediately. Wash off in safety shower for at least 15 minutes. Call x5911 for medical assistance.
- In case of eye contact: Rinse thoroughly with plenty of water at eyewash for at least 15 minutes and call x5911 for medical assistance.
- If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.
- Call x5911 and describe the extent of injuries.
- Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
- Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

SPILL AND ACCIDENT PROCEDURES

SPILL QUANTITY	PROPER SPILL RESPONSE
Spill less than 500 mL	**Contact Environmental Health and Safety (x3427) and clean up spill using spill kit. Avoid breathing vapors.**
Spill greater than 500 mL	**Do not attempt to clean up spill. Leave the area and immediately report to WFU Police (x5911) and EHS (x3427).**

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

BLOOD AND BODILY FLUIDS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

- This SOP applies to work with HUMAN BLOOD OR BODILY FLUIDS.
- Human blood and bodily fluids are potential sources of bloodborne pathogens.

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.

HEALTH HAZARDS

- Human blood and bodily fluids are potential sources of bloodborne pathogens, including Hepatitis B or Human Immunodeficiency Virus (HIV).

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn during operations in which HUMAN BLOOD OR BODILY FLUIDS might contact the eyes (e.g., through vapors or splashes of solution).
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use disposable nitrile gloves when working with HUMAN BLOOD OR BODILY FLUIDS. Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling HUMAN BLOOD OR BODILY FLUIDS. Protective clothing shall be worn to prevent any possibility of skin contact with HUMAN BLOOD OR BODILY FLUIDS.

MASKS

- Masks, in combination with eye protection devices, such as goggles or glasses with solid side shields, or chin-length face shields, shall be worn whenever splashes, spray, spatter, or droplets of blood or other potentially infectious materials may be generated and dye nose, or mouth contamination can be reasonably anticipated.

WORK PRACTICES

- Prior to working with biohazards, lab personnel must read and understand the Wake Forest University Biohazard Waste Management Plan. The plan is available on-line at the EHS website and several departmental websites. The Plan covers proper decontamination and disposal techniques for biohazards, blood and bodily fluids, and sharps.
- All procedures involving blood or other potentially infectious materials shall be performed in a manner to minimize splashing, spraying, spattering, and generations of droplets of these substances.
- Mouth pipetting/suctioning of blood or other potentially infectious materials is prohibited.
- Specimens of blood or other potentially infectious materials shall be placed in a container which prevents leakage during collection, handling, processing, storage, transport, or shipping. The container for storage, transporting, or shipping shall be labeled or appropriately color-coded and closed prior to being stored, transported or shipped. When universal precautions are utilized in the handling of specimens, the labeling/color-coding of specimens is not necessary provided containers are recognizable as containing specimens. This exception only applies while such container is being handled by the person generating material. It must be appropriately labeled/ color-coded prior to being given to any other individuals.
- If an outside contamination of the primary container occurs, the primary container shall be placed within a second container which prevents leakage during handling, processing, storage, transport, or shipping and is labeled or color-coded. If the specimen could puncture the primary container, the primary container shall be placed within a secondary container which is puncture-resistant in addition to the above characteristics.
- Equipment which may become contaminated with blood or other potentially infectious materials shall be examined prior to servicing or shipping and shall be decontaminated as necessary. An appropriate readily observable label will be attached to the equipment stating which portions remain contaminated. The University department which ships the equipment is responsible to ensure that this information is conveyed to all affected employees, the servicing representative, and/or the manufacturer as appropriate, prior to handling, servicing, or shipping.

ENGINEERING CONTROLS

- Handwashing facilities are readily accessible in the workplace to employees that are reasonably anticipated to contact blood or other potentially infectious materials during the performance of their duties. In the event that handwashing facilities are not feasible, provisions will be provided for the placement of either an appropriate antiseptic hand cleanser in conjunction with clean cloth/paper

towels or antiseptic towelettes. When antiseptic hand cleansers or towelettes are used, employees have been instructed to wash their hands with soap and running water as soon as possible.

- Employees are required to wash their hands immediately or as soon as feasible after removal of gloves or other personal protective equipment. And, most importantly, employees are required to wash their hands and any other skin with soap and water, or flush mucous membranes with water immediately or as soon as feasible following contact of such body areas with blood or other potentially infectious materials.
- Contaminated needles and other contaminated sharps will not be recapped or removed unless it can be demonstrated that no alternative is feasible or that such action is required by a specific medical procedure. Under these circumstances, recapping or needle removal shall be accomplished through the use of a mechanical device or a one-handed technique.
- Immediately or as soon as possible after use, contaminated reusable sharps shall be placed in an appropriate container until properly processed. These containers shall be:
  - Puncture resistant
  - Appropriately labeled or color-coded
  - Leakproof on the sides and bottoms
  - Shall not be handled in a manner that requires employees to reach, by hand, into containers where these sharps have been placed.
- Eating, smoking, drinking, applying cosmetics or lip balm, and handling contact lenses is prohibited in work areas where there is reasonable likelihood of occupational exposure. Food and drink will not be stored in refrigerators, freezers, shelves, cabinets, or on cabinet tops or bench tops where blood or other potentially infectious materials are present.

Additional Lab Specific Special Handling/Storage Procedures

WASTE DISPOSAL

- The Wake Forest Biohazard Waste Management Plan will be followed for the disposal of any blood or bodily fluids, contaminated PPE or debris, and any associated biohazardous material.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

BLOOD AND BODILY FLUIDS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

Student Health (students only)	x5218
Poison Control	800-222-1222

FIRST AID

- In case of skin contact: Take off contaminated clothing and shoes immediately. Wash area with warm water and soap for at least 15 minutes.
- In case of eye contact: Rinse thoroughly with plenty of water at eyewash for at least 15 minutes.
- If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.
- Call x5911 and describe the extent of injuries.
- Report all accidental exposures to your supervisor and Human Resources (employees) or Student Health (students). Strict confidentiality is maintained.
- Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

SPILL AND ACCIDENT PROCEDURES

In the event of a spill, unplanned release, or potential release of Biohazard waste to the environment, Campus Police shall be contacted immediately, 24 hours a day, at extension 5911. The dispatcher on duty will contact the Environmental, Health and Safety Office and Environmental, Health and Safety shall take the necessary actions to mitigate or remediate the situation.

Spill of biohazardous materials shall be decontaminated using one of the following methods:

- Exposure to hot water of at least 82 degrees Centigrade (180 Fahrenheit) for a minimum of 15 seconds.
- Exposure to chemical sanitizer by rinsing with, or immersion in, one of the following for a minimum of three minutes:
  - Hypochlorite solution (500 ppm available chlorine)
  - Phenolic solution (500 ppm active agent)
  - Iodoform solution (100 ppm available iodine)
  - Quaternary ammonium solution (400 ppm active agent)

Personnel performing disinfection procedures shall be equipped with the appropriate personal protective equipment for the situation, but at a minimum shall wear splash eye protection and latex gloves. Protective clothing, shoes, and a face shield may be required for large quantities of biohazardous materials.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

CARCINOGENS, REPRODUCTIVE TOXINS AND ACUTELY TOXIC COMPOUNDS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

- This SOP applies to CARCINOGENS, REPRODUCTIVE TOXINS AND ACUTELY TOXIC COMPOUNDS.
- The provisions for working with these substances may include, but is not limited to:
  - Establishing a designated area for work
  - Use of containment devices such as a fume hood or glove box
  - Procedures for safe removal of waste contaminated with the substance
  - Decontamination procedures

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
  - after handling chemicals materials,
  - after removing gloves, and
  - before leaving the laboratory.

POTENTIAL HAZARDS

- Consult the SDS for specific hazards, both chemical and physical, of the compounds prior to its use.
- In addition to the toxicological hazard associated with these compounds, additional chemical or physical hazards may be present requiring additional safety precautions or PPE criteria.

HEALTH HAZARDS

- Carcinogens are substances capable of causing cancer.
- Reproductive toxins are defined by OSHA as “chemicals that affect the reproductive capabilities including adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on the development of the offspring. “ (29 CFR 1910.1200)
- Substances with high acute toxicity “may be fatal or cause damage to target organs as a result of a single exposure or exposure of short duration”. (29 CFR 1910.1200 Preamble).

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

CARCINOGENS, REPRODUCTIVE TOXINS AND ACUTELY TOXIC COMPOUNDS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn during operations in which CARCINOGENS REPRODUCTIVE TOXINS AND ACUTELY TOXIC COMPOUNDS might contact the eyes (e.g., through vapors or splashes of solution).
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use disposable nitrile gloves when working with CARCINOGENS, REPRODUCTIVE TOXINS AND ACUTELY TOXIC COMPOUNDS. Check chemical compatibility chart for breakthrough time when using CARCINOGENS, REPRODUCTIVE TOXINS AND ACUTELY TOXIC COMPOUNDS.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling CARCINOGENS, REPRODUCTIVE TOXINS AND ACUTELY TOXIC COMPOUNDS. Protective clothing shall be worn to prevent any possibility of skin contact with CARCINOGENS, REPRODUCTIVE TOXINS AND ACUTELY TOXIC COMPOUNDS.

WORK PRACTICES

- All work with Carcinogens, Reproductive Toxins or Acutely Toxic Compounds is to be conducted in the fume hood. If this is not possible, contact the Office of Environmental Health and Safety at x3427 prior to beginning work.
- A designated work area is to be established in the hood whenever using Carcinogens, Reproductive Toxins or Acutely Toxic Compounds.
- The fume hood must be marked with a warning identifying the compound in use and the chief hazard associated with the compound.
- The area must be maintained in a clean and orderly fashion.
- After working with the compound the designated area is to be decontaminated with soap and water, or by means stated in the SDS.

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Do not store with incompatible material.
- Storage areas for CARCINOGENS, REPRODUCTIVE TOXINS AND ACUTELY TOXIC COMPOUNDS are to be marked accordingly to identify the specific hazard.

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CARCINOGENS, REPRODUCTIVE TOXINS AND ACUTELY TOXIC COMPOUNDS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

Additional Lab Specific Special Handling/Storage Procedures

WASTE DISPOSAL

- Chemicals shall not be drain disposed unless prior approval is given by EH&S.
- Excess CARCINOGENS, REPRODUCTIVE TOXINS AND ACUTELY TOXIC COMPOUNDS and all waste material containing CARCINOGENS, REPRODUCTIVE TOXINS AND ACUTELY TOXIC COMPOUNDS must be placed in a container labeled with the following **"HAZARDOUS WASTE CARCINOGENS, REPRODUCTIVE TOXINS AND ACUTELY TOXIC COMPOUNDS"**, AND THE FULL CHEMICAL NAME.
- Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

FIRST AID

- If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
- In case of skin contact: Take off contaminated clothing and shoes immediately. Wash off in safety shower for at least 15 minutes. Call x5911 for medical assistance.
- In case of eye contact: Rinse thoroughly with plenty of water at eyewash for at least 15 minutes and call x5911 for medical assistance.
- If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.
- Call x5911 and describe the extent of injuries.
- Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
- Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

CARCINOGENS, REPRODUCTIVE TOXINS AND ACUTELY TOXIC COMPOUNDS			
Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

SPILL AND ACCIDENT PROCEDURES

- **Any spill or release greater than that which could ordinarily be cleaned through general lab housekeeping is to be reported immediately to the PI.**
- **Evacuate the area and call EHS at x3427.**
- **After hours, evacuate the area and call x5911 and then x 3427.**
- **EHS will perform clean-up.**

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

CHLOROFORM

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

- This SOP applies to CHLOROFORM.
- Chloroform is a probable human carcinogen and possible reproductive and developmental toxin. Target organs are: Central nervous system, Blood, Liver, Cardiovascular system, Kidney.

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.

POTENTIAL HAZARDS

- Exposure to fire or high temperatures may release Phosgene, a highly toxic gas.
- Inhalation of vapors may cause headaches, drowsiness, dizziness and / or nausea.
- Eye and skin irritant.

HEALTH HAZARDS

- The OSHA Permissible Exposure Limit for chloroform is 50 ppm as a ceiling limit (exposure must never exceed this level). ACGIH has a threshold limit value (TLV) for chloroform of 10 ppm for an 8-hour workday.
- The odor threshold for chloroform ranges from 85-307 ppm (above OSHA's ceiling limit), so it does not have good warning properties.
- **Inhalation** May be harmful if inhaled. Causes respiratory tract irritation. Vapors may cause drowsiness and dizziness.
- **Skin** Harmful if absorbed through skin. Causes skin irritation.
- **Eyes** Causes eye irritation.
- **Ingestion** Harmful if swallowed.

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CHLOROFORM

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn during operations in which CHLOROFORM might contact the eyes (e.g., through vapors or splashes of solution).
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Chloroform readily penetrates standard nitrile laboratory gloves (and many other types of gloves).
- Wear two pairs of standard nitrile gloves and work so that gloves do not contact chloroform.
- Remove outer gloves immediately if splashed. Remove inner gloves also if degradation is noted.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling CHLOROFORM. Protective clothing shall be worn to prevent any possibility of skin contact with CHLOROFORM.

WORK PRACTICES

- Perform all work using Chloroform in the fume hood.
- Wear two pairs of standard nitrile gloves and work so that gloves do not contact chloroform.
- Remove outer gloves immediately if splashed. Remove inner gloves also if degradation is noted.
- Plan work so that minimal glove contact is expected, and purchase appropriate gloves for cleaning up small spills.
- **If phenol and chloroform will be used together,** please note that phenol is a severe skin hazard and chloroform's easy penetration of nitrile gloves increases the risk of skin contact. Wear doubled **8-mil thick** nitrile gloves (most lab gloves are 4 mils thick), and change gloves immediately if there is a splash.
- If extensive work with phenol and chloroform is done in the lab, use North Silver Shield/4H gloves or reusable ChemTek Viton/Butyl glove which provides good protection from both of these chemicals.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

CHLOROFORM

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Do not store with incompatible material: Strong oxidizing agents, Strong bases, Magnesium, Sodium/sodium oxides, Lithium.

Additional Lab Specific Special Handling/Storage Procedures

WASTE DISPOSAL

- Chemicals shall not be drain disposed unless prior approval is given by EH&S.
- Excess CHLOROFORM and all waste material containing CHLOROFORM must be placed in a container labeled with the following **"HAZARDOUS WASTE CHLOROFORM"**, AND THE FULL CHEMICAL NAME. Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

FIRST AID

- If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
- In case of skin contact: Take off contaminated clothing and shoes immediately. Wash off in safety shower for at least 15 minutes. Call x5911 for medical assistance.
- In case of eye contact: Rinse thoroughly with plenty of water at eyewash for at least 15 minutes and call x5911 for medical assistance.
- If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.
- Call x5911 and describe the extent of injuries.
- Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
- Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

CHLOROFORM

Effective Date:	8/23/2013	Revised Date:	8/23/2013

SPILL AND ACCIDENT PROCEDURES

SPILL QUANTITY	PROPER SPILL RESPONSE
Spill less than 500 mL	Contact Environmental Health and Safety (x3427) and clean up spill using spill kit. Avoid breathing vapors. Wear Silver Shield, Neoprene, or ChemTek Viton gloves.
Spill greater than 500 mL	Do not attempt to clean up spill. Leave the area and immediately report to WFU Police (x5911) and EHS (x3427).

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

COMPRESSED GASES AND CRYOGENIC FLUIDS

Effective Date:	8/23/2013	Revised Date:	8/23/2013

INTRODUCTION

- This SOP applies to COMPRESSED GASES AND CRYOGENIC FLUIDS.
- COMPRESSED GAS is defined as a gas or mixture of gases having an absolute pressure exceeding 40 psi at 70 degrees F (21.1 degrees C); or, a gas or mixture of gases having an absolute pressure exceeding 104 psi at 130 degrees F (54.4 degrees C) regardless of the pressure at 70 degrees F; or, a liquid having a vapor pressure exceeding 40 psi at 100 degrees F (37.8 degrees C) as determined by ASTM D-323-72.
- COMPRESSED GASES may be categorized as follows:
    1. **Asphyxiant gas**: A gas, usually inert, that may cause suffocation by displacing the oxygen in the air necessary to sustain life, or is labeled by the DOT as Division 2.2.
    2. **Corrosive gas:** A gas that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the point of contact or is labeled by the DOT as Division 2.3 and Division 8 (Corrosive).
    3. **Cryogenic fluid:** A refrigerated liquefied gas having a boiling point colder than -90 °C (130 °F) at 14.7 psia absolute, or which the DOT requires the Division 2.2 label for non-flammable, nonpoisonous compressed gas-including compressed gas, liquefied gas, pressurized cryogenic gas, compressed gas in solution, asphyxiant gas and oxidizing gas.
    4. **Flammable gas:** A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13 percent by volume or less; or, a gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12 percent by volume, regardless of the lower limit; or, one for which the United States Department of Transportation (DOT) requires the red flammable gas label or is labeled as Division 2.1.

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COMPRESSED GASES AND CRYOGENIC FLUIDS

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5. **Oxidizer gas:** A gas that is nonflammable but can support and vigorously accelerate combustion in the presence of an ignition source and a fuel or is labeled by DOT as Division 2.2 and Division 5.1 (Oxidizer).
6. **Toxic gas:** A gas that has a median lethal concentration (LC_{50}) in air of 2,000 parts per million or less by volume of gas (Highly Toxic has an LC_{50} of 200 ppm or less); or, a gas which the DOT requires the white poison label or is labeled as Division 2.3 "Gas poisonous by inhalation" because it is known to be so toxic to humans as to pose a hazard to health during transportation; or a gas that has an NFPA Health Hazard Rating of 3 (Toxic) or 4 (Highly Toxic).

(SOURCE: Stony Brook University Compressed gas and Cryogenic Fluid Handling, Storage, Disposal, 1993)

GENERAL LAB RULES

No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
All procedures are performed carefully to minimize the creation of splashes or aerosols.

Wash hands

- after handling chemicals materials,
- after removing gloves, and
- before leaving the laboratory.

Additional Lab Specific Rules Here

POTENTIAL HAZARDS

- The high pressure of compressed gases constitutes a serious potential hazard in the event of containment rupture or unregulated release.
- Additional hazards from compressed gases are posed from the physical and health hazards associated with the properties of the gas.

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COMPRESSED GASES AND CRYOGENIC FLUIDS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

HEALTH HAZARDS

- Asphyxiation.
- See SDS for additional health hazards for specific gas.

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn during operations in which COMPRESSED GASES might contact the eyes (e.g., through vapors or splashes of solution).
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use disposable nitrile gloves when working with chemicals. Check chemical compatibility chart for breakthrough time when using compressed gases.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling COMPRESSED GASES. Protective clothing shall be worn to prevent any possibility of skin contact with COMPRESSED GASES.

GENERAL WORK PRACTICES

- Identifying labels must be kept in place on cylinders.
- Do not use inappropriate hose material as dispensing tubes from gas cylinder regulators. Corrosive gases may destroy rubber or latex tubing. Tygon tubing should perhaps be used instead, or copper or stainless steel.
- Corroded cylinder valve stems, gas line fittings, or regulators are a source of danger and should be exchanged for better quality equipment.
- Take the regulator off the cylinder before moving. Move the cylinder on a two-wheeled chain cylinder dolly or similar device made specifically for cylinders. Chain the cylinder and push the cart slowly. Never move a cylinder without a threaded valve cap cover attached.
- Never leave cylinders unstrapped in the lab. Secure them against a wall or a lab bench.
- Keep track of where you store cylinder caps for cylinders being in use.
- Do not grease or oil the regulator thread of a cylinder valve. Oil on a gas cylinder thread will soon be under very high pressure. If the gas reacts at all with organic material, this could lead to an explosion.

This is especially true for Oxygen gas cylinders. Teflon tape can be used on the outlet side of the regulator, but not on the primary fitting connection between the regulator and the cylinder.

- Never use a cylinder without an attached regulator.
- Add flashback arresters to oxygen and hydrogen cylinders when used for torches for glassblowing or glass working. Flashback occurs when flames actually traverse through the gas line back to the cylinder outlet.
- Do not completely empty a cylinder before returning it to the loading dock area. Slight positive pressure (between 5 and 15 psi) will keep atmospheric oxygen from contaminating the cylinder contents, so that the cylinder can be safely refilled by the gas cylinder supplier.
- Do not over-tighten a hand-valve on a gas cylinder. If hand tightening will not completely close the valve, call the gas cylinder company for remove.

FLAMMABLE GASES

- Flammable gases must be stored in well-ventilated areas away from flammable liquids, combustible materials, oxidizers, open flames, sparks and other sources of heat or ignition.
- Portable fire extinguishers (carbon dioxide or dry chemical type) must be available for fire emergencies where flammable gas is stored.
- Spark-proof tools should be used when working with flammable gas cylinders.
- In the event of an emergency involving a flammable gas, such as a gas leak, fire or explosion, personnel must immediately evacuate the area. Do not attempt to extinguish burning gas if the flow of product cannot be shut off immediately and without risk.
- All lines and equipment associated with flammable gas systems must be grounded and bonded.
- Acetylene should not be utilized in lines or hoses at a pressure exceeding 15 psi.

ASPHYXIANT GASES

- Do not store asphyxiant gases in areas without ventilation. This includes environmental chambers (e.g. cold boxes) that do not have a fresh air supply or exhaust system.
    - Any gas that has the potential to displace oxygen in sufficient quantities can cause asphyxiation. Only EHS should respond to an inert gas leak or enter an area where an asphyxiant gas could be present. Shut off the source of the gas leak if there is no risk to personnel and ventilate the area. If a person has symptoms of asphyxiation, move the victim to fresh air and call x5911 for medical assistance.

OXIDIZING GASES

- All equipment used for oxidizing gases must be cleaned with oxygen-compatible materials free from oils, greases, and other contaminants (hydrocarbons and neoprene are not oxygen-compatible; PTFE Teflon is compatible. The equipment will state that it is oxygen compatible).
- Do not handle cylinders with oily hands or gloves.
- Oxidizers shall be stored separately from flammable gas containers or combustible materials by a distance of 20 feet.

CORROSIVE GASES

- Keep exposure to gas as low as possible. Use in fume hood or other vented enclosure when possible. Avoid contact with skin and eyes.
  - Wear safety goggles when handling compressed gases which are corrosive.
  - An emergency response procedure must be in place and everyone working in the area must be trained on the procedures.
  - Safety plugs in the valves of chlorine cylinders fuse at 157 degrees F. Care must be exercised to see that they are not exposed to steam, hot water, etc. which could achieve this temperature. Chlorine leaks may be located using a cloth wet with aqua-ammonia which will produce white fumes (ammonia chloride) in the presence of chlorine. NOTE: This procedure may only be performed with appropriate respiratory protection. In order for any individual to wear a respirator, he/she must have written physician's approval, attend respiratory protection training, and pass a respirator fit test. Training and fit testing are provided by the Office of Environmental Health and Safety.

TOXIC AND HIGHLY TOXIC GAS

- Lecture bottle-sized cylinders for all gases that have a health hazard rating of 3 or 4 or a health hazard rating of 2 without physiological warning properties, must be kept in a fume hood or other continuously mechanically ventilated enclosure. Larger cylinders of toxic or highly toxic gas must be stored in gas cabinets, exhausted enclosures or gas rooms.
- Toxic and highly toxic gases shall not be stored or used outside of academic or research laboratories.
- Keep exposure to gas as low as possible. Use in fume hood or other vented enclosure when possible. Avoid contact with skin and eyes.
- Wear safety goggles when handling compressed gases which are toxic or highly toxic
- A gas detection system with visible and audible alarms to detect the presence of leaks, etc. must be installed for all toxic and highly toxic gases when the physiological warning properties for the gas are at a level below the accepted permissible exposure limit or ceiling limit for the gas. Contact EH&S for specifics on installing the gas monitoring system.
- An emergency response procedure must be in place and everyone working in the area must be trained on the procedures.

CRYOGENIC FLUIDS

- Wear face shield and chemical safety goggles when dispensing from cylinder or dewar .
- Wear appropriate insulated gloves to protect from the extreme cold when handling cryogenic containers. Gloves need to be loose fitting so that they can be readily removed in the event liquid is splashed into them. Never allow an unprotected part of the body to touch uninsulated pipes or containers of cryogenic material.
- Keep liquid oxygen containers, piping, and equipment clean and free of grease, oil, and organic materials.
- Do not store cylinders or dewars in areas that do not have fresh air ventilation. A leak or venting from the container could cause an oxygen deficient atmosphere.
- First aid treatment for cold-contact burns:
  - Remove any clothing not frozen to the skin that may restrict circulation to the frozen area. Do not rub frozen parts, as tissue damage may result. Obtain medical assistance as soon as possible.
  - Place the affected part of the body in a warm water bath (not to exceed 40 ^{o} C). Never use dry heat.

PYROPHORIC GAS

- Lecture bottle-sized cylinders for Pyrophoric (e.g. Silane) gases must be kept in a fume hood or other continuously mechanically ventilated enclosure.
  - Silane gas with a concentration of 2% or more by volume silane has additional safety requirements for flow control, exhausted enclosures or gas cabinets and emergency power. Contact EHS for information.

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Handle gas cylinders with extreme care. They are, of course, under a great deal of pressure and would transform themselves into fairly powerful missiles if the valve stem on top were to be sheared off. This could conceivably happen if they were dropped, especially if the valve stem falls against something on the way down. This will only be prevented if you endeavor to keep the valve cap on when moving the cylinder.
- Do not store with incompatible material.
- By Fire Code, cylinders must always be secured either by chain or strap to a wall or laboratory bench.
- Keep lecture bottles in ventilated lower hood cabinets when not in use.
- Store flammable gases away from oxidizers and corrosives.
- When cylinders are no longer in use, take off their regulators, cap them with valve caps, and return them to storage. Do not allow unused cylinders to accumulate in your laboratory.

Additional Lab Specific Special Handling/Storage Procedures

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

COMPRESSED GASES AND CRYOGENIC FLUIDS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

WASTE DISPOSAL

- Excess and empty COMPRESSED GASES should be return to the manufacturer.
- Do not dispose of compressed gas cylinders, even if empty, as residual pressure and product will remain.
- Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

FIRST AID

If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
Call x5911 and describe the extent of injuries.
Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

SPILL AND ACCIDENT PROCEDURES

- In the event of a leak or suspected leak of gas, evacuate the area and contact the DCHO and x3427.
- A liquid soap and water mixture can be used to detect line leaks.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

CORROSIVES (Excluding Hydrofluoric and Nitric Acid)

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

This SOP applies to the various chemicals that are Corrosive, either acidic or alkali. Corrosives materials can cause destruction of living tissue by chemical action at the site of contact. This SOP does not apply to Hydrofluoric acid or Nitric acid. These have individual SOP's.

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.

Additional Lab Specific Rules Here

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

CORROSIVES (Excluding Hydrofluoric and Nitric Acid)

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

POTENTIAL HAZARDS

Corrosives damage can occur not only on the skin and eyes, but also in the respiratory tract and, in the case of ingestion, in the gastrointestinal tract. While acids and bases are familiar corrosives, many other materials are corrosive to the body including bleach and phenol.

HEALTH HAZARDS

Acids and alkalis are caustic materials that can cause serious burns to the eyes and skin. In addition, many give off vapors that can cause serious damage to the mucous membranes. They are classified as primary irritants and cause damage by direct action on body tissues.

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn during operations in which Corrosives might contact the eyes (e.g., through vapors or splashes of solution).
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use disposable nitrile gloves when working with corrosives. Check chemical compatibility chart for breakthrough time when using Corrosives.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling Corrosives. Protective clothing shall be worn to prevent any possibility of skin contact with Corrosives.

WORK PRACTICES

- Purchase corrosives in the smallest containers that are practical for lab use.
- Purchase in shatter-resistant containers if available (such as PVC-coated glass).
- Work with the smallest practicable amount and lowest practicable concentration of corrosive materials.
- When diluting acids, the acid should be added to water slowly, in small amounts.
- Avoid contact with incompatible materials.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

CORROSIVES (Excluding Hydrofluoric and Nitric Acid)

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

- Use fume hood when working with corrosives with high vapor pressure. Contact Facilities and Campus Services (x4255) immediately if fume hood is malfunctioning.

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Do not store with incompatible material (acids and bases may not be stored together)
- Do not store with flammables or oxidizers.
- Do not store in metal cabinets unless containers are placed in a plastic secondary containment tray.

Additional Lab Specific Special Handling/Storage Procedures

WASTE DISPOSAL

- Chemicals shall not be drain disposed unless prior approval is given by EH&S.
- Excess Corrosives and all waste material containing Corrosives must be placed in a container labeled with the following **"HAZARDOUS WASTE (Corrosive Chemical Name)"**.
- Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

CORROSIVES (Excluding Hydrofluoric and Nitric Acid)

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

FIRST AID

If chemical exposure occurs, remove contaminated clothing and flush exposed area for 15 to 20 minutes using emergency eyewash station and/or safety shower.
If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
Call x5911 and describe the extent of injuries.
Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

SPILL AND ACCIDENT PROCEDURES

If the chemical spilled is considered a carcinogen, reproductive toxin or highly toxic chemical, contact x3427 and evacuate area immediately, regardless of spill amount.

For all other spills use the chart below for spill reporting and response:

SPILL QUANTITY	PROPER SPILL RESPONSE
Spill less than 500 mL	**Contact Environmental Health and Safety (x3427) and clean up spill using spill kit.**
Spill greater than 500 mL	**Do not attempt to clean up spill. Leave the area and immediately report to WFU Police (x5911) and EHS (x3427).**

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

DIETHYL ETHER (ETHER, ETHYL ETHER)

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

- This SOP applies to DIETHYL ETHER
- Ether is highly volatile and extremely flammable as a liquid or vapor. It is considered one of the most dangerous fire hazards commonly used in the lab due to its volatility and extremely low ignition temperature.

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.

Additional Lab Specific Rules Here

POTENTIAL HAZARDS

- Ether will spontaneously ignite at temperatures at or above 160°C (320°F).
- Ether vapor forms explosive mixtures in air at concentrations of 1.9-36% by volume.
- Ether may react violently with halogens or strong oxidizers (e.g. perchloric acid, nitric acid).
- Ether can form explosive peroxides upon storage in contact with air.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

DIETHYL ETHER (ETHER, ETHYL ETHER)

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

HEALTH HAZARDS

- Inhalation of high concentrations of ether vapor can result in sedation, unconsciousness, and respiratory paralysis.
- Ether is mildly irritating to the eyes and skin. Repeated skin contact can result in dryness and cracking due to removal of skin oils.
- Chronic exposure to ether vapors can lead to loss of appetite, exhaustion, dizziness, drowsiness, and other central nervous system effects.

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn during operations in which DIETHYL ETHER might contact the eyes (e.g., through vapors or splashes of solution).
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use disposable nitrile gloves when working with Ether. Check chemical compatibility chart for breakthrough time when using Ether.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling DIETHYL ETHER. Protective clothing shall be worn to prevent any possibility of skin contact with DIETHYL ETHER.

WORK PRACTICES

- All DIETHYL ETHER work shall be done in the laboratory fume hood.
- Never open a dented or otherwise compromised container of ether.
- Purchase ether with inhibitors added (for peroxide-forming) when possible.
- Due to its peroxide-forming hazard, ether containers shall be dated upon receipt and at the time they are opened. If tested, note the date it was tested.
- Periodically test ether containers with peroxide test strips.
- Do not allow to evaporate to near dryness unless absence of peroxides has been shown.
- Eliminate ignition sources such as open flames, hot surfaces, steam baths, and operation of mechanical and electrical equipment that is not intrinsically safe.
- Ensure proper grounding and avoid creating static electricity.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

DIETHYL ETHER (ETHER, ETHYL ETHER)

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Do not store with incompatible material.
- Ether is to be stored in a designated flammable cabinet.
- Ether may not be stored in a refrigerator that is not labeled as intrinsically safe for flammables.

Additional Lab Specific Special Handling/Storage Procedures

WASTE DISPOSAL

- DO NOT open or move any ETHER container that has developed crystals at the lid. Call x3427 immediately.
- Ether must be checked for the presence of peroxides prior to removal.
- Excess DIETHYL ETHER and all waste material containing DIETHYL ETHER must be placed in a container labeled with the following **"HAZARDOUS WASTE DIETHYL ETHER"**.
- Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

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DIETHYL ETHER (ETHER, ETHYL ETHER)

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

FIRST AID

If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
In case of skin contact: Take off contaminated clothing and shoes immediately. Wash off in safety shower for at least 15 minutes. Call x5911 for medical assistance.
In case of eye contact: Rinse thoroughly with plenty of water at eyewash for at least 15 minutes and call x5911 for medical assistance.
If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.
Call x5911 and describe the extent of injuries.
Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

SPILL AND ACCIDENT PROCEDURES

SPILL QUANTITY	PROPER SPILL RESPONSE
Spill less than 500 mL	**Contact Environmental Health and Safety (x3427) and clean up spill using spill kit.**
Spill greater than 500 mL	**Do not attempt to clean up spill. Leave the area and immediately report to WFU Police (x5911) and EHS (x3427).**

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

DISTILLATION AT ATMOSPHERIC PRESSURE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

- This SOP applies to distillation. Distillation is the traditional method of purifying a chemical liquid. It is also used to separate one component in a liquid mixture from another. Distillation in most laboratories involves refluxing volatile liquids at atmospheric or normal air pressure from a distilling flask through a "simple" or short path still head, or a longer "fractional" vertically held column, into a slightly downward angled condenser with a water-cooled jacket into receiving flasks.

DISTILLATION PROCEDURES

- Many different sizes and shapes of distillation heads and columns exist in chemical laboratories, but all adhere to the same basic principles of safe use. Trouble can arise mainly from excess pressure build-up due to too rapid heating and unsafe use of flammable solvents, resulting in fires.
- In general, common high-boiling or nontoxic solvents can be distilled on lab benches, with efficient condenser jacket water-cooling. Very low-boiling or more toxic compounds should be distilled only in a fume hood.
- Begin by attaching the water inlet hose on the lower water jacket inlet on the condensing column. The thermometer bulb should be placed just below the level of the roughly horizontal side arm of the distillation head. Just enough heat should be added to the distillation flask to raise the level of reflux only as high as the side arm. Additional heat is not needed.
- Do not completely fill the flask with liquid. A half-full or, at most, two-thirds full level is safer.
- Be sure all joints are tight, with grease if needed, and that the entire apparatus is well clamped and supported by ring stands. Fumes leaking through loose joints could come into contact with the heat source and cause a fire.
- Add boiling stones for atmospheric pressure distillations. More even boiling can be achieved with use of magnetic stir-bars. You should certainly use stirring for high boiling or very toxic compounds. Add boiling stones and stir bars to cool solutions, before you begin heating. Dropping cold boiling chips through a condenser into hot solutions will result in very rapid boiling and has been known to cause boil-over of liquid through the top of the condenser.
- Ordinarily, you should raise the heating mantel on a platform, or "lab jack" so that you may quickly remove the source of heat if the liquid "bumps" uncontrollably or loss of vapor occurs through the top of the condenser. Heat sources ordinarily used in undergraduate organic labs include bare corning stirrer/hotplates, on low thermostat settings of about "3", with distilling flasks just touching or just above the surface and surrounded in a funnel of aluminum foil. Research labs make use of various types of heat sources, including heating mantels attached to variable transformers and oil baths on hotplates. When using oil baths, do not overheat the oil.
- The receiving flask should be of such design as to efficiently receive the condensed liquid through the receiving adapter. Vacuum adapters can be used for water-aspirator vacuum distillations or inert atmosphere applications. Gas cylinders of nitrogen or argon are commonly attached via hoses to reaction stills with appropriate regulators and fittings.
- Never heat a closed vessel. Always have some means of venting heated gasses through distillation setups. One could also attach a hose to the vacuum adapter and direct it into a

hood for more effective removal of any uncondensed vapors which may escape from normal atmospheric pressure distillation. Purging of distillation apparatus with inert gasses while distilling is sometimes employed in research laboratories. Make sure to include some sort of "safety valve".

- Surround the receiving flask in an ice bath to further condense very volatile organic compounds.
- Make sure coolant is running through the condenser before you start heating the liquid. The rate of distillation, as determined by the number of condensed drops falling into the receiving flasks, should be relatively low, a few drops per second.
- Potentially reactive or explosive solvents should be distilled behind transparent explosion shields
- Refill liquid in the receiving flask or disassemble the entire setup only when the glassware has cooled down from the previous distillation.

POTENTIAL HAZARDS

- Excess pressure build-up due to too rapid heating and unsafe use of flammable solvents, may result in fires.
- Very low-boiling or more toxic compounds should be distilled only in a fume hood.
- Fumes leaking through loose joints could come into contact with the heat source and cause a fire.
- Dropping cold boiling chips through a condenser into hot solutions will result in very rapid boiling and has been known to cause boil-over of liquid through the top of the condenser.
- When using oil baths, do not overheat the oil.
- Never heat a closed vessel.
- Do not distill to dryness or "superheating" of the flask will occur, either cracking the glass or leaving a "tarry" residue which may be very flammable or even explosive.
- Potentially reactive or explosive solvents should be distilled behind transparent explosion shields

HEALTH HAZARDS

Check SDS for each chemical to be distilled prior to procedure for information on specific health hazards.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

DISTILLATION AT ATMOSPHERIC PRESSURE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn during DISTILLATION operations.
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use disposable nitrile gloves when working with chemicals. Check chemical compatibility chart for breakthrough time when using chemicals.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when PERFORMING DISTILLATIONS. Protective clothing shall be worn to prevent any possibility of skin contact with CHEMICALS DURING DISTILLATION.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

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DISTILLATION AT ATMOSPHERIC PRESSURE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

FIRST AID

- If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
- In case of skin contact: Take off contaminated clothing and shoes immediately. Wash off in safety shower for at least 15 minutes. Call x5911 for medical assistance.
- In case of eye contact: Rinse thoroughly with plenty of water at eyewash for at least 15 minutes and call x5911 for medical assistance.
- If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.
- Call x5911 and describe the extent of injuries.
- Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
- Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

SPILL AND ACCIDENT PROCEDURES

SPILL QUANTITY	PROPER SPILL RESPONSE
Spill less than 500 mL	**Contact Environmental Health and Safety (x3427) and clean up spill using spill kit. Avoid breathing vapors.**
Spill greater than 500 mL	**Do not attempt to clean up spill. Leave the area and immediately report to WFU Police (x5911) and EHS (x3427).**

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

ETHIDIUM BROMIDE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

- This SOP applies to Ethidium bromide (EtBr). Ethidium bromide is a non-radioactive marker used in identification of nucleic acid bands in electrophoresis.

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.

POTENTIAL HAZARDS

- Ethidium bromide is highly toxic by inhalation.
- Mutagen, suspected of causing birth defects.
- Harmful if absorbed through skin or ingested.

HEALTH HAZARDS

- Ethidium bromide is a potent mutagen and should be treated as a possible reproductive hazard and carcinogen.
- Irritating to mucous membranes, eyes, skin and upper respiratory tract.

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ETHIDIUM BROMIDE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn during operations in which ETHIDIUM BROMIDE might contact the eyes (e.g., through vapors or splashes of solution).
- When using UV light to identify EtBr contamination, UV-blocking eyewear must be worn.

HAND PROTECTION

- Use disposable nitrile gloves when working with EtBr. Check chemical compatibility chart for breakthrough time when using EtBr.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling ETHIDIUM BROMIDE. Protective clothing shall be worn to prevent any possibility of skin contact with ETHIDIUM BROMIDE.

WORK PRACTICES

- Stock solutions of Ethidium bromide should be prepared in a chemical fume hood.
- Aerosols may be produced during any open handling of dry powder, and during open or pressurized manipulations of solutions. Conduct all operations in fume hood that may produce aerosols.
- Check the work area for contamination using a UV light (EtBr will fluoresce a reddish-brown). If decontamination is needed, try the methods below after wiping up excess liquid with paper towels.
    - Wipe the contaminated area or equipment with fresh towels and a soap/water solution multiple times. You can also wipe with towels soaked in ethanol. Check for any remaining contamination using UV light.
    - Take fresh paper towels soaked in ethanol and place them over the contaminated surface. Sprinkle activated charcoal on the ethanol-saturated towel in contact with contaminated surface. Wipe up ethanol/charcoal mixture with additional towels and place all clean-up materials into a plastic bag. Check for any remaining contamination with UV light and repeat if needed.
    - Use a solution of 4.2 grams of sodium nitrite ($NaNO_2$), 20 milliliters of 50% hypophosphorous acid solution (H_3PO_2), and 300 milliliters of water to decontaminate. Check the area again with the UV light until all EtBr has been removed, then rinse with water. It should be noted that hypophosphorous acid is a DEA listed chemical and may require additional authorization for purchase.

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Do not store with incompatible material. See SDS for details.

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ETHIDIUM BROMIDE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

Additional Lab Specific Special Handling/Storage Procedures

WASTE DISPOSAL

- Chemicals shall not be drain disposed unless prior approval is given by EH&S.
- Ethidium bromide may be treated according to protocols established by the Department of Biology.
- Excess ETHIDIUM BROMIDE and all waste material containing ETHIDIUM BROMIDE must be placed in a container labeled with the following **"WASTE ETHIDIUM BROMIDE"**, AND THE FULL CHEMICAL NAME. Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

FIRST AID

- If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
- In case of skin contact: Take off contaminated clothing and shoes immediately. Wash off in safety shower for at least 15 minutes. Call x5911 for medical assistance.
- In case of eye contact: Rinse thoroughly with plenty of water at eyewash for at least 15 minutes and call x5911 for medical assistance.
- If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.
- Call x5911 and describe the extent of injuries.
- Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
- Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

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ETHIDIUM BROMIDE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

SPILL AND ACCIDENT PROCEDURES

SPILL QUANTITY	PROPER SPILL RESPONSE
Spill less than 500 mL	Contact Environmental Health and Safety (x3427) and clean up spill using spill kit. Avoid breathing vapors. Follow decontamination procedures listed under "Work Practices", above.
Spill greater than 500 mL	Do not attempt to clean up spill. Leave the area and immediately report to WFU Police (x5911) and EHS (x3427).

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

FLAMMABLES

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

This SOP applies to the various chemicals that are Flammable. Flammables fall under the following categories:

- Flammable gas – a gas that, at STP, forms a flammable mixture with air at a concentration of 13% by volume or less OR that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12% by volume, regardless of the lower limit.
- Flammable liquid – a liquid having a flash point below 100°F.
- Flammable solid – a solid, other than a blasting agent or explosive, that (1) has an ignition temperature below 212°F, or (2) is capable of causing a fire through friction, absorption of moisture, or spontaneous chemical change, or (3) burns so vigorously and persistently as to create a serious hazard.
- Combustible liquid – a liquid having a flash point at or above 100°F (definition listed for storage considerations).

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.

Additional Lab Specific Rules Here

POTENTIAL HAZARDS

Fire is the main hazard with Flammables.
Never use flammable materials near sources of heat, flame, sparks or static discharge (direct sunlight, furnaces, pilot lights etc.)
Do not use in unventilated areas. Use in fume hood.
Vapors are heavier than air. These can pool in low-lying areas and travel significant distances to an ignition source.

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FLAMMABLES

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

HEALTH HAZARDS

- Chronic exposure by inhalation or skin contact may result in liver or kidney damage, CNS disorders, blood disorders and GI tract disorders.
- Symptoms of acute exposure can lead to:
  - Dermatitis
  - Dizziness
  - Incoherency
  - Nausea
  - Vomiting
  - Abdominal pain
- May irritate eyes, nose and respiratory tract
- Can be absorbed through the skin and may cause dermatitis

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn.
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use disposable nitrile gloves when working with flammables. Check chemical compatibility chart for breakthrough time when using flammable.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling FLAMMABLES. Flame resistant lab coat should be worn. Protective clothing shall be worn to prevent any possibility of skin contact with FLAMMABLES.

WORK PRACTICES

- Work in a chemical fume hood if air concentrations above 10% of the lower flammable limit may be reached, if the chemical is irritating to the eyes and respiratory system, and/or is toxic by inhalation. Contact Facilities and Campus Services (x4255) immediately if fume hood is malfunctioning.
- Know the location of the nearest fire extinguisher before beginning work.
- Avoid using ignition sources (Bunsen burners, hot plates, electrical equipment with frayed or cracked wiring, etc.) and/or creating static electricity in areas where highly flammable chemicals are used.
- Ensure proper grounding. Be sure to ground metal containers when transferring flammable liquids.
- Keep containers of flammable chemicals closed at all times when not in use to prevent accumulation of flammable vapor concentrations.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

FLAMMABLES

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Do not store with incompatible material.
- Incompatible with acids and oxidizers.
- FLAMMABLES are to be stored in a designated flammable cabinet when not in use.

Additional Lab Specific Special Handling/Storage Procedures

WASTE DISPOSAL

- Chemicals shall not be drain disposed unless prior approval is given by EH&S.
- Excess FLAMMABLES and all waste material containing FLAMMABLES must be placed in a container labeled with the following **"HAZARDOUS WASTE FLAMMABLES" "**, AND INCLUDE THE FULL CHEMICAL NAME.
- Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

FIRST AID

If chemical exposure occurs, remove contaminated clothing and flush exposed area for 15 to 20 minutes using emergency eyewash station and/or safety shower.
If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
Call x5911 and describe the extent of injuries.
Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

FLAMMABLES

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

SPILL AND ACCIDENT PROCEDURES

If the chemical spilled is considered a carcinogen, reproductive toxin or highly toxic chemical, contact x3427 and evacuate area immediately, regardless of spill amount.

For all other spills use the chart below for spill reporting and response:

SPILL QUANTITY	PROPER SPILL RESPONSE
Spill less than 500 mL	**Contact Environmental Health and Safety (x3427) and clean up spill using spill kit.**
Spill greater than 500 mL	**Do not attempt to clean up spill. Leave the area and immediately report to WFU Police (x5911) and EHS (x3427).**

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

FORMALDEHYDE, FORMALIN AND PARAFOMALDEHYDE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

- This SOP applies to FORMALDEHYDE, FORMALIN AND PARAFOMALDEHYDE.
- FORMALDEHYDE exposure in Anatomy Lab will be monitored at the beginning of each semester dissections are performed. Environmental Health and Safety will perform monitoring and results will be provided to the PI.
- Other laboratories on campus are required to use FORMALDEHYDE, FORMALIN AND PARAFOMALDEHYDE in fume hood.

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.

Additional Lab Specific Rules Here

POTENTIAL HAZARDS

- Potential human carcinogen.
- Moderate fire and explosion hazard when exposed to heat or flame.
- Incompatibilities and materials to avoid: Aniline, Phenol, Isocyanates, Acid anhydrides, Acids, Strong bases, Strong oxidizing agents, Amines, Peroxides.

HEALTH HAZARDS

- Potential human carcinogen.
- Irritation of the eyes, nose, and throat (airborne concentrations above 0.1 ppm).
- Toxic if inhaled. Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract.
- Severity of irritation increases as concentrations increase; at 100 ppm it is immediately dangerous to life and health.
- Dermal contact causes various skin reactions including sensitization.
- Target Organs: Eyes, Kidney, Liver, Heart, Central nervous system.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

FORMALDEHYDE, FORMALIN AND PARAFOMALDEHYDE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn during operations in which FORMALDEHYDE, FORMALIN AND PARAFOMALDEHYDE might contact the eyes (e.g., through vapors or splashes of solution).
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use disposable nitrile gloves when working with FORMALDEHYDE, FORMALIN AND PARAFOMALDEHYDE. Check chemical compatibility chart for breakthrough time when using FORMALDEHYDE, FORMALIN AND PARAFOMALDEHYDE.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling FORMALDEHYDE, FORMALIN AND PARAFOMALDEHYDE.
- Protective clothing shall be worn to prevent any possibility of skin contact with FORMALDEHYDE, FORMALIN AND PARAFOMALDEHYDE.

WORK PRACTICES

- All FORMALDEHYDE, FORMALIN AND PARAFOMALDEHYDE work shall be done in the laboratory fume hood or on anatomy dissection draw-down table.
- If fume hood or anatomy dissection draw-down table are not functioning, do not proceed with work. Call x4255 immediately for repair.
- If you are weighing paraformaldehyde powder and the balance cannot be located in a fume hood or BSC, tare a container then add powder in the hood and cover before returning to the balance to weigh the powder.
- Labs handling moderate to large quantities of formaldehyde-containing solutions on a regular basis should contact EHS at x3427 for assessment of exposure. Areas that handle only small (100 ml or less) pre-filled specimen containers, or that work with formaldehyde-containing solutions exclusively in a functioning chemical fume hood, would have low potential for overexposure, but should contact EHS if there are concerns.
- Once work with formalin/paraformaldehyde is complete, wipe down area with a soap and water solution.

EXPOSURE MONITORING

- WFU EH&S will periodically monitor faculty to determine their exposure to formaldehyde.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

FORMALDEHYDE, FORMALIN AND PARAFOMALDEHYDE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

- WFUHS EH&S will periodically measure and accurately determine exposure to formaldehyde for faculty, staff, and students shown by the initial monitoring to be exposed at or above the action level, or at or above the Short Term Exposure Limit.
- If the last monitoring results reveal employee exposure at or above the action level, WFU EH&S will repeat monitoring of the faculty, staff, and/or students.
- Regulated areas where the concentration of airborne formaldehyde exceeds either the Time Weighted Average (TWA) or the Short Term Exposure Limit (STEL) will be posted at all entrances and access ways with signs bearing the following information:

DANGER
FORMALDEHYDE
IRRITANT AND POTENTIAL CANCER HAZARD
AUTHORIZED PERSONNEL ONLY

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Do not store with incompatible material
- Avoid contact with skin and eyes. Avoid inhalation of vapor or mist.
- Keep away from sources of ignition - No smoking. Take measures to prevent the build-up of electrostatic charge.
- 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.

Additional Lab Specific Special Handling/Storage Procedures

WASTE DISPOSAL

- Excess FORMALDEHYDE and all waste material containing FORMALDEHYDE must be placed in a container labeled with the following **"HAZARDOUS WASTE (FORMALDEHYDE, FORMALIN OR PARAFORMALDEHYDE)".**
- Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

FORMALDEHYDE, FORMALIN AND PARAFOMALDEHYDE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

Student Health (students only)	x5218
Poison Control	800-222-1222

FIRST AID

- If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
- In case of skin contact: Take off contaminated clothing and shoes immediately. Wash off in safety shower for at least 15 minutes. Call x5911 for medical assistance.
- In case of eye contact: Rinse thoroughly with plenty of water at eyewash for at least 15 minutes and call x5911 for medical assistance.
- If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.
- Call x5911 and describe the extent of injuries.
- Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
- Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

SPILL AND ACCIDENT PROCEDURES

- If FORMALDEHYDE, FORMALIN OR PARAFOMALDEHYDE is released outside a fume hood, evacuate area immediately and contact x3427, regardless of spill amount.
- Lab personnel will clean up minor spills, including most spills confined to the chemical fume hood. Wearing double nitrile gloves, splash goggles, face shield and lab coat (and impermeable apron, if available), use absorbent pads to absorb spilled material. (For small spills of solid PFA, dampen the absorbent pad with methanol before placing over the spilled material and allow to sit for a few minutes before wiping up.) After spill has been completely absorbed, wash down contaminated area with soap and water at least two times. Contaminated PPE and clean-up materials must be placed in a clear plastic bag or compatible container for pick-up.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

HUMAN GROSS ANATOMY

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

- This SOP applies to HUMAN GROSS ANATOMY laboratory. This lab is operated through the Department of Health and Exercise Science.

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
  - after handling chemicals materials,
  - after removing gloves, and
  - before leaving the laboratory.

1. **Human Gross Anatomy Lab Specific Rules.**
   a. **Access to the lab is restricted to faculty, HES 352 students and Anatomy TAs only.** ***You must receive permission*** from the lab director (Dr. Messier) before ***ANY*** guest may be brought into the lab to see your dissection.
   b. **All lab materials must remain in the lab at all times**. At no time may any lab materials leave the lab for any reason without permission of the lab director (including any cadaveric parts, osteology samples, lab models, and desk copies of textbooks).
   c. **Photography is strictly prohibited in the lab**.
   d. **All eating and drinking (including water, coffee and soft drinks) are prohibited in the lab at all times (24 hours a day, 7 days a week)**.
   e. **Smoking and the use of smokeless tobacco products are prohibited throughout the building.**

2. **Rules for Anatomy Teaching Assistants (TAs).**
   a. Dissection lab will be held every Tuesday from 4:30-7:00 PM. Drs. Marsh and Messier will supervise the dissection. All TAs are expected to attend these sessions.
   b. In addition to the Tuesday evening dissection, TAs are expected to complete any unfinished dissection on their own or with your dissection group before the next week's dissection lab.
   c. Lab TAs will also be responsible for supervising 1-3hr open lab period per week.
   d. For Open Labs, TAs are to arrive 5 minutes early to set up.
   e. TAs are to make specimens available to the students. ONLY the TAs are to remove the specimens from their containers and place them in the dissecting trays. ONLY TAs are to return the specimens to the containers, making sure to use protective glasses incase of a splash or spill.
   f. TAs are to be available to answer student questions. This means that you must be prepared and not doing your own work as long as at least one student in the lab.

g. Clean up the lab at the end of the period, including tables, counters, etc. The lab should be spotless when you leave.
h. Always abide by the rules contained in this document.

PROPER USE OF DISSECTION TABLES

a. **Do NOT push or move the dissection tables** or unlock the table wheels for any reason at any time. Downdraft tables are attached to wall duct work to remove volatile embalming vapors and should not be moved for any reason.

b. **Dissection tables can be opened by one person but are best locked in place under the table with two people.** First open and remove the books, instruments and gloves that your group will need from their underlying storage compartment. Then grab the central handle of the table cover and pull back to open the table. If possible, get a nearby student to help you latch the table cover on one side. Working together with a neighbor, swing the cover under the table and latch the covers in place (the proper technique will be demonstrated during lab orientation). Repeat the process when you open the cover on the opposite side.

c. **Do NOT place tissue removed from the body on the table surface.** The table surface contains many perforated holes elevated above a collecting trough. These holes are used to remove potentially harmful vapors and fluids. When you remove tissue from the body (i.e. skin, fat, fascia etc.) do not simply lay it on the surface where it can clog these holes and interfere with downdraft. Each dissection table has a 5 gallon white round plastic container for human waste disposal. This container is for ALL human tissues removed from the body (skin, fascia, fat etc.) and is sealed when full.

d. **Desiccation prevention**. To prevent a skilled dissection from being ruined by unwanted drying, follow these required steps. First use the spray bottle to wet dissected surfaces of the body (it is not necessary to wet or wrap areas that have not yet been skinned or dissected). Where possible close the dissected area with skin. Then before you close the tables, cover these surfaces with a blue wrapper saturated with spray bottle Carosafe to prevent desiccation. Apply the wrap to the dissected surfaces of the body. Only the necessary quantity of wrapping material is required to prevent direct exposure to air. When viewing the bodies dissected by other groups in the afternoon, at night or on weekends; REMEMBER to always wrap the cadaver **IMMEDIATELY** after viewing to prevent desiccation.

e. **Do NOT leave any instruments or books inside the closed table.** Do not leave any books (i.e. - dissector or atlas), paper towels, instruments or gloves on your cadaver, bookstand or table surface when you finish and close the covers. All of these items must be placed neatly in the

appropriate storage containers at the end of the lab session or when you finish dissecting at other times. Your group will be held responsible to keep the surface of your table and your assigned work area as clean as possible at all times. When you close the table, only the cadaver, the bookstand, the spray bottle and the 5 gallon white plastic disposal container (for human waste) should remain inside. Everything else should be stored neatly beneath the table.

HEALTH HAZARDS

See FORMALDEHYDE SOP for information on health hazards of this chemical.
See SODIUM HYPOCHLORITE for information on bleach.

Be careful to avoid self-inflicted wounds at all times! Scalpels are sharp! Use the hemostat in your dissection kits to add or remove a scalpel blade – do not use your fingers.

EXPOSURE MONITORING

- WFU EH&S will periodically monitor faculty to determine their exposure to formaldehyde.
- WFUHS EH&S will periodically measure and accurately determine exposure to formaldehyde for faculty, staff, and students shown by the initial monitoring to be exposed at or above the action level, or at or above the Short Term Exposure Limit.
- If the last monitoring results reveal employee exposure at or above the action level, WFU EH&S will repeat monitoring of the faculty, staff, and/or students.
- Regulated areas where the concentration of airborne formaldehyde exceeds either the Time Weighted Average (TWA) or the Short Term Exposure Limit (STEL) will be posted at all entrances and access ways with signs bearing the following information:

DANGER
FORMALDEHYDE
IRRITANT AND POTENTIAL CANCER HAZARD
AUTHORIZED PERSONNEL ONLY

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn during operations in which fluids, aerosols or solids might contact the eyes (e.g., through vapors or splashes of solution).
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.
- **ANYTIME YOU TOUCH A HUMAN CADAVER** - **Protective clothing and gloves are required for dissection.** Put on your protective bib and gloves BEFORE you handle the group dissector, atlas, instruments or bones and BEFORE you open the TABLE COVER.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

HUMAN GROSS ANATOMY

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

- Disposable lab gowns and gloves must be worn by everyone and at all times when dissecting a cadaver (TAs AND STAFF ALIKE - **NO EXCEPTIONS**). The disposable gowns and gloves are provided for the TAs. When you are finished dissecting, place your used gloves in the floor trash can and place your gowns on the rack in your work space that has been designated for only your group use. Make sure you do this before you leave your group work area. New gowns will normally be provided twice a week. When new gowns are provided you must dispose of the old used gowns in the floor trash can.
- You may observe a dissection without protective clothing and gloves but you must at all times prevent direct skin exposure to human tissues or embalming fluids (i.e. by touching the cadaver or dissection instruments). Contaminated protective clothing and gloves may not be worn in the central clean area (see below). These rules apply both during scheduled class hours and when using the lab after class.

- **What to wear and what NOT to wear.** Clothing and shoes in the lab should be comfortable but also protective. You may not wear open toe shoes at any time. Shoes that have good cushioning and arch support are recommended for extended periods of standing. If shoes have black rubber soles be sure they do not mark the floor. Do not wear contact lenses in the lab. **Students will not dissect the cadavers; hence, they are not required to wear lab coats or protective glasses.** They are required to wear gloves when handling specimens from the containers and while at the dissecting tables examining the cadavers.

- **What to wear:** comfortable clothing and closed toe shoes that do not mark the floor

- **What NOT to wear:** open toe shoes and contact lenses.

WORK PRACTICES

Proper use of non-dissecting area :
The area separate from the dissecting tables is designed for students to work on specimens, models, and skeletons. While in this area, wearing gloves on both hands is required if a specimen is being studied.

Proper use of specimens:
Specimens of segments have been harvested to facilitate learning and are often used in practical examinations. These sections are stored in containers on shelves in a wall cabinet. You will need gloves to handle the specimens. Be sure you handle the specimens with care. When you have finished using a specimen – return it to the counter. **ONLY TAs OR CLASS INSTRUCTORS ARE PERMITTED TO RETURN THE SPECIMENS TO THE CONTAINERS.**

Proper Use of Osteology Specimens:
Osteology specimens should never be removed from the lab and always stored in the group container. These specimens are often fragile (especially skulls) so be sure they do not drop and hit the floor.

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HUMAN GROSS ANATOMY

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

ENGINEERING CONTROLS MAINTENANCE AND INSPECTION

MAINTENANCE/INSPECTION REQUIREMENT	INTERVAL	ORGANIZATION RESPONSIBLE
Exhaust Fan	Annually	Facilities Management
Eyewash – Laboratory	Monthly	Environmental Health and Safety
Laboratory Air Flow	Annually	Facilities Management
Safety Audit of Lab	Daily	Principle Investigator
Safety Audit of Lab	Monthly	Environmental Health and Safety

- Upon completion of semester when the dissection tables in anatomy have held cadavers the tables will be cleaned and disinfected by an outside contractor.
- General housekeeping, cleaning and disinfecting will be conducted by the Department during the semester while the tables are in use with a 10% Bleach solution or equivalent disinfectant.

Additional Lab Specific Special Handling/Storage Procedures

WASTE DISPOSAL

- All trash must be disposed in the appropriate container as you dissect (and not just when you finish).
- None of the dissected tissues removed from the cadaver may be placed on the table top (these tissues and any other objects including paper towels can obstruct table downdraft vents).
- Place all of the removed tissue in the white bucket on the table top.
- Do **NOT** place human tissues in the floor trash can – this trash can is for the disposal of only the protective plastic gowns, gloves and paper waste only.
- Place all used blades in the specific sharps disposal container provided for your group. Each sharps disposal container has a window, if you cannot see inside this window then have a taller classmate dispose of your blade.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

HUMAN GROSS ANATOMY

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

FIRST AID

CHEMICAL EXPSOURE

- In case of skin contact: Take off contaminated clothing and shoes immediately. Wash off in safety shower for at least 15 minutes. Call x5911 for medical assistance.
- In case of eye contact: Rinse thoroughly with plenty of water at eyewash for at least 15 minutes and call x5911 for medical assistance.
- If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.
- Call x5911 and describe the extent of injuries.
- Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
- Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

CUTS OR PUNCTURES

1. If you cut yourself then use direct pressure immediately applied with a clean paper towel directly on the laceration. Go to a nearby sink and flush the open wound with copious amounts of water. Apply additional direct pressure until all of the bleeding has stopped. Then, apply antiseptic and a sterile pressure dressing when bleeding to the washed wound has subsided.
2. A puncture wound should instead be made to bleed immediately to better wash out the wound. If you have punctured (not cut) your hand then rapidly spin your arm in windmill fashion to encourage bleeding by centripetal force. Go to a nearby sink, wash the puncture and repeat the process to encourage more bleeding. After again washing with copious amounts of water, apply antiseptic to the surface of the puncture and a sterile pressure dressing.
3. Report ALL injuries to an instructor immediately. Present to the Student Health Center or Emergency Room if the injury is serious or progressing badly. In addition to the instructor all injuries or potential bio-hazard exposure (cuts, puncture, etc) should be reported to the professor, facilities coordinator, and the EHS Office. All information is kept strictly confidential.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

HUMAN GROSS ANATOMY

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

SPILL AND ACCIDENT PROCEDURES

If you should accidentally spill human tissue (removed fat or fascia) or accidentally spill fluid (embalming fluid) on the floor around your table it should be reported to the Lab Director/technician immediately. Isolate the area to prevent others from tracking contaminated fluids on their shoes around the room. The lab technician/director should report the spill immediately to EHS. There can be no trash, books or any other items ever placed on the floor at any time or for any reason.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

HYDROFLUOIC ACID

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

- This SOP applies to HYDROFLUORIC ACID (HF).
- HYDROFLUORIC ACID is one of the strongest acids. It is extremely destructive to tissue and potentially fatal.
- HF causes such severe burns because it penetrates beneath the skin and dissociates into hydrogen and fluoride ions. When fluoride ions bind with calcium in the body, it can result in tissue destruction, decalcification of bone, cardiac arrhythmia, and liver and kidney damage.
- Calcium gluconate will bind to the fluoride ions and prevent further tissue destruction, but it must be applied quickly (even if burns have not been felt) to be effective.

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

HYDROFLUOIC ACID

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

Additional Lab Specific Rules Here

POTENTIAL HAZARDS

- Fatal if swallowed or in contact with skin
- Extremely corrosive material which attacks all tissues of the body.
- Possesses an irritating odor at or near the PEL (3 ppm).

HEALTH HAZARDS

- Inhalation: Toxic if inhaled. Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract.
- Skin: May be fatal if absorbed through skin. Causes skin burns.
- Eyes: Causes eye burns. Causes severe eye burns.
- Ingestion: May be fatal if swallowed.
- Contact with dilute (<25%) HF solutions may not be felt until a few hours has passed, resulting in major tissue damage. Skin contact with higher concentrations of HF causes immediate and painful burns as well as massive tissue and bone destruction.
- Burns the eyes, ultimately leading to blindness. At concentrations of 10 ppm to 15 ppm HF vapors begin to irritate the eyes.
- Causes severe digestive tract burns with abdominal pain, vomiting, and possible death. May cause systemic toxic effects on the heart, liver, and kidneys. Ingestion of large amounts of fluoride may include salivation, nausea, vomiting, abdominal pain, fever, labored breathing. Inorganic fluorides can be harmful. Acute exposure to fluorine compounds can lead to digestive tract burns, and abdominal pain. Exposure to fluoride compounds can result in systemic toxic effects on the heart, liver, and kidneys. It may also deplete calcium levels in the body leading to hypocalcaemia and death. Contains fluoride. Human fatalities have been reported from acute poisoning. Fluoride can reduce calcium levels leading to fatal hypocalcaemia.
- Chronic inhalation and ingestion may cause chronic fluoride poisoning (fluorosis) characterized by weight loss, weakness, anemia, brittle bones, and stiff joints. Repeated inhalation may cause chronic bronchitis. Prolonged or repeated exposure may cause permanent bone structure abnormalities. Chronic exposure to fluoride compounds may cause systemic toxicity.

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

HYDROFLUOIC ACID

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

- Safety glasses, goggles or face shields shall be worn during operations in which HYDROFLUORIC ACID might contact the eyes (e.g., through vapors or splashes of solution).
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use of SilverShield®/4H Protective Wear Gloves is recommended in conjunction with nitrile gloves for use against hydrofluoric acid. Check chemical compatibility chart for breakthrough time when using.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling HYDROFLUORIC ACID. Protective clothing shall be worn to prevent any possibility of skin contact with HYDROFLUORIC ACID.

WORK PRACTICES

- All HYDROFLUORIC ACID work shall be done in the laboratory fume hood.
- Keep an updated supply of 2.5% calcium gluconate ointment in the work area.
- Hydrofluoric acid reacts violently with water so do not store under sink or in an area that may be susceptible to water intrusions.
- Do not use glass, ceramic, or other incompatible containers for HF.
- Once work with HF is complete, decontaminate the area by wiping it down with a 10% sodium carbonate (Na_2CO_3, also known as soda ash) solution.

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Do not store with incompatible material – Metals, Alkali metals, Strong bases.
- Hydrofluoric acid reacts violently with water so do not store under sink or in an area that may be susceptible to water intrusions.
- HYDROFLUORIC ACID corrodes glass. DO NOT STORE IN GLASS CONTAINER.

Additional Lab Specific Special Handling/Storage Procedures

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

HYDROFLUOIC ACID

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

WASTE DISPOSAL

- Chemicals shall not be drain disposed unless prior approval is given by EH&S.
- Excess HYDROFLUORIC ACID and all waste material containing HF must be placed in a NON-GLASS container labeled with the following **"HAZARDOUS WASTE HYDROFLUORIC ACID".**
- Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

FIRST AID

1. Hydrofluoric (HF) acid burns require immediate and specialized first aid and medical treatment. Symptoms may be delayed up to 24 hours depending on the concentration of HF. After decontamination with water, further damage can occur due to penetration/absorption of the fluoride ion. Treatment should be directed toward binding the fluoride ion as well as the effects of exposure. Skin exposures can be treated with a 2.5% calcium gluconate gel repeated until burning ceases. More serious skin exposures may require subcutaneous calcium gluconate except for digital areas unless the physician is experienced in this technique, due to the potential for tissue injury from increased pressure. Absorption can readily occur through the subungual areas and should be considered when undergoing decontamination. Prevention of absorption of the fluoride ion in cases of ingestion can be obtained by giving milk, chewable calcium carbonate tablets or Milk of Magnesia to conscious victims. Conditions such as hypocalcemia, hypomagnesemia and cardiac arrhythmias should be monitored for, since they can occur after exposure. Consult a physician. Show this safety data sheet to the doctor in attendance.
2. If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
3. In case of skin contact: Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Consult a physician.
4. In case of eye contact: Rinse thoroughly with plenty of water for at least 15 minutes and call x5911 for medical assistance.
5. If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.

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HYDROFLUOIC ACID

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6. Call x5911 and describe the extent of injuries.
7. Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
8. Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

SPILL AND ACCIDENT PROCEDURES

- If HYDROFLUORIC ACID is spilled, contact x3427 and evacuate area immediately, regardless of spill amount.
- Do NOT use organic spill kits that contain Floor-Dri, kitty litter, or sand because HF reacts with silica to produce silicon tetrafluoride (a toxic gas).
- Neutralize with sodium carbonate or lime.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

NITRIC ACID

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

- This SOP applies to Nitric Acid.
- Nitric acid is a strong oxidizer capable of igniting on contact or reacting explosively with many substances.
- Nitric acid will cause severe skin burns and eye damage in the event of exposure.

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.

Additional Lab Specific Rules Here

POTENTIAL HAZARDS

- Contact with organic substances such as acetone, acetonitrile, various alcohols, dichloromethane, DMSO, (and many others) may result in fires or explosions.
- Nitric acid also reacts violently with many inorganic substances including various bases, reducing agents, ammonia, and alkali metals.

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NITRIC ACID

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

HEALTH HAZARDS

- Concentrated nitric acid can release vapors and toxic gases (including NO_2), which can cause moderate to severe health effects, especially irritation to the eyes, skin, respiratory tract, and other mucosal membranes.
- Concentrated nitric acid causes severe skin burns. Dilute concentrations that contact skin can cause mild irritation.
- Contact with eyes can cause severe burns and permanent eye damage.
- If high concentrations of nitric acid are inhaled, severe respiratory irritation can develop, along with possible delayed effects such as pulmonary edema, which can be fatal.
- Ingestion of nitric acid can cause severe corrosion and burning of the mouth, esophagus, and stomach. As little as 10 ml of ingested nitric acid can be fatal.

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Goggles or face shields shall be worn during operations in which NITRIC ACID might contact the eyes (e.g., through vapors or splashes of solution).
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use two (2) pair disposable nitrile gloves when working with chemicals. Check chemical compatibility chart for breakthrough time when using Nitric acid.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling NITRIC ACID. Protective clothing shall be worn to prevent any possibility of skin contact with NITRIC ACID.

WORK PRACTICES

- Avoid glove contact with NITRIC ACID. If gloves come into contact from a splash or spill remove gloves immediately and replace.
- Decontaminate areas where NITRIC ACID has been used by washing with soap and water after work is completed.

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NITRIC ACID

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Do not store with incompatible material.
- Materials to avoid: Alkali metals, Organic materials, Acetic anhydride, Acetonitrile, Alcohols, Acrylonitrile, Ammonia, Crotonaldehyde, Halogenated hydrocarbon, Acids, Bases, Metals, hexalithium disilicide, Hydrogen peroxide, Ketones, metal acetylides, Water, Fluorine, Amines, Thiols, cadmium, Bromine, Copper, Hydrazine, Hydrazinium nitrate, Nitro compounds,Cyanides, Phosphorus trihydride (phosphine), Diphosphine, Halides, Organic halides, May set fire to wood or paper Polyethers, Methyl vinyl ether
- Do not store in metal cabinet unless cabinet has been coated with corrosion proofing.
- Keep away from sources of ignition.

Additional Lab Specific Special Handling/Storage Procedures

WASTE DISPOSAL

- Chemicals shall not be drain disposed unless prior approval is given by EH&S.
- Excess NITRIC ACID and all waste material containing NITRIC ACID must be placed in a container labeled with the following **"HAZARDOUS WASTE NITRIC ACID"**.
- Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

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NITRIC ACID

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

FIRST AID

- If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
- In case of skin contact: Take off contaminated clothing and shoes immediately. 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 call x5911 for medical assistance.
- If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.
- Call x5911 and describe the extent of injuries.
- Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
- Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

SPILL AND ACCIDENT PROCEDURES

Neutralize with baking soda and absorb with spill kit absorbent. Avoid breathing vapors.

Use the chart below for spill reporting and response:

SPILL QUANTITY	PROPER SPILL RESPONSE
Spill less than 500 mL	**Contact Environmental Health and Safety (x3427) and clean up spill using spill kit.**
Spill greater than 500 mL	**Do not attempt to clean up spill. Leave the area and immediately report to WFU Police (x5911) and EHS (x3427).**

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

OSMIUM TETROXIDE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

This SOP applies to Osmium tetroxide.

- Osmium tetroxide is highly toxic and may cause death by inhalation, ingestion and/or skin absorption.
- Osmium tetroxide is a strong oxidizer that will sublime (pass directly from solid to vapor and back to solid) readily at room temperature and significantly when refrigerated.

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
  - after handling chemicals materials,
  - after removing gloves, and
  - before leaving the laboratory.

Additional Lab Specific Rules Here

POTENTIAL HAZARDS

- Osmium tetroxide is a strong oxidizer that will sublime (pass directly from solid to vapor and back to solid) readily at room temperature and significantly when refrigerated.
- It is highly toxic (LD50 oral [rat] 14 mg/kg) – ingesting very small amounts can cause death. It is also a severe eye and respiratory irritant – acute exposure can cause severe eye damage, even blindness, or chemical burns to the respiratory tract. It can also cause dermatitis or lung or kidney damage.
- The OSHA Permissible Exposure Limit is 0.002 mg/m^3, and the ACGIH Threshold Limit Value is 0.0002 ppm over 8 hours or 0.0006 ppm over 15 minutes.
- Chronic exposure to osmium tetroxide can result in accumulation of osmium compounds in the liver and kidney and damage to these organs. Osmium tetroxide has been reported to cause reproductive toxicity in

animals; this substance has not been shown to be carcinogenic or to show reproductive or developmental toxicity in humans.

HEALTH HAZARDS

- **Inhalation:** May be fatal if inhaled. Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract.
- **Skin:** May be fatal if absorbed through skin. Causes skin burns.
- **Eyes:** Causes eye burns.
- **Ingestion:** May be fatal if swallowed.
- Chronic exposure to osmium tetroxide can result in accumulation of osmium compounds in the liver and kidney and damage to these organs. Osmium tetroxide has been reported to cause reproductive toxicity in animals; this substance has not been shown to be carcinogenic or to show reproductive or developmental toxicity in humans.

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Goggles or face shields shall be worn during operations in which OSMIUM TETROXIDE might contact the eyes (e.g., through vapors or splashes of solution).
- Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use 2 pair of disposable nitrile gloves when working with OSMIUM TETROXIDE. Change gloves at least every two hours.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling OSMIUM TETROXIDE. Protective clothing shall be worn to prevent any possibility of skin contact with OSMIUM TETROXIDE.

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OSMIUM TETROXIDE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

WORK PRACTICES

- All OSMIUM TETROXIDE work shall be done in the laboratory fume hood.
- If fume hood is not functioning, do not proceed with work. Call x4255 immediately for repair.
- Use of a Biological Safety Cabinet for working with osmium tetroxide is not appropriate because it sublimes and the BSC is not designed to prevent exposure to vapors.
- Use a less dangerous product than osmium tetroxide if possible, or purchase in dilute solution.
- *Laboratory-specific written procedures are required for work with osmium tetroxide, including a designated work area.*
- Purchase a minimal amount of osmium tetroxide to do your work.
- Purchase in liquid form if at all possible.
- Keep corn oil on hand to use for decontamination and in case of a spill – it deactivates osmium tetroxide.
- Set up a designated area for work with osmium tetroxide and suspensions thereof, and label it with the following wording: **DANGER: Osmium Tetroxide in use. Oxidizing Agent, Severe Irritant, Causes Eye Damage, Toxic to Liver and Kidney, Authorized Personnel Only.**
- Line work surfaces with plastic-backed absorbent pads.
- Keep containers closed as much as possible.
- If weighing osmium tetroxide powder and the balance cannot be located in a chemical fume hood, tare a container then add the powdered osmium tetroxide to the container in a chemical fume hood (NOT a Biological Safety Cabinet) and seal the container before returning to the balance to weigh the powder.
- Change gloves regularly (at least every two hours) and wash hands at the time of the glove change.
- Wash hands thoroughly immediately after working with any concentration of osmium tetroxide.
- Contaminated containers and equipment may be decontaminated by dipping in corn oil before removing from the hood. The corn oil will turn black. Paper soaked with corn oil may be used to test if the osmium tetroxide is fully neutralized – if the paper blackens, osmium tetroxide is still present and more corn oil should be added.
- Contaminated work surfaces may be decontaminated with corn oil or an aqueous solution of sodium sulfite, followed by a cleaning with detergent and water.

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Osmium tetroxide powder and concentrated solutions should be stored in a location that is secure (no unauthorized access).
- Osmium tetroxide can penetrate plastic, so should be stored in a sealed glass container (such as a vacuum-type blood collection tube), and placed inside a secondary container.
- Osmium tetroxide should be kept in a refrigerator, and should be stored separately from hydrochloric acid as well as other acids, bases, organic materials, metals, strong reducing agents, and strong oxidizing agents. Keep container tightly closed in a dry and well-ventilated place.
- Recommended storage temperature: 2 - 8 °C

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OSMIUM TETROXIDE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

Additional Lab Specific Special Handling/Storage Procedures

WASTE DISPOSAL

- Excess OSMIUM TETROXIDE and all waste material containing OSMIUM TETROXIDE must be placed in a glass container labeled with the following **"HAZARDOUS WASTE OSMIUM TETROXIDE"**.
- Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

FIRST AID

1. If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
2. In case of skin contact: Take off contaminated clothing and shoes immediately. Wash off in safety shower for at least 15 minutes. Call x5911 for medical assistance.
3. In case of eye contact: Rinse thoroughly with plenty of water at eyewash for at least 15 minutes and call x5911 for medical assistance.
4. If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.
5. Call x5911 and describe the extent of injuries.
6. Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
7. Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

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OSMIUM TETROXIDE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

SPILL AND ACCIDENT PROCEDURES

- Contaminated containers and equipment may be decontaminated by dipping in corn oil before removing from the hood. The corn oil will turn black. Paper soaked with corn oil may be used to test if the osmium tetroxide is fully neutralized – if the paper blackens, osmium tetroxide is still present and more corn oil should be added.
- Contaminated work surfaces may be decontaminated with corn oil or an aqueous solution of sodium sulfite, followed by a cleaning with detergent and water.
- For cleaning up a small spill (<2 ml) of osmium tetroxide solution (or powder if confined to a chemical fume hood), cover the spill with corn oil-soaked kitty litter, then scoop up the material and place it in a plastic bag. After spill has been absorbed, wipe down area again with corn-oil, then soap and water solution to decontaminate. Call x3427 for removal.
- If 2mL or more of OSMIUM TETROXIDE is spilled evacuate area immediately and contact x3427.

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OXIDIZERS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

- This SOP applies to OXIDIZERS. Oxidizers initiate or promote combustion, usually through the release of oxygen.

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OXIDIZERS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.

POTENTIAL HAZARDS

- Oxidizers accelerate development of fire and increase the intensity if fires.
- Cause substances that do not readily burn in air to ignite and burn rapidly.
- Cause combustible materials to burn spontaneously.

HEALTH HAZARDS

See SDS for specific health hazards.

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn during operations in which OXIDIZERS might contact the eyes (e.g., through vapors or splashes of solution).
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use disposable nitrile gloves when working with oxidizers. Check chemical compatibility chart for breakthrough time when using oxidizers.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

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OXIDIZERS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling OXIDIZERS. Protective clothing shall be worn to prevent any possibility of skin contact with OXIDIZERS.

WORK PRACTICES

- Use extreme caution when mixing oxidizing agents with flammables or combustibles.
- Follow all PPE recommendations on SDS
- Ensure no additional flammable or combustible materials are in the area when using oxidizers.

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Do not store with incompatible material.
- Do not store with flammables or combustibles.
- Review SDS for specific storage conditions.

Additional Lab Specific Special Handling/Storage Procedures

WASTE DISPOSAL

- Chemicals shall not be drain disposed unless prior approval is given by EH&S.
- Excess OXIDIZERS and all waste material containing OXIDIZERS must be placed in a container labeled with the following **"HAZARDOUS WASTE OXIDIZERS"**, AND THE FULL CHEMICAL NAME.
  Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)

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OXIDIZERS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

FIRST AID

- If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
- In case of skin contact: Take off contaminated clothing and shoes immediately. Wash off in safety shower for at least 15 minutes. Call x5911 for medical assistance.
- In case of eye contact: Rinse thoroughly with plenty of water at eyewash for at least 15 minutes and call x5911 for medical assistance.
- If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.
- Call x5911 and describe the extent of injuries.
- Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
- Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

SPILL AND ACCIDENT PROCEDURES

SPILL QUANTITY	PROPER SPILL RESPONSE
Spill less than 500 mL	**Contact Environmental Health and Safety (x3427) and clean up spill using spill kit. Avoid breathing vapors.**
Spill greater than 500 mL	**Do not attempt to clean up spill. Leave the area and immediately report to WFU Police (x5911) and EHS (x3427).**

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

PEROXIDE FORMING CHEMICALS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

- This SOP applied to the various chemicals that can form PEROXIDES. The peroxide forming chemicals should be tested every three to six months to ensure that PEROXIDES have not formed.
- Some organic chemicals that are prone to peroxide formation are ethers, acetals, olefins, vinyl monomers, dienes, acrylates and methacrylates, secondary alcohols, and ketones. While aldehydes, ureas, amides, and lactams readily peroxidize, the products are degraded and do not accumulate to a hazardous level.
- Some inorganic chemicals that form PEROXIDES are alkali metals, metal amides, and organometallic compounds with a metal atom bounded to carbon, and metal alkoxides.

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.

Additional Lab Specific Rules Here

POTENTIAL HAZARDS

- Peroxides and hydroperoxides are highly reactive materials and may be extremely shock-sensitive explosives.
- Moving or unscrewing the cap from a bottle contaminated with peroxides can lead to explosion, injury and/or death.
- Many chemicals form PEROXIDES when allowed access to air over a period of time. Enough air can be introduced upon opening the container for PEROXIDES to form. Some PEROXIDES become explosive upon concentration, as happens in distillation experiments. Others cause potentially explosive polymerization reactions to occur. Organic PEROXIDES are extremely sensitive to shock, heat, friction, light, strong oxidizers or reducers, or other forms of ignition.

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PEROXIDE FORMING CHEMICALS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

- Friction, grinding, and all forms of impact shall be avoided near PEROXIDES (especially solid ones). Glass containers that have screw cap lids or glass stoppers shall not be used. Polyethylene bottles that have screw-cap lids may be used.
- Metal spatulas shall not be used to handle PEROXIDES because contamination by metals can lead to explosive decomposition. Ceramic or wooden spatulas may be used.
- Pure compounds are more likely to have peroxide formation. Volatile compounds usually present greater hazard, as the PEROXIDES become concentrated when evaporation occurs.

HEALTH HAZARDS

- Harmful if swallowed.
- Irritating to eyes and skin.
- Vapors may cause drowsiness and dizziness. Aspiration hazard if swallowed - can enter lungs and cause damage.
- May cause irritation of respiratory tract.
- Repeated exposure may cause skin dryness or cracking.
- Hygroscopic

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn during operations in which PEROXIDE FORMING CHEMICALS might contact the eyes (e.g., through vapors or splashes of solution).
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use disposable nitrile gloves when working with PEROXIDE FORMING CHEMICALS. Check chemical compatibility chart for breakthrough time when using PEROXIDE FORMING CHEMICALS.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling PEROXIDE FORMING CHEMICALS. Protective clothing shall be worn to prevent any possibility of skin contact with PEROXIDE FORMING CHEMICALS.

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PEROXIDE FORMING CHEMICALS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

WORK PRACTICES

- All PEROXIDES FORMING CHEMICALS work shall be done in the laboratory fume hood.
- Peroxide hazard on concentration—do not distill or evaporate without first testing for the presence of PEROXIDES—discard or test for PEROXIDES after 6 months.
- The quantity of peroxide forming chemical used and stored shall be limited to the minimum amount required.
- Date peroxide forming chemicals when received and first opened.
- It may be dangerous to assume that a compound can be used for any procedure out of an unopened bottle. Tests have shown that 0.008 percent or more of peroxide (tested as H202) in any compound might be dangerous. According to the catalogs of several suppliers, no tetrahydrofuran presently sold is guaranteed to have less than 0.015 percent peroxide. Thus, even unopened containers might have dangerous quantities of PEROXIDES for a distillation or refluxing experiment. All containers shall be tested for PEROXIDES prior to a use that might concentrate a hazard, such as a distillation procedure.
- The sensitivity of most PEROXIDES to shock and heat can be reduced by dilution with inert solvents, such as aliphatic hydrocarbons. However, toluene is known to induce the decomposition of diacyl PEROXIDES.
- Solutions of PEROXIDES in volatile solvents shall not be used under conditions in which the solvent might be vaporized because this will increase the peroxide concentration in the solution.
- Metal spatulas shall not be used to handle PEROXIDES because contamination by metals can lead to explosive decomposition. Ceramic or wooden spatulas may be used.
- Smoking, open flames, and other sources of heat shall not be permitted near PEROXIDES.
- Friction, grinding, and all forms of impact shall be avoided near PEROXIDES (especially solid ones). Glass containers that have screw cap lids or glass stoppers shall not be used. Polyethylene bottles that have screw-cap lids may be used.
- Polymerizable monomers shall be stored with a polymerization inhibitor from which the monomer can be separated by distillation just before use. Common acrylic monomers such as acrylonitrile, acrylic acid, ethyl acrylate, and methyl methacrylate can form PEROXIDES, they have not been reported to develop hazardous levels in normal use and storage. The hazard from PEROXIDES in these compounds is substantially greater when they are stored in the liquid phase.
- Although air will not enter a gas cylinder in which gases are stored under pressure, these gases are sometimes transferred from the original cylinder to another in the laboratory, and it is difficult to be sure that there is no residual air in the receiving cylinder. An inhibitor shall be put into any such secondary cylinder before one of these gases is transferred into it; the supplier can suggest inhibitors to be used. The hazard posed by these gases is much greater if there is a liquid phase in such a secondary container, and even ignited gases that have been put into a secondary container under conditions that create a liquid phase shall be discarded within 12 months.
- Carry out distillation behind shields.
- Do not leave ethers for long periods of time (about six months), in a half-filled container or in the light.

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PEROXIDE FORMING CHEMICALS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Do not store with incompatible material
- PEROXIDE FORMING CHEMICALS may not be stored for more than one year. After one year these materials must be disposed.
- Store flammable PEROXIDE FORMING CHEMICALS in a flammable storage cabinet.
- Store peroxide forming chemicals away from heat and light.
- To minimize the rate of decomposition, PEROXIDES shall be stored at the lowest possible temperature consistent with their solubility or freezing point. Liquids or solutions of PEROXIDES shall not be stored at or lower than the temperatures at which the PEROXIDES freeze or precipitate because PEROXIDES in these forms are extremely sensitive to shock and heat.

Additional Lab Specific Special Handling/Storage Procedures

WASTE DISPOSAL

- PEROXIDE FORMING CHEMICALS may not be stored for more than one year. After one year these materials must be disposed.
- Excess PEROXIDE FORMING CHEMICALS and all waste material containing PEROXIDE FORMING CHEMICALS must be placed in a container labeled with the following **"HAZARDOUS WASTE PEROXIDE FORMING CHEMICALS"** , AND INCLUDE THE FULL CHEMICAL NAME.
- Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

PEROXIDE FORMING CHEMICALS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

FIRST AID

If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
In case of skin contact: Take off contaminated clothing and shoes immediately. Wash off in safety shower for at least 15 minutes and call x5911 for medical assistance.
In case of eye contact: Rinse thoroughly at eyewash for at least 15 minutes and call x5911 for medical assistance.
If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.
Call x5911 and describe the extent of injuries.
Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

SPILL AND ACCIDENT PROCEDURES

- If the chemical spilled is considered a carcinogen, reproductive toxin or highly toxic chemical, contact x3427 and evacuate area immediately, regardless of spill amount.
- If you are unsure if peroxides have formed, DO NOT MOVE the container. Evacuate the area and contact x3427.

For all other spills use the chart below for spill reporting and response:

SPILL QUANTITY	PROPER SPILL RESPONSE
Spill less than 500 mL	**Contact Environmental Health and Safety (x3427) and clean up spill using spill kit.**
Spill greater than 500 mL	**Do not attempt to clean up spill. Leave the area and immediately report to WFU Police (x5911) and EHS (x3427).**

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

PHENOL

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

- This SOP applies to PHENOL. Phenol is a very toxic mutagen. Target organs are Central nervous system, Kidney, Liver, Pancreas, and Spleen. Phenol is a vesicant and is rapidly absorbed through the skin.

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.

POTENTIAL HAZARDS

- Very hazardous on contact with skin. Corrosive and toxic.

HEALTH HAZARDS

- Contact may cause numbness or slight tingling, so employees may not be immediately aware of contact. If absorbed through the skin, it can cause muscle weakness, tremors, loss of coordination, shock, sudden collapse, coma, convulsions, organ damage, and death.
- Inhalation exposure is less likely – it does not evaporate easily at room temperature, but can be inhaled if heated and/or misted, or in the case of a large spill. If inhaled, phenol can cause upper respiratory irritation, lung damage, and CNS impairment. The OSHA PEL and ACGIH TLV are both 5 ppm as an 8 hour time-weighted average.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

PHENOL

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn during operations in which PHENOL might contact the eyes (e.g., through vapors or splashes of solution).
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use two pair disposable nitrile gloves when working with Phenol. Replace immediately if contaminated.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.
- If using phenol and chloroform together, North Silver Shield/4H gloves are to be worn.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling PHENOL. Protective clothing shall be worn to prevent any possibility of skin contact with PHENOL.

WORK PRACTICES

- Labs using Phenol or reagents containing Phenol (TRIzol) will have PEG300 or 400 available in the event of dermal exposure.
- Purchase in a shatter-resistant container if available (such as PVC-coated glass).
- Keep containers closed as much as possible.
- Use in the smallest quantities and lowest concentration practicable for the experiment being performed.
- Avoid heating if possible as this increases risk of inhalation exposure.
- After work with phenol is complete, wipe down work area with soap and water solution.

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Do not store with incompatible material.
- Store in secondary containment away from moisture, strong oxidizers, strong caustics, plastics, rubber, nitric acid, water + heat, and chemically active metals, such as aluminum and magnesium powder, sodium, potassium, and lithium.

Additional Lab Specific Special Handling/Storage Procedures

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

PHENOL

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

WASTE DISPOSAL

- Chemicals shall not be drain disposed unless prior approval is given by EH&S.
- Excess PHENOL and all waste material containing PHENOL must be placed in a container labeled with the following **"HAZARDOUS WASTE PHENOL"**, AND THE FULL CHEMICAL NAME.
  Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

FIRST AID

- If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
- **Quickly remove contaminated clothing.**
- **If a small area of skin has been exposed to phenol, swab polyethylene glycol 300 or 400 (PEG-300 or 400) onto the affected area immediately and repeatedly until the smell of phenol is no longer evident, then seek medical attention. If PEG-300 or 400 is not available, flush area with COPIOUS amounts of water (such as from a drench hose or safety shower) for at least 15 minutes, then seek medical attention.**
- **For larger areas of exposed skin or eye exposure, flush area with COPIOUS amounts of water for at least 15 minutes, then seek immediate medical attention. Please note that using high-density water irrigation will reduce phenol uptake, but if lesser amounts of water are used it will merely dilute the phenol and increase the area of exposure.**
- In case of eye contact: Rinse thoroughly with plenty of water at eyewash for at least 15 minutes and call x5911 for medical assistance.
- If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.
- Call x5911 and describe the extent of injuries.
- Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

PHENOL

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

- Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

SPILL AND ACCIDENT PROCEDURES

SPILL QUANTITY	PROPER SPILL RESPONSE
Spill less than 500 mL	**Contact Environmental Health and Safety (x3427) and clean up spill using spill kit. Avoid breathing vapors. Wear Silver Shield, Neoprene, or ChemTek Viton gloves.**
Spill greater than 500 mL	**Do not attempt to clean up spill. Leave the area and immediately report to WFU Police (x5911) and EHS (x3427).**

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

PYROPHORICS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

Pyrophorics can spontaneously ignite in air. Many pyrophorics are also water reactive, igniting on contact with water or high humidity.

Examples of pyrophoric materials include:

- Organometallic reagents such as alkyllithiums, alkylzincs, alkylmagnesiums (Grignards)
- Some finely divided metal powders.

Specific examples include diborane (B_2H_6), diethylzinc ($Zn(CH_2CH_3)_2$), *tert*-butyllithium ($LiC(CH_3)_3$) and diphosphine (P_2H_4).

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.

Prior to working with pyrophorics, the Aldrich Technical Bulletins AL-134, Handling Air-Sensitive Reagents and AL-164 Handling Pyrophoric Reagents must be read and all safety precautions followed.

POTENTIAL HAZARDS

- Pyrophorics can ignite in air spontaneously.
- Many pyrophorics are waster reactive, igniting upon contact with water or humidity in air.
- Synthetic fiber clothing must not be worn when working with PYROPHORICS. In event of fire, synthetic fibers will melt to skin, causing severe damage. Only natural fiber clothing may be worn when working with PYROPHORICS.
- *Check the Safety Data Sheet (SDS) to see if the material presents other hazards, such as corrosivity, teratogenicity, water reactivity, peroxide formation, or systemic effects. If other hazards are present, appropriate safety precautions should be addressed in this SOP.*

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

PYROPHORICS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

HEALTH HAZARDS

- **Inhalation:** May be harmful if inhaled. Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract. Vapors may cause drowsiness and dizziness.
- **Skin:** May be harmful if absorbed through skin. Causes skin burns.
- **Eyes:** Causes eye burns.
- **Ingestion:** May be harmful if swallowed. Aspiration hazard if swallowed - can enter lungs and cause damage.

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety goggles or face shields shall be worn during operations in which PYROPHORICS are used.
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use disposable nitrile gloves when working with PYROPHORICS. Check chemical compatibility chart for breakthrough time when using PYROPHORICS.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Flame resistant lab coat shall be worn (Nomex material or equivalent). Buttoned lab coat, closed toed shoes, long pants and long sleeved NATURAL FIBER clothing shall be worn when handling PYROPHORICS. Protective clothing shall be worn to prevent any possibility of skin contact with PYROPHORICS.

WORK PRACTICES

- Prior to working with pyrophorics, the Aldrich Technical Bulletins AL-134, Handling Air-Sensitive Reagents and AL-164 Handling Pyrophoric Reagents must be read and all safety precautions followed.
- Prior to working with pyrophorics, Section 6G in *Prudent Practices in the Laboratory* (National Academies Press) must be read.
- Purchase the smallest amount of pyrophoric materials.
- Set up a designated area for work with pyrophoric materials – a chemical fume hood and/or a (dry) glove box (with inert atmosphere, if needed) located within 10 seconds of an eyewash/drench hose, safety shower, and an appropriate fire extinguisher.
- Incompatible materials and flammable chemicals are to be removed from the area.
- A container of powdered lime or sand should be kept within arm's reach (for covering spills).
- Store and use pyrophoric chemicals under an inert atmosphere or under kerosene as appropriate.
- Mineral oil bubblers must be used to release pressure from reagent or reaction vessels.
- Know the location of the nearest compatible fire extinguisher and how to use it.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

PYROPHORICS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

- Before conducting the actual procedure, always perform a dry run (without the pyrophoric material) to identify and resolve possible safety hazards.
- Work within sight and/or hearing of at least one other person who is familiar with the hazards and written procedures.

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Liquid pyrophorics should be stored in sealed containers with PTFE-lined septa to prevent air exposure, and manipulated via syringe or cannula in a chemical fume hood (over a spill tray if possible) with the sash as low as possible.
- Solid pyrophorics must be handled only in an inert atmosphere glove box or glove bag.
- Do not store with incompatible material.

Additional Lab Specific Special Handling/Storage Procedures

WASTE DISPOSAL

- Excess PYROPHORICS and all waste material containing PYROPHORICS must be placed in a container labeled with the following **"HAZARDOUS WASTE PYROPHORICS"**, AND INCLUDE THE FULL CHEMICAL NAME.
- Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

PYROPHORICS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

FIRST AID

If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.

In case of skin contact: Take off contaminated clothing and shoes immediately. Wash off in safety shower for at least 15 minutes. Call x5911 for medical assistance.

In case of eye contact: Rinse thoroughly with plenty of water at eyewash for at least 15 minutes and call x5911 for medical assistance.

If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.

Call x5911 and describe the extent of injuries.

Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).

Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

SPILL AND ACCIDENT PROCEDURES

In the event of a spill of PYROPHORIC material evacuate area immediately and contact x3427 and x5911, regardless of spill amount.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

SODIUM AZIDE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

- This SOP applies to SODIUM AZIDE. Sodium azide is extremely toxic .

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.

POTENTIAL HAZARDS

- Shock sensitive!
- Forms toxic hydrazoic acid on contact with water or acids.
- May undergo violent decomposition at temperatures greater than 270°C.
- Sodium azide reacts with heavy metals and their salts to form heavy metal azides, which are shock-sensitive explosives. Do not store on metal shelves or use metal items to handle sodium azide (i.e., spatulas). Contact with metal shelves, containers, and utensils can result in formation of heavy metal azides and the risk of explosion.
- Sodium azide reacts violently with nitric acid, bromine, carbon disulfide, dimethylsulfate, and several heavy metals including copper and lead.
- Sodium Azide may react with lead and copper plumbing to form highly explosive metal azides.

HEALTH HAZARDS

- Sodium azide is extremely toxic (LD50 oral [rat] 27mg/kg). Ingesting a small amount can be lethal.
- **Inhalation:** May be harmful if inhaled. May cause respiratory tract irritation.
- **Skin:** May be fatal if absorbed through skin. May cause skin irritation.
- **Eyes:** May cause eye irritation.
- **Ingestion:** May be fatal if swallowed.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

SODIUM AZIDE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn during operations in which SODIUM AZIDE might contact the eyes (e.g., through vapors or splashes of solution).
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use 2 pair disposable nitrile gloves when working with SODIUM AZIDE. Check chemical compatibility chart for breakthrough time when using SODIUM AZIDE.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling SODIUM AZIDE. Protective clothing shall be worn to prevent any possibility of skin contact with SODIUM AZIDE.

WORK PRACTICES

- If hydrazoic acid or aerosols may be produced, sodium azide (and sodium azide solutions) must be handled in a chemical fume hood, exhausted biological safety cabinet with negative pressure ductwork, or other exhausted enclosure.
- If weighing dry powders and the balance cannot be located in a fume hood or BSC, tare a container then add the powdered sodium azide to the container in a hood and seal the container before returning to the balance to weigh the powder. (Do not use a metal scoop to transfer sodium azide powder!)
- Change gloves regularly (at least every two hours) and wash hands at the time of the glove change.
- Do not use a HEPA vacuum for cleaning up sodium azide – sodium azide could react with metal inside the vacuum.
- Keep containers closed as much as possible.
- Once work with sodium azide is complete, wipe down the work area with a soap and water solution.

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Do not store with incompatible material.
- Avoid formation of dust and aerosols.
- Never allow product to get in contact with water during storage.
- Do not store near acids.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

SODIUM AZIDE

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

Additional Lab Specific Special Handling/Storage Procedures

WASTE DISPOSAL

- Chemicals shall not be drain disposed unless prior approval is given by EH&S.
- Excess SODIUM AZIDE and all waste material containing SODIUM AZIDE must be placed in a container labeled with the following **"HAZARDOUS WASTE SODIUM AZIDE"**, AND THE FULL CHEMICAL NAME. Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

FIRST AID

- If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
- In case of skin contact: Take off contaminated clothing and shoes immediately. Wash off in safety shower for at least 15 minutes. Call x5911 for medical assistance.
- In case of eye contact: Rinse thoroughly with plenty of water at eyewash for at least 15 minutes and call x5911 for medical assistance.
- If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.
- Call x5911 and describe the extent of injuries.
- Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
- Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

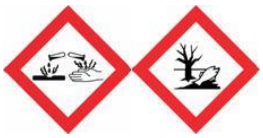
WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

SODIUM AZIDE

Effective Date:	8/23/2013	Revised Date:	8/23/2013

SPILL AND ACCIDENT PROCEDURES

SPILL QUANTITY	PROPER SPILL RESPONSE
Spill less than 500 mL	Contact Environmental Health and Safety (x3427) and clean up spill using spill kit. Avoid breathing vapors. DO NOT use metal instruments.
Spill greater than 500 mL	Do not attempt to clean up spill. Leave the area and immediately report to WFU Police (x5911) and EHS (x3427).

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

SODIUM HYPOCHLORITE (BLEACH)

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

- This SOP applies to SODIUM HYPOCHLORITE (BLEACH).

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.

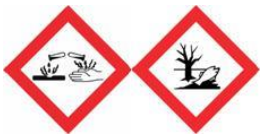
Additional Lab Specific Rules Here

POTENTIAL HAZARDS

- Causes severe skin burns and eye damage.
- Incompatibilities: Strong acids, Organic materials, powdered metals.
- Reacts violently with ammonium salts, aziridine, methanol, and phenylacetonitrile, sometimes resulting in explosions.
- Reacts with primary aliphatic or aromatic amines to form explosively unstable n-chloroamines.
- Reaction with formic acid becomes explosive at 55°C.

HEALTH HAZARDS

- **Inhalation:** May be harmful if inhaled. Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract.
- **Skin:** May be harmful if absorbed through skin. Causes skin burns.
- **Eyes:** Causes eye burns.
- **Ingestion:** May be harmful if swallowed.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

SODIUM HYPOCHLORITE (BLEACH)

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Tightly fitting safety goggles or faceshield (8-inch minimum) shall be worn during operations in which SODIUM HYPOCHLORITE might contact the eyes (e.g., through vapors or splashes of solution).

HAND PROTECTION

- Use disposable nitrile gloves when working with bleach. Check chemical compatibility chart for breakthrough time when using bleach.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling SODIUM HYPOCHLORITE. Protective clothing shall be worn to prevent any possibility of skin contact with SODIUM HYPOCHLORITE.

WORK PRACTICES

- ALWAYS check the Safety Data Sheet of a chemical/agent before mixing it with bleach to ensure compatibility.
- NEVER mix bleach with an unknown liquid or unknown residue.
- Do not mix bleach with any compound that is incompatible with oxidizers.

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Store SODIUM HYPOCHLORITE away from incompatibles.
- Never allow product to get in contact with water during storage. Do not store near acids.

Additional Lab Specific Special Handling/Storage Procedures

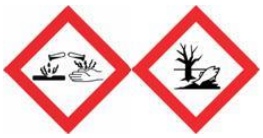
WASTE DISPOSAL

- Chemicals shall not be drain disposed unless prior approval is given by EH&S.
- Excess SODIUM HYPOCHLORITE and all waste material containing SODIUM HYPOCHLORITE must be placed in a container labeled with the following **"HAZARDOUS WASTE SODIUM HYPOCHLORITE"**, AND THE FULL CHEMICAL NAME.
- Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

SODIUM HYPOCHLORITE (BLEACH)

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

FIRST AID

- If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
- In case of skin contact: Take off contaminated clothing and shoes immediately. Wash off in safety shower for at least 15 minutes. Call x5911 for medical assistance.
- In case of eye contact: Rinse thoroughly with plenty of water at eyewash for at least 15 minutes and call x5911 for medical assistance.
- If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.
- Call x5911 and describe the extent of injuries.
- Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
- Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

SPILL AND ACCIDENT PROCEDURES

SPILL QUANTITY	PROPER SPILL RESPONSE
Spill less than 500 mL	**Contact Environmental Health and Safety (x3427) and clean up spill using spill kit. Avoid breathing vapors.**
Spill greater than 500 mL	**Do not attempt to clean up spill. Leave the area and immediately report to WFU Police (x5911) and EHS (x3427).**

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

WATER REACTIVES

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

Water reactive materials are incompatible with water. These chemicals undergo a chemical reaction with water that may release flammable or toxic gas. The heat of reaction is typically great enough to cause spontaneous combustion or explosion.
Examples of Water reactives include: alkali metals, alkaline earth metals, anhydrides, certain carbides, hydrides and sodium hyposulfite.

GENERAL LAB RULES

- No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
- Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
- Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.

Additional Lab Specific Rules Here

POTENTIAL HAZARDS

- Water reactives are materials which react violently with water to produce heat and flammable or toxic gas.
- The heat generated by reactions is typically sufficient to ignite the hydrogen gas evolved in the reaction, resulting in a powerful explosion.
- These materials may present other hazards, such as corrosivity, teratogenicity, water reactivity, peroxide formation, or systemic effects. *Review the SDS for the specific chemical prior to use*.
- In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

WATER REACTIVES

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

HEALTH HAZARDS

- **Inhalation:** May be harmful if inhaled. Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract.
- **Skin:** May be harmful if absorbed through skin. Causes skin burns.
- **Eyes:** May cause eye burns.
- **Ingestion:** May be harmful if swallowed.

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn during operations in which WATER REACTIVES might contact the eyes (e.g., through vapors or splashes of solution).
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use disposable nitrile gloves when working with chemicals. Check chemical compatibility chart for breakthrough time when using
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling WATER REACTIVES. Protective clothing shall be worn to prevent any possibility of skin contact with WATER REACTIVES.

WORK PRACTICES

- *Specific written procedures, approved in advance by the Principal Investigator (signature required at top of customized SOP), are required. These must include a designated work area (under Additional Lab Rules) and cover all sections of this template.*
- Before working with these compounds, read the Safety Data Sheet (SDS) and other reference material carefully.
- Purchase minimal amounts of water-reactive materials.
- Make sure an appropriate fire extinguisher is available.
- Before conducting the actual procedure, always perform a dry run (without the water reactive material) to identify and resolve possible safety hazards.
- Work within sight and/or hearing of at least one other person who is familiar with the hazards and written procedures.

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

WATER REACTIVES

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Do not store with incompatible material.
- Store in a cool, dry place, off the floor.
- Do not store under, over, or around sinks or other sources of water (i.e. safety showers or eyewash stations).
- Isolate in water tight or water resistant container.
- Store alkali metals under mineral oil to prevent exposure to moisture in the air.

Additional Lab Specific Special Handling/Storage Procedures

WASTE DISPOSAL

- Excess WATER REACTIVES and all waste material containing WATER REACTIVES must be placed in a container labeled with the following **"HAZARDOUS WASTE WATER REACTIVES"**, AND INCLUDE THE FULL CHEMICAL NAME.
- Contact EHS at x3427 for hazardous waste removal.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

WATER REACTIVES

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

FIRST AID

- If chemical exposure occurs, remove contaminated clothing and flush exposed area for 15 to 20 minutes using emergency eyewash station and/or safety shower.
- If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
- Call x5911 and describe the extent of injuries.
- Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
- Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

SPILL AND ACCIDENT PROCEDURES

If the chemical spilled is considered a carcinogen, reproductive toxin or highly toxic chemical, contact x3427 and evacuate area immediately, regardless of spill amount.
In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
DO NOT USE WATER FOR CLEAN UP. See SDS for details.
For all other spills use the chart below for spill reporting and response:

SPILL QUANTITY	PROPER SPILL RESPONSE
Spill less than 500 mL	**Contact Environmental Health and Safety (x3427) and clean up spill using spill kit.**
Spill greater than 500 mL	**Do not attempt to clean up spill. Leave the area and immediately report to WFU Police (x5911) and EHS (x3427).**

Appendix II: Carcinogens, Reproductive Toxins, Select Agents and Toxins

Source: http://www.ehs.wustl.edu/Bluebook/carcinogenlist.html

Chemical Carcinogen	CAS Number
A-alpha-C (2-Amino-9H-pyrido[2,3-b]indole)	26148-68-5
Acetaldehyde	75-07-0
Acetamide	60-35-5
Acetochlor	34256-82-1
2-Acetylaminofluorene	53-96-3
Acifluorfen	62476-59-9
Acrylamide	79-06-1
Acrylonitrile	107-13-1
Actinomycin D	50-7-60
Adriamycin (Doxorubicin hydrochloride)	23214-92-8
AF-2;[2-(2-furyl)-3-(5-nitro-2-furyl)]acrylamide	3688-53-7
Aflatoxins	1402-68-2
Alachlor	15972-60-8
Alcoholic beverages, when associated with alcohol abuse	n/a
Aldrin	309-00-2
Allyl chloride	107-05-1
Aluminum products	n/a
2-Aminoanthraquinone	117-79-3
p-Aminoazobenzene	60-09-3
ortho-Aminoazotoluene	97-56-3
4-Aminobiphenyl (4-aminodiphenyl)	92-67-1
3-Amino-9-ethylcarbazole hydrochloride	6109-97-3
1-Amino-2-methylanthraquinone	82-28-0
2-Amino-5-(5-nitro-2-furyl)-1,3,4-thiadiazole	712-68-5
Amitrole	61-82-5
Analgesic mixtures containing phenacetin	n/a
Androgenic (anabolic) steroids	n/a
Aniline	62-53-3
ortho-Anisidine	90-04-0
ortho-Anisidine hydrochloride	134-29-2
Antimony oxide (antimony trioxide)	1309-64-4
Aramite	140-57-8
Arsenic (inorganic arsenic compounds)	various
Asbestos	1332-21-4
Auramine	492-80-8
Azaserine	115-02-6
Azathioprine	446-86-6
Azacitidine	320-67-2
Azobenzene	103-33-3
Benz[a]anthracene	56-55-3
Benzene	71-43-2
Benzidine [and its salts]	92-87-5
Benzidine-based dyes	various
Benzo[b]fluoranthene	205-99-2
Benzo[j]fluoranthene	205-82-3
Benzo[k]fluoranthene	207-08-9
Benzofuran	271-89-6
Benzo[a]pyrene	50-32-8
Benzotrichloride	98-07-7
Benzyl chloride	100-44-7
Benzyl violet 4B	1694-09-3
Beryllium and beryllium compounds	various
Betel quid with tobacco	n/a
Bis(2-chloroethyl)ether	111-44-4
N,N-Bis(2-chloroethyl)-2- naphthylamine (Chlornapazine)	494-03-1
Bischloroethyl nitrosourea (BCNU) (Carmustine)	154-93-8
Bis(chloromethyl)ether	542-88-1
Bitumens, extracts of steam-refined and air refined	various
Bleomycins	various

Chemical Carcinogen	CAS Number
Bracken fern	n/a
Bromodichloromethane	75-27-4
Bromoform	75-25-2
1,3-Butadiene	106-99-0
1,4-Butanediol dimethanesulfonate (Busulfan)	55-98-1
Butylated hydroxyanisole (BHA)	25013-16-5
beta-Butyrolactone	3068-88-0
Cadmium and cadmium compounds	various
Caffeic acid	331-39-5
Captafol	2425-06-1
Captan	133-06-2
Carbon tetrachloride	56-23-5
Carbon-black extracts	n/a
Carrageenan, degraded	n/a
Ceramic fibers (airborne particles of respirable size)	n/a
Certain combined chemotherapy drugs for lymphomas	n/a
Chlorambucil	305-03-3
Chloramphenicol	56-75-7
Chlordane	57-74-9
Chlordecone (Kepone)	143-50-0
Chlordimeform	6164-98-3
Chlorendic acid (approximately 60 percent chlorine by weight)	115-28-6
Chlorinated Parrafins (C12, 60% chlorine)	108171-26-2
alpha-Chlorinated toluenes	various
p-Chloroaniline	106-47-8
Chlorodibromomethane	124-48-1
Chloroethane (ethyl chloride)	75-00-3
1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU) (Lomustine)	13010-47-4
1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea (Methyl-CCNU)	13909-09-6
Chloroform	67-66-3
Chloromethyl methyl ether (technical grade)	107-30-2
3-Chloro-2-methylpropene	563-47-3
4-Chloro-ortho-phenylenediamine	95-83-0
p-Chloro-o-toluidine	95-69-2
Chlorophenols	various
Chlorophenoxy herbicides	various
Chlorothalonil	1897-45-6
Chlorozotocin	54749-90-5
Chromium (hexavalent compounds)	various
Chrysene	218-01-9
C. I. Acid Red 114	6459-94-5
C. I. Basic Red 9 monohydrochloride	569-61-9
Ciclosporin (Cyclosporin A; Cyclosporine)	59865-13-3
Cinnamyl anthranilate	87-29-6
Cisplatin	15663-27-1
Citrus Red No. 2	6358-53-8
Coal gasification	n/a
Coal-tar pitches	n/a
Coal-tars	n/a
Cobalt metal powder	7440-48-4
Cobalt [II] oxide	1307-96-6
Coke Production oven emissions	n/a
Conjugated estrogens	n/a
Creosotes	n/a
para-Cresidine	120-71-8
Cupferron	135-20-6
Cycasin	14901-08-7
Cyclophosphamide (anhydrous)	50-18-0
Cyclophosphamide (hydrated)	6055-19-2

Chemical Carcinogen	CAS Number
D&C Orange No. 17	3468-63-1
D&C Red No. 8	2092-56-0
D&C Red No. 9	5160-02-1
D&C Red No. 19	81-88-9
Dacarbazine	4342-03-4
Daminozide	1596-84-5
Dantron (Chrysazin; 1,8-Dihydroxyanthraquinone)	117-10-2
Daunomycin	20830-8-13
DDD (Dichlorodiphenyldichloroethane)	72-5-48
DDE (Dichlorodiphenyldichloroethylene)	72-55-9
DDT (Dichlorodiphenyltrichloroethane)	50-29-3
DDVP (Dichlorvos)	62-73-7
N,N'-Diacetylbenzidine	613-35-4
2,4-Diaminoanisole	615-05-4
2,4-Diaminoanisole sulfate	39156-41-7
4,4'-Diaminodiphenyl ether (4,4'-Oxydianiline)	101-80-4
2,4-Diaminotoluene	95-80-7
Diaminotoluene (mixed)	n/a
Dibenz[a,h]acridine	226-36-8
Dibenz[a,j]acridine	224-42-0
Dibenz[a,h]anthracene	53-70-3
7H-Dibenzo[c,g]carbazole	194-59-2
Dibenzo[a,e]pyrene	192-65-4
Dibenzo[a,h]pyrene	189-64-0
Dibenzo[a,i]pyrene	189-55-9
Dibenzo[a,l]pyrene	191-30-0
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8
1,2-Dibromoethane	106-93-4
2,3-Dibromo-1-propanol	96-13-9
p-Dichlorobenzene	106-46-7
3,3'-Dichlorobenzidine	91-9-41
3,3'-Dichlorobenzidine 2HCl	612-83-9
1,4-Dichloro-2-butene	764-41-0
3,3'-Dichloro-4,4'-diaminodiphenyl ether	28434-86-8
1,1-Dichloroethane	75-34-3
1,2-Dichloroethane	107-06-2
Dichloromethane (Methylene chloride)	75-09-2
1,2-Dichloropropane	78-87-5
1,3-Dichloropropene (technical grade)	542-75-6
Dieldrin	60-57-1
Dienestrol	84-17-3
Diepoxybutane	1464-53-5
Diesel engine exhaust	n/a
Di(2-ethylhexyl)phthalate	117-81-7
1,2-Diethylhydrazine	1615-80-1
Diethyl sulfate	64-67-5
Diethylstilbestrol	56-53-1
Diglycidyl resorcinol ether (DGRE)	101-90-6
Dihydrosafrole	94-58-6
Diisopropyl sulfate	2973-10-6
3,3'-Dimethoxybenzidine (ortho-Dianisidine)	119-90-4
3,3'-Dimethoxybenzidine dihydrochloride (ortho-dianisidine dihydrochloride)	20325-40-0
para-Dimethylaminoazobenzene	60-11-7
4-Dimethylaminoazobenzene	60-11-7
trans-2-[(Dimethylamino)methylimino]-5-[2-(5-nitro-2-furyl)vinyl]-1,3,4- oxadiazole	55738-54-0
7,12-Dimethylbenz(a)anthracene	57-97-6
3,3'-Dimethylbenzidine (ortho-Tolidine)	119-93-7
3,3'-Dimethylbenzidine dihydrochloride	612-82-8
Dimethylcarbamoyl chloride	79-44-7

Chemical Carcinogen	CAS Number
1,1-Dimethylhydrazine (UDMH)	57-14-7
1,2-Dimethylhydrazine	540-73-8
Dimethyl sulfate	77-78-1
Dimethylvinyl Chloride	513-37-1
1,6-Dinitropyrene	42397-64-8
1,8-Dinitropyrene	42397-65-9
2,4-Dinitrotoluene	121-14-2
2,6-Dinitrotoluene	606-20-2
1,4-Dioxane	123-91-1
Diphenylhydantoin (Phenytoin)	57-41-0
Diphenylhydantoin (Phenytoin), sodium salt	630-93-3
Direct Black 38 (technical grade)	1937-37-7
Direct Blue 6 (technical grade)	2602-46-2
Direct Brown 95 (technical grade)	16071-86-6
Disperse Blue 1	2475-45-8
Epichlorohydrin	106-89-8
Erionite	12510-42-8
Estradiol 17B	50-28-2
Estrone	53-16-7
Ethinylestradiol	57-63-6
Ethyl acrylate	140-88-5
Ethyl methanesulfonate	62-50-0
Ethyl-4,4'-dichlorobenzilate	510-15-6
Ethylene dibromide	106-93-4
Ethylene dichloride (1,2-Dichloroethane)	107-06-2
N-Ethyl-N-nitrosourea	759-73-9
Ethylene oxide	75-21-8
Ethylene thiourea	96-45-7
Ethyleneimine	151-56-4
Folpet	133-07-3
Formaldehyde (gas or aqueous solution)	50-00-0
2-(2-Formylhydrazino)-4-(5-nitro-2-furyl) thiazole	3570-75-0
Furan	110-00-9
Furazolidone	67-45-8
Furmecyclox	60568-05-0
Fusarin C	
Gasoline engine exhaust (condensates/extracts)	n/a
Glasswool fibers (airborne particles of respirable size)	n/a
Glu-P-1 (2-Amino-6-methyldipyrido[1,2- a:3', 2'-d]imidazole)	67730-11-4
Glu-P-2 (2-Aminodipyrido[1,2-a:3',2'-d]imidazole)	67730-10-3
Glycidaldehyde	765-34-4
Glycidol	556-52-5
Griseofulvin	126-07-8
Gyromitrin (Acetaldehyde methylformylhydrazone)	16568-02-8
HC Blue 1	2784-94-3
Heptachlor	76-44-8
Heptachlor epoxide	1024-57-3
Hexachlorobenzene	118-74-1
Hexachlorocyclohexanes (technical grade)	various
Hexachlorodibenzodioxin	34465-46-8
Hexachloroethane	67-72-1
Hexamethylphosphoramide	680-31-9
Hydrazine	302-01-2
Hydrazine sulfate	10034-93-2
Hydrazobenzene (1,2-Diphenylhydrazine)	122-66-7
Indeno [1,2,3-cd]pyrene	193-39-5
IQ (2-Amino-3-methylimidazo[4,5-f]quinoline)	76180-96-6
Iron dextran complex	9004-66-4
Isosafrole	120-58-1

Chemical Carcinogen	CAS Number
Kepone (Chlordecone)	143-50-0
Lactofen	77501-63-4
Lasiocarpine	303-34-4
Lead acetate	301-04-2
Lead and lead compounds	various
Lead phosphate	7446-27-7
Lindane and other hexachlorocyclohexane isomers	various
Mancozeb	8018-01-7
Maneb	12427-38-2
Me-A-alpha-C (2-Amino-3-methyl-9H-pyrido[2, 3-b]indole)	68006-83-7
Medroxyprogesterone acetate	71-58-9
MeIQ(2-Amino-3,4-dimethylimidazo[4,5-f]quinoline)	
MeIQx(2-Amino-3,8-dimethylimidazo[4,5-f]quinoxaline)	7500-04-0
Melphalan	148-82-3
Merphalan	531-76-0
Mestranol	72-33-3
Methoxsalen with ultraviolet A therapy	n/a
8-Methoxypsoralen with ultraviolet A therapy	298-81-7
5-Methoxypsoralen with ultraviolet A therapy	484-20-8
2-Methylaziridine (Propyleneimine)	75-55-8
Methylazoxymethanol	590-96-5
Methylazoxymethanol acetate	592-62-1
3-Methylcholanthrene	56-49-5
5-Methylchrysene	3697-24-3
4,4'-Methylene bis(2-chloroaniline) (MOCA)	101-14-4
4,4'-Methylene bis(N,N-dimethyl)benzenamine	101-61-1
4,4'-Methylene bis(2-methylaniline)	838-88-0
4,4'-Methylenedianiline	101-77-9
4,4'-Methylenedianiline dihydrochloride	13552-44-8
Methylhydrazine and its salts	13552-44-8
Methyl chloromethyl ether	107-30-2
Methyl-CCNU	13909-09-6
Methyl iodide	74-88-4
Methyl methanesulfonate	66-27-3
2-Methyl-1-nitroanthraquinone (of uncertain purity)	129-15-7
N-Methyl-N'-nitro-N-nitrosoguanidine (MNNG)	70-25-7
N-Methyl-N-nitrosourea	
N-Methylolacrylamide	924-42-5
Methylthiouracil	56-04-2
Metiram	9006-4222
Metronidazole	443-48-1
Michler's ketone	90-94-8
Mineral Oils, untreated and mildly treated	n/a
Mirex	2385-85-5
Mitomycin C	50-07-7
MOPP	
Monocrotaline	135-22-0
5-(Morpholinomethyl)-3-[(5-nitro-fufurylidene)-amino]-2-oxazolidinone	139-91-3
Mustard gas	505-60-2
Nafenopin	3771-19-5
1-Naphthylamine	134-32-7
2-Naphthylamine	91-59-8
3-Naphthylamine	
Nickel and certain nickel compounds	various
Nickel carbonyl	
Nickel refinery dust, from the pyrometallurgical process	7440-02-0
Nickel subsulfide	12035-72-2
Niridazole	61-57-4
Nitrilotriacetic acid	139-13-9

Chemical Carcinogen	CAS Number
Nitrilotriacetic acid, trisodium salt monohydrate	18662-53-8
5-Nitroacenaphthene	602-87-9
5-Nitro-o-anisidine	99-59-2
o-Nitroanisole	91-23-6
4-Nitrobiphenyl	92-93-3
6-Nitrochrysene	7496-02-8
Nitrofen (technical grade)	1836-755
2-Nitrofluorene	607-57-8
Nitrofurazone	59-87-0
1-[(5-Nitrofurfurylidene)amino]-2-imidazollidinone	555-84-0
1-[(5-Nitrofurfurylidene)-N-[4-(5-Nitro-2-furyl)-2 thiazolyl]acetamide	531-82-8
Nitrogen mustard (Mechlorethamine)	51-75-2
Nitrogen mustard hydrochloride (Mechlorethamine hydrochloride)	55-86-7
Nitrogen mustard N-oxide	126-85-2
Nitrogen mustard N-oxide hydrochloride	302-70-5
2-Nitropropane	79-46-9
4-Nitropyrene	57835-92-4
N-Nitrosodi-n-butylamine	924-16-3
N-Nitrosodiethanolamine	1116-54-7
N-Nitrosodiethylamine	55-18-5
N-Nitrosodimethylamine	62-75-9
p-Nitrosodiphenylamine	156-10-5
N-Nitrosodiphenylamine	86-30-6
N-Nitrosodi-n-propylamine	
N-Nitroso-N-ethylurea	759-73-9
3-(N-Nitrosomethylamino)propionitrile	60153-49-3
4-(N-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4
N-Nitrosomethylethylamine	10595-95-6
N-Nitroso-N-methylurea	684-93-5
N-Nitroso-N-methylurethane	615--532
N-Nitrosomethylvinylamine	4549-40-0
N-Nitrosomorpholine	59-89-2
N-Nitrosonornicotine	16543-55-8
N-Nitrosopiperidine	100-75-4
N-Nitrosopyrrolidine	930-55-2
N-Nitrososarcosine	13256-22-9
Norethisterone (Norethindrone)	68-22-4
Ochratoxin A	303-47-9
Oestrogen replacement therapy	n/a
Oestrogen, nonstreoidal	
Oestrogen, steroidal	
Oil Orange SS	2646-17-5
Oral contraceptives, combined	n/a
Oral contraceptives, sequential	n/a
4,4'-Oxydianiline	101-80-4
Oxadiazon	19666-30-9
Oxymetholone	434-07-1
Oxazepam	604-75-1
Panfuran S	794-93-4
Pentachlorophenol	87-86-5
Phenacetin	62-44-2
Phenazopyridine hydrochloride	136-40-3
Phenesterin	3546-10-9
Phenobarbital	50-06-6
Phenoxybenzamine	
Phenoxybenzamine hydrochloride	63-92-3
Phenyl glycidyl ether	122-60-1
Phenylhydrazine and its salts	various
o-Phenylphenate, sodium	132-27-4

Chemical Carcinogen	CAS Number
Phenytoin	57-41-0
PhiP(2-Amino-1-methyl-6-phenylimidazol[4,5-b]pyridine)	105650-23-5
Polybrominated biphenyls	various
Polychlorinated biphenyls	various
Polychlorinated biphenyls (containing 60 or more percent chlorine by molecular weight)	various
Polychlorinated dibenzo-p-dioxins	various
Polychlorinated dibenzofurans	various
Polycyclic aromatic hydrocarbons	various
Polygeenan	53973-98-1
Ponceau MX	3761-53-3
Ponceau 3R	3564-09-8
Potassium bromate	7758-01-2
Procarbazine	671-16-9
Procarbazine hydrochloride	366-70-1
Procymidone	32809-16-8
Progesterone	57-83-0
Progestins	various
1,3-Propane sultone	1120-71-4
Progargite	2312-35-8
beta-Propiolactone	57-57-8
Propylene oxide	75-56-9
Propylthiouracil	51-52-5
Radionuclides	various
Radon	10043-92-2
Reserpine	50-55-5
Residual (heavy) fuel oils	n/a
Saccharin	81-07-2
Saccharin, sodium	128-44-9
Safrole	94-59-7
Selenium sulfide	7446-34-6
Shale-oils	68308-34-9
Silica, crystalline (airborne particles of respirable size)	n/a
Sodium ortho-phenylphenate	
Soots, tars, and mineral oils (untreated and mildly treated oils and used engine oils)	n/a
Sterigmatocystin	10048-13-2
Streptozotocin	18883-66-4
Styrene	100-42-5
Styrene oxide	96-09-3
Sulfallate	95-06-7
Talc containing asbestiform fibers	n/a
Terrazole	2593-15-9
Testosterone and its esters	58-22-0
2,3,7,8-Tetrachlorodibenzo-para-dioxin (TCDD)	1746-01-6
1,1,2,2-Tetrachloroethane	79-34-5
Tetrachloroethylene (Perchloroethylene)	127-18-4
p-a,a,a-Tetrachlorotoluene	5216-25-1
Tetranitromethane	509-14-8
Thioacetamide	62-55-5
4,4'-Thiodianiline	139-65-1
Thiourea	62-56-6
Thorium dioxide	1314-20-1
Tobacco, oral use of smokeless products	n/a
Tobacco smoke	n/a
Toluene diisocyanate	26471-62-5
ortho-Toluidine	95-53-4
ortho-Toluidine hydrochloride	636-21-5
para-Toluidine	106-49-0
Toxaphene (Polychorinated camphenes)	8001-35-2
Treosulfan (Tresoluphan)	299-75-2

Chemical Carcinogen	CAS Number
Trichlormethine (Trimustine hydrochloride)	817-09-4
2,4,6-Trichlorophenol	88-06-2
1,2,3-Trichloropropane	96-18-4
Triphenyltin hydroxide	76-87-9
Trichloroethylene	79-01-6
Tris(aziridinyl)-para-benzoquinone (Triaziquone)	68-76-8
Tris(1-aziridinyl)phosphine sulfide (Thiotepa)	52-24-4
Tris(2-chloroethyl) phosphate	115-96-8
Tris(2,3-dibromopropyl)phosphate	126-72-7
Trp-P-1 (Tryptophan-P-1) (3-Amino-1,4-dimethyl-5H-pyrido[4,3-b]indole)	62450-06-0
Trp-P-2 (Tryptophan-P-2) (3-Amino-1-methyl-5H-pyrido[4,3-b]indole)	62450-07-1
Trypan blue (commercial grade)	72-57-1
Unleaded gasoline (wholly vaporized)	n/a
Uracil mustard	66-75-1
Urethane (Ethyl carbamate)	51-79-6
Vinyl bromide	593-60-2
Vinyl chloride	75-01-4
4-Vinyl-1-cyclohexene diepoxide (Vinyl cyclohexene dioxide)	106-87-6
Vinyl trichloride (1,1,2-Trichloroethane)	79-00-5
2,6-Xylidine (2,6-Dimethylaniline)	87-62-7
Zineb	12122-67-7

CHEMICALS KNOWN TO CAUSE REPRODUCTIVE TOXICITY	CAS Number
Developmental Toxicity	
Acetohydroxamic acid	546-88-3
Actinomycin D	50-76-0
All-trans retinoic acid	302-79-4
Alprazolam	28981-97-7
Amikacin sulfate	39831-55-5
Aminoglutethimide	125-84-8
Aminoglycosides	various
Aminopterin	54-62-6
Angiotensin converting enzyme (ACE) inhibitors	various
Anisindione	117-37-3
Aspirin (NOTE: It is especially important not to use aspirin during the last three months of pregnancy, unless specifically directed to do so by a because it may cause problems in the unborn child or complications during delivery.)	50-78-2
Barbiturates	various
Benomyl	17804-35-2
Benzphetamine hydrochloride	5411-22-3
Benzodiazepines	various
Bischloroethyl nitrosourea (BCNU) (Carmustine)	1540-93-8
Bromoxynil	1689-84-5
Butabarbital sodium	143-81-7
1,4-Butanediol dimethylsulfonate (Busulfan)	55-98-1
Carbon disulfide	75-15-0
Carbon monoxide	630-08-0
Carboplatin	41575-94-4
Chenodiol	474-25-9
Chlorcyclizine hydrochloride	1620-21-9
Chlorambucil	305-03-3
Chlordecone (Kepone)	143-50-0
Chlordiazepoxide	58-25-3
Chlordiazepoxide hydrochloride	438-41-5
1-(2-Chloroethyl)-3-cyclohexyl-l-nitrosourea (CCNU) (Lomustine)	13010-47-4
Clomiphene citrate	50-41-9
Clorazepate dipotassium	57109-90-7
Cocaine	50-36-2
Colchicine	64-86-8
Conjugated estrogens	n/a
Cyanazine	21725-46-2
Cycloheximide	66-81-9
Cyclophosphamide (anhydrous)	50-18-0
Cyclophosphamide (hydrated)	6055-19-2
Cyhexatin	13121-70-5
Cytarabine	147-94-4
Danazol	17230-88-5
Daunorubicin hydrochloride	23541-50-6
Demeclocycline hydrochloride (internal use)	64-73-3
Diazepam	439-14-5
Dicumarol	66-76-2
Diethylstilbestrol (DES)	56-53-1

CHEMICALS KNOWN TO CAUSE REPRODUCTIVE TOXICITY	CAS Number
Developmental Toxicity	
Dinoseb	88-85-7
Diphenylhydantoin (Phenytoin)	57-41-0
Doxycycline (internal use)	564-25-0
Doxycycline calcium (internal use)	94088-85-4
Doxycycline hyclate (internal use)	24390-14-5
Doxycycline monohydrate (internal use)	17086-28-1
Ergotamine tartrate	379-79-3
Ethyl alcohol in alcoholic beverages	n/a
Ethylene glycol monoethyl ether	110-80-5
Ethylene glycol monomethyl ether	109-86-4
Ethylene glycol monoethyl ether acetate	111-15-9
Ethylene glycol monomethyl ether acetate	110-49-6
Ethylene thiourea	96-45-7
Etoposide	33419-42-0
Etretinate	54350-48-0
Fluorouracil	51-21-8
Fluoxymesterone	76-43-7
Flurazepam hydrochloride	1172-18-5
Flutamide	13311-84-7
Halazepam	23092-17-3
Hexachlorobenzene	118-74-1
Ifosfamide	3778-73-2
Iodine-131	10043-66-0
Isotretinoin	4759-48-2
Lead	7439-92-1
Lithium carbonate	554-13-2
Lithium citrate	919-16-4
Lorazepam	846-49-1
Lovastatin	75330-75-5
Medroxyprogesterone acetate	71-58-9
Megestrol acetate	595-33-5
Melphalan	148-82-3
Menotropins	9002-68-0
Meprobamate	57-53-4
Mercaptopurine	6112-76-1
Mercury and mercury compounds	various
Methacycline hydrochloride	3963-95-9
Methimazole	60-56-0
Methotrexate	59-05-2
Methotrexate sodium	15475-56-6
Methyl bromide as a structural fumigant	74-83-9
Methyl mercury (dimethyl mercury)	593-74-8
Methyltestosterone	58-18-4
Midazolam hydrochloride	59467-96-8
Minocycline hydrochloride (internal use)	13614-98-7
Misoprostol	59122-46-2
Mitoxantrone hydrochloride	70476-82-3

CHEMICALS KNOWN TO CAUSE REPRODUCTIVE TOXICITY	CAS Number
Developmental Toxicity	
Neomycin sulfate (internal use)	1405-10-3
Netilmicin sulfate	56391-57-2
Nicotine	54-11-5
Nitrogen mustard (Mechlorethamine)	51-75-2
Nitrogen mustard hydrochloride (Mechlorethamine hydrochloride)	55-86-7
Norethisterone (Norethindrone)	68-22-4
Norethisterone acetate (Norethindrone acetate)	51-98-9
Norethisterone (Norethindrone)/Ethinyl estradiol	68-22-4/57-63-6
Norethisterone (Norethindrone)/Mestranol	68-22-4/72-33-3
Norgestrel	6533-00-2
Oxazepam	604-75-1
Oxytetracycline (internal use)	79-57-2
Oxytetracycline hydrochloride(internal use)	2058-46-0
Paramethadione	115-67-3
Penicillamine	52-67-5
Pentobarbital sodium	63-98-9
Phenprocoumon	435-97-2
Pipobroman	54-91-1
Plicamycin	18378-89-7
Polybrominated biphenyls	922-66-0
Polychlorinated biphenyls	various
Procarbazine hydrochloride	366-70-1
Propylthiouracil	51-52-5
Retinol/retinyl esters, when in daily dosages in excess of 10,000 IU, or 3,000 retinol equivalents. (NOTE: Retinol/retinyl esters are required and essential for maintenance of normal reproductive function. The recommended daily level during pregnancy is 8,000 IU.)	
Ribavirin	
Secobarbital sodium	309-43-3
Streptomycin sulfate	3810-74-0
Tamoxifen citrate	54965-24-1
Temazepam	846-50-4
Testosterone cypionate	58-20-8
Testosterone enanthate	315-37-7
2,3,7,8-Tetrachlorodibenzo-para-dioxin (TCDD)	1746-01-6
Tetracyclines (internal use)	various
Tetracycline (internal use)	60-54-8
Tetracycline hydrochloride (internal use)	64-75-5
Thalidomide	50-35-1
Thioguanine	154-42-7
Tobacco smoke (primary)	n/a
Tobramycin sulfate	108-88-3
Triazolam	28911-01-5
Trilostane	13647-35-3
Trimethadione	127-48-0
Uracil mustard	66-75-1
Urethane	51-79-6
Urofollitropin	26995-91-5
Valproate (Valproic acid)	99-66-1
Vinblastine sulfate	143-67-9
Vincristine sulfate	2068-78-2
Warfarin	81-81-2

Female Reproductive Toxicity	**CAS Number**
Aminopterin	54-62-6
Anabolic steroids	n/a
Aspirin(NOTE: It is especially important not to use aspirin during the last three months of pregnancy, unless specifically directed to do so by a physician because it may cause problems in the unborn child or complications during delivery.)	50-78-2
Carbon disulfide	75-15-0
Cocaine	50-36-2
Cyclophosphamide (anhydrous)	50-18-0
Cyclophosphamide (hydrated)	6055-19-2
Ethylene oxide	75-21-8
Lead	
Tobacco smoke (primary)	n/a
Uracil mustard	66-75-1

Male Reproductive Toxicity	**CAS Number**
Anabolic steroids	n/a
Benomyl	17804-35-2
Carbon disulfide	75-15-0
Colchicine	64-86-8
Cyclophosphamide (anhydrous)	50-18-0
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8
m-Dinitrobenzene	99-65-0
o-Dinitrobenzene	528-29-0
p-Dinitrobenzene	100-25-4
Dinoseb	88-85-7
Ethylene glycol monoethyl ether	110-80-5
Ethylene glycol monomethyl ether	109-86-4
Ethylene glycol monoethyl ether acetate	111-15-9
Ethylene glycol monomethyl ether acetate	110-49-6
Hexamethylphosphoramide	680-31-9
Lead	7439-92-1
Nitrofurantoin	67-20-9
Tobacco smoke (primary)	n/a
Uracil mustard	66-75-1

The following biological agents and toxins have been determined to have the potential to pose a severe threat to both human and animal health, to plant health, or to animal and plant products. An attenuated strain of a select agent or an inactive form of a select toxin may be excluded from the requirements of the Select Agent Regulations. The list of excluded agents and toxins can be found at:http://www.selectagents.gov/Select%20Agents%20and%20Toxins%20Exclusions.html.

HHS AND USDA SELECT AGENTS AND TOXINS
7 CFR Part 331, 9 CFR Part 121, and 42 CFR Part 73

HHS SELECT AGENTS AND TOXINS

Abrin
Botulinum neurotoxins*
Botulinum neurotoxin producing species of*Clostridium**
Conotoxins (Short, paralytic alpha conotoxins containing the following amino acid sequence $X_1CCX_2PACGX_3X_4X_5X_6CX_7$)
Coxiella burnetii
Crimean-Congo haemorrhagic fever virus
Diacetoxyscirpenol
Eastern Equine Encephalitis virus[1]
Ebola virus*
*Francisella tularensis**
Lassa fever virus
Lujo virus
Marburg virus*
Monkeypox virus[1]
Reconstructed replication competent forms of the 1918 pandemic influenza virus containing any portion of the coding regions of all eight gene segments (Reconstructed 1918 Influenza virus)
Ricin
Rickettsia prowazekii
SARS-associated coronavirus (SARS-CoV)
Saxitoxin
South American Haemorrhagic Fever viruses:
Chapare
Guanarito
Junin
Machupo
Sabia
Staphylococcal enterotoxins A,B,C,D,E subtypes
T-2 toxin
Tetrodotoxin
Tick-borne encephalitis complex (flavi) viruses:
Far Eastern subtype
Siberian subtype
Kyasanur Forest disease virus
Omsk hemorrhagic fever virus
Variola major virus (Smallpox virus)*
Variola minor virus (Alastrim)*
*Yersinia pestis**

OVERLAP SELECT AGENTS AND TOXINS

*Bacillus anthracis **
Bacillus anthracis Pasteur strain
Brucella abortus
Brucella melitensis
Brucella suis
*Burkholderia mallei**
*Burkholderia pseudomallei**
Hendra virus
Nipah virus
Rift Valley fever virus
Venezuelan equine encephalitis virus[1]

USDA SELECT AGENTS AND TOXINS

African horse sickness virus
African swine fever virus
Avian influenza virus[1]
Classical swine fever virus
Foot-and-mouth disease virus*
Goat pox virus
Lumpy skin disease virus
Mycoplasma capricolum[1]
Mycoplasma mycoides[1]
Newcastle disease virus[1,2]
Peste des petits ruminants virus
Rinderpest virus*
Sheep pox virus
Swine vesicular disease virus

USDA PLANT PROTECTION AND QUARANTINE (PPQ) SELECT AGENTS

Peronosclerospora philippinensis (Peronosclerospora sacchari)
Phoma glycinicola (formerly Pyrenochaeta glycines)
Ralstonia solanacearum
Rathayibacter toxicus
Sclerophthora rayssiae
Synchytrium endobioticum
Xanthomonas oryzae

*Denotes Tier 1 Agent

[1]Select agents that meet any of the following criteria are excluded from the requirements of this part: Any low pathogenic strains of avian influenza virus, South American genotype of eastern equine encephalitis virus , west African clade of Monkeypox viruses, any strain of Newcastle disease virus which does not meet the criteria for virulent Newcastle disease virus, all subspecies Mycoplasma capricolum except subspecies capripneumoniae (contagious caprine pleuropneumonia), all subspecies Mycoplasma mycoides except subspecies mycoides small colony (Mmm SC) (contagious bovine pleuropneumonia), any subtypes of Venezuelan equine encephalitis virus except for Subtypes IAB or IC, and Vesicular stomatitis virus (exotic): Indiana subtypes VSV-IN2, VSV-IN3, provided that the individual or entity can verify that the agent is within the exclusion category.

[2] A virulent Newcastle disease virus (avian paramyxovirus serotype 1) has an intracerebral pathogenicity index in day-old chicks (Gallus gallus) of 0.7 or greater or has an amino acid sequence at the fusion (F) protein cleavage site that is consistent with virulent strains of Newcastle disease virus. A failure to detect a cleavage site that is consistent with virulent strains does not confirm the absence of a virulent virus.

12/4/2012

Appendix III: Breakthrough Chart for Disposable Gloves

Example Only – Contact Manufacturer for specific chart

Kimberly-Clark PROFESSIONAL*

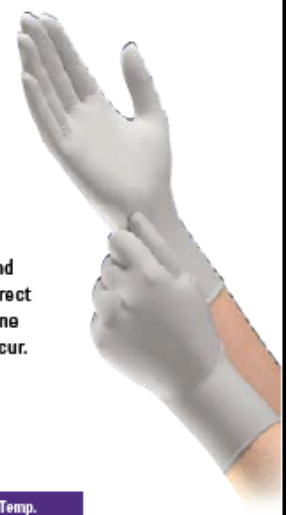
KIMBERLY-CLARK* Nitrile Gloves

Chemical Resistance Guide

KIMTECH* BRAND

KIMBERLY-CLARK® Nitrile Gloves

Chemical Resistance Guide



Incidental Exposure Only

KIMBERLY-CLARK® Nitrile gloves are thin gauge disposable gloves designed to provide barrier protection and tactile sensitivity to the wearer. Our thin mil gloves are not designed for applications involving prolonged, direct exposure to chemicals. Our intent in providing this chemical compatibility information is to provide a guideline for use of our thin mil gloves in applications where incidental splash exposure to various chemicals may occur. Gloves should be removed and replaced immediately if incidental splash exposure occurs.

How to Use this Guide

Two categories of data are used to determine a color code for each chemical:

1. Permeation Breakthrough Time
2. Chemical Boiling Point

Criteria for Chemical Resistance Rating

Permeation Breakthrough Time (PB)

Rating	Minutes
Excellent (E)	60-480
Good (G)	10-59
Poor (P)	1-9
Not Recommended (NR)	<1

Boiling Point

Volatility	Temp.
High Volatility	<24° C
Low Volatility	>24° C

Precaution: This data was generated from the KIMBERLY-CLARK® STERLING® Nitrile Exam Gloves. This data does not represent gloves thinner than the STERLING® Nitrile glove, such as the KLEEN-GUARD® G10 Arctic Blue Nitrile Gloves.

Color Code Rating System

A glove/chemical combination receives a GREEN rating if:
- The permeation breakthrough time is excellent or good and the chemical has high volatility.
  OR
- The permeation breakthrough time is excellent and the chemical has low volatility.

A glove/chemical combination receives a YELLOW rating if:
- Any glove/chemical combination does not meet either set of conditions required for a GREEN or RED rating.

A glove/chemical combination receives a RED rating if:
- The permeation breakthrough time is poor and the chemical has low volatility.
  OR
- The permeation breakthrough time is not recommended and the chemical has either high or low volatility.

Interpreting Chemical Resistance Ratings

GREEN

The results for this specific chemical suggest that the glove would provide an adequate barrier for use in most applications.

YELLOW

The results require additional consideration to determine suitability for use.

RED

Not recommended for use.

For additional information on choosing the right chemical glove for your application, please visit our Chemical Resistance Database at:
http://www.kcprofessional.com/us/mkt/ChemicalSelectorGuide/

Chemical Name	Permeation Time (minutes) *ASTM F739*	Permeation Rate (pg/cm²/min) *ASTM F739*	Concentration	Color Code Rating
Acetaldehyde	<1	353	99.5%	
Acetic Acid	5	482	99.7%	
Acetone	1	486	99.5%	
Acetonitrile	1	329	99%	
Acrylic Acid	1	57.8	99%	
Ammonium Hydroxide	7	395	30%	
Amyl Acetate	4	261	99%	
Analine	7	74.7	99.5%	
Benzaldehyde	78	0.57	99.5%	
Benzene	<1	627	99.8%	
Benzyl Alcohol	5	86.8	99%	
n-Butanol	10	5.99	99.8%	
Butyl Acetate	3	233	99%	
Carbon Disulfide	2	3.81	99%	
Carbon Tetrachloride	5	48.9	99.5%	
Chloroform	1	958	99%	
Citric Acid	>480	Not Detected	50%	
Cyclohexane	>480	Not Detected	99.7%	
Cyclohexanol	112	1.18	99%	
Cyclohexanone	1	787	99.8%	
d-Limonene	107	0.157	97%	
n-Dibutyl Phthalate	>480	Not Detected	99%	
1,2-Dichlorobenzene	<1	1179	99%	
Dichloromethane	1	2006	99.9%	
Diesel Fuel, mixture	160	0.63	Mixture	
Diethyl Ether	1	595	99.9%	
Diethylamine	<1	587	99.5%	
Di-isobutyl Ketone	10	1141	80%	
Dimethyl Sulfoxide	8	501	99.90%	
Dibutyl Phthalate	>480	Not Detected	99%	
1,4-Dioxane	<1	707	99.4%	
Ethanol	7	296	99.5+%	
Ethanolamine	>480	Not Detected	99%	
Ethidium Bromide	90	0.68		
Ethylene Glycol	>480	Not Detected	99.8%	
Formaldehyde	110	0.172	37%	
Formic Acid	6	0.554	88%	
2-Furaldehyde	<1	385	99%	
Glutaraldehyde	>480	Not Detected	50%	
Heptane	145	0.73	99+%	
n-Hexane	16	55.3	99+%	
Hydrazine	31	40.2	98%	
Hydrochloric Acid	16	29.2	37%	
Hydrochloric Acid	>480	Not Detected	10%	

KIMBERLY-CLARK® Nitrile Gloves

Chemical Resistance Guide

Chemical Name	Permeation Time (minutes) ASTM F739-99A	Permeation Rate (pg/cm²/min) ASTM F739-99A	Concentration	Color Code Rating
Hydrogen Peroxide	>480	Not Detected	30%	
Isopropyl Alcohol (IPA)	29	38.6	99.50%	
Jet Fuel (Kerosene)	82	0.259	Mixture	
Lactic Acid	>480	Not Detected	85%	
Methanol	<1	257	99.8%	
1-Methoxy 2-Propanol	>480	Not Detected	99.5%	
1-Methyl 2-Pyrrolidinone	3	398	99%	
Methyl Methacrylate	<1	803	99%	
Mineral Spirits	105	1.6	mixture	
Morpholine	1	349	99%	
Naphtha	122	0.139	99%	
Nitric Acid	1	197	70%	
Nitric Acid	277	197	10%	
Nitromethane	<1	490	99%	
Nitropropane	<1	715	98%	
Octane	>480	Not Detected	99%	
Octanol	235	0.85	99+%	
Oleic Acid	>480	Not Detected	99%	
Pentane	208	0.118	99%	
Phenol	6	120	99%	
Phosphoric Acid	>480	Not Detected	85%	
Potassium Hydroxide	>480	Not Detected	50%	
Propyl Acetate	<1	819	99.5%	
Propylene Glycol	>480	Not Detected	99%	
Pyridine	<1	635	99%	
Sodium Hydroxide	>480	Not Detected	50%	
Sodium Hypochlorite (Bleach)	>480	Not Detected	10-13%	
Stoddard Solvent	207	0.78	mixture	
Styrene	<1	836	99%	
Sulfuric Acid	>480	Not Detected	47.0%	
Sulfuric Acid	1	197	95-98%	
Tetrachloroethylene	3	11	99.9%	
Trichloroethylene	<1	1054	99%	
Triethanolamine	>480	Not Detected	98%	
Turpentine	115	0.361	Mixture	
o-Xylene	1	852	98%	

Effective June 2009

Appendix IV: Common Laboratory Abbreviations

Abbreviation	Full Name
Ac	Acetyl
Ac2O	Acetic anhydride
AcO	Acetate
Bn	Benzyl
Boc	tert-Butoxycarbonyl
BSA	bovine serum albumin
Bu or n-Bu	n-Butyl
Bz	Benzoyl
Bzl	Benzyl
$Ca(OH)_2$	Calcium hydroxide
$CaCO_3$	Calcium carbonate
$CaSO_4$	Calcium sulfate
CH3COOH	Vinegar
CH4	methane
CMF-DPBS	calcium- and magnesium-free Dulbecco's phosphate-buffered saline
CO	Carbon monoxide
CO2	Carbon dioxide
CSA	Camphorsulphonic acid
DABCO	1,4-Diazabicyclo[2.2.2]octane, Triethylendiamine
DCM	Dichloromethane
DMEM	Dulbecco's modified Eagle medium
DMF	N,N-Dimethylformamide
DMP	Dess-Martin periodinane
DMS	Dimethylsulfide
DMSO	Dimethylsulfoxide
DPA	Diisopropylamine
DPBS	Dulbecco's phosphate-buffered saline
DTT	dithiothreitol
EDTA	Ethylenediaminetetraacetic acid
EE	Ethoxyethyl
EOM	Ethoxymethyl
Et2O	Diethyl ether
EtBr	Ethidium bromide
EtOH	Ethanol
H2CO3	carbonic acid
H_2O2	Hydrogen peroxide
H2SO4	sulfuric acid
HBSS	Hanks'balanced salt solution
HCl	hydrochloric acid
HClO4	perchloric acid
HCN	hydrocyanic acid
HNO3	nitric acid
Im	Imidazole
IPA	Isopropyl alcohol
IPTG	Isopropyl β-D-1-thiogalactopyranoside
KCl	Potassium chloride
KNO_3	Potassium nitrate

Abbreviation	Full Name
KOH	Potassium hydroxide
Me	Methyl
MEK	Methyl ethyl ketone
MIBK	Methyl isobutyl ketone
MOM	Methoxymethyl
MOPS	3-(N-morpholino)propanesulfonic acid
MS	Molecular sieves
MTBE	Methyl tert-butyl ether
N2	nitrogen gas
Na_2CO_3	Sodium carbonate
Na_2CO_4	Sodium percarbonate
$NaBO_3$	sodium perborate
NaCl	Sodium chloride
NaCl	Sodium chloride
NaOH	Sodium hydroxide
NH3	Ammonia
$(NH_4)_2SO_4$	Ammonium sulfate
O2	oxygen gas
PBS	Phosphate-buffered saline
PCR	Polymerase Chain Reaction
Ph	Phenyl
PMSF	phenylmethylsulfonyl fluoride
Pr	Propyl
Py	Pyridine
s-Bu or sBu	sec-Butyl
SDS	Sodium Dodecyl Sulfate
SDS-PAGE	Sodium Dodecylsulfate-Polyacrimide Gel Electrophoresis
SOB	Super Optimal Broth
SSC	saline-sodium citrate
TAE	Tris/acetate/EDTA
TBE	Tris-borate-EDTA
TBS	Tris buffered saline
t-Bu or tBu	tert-Butyl
TE	Tris-EDTA
TEA	Triethylamine
TEA	triethanolamine
TEMED	Tetramethylethylenediamine
TEN	Tris/EDTA/NaCl
TESH	Triethylsilane
Tf	Trifluoromethanesulfonyl
TFA	Trifluoroacetic acid
TFAA	Trifluoroacetic anhydride
Thexyl	2,3-dimethyl-2-butyl
THF	Tetrahydrofuran
TMEDA	N,N,N',N'-Tetramethylethylendiamine
TMS	Tetramethylsilane
Tol	p-Toluyl
TTBS	Tween 20/TBS

Appendix V: Chemical Storage Compatibility Groups

Source: Prudent Practices (2011)

CHEMICAL COMPATIBILITY STORAGE CODES[1]

Storage Group A: Compatible Organic Bases

Identifier	Name
100-46-9	Benzylamine
100-85-6	Benzyltrimethylammonium hydroxide
108-91-8	Cyclohexylamine
111-42-2	Diethanolamine
109-89-7	Diethylamine
75-04-7	Ethylamine
107-15-3	Ethylenediamine
110-89-4	Piperidine
102-71-6	Triethanolamine
121-44-8	Triethylamine

Storage Group B: Compatible Pyrophoric And Water Reactive Materials

Identifier	Name
7783-70-2	Antimony pentafluoride
98-88-4	Benzoyl chloride
353-42-4	Boron triflouride compound with methyl ether (1:1)
594-19-4	*Tert*-Butyllithium
156-62-7	Calcium cyanamide
16853-85-3	Lithium aluminum hydride
4111-54-0	Lithium diisopropylamide
7580-67-8	Lithium hydride
7439-93-2	Lithium metal (e.g., in THF)
124-63-0	Methanesulfonyl chloride
917-54-4	Methyllithium solution (and other alkyls)
7440-09-7	Potassium metal
17242-52-3	Potassium amide
16940-66-2	Sodium borohydride
7646-69-7	Sodium hydride
7440-66-6	Zinc (fume or dust)

Storage Group C: Compatible Inorganic Bases

Identifier	Name
1336-21-6	Ammonium hydroxide
17194-00-2	Barium hydroxide
1305-62-0	Calcium hydroxide
21351-79-1	Cesium hydroxide
1310-65-2	Lithium hydroxide
1310-58-3	Potassium hydroxide
1310-82-3	Rubidium hydroxide
1310-73-2	Sodium hydroxide
18480-07-4	Strontium hydroxide

Storage Group D: Compatible Organic Acids

Identifier	Name
64-19-7	Acetic acid
79-10-7	Acrylic acid
65-85-0	Benzoic acid
98-07-7	Benzotrichloride
98-88-4	Benzoyl chloride
10043-35-3	Boric acid
79-11-8	Chloroacetic acid
627-11-2	Chloroethyl chloroformate
77-92-9	Citric acid
79-44-7	Dimethylcarbamyl chloride
64-18-6	Formic acid
6915-15-7	Malic acid
108-31-6	Maleic anhydride
7697-37-2	Nitric acid
139-13-9	Nitrilotriacetic acid
79-09-4	Propionic acid
7783-00-8	Selenious acid
76-05-1	Trifluoroacetic acid (TFA)
76-03-9	Trichloroacetic acid

Storage Group E: Compatible Oxiders, Including Peroxides

Identifier	Name
21205-91-4	9-BBN
13473-90-0	Aluminum nitrate
7789-09-5	Ammonium dichromate
7790-98-9	Ammonium perchlorate
13446-10-1	Ammonium permanganate
7727-54-0	Ammonium persulfate
10022-31-8	Barium nitrate
10124-37-5	Calcium nitrate
1305-79-9	Calcium peroxide
19004-19-4	Cupric nitrate
506-93-4	Guanidine nitrate
937-14-4	3-Chloroperoxybenzoic acid
7722-84-1	Hydrogen peroxide
10099-74-8	Lead nitrate
13840-33-0	Lithium hypochlorite
10377-60-3	Magnesium nitrate
10034-81-8	Magnesium perchlorate
13138-45-9	Nickel nitrate
7697-37-2	Nitric acid
79-21-0	Peracetic acid
7601-90-3	Perchloric acid
7778-50-9	Potassium dichromate
7757-79-1	Potassium nitrate
7722-64-7	Potassium permanganate
7727-21-1	Potassium persulfate
17014-71-0	Potassium superoxide
7761-88-8	Silver nitrate
15630-89-4	Sodium carbonate peroxide
7775-09-9	Sodium chlorate
7758-19-2	Sodium chlorite
2893-78-9	Sodium dichloro-s-triazinetrione
10588-01-9	Sodium dichromate
7681-52-9	Sodium hypochlorite
7631-99-4	Sodium nitrate
7632-00-0	Sodium nitrite
10101-50-5	Sodium permanganate
1313-60-6	Sodium peroxide
7775-27-1	Sodium persulfate
7791-10-8	Strontium chlorate
10042-76-9	Strontium nitrate
1314-18-7	Strontium peroxide
87-90-1	Trichloro-s-triazinetrione (Trichloroisocyanuric acid, TCCA)

Storage Group F: Compatible Inorganic Acids, Not Including Oxidizers Or Combustibles

Identifier	Name
7790-93-4	Chloric acid
10034-85-2	Hydrioic acid
7647-01-0	Hydrochloric acid
7664-39-3	Hydrogen fluoride solution
7664-38-2	Phosphoric acid
7664-93-9	Sulfuric acid

Storage Group G: Not Instrinsically Reactive Or Flammable Or Combustible

Identifier	Name
71751-41-2	Abamectin [avermectin b1]
640-19-7	Acetamide, 2-fluoro-
62-74-8	Acetic acid, fluoro-, sodium salt
1752-30-3	Acetone thiosemicarbazide
53-96-3	2-Acetylaminofluorene
79-06-1	Acrylamide
814-68-6	Acrylyl chloride
111-69-3	Adiponitrile
309-00-2	Aldrin
60-09-3	4-Aminoazobenzene
92-67-1	4-Aminodiphenyl
82-28-0	1-Amino-2-methylanthraquinone
54-62-6	Aminopterin
504-24-5	4-Aminopyridine
61-82-5	Amitrole
101-05-3	Anilazine [4, 6-dichloro-*N*-(2-chlorophenyl)-1, 3, 5-triazin-2-amine]
90-04-0	*o*-Anisidine
7440-36-0	Antimony
7440-38-2	Arsenic
1303-28-2	Arsenic pentoxide
7784-34-1	Arsenic trichloride
1327-53-3	Arsenic trioxide
86-50-0	Azinphos-methyl
7440-39-3	Barium
56-55-3	Benz[a]anthracene
98-87-3	Benzal chloride
55-21-0	Benzamide
98-16-8	Benzenamine, 3-(trifluoromethyl)-
100-14-1	Benzene, 1-(chloromethyl)-4-nitro-
98-05-5	Benzenearsonic acid
108-98-5	Benzenethiol
92-87-5	Benzidine
50-32-8	Benzo[a]pyrene
57-64-7	Benzoic acid, 2-hydroxy-, compound with (3as-cis)-1,2,3,3a,8,8a-hexahydro-1,3a,8-trimethylpyrrolo[2,3,b]indol-5-ylmethylcarbamate ester (1:1)
100-44-7	Benzyl chloride
140-29-4	Benzyl cyanide
7440-41-7	Beryllium powder
91-59-8	Beta-naphthylamine
82657-04-3	Bifenthrin
92-52-4	Biphenyl
534-07-6	Bis(chloromethyl) ketone
542-88-1	Bis(chloromethyl)ether
28772-56-7	Bromadiolone
75-25-2	Bromoform (tribromomethane)
74-83-9	Bromomethane
75-63-8	Bromotrifluoromethane (halon 1301)
81-88-9	C.I. Food red 15 (Rhodamine B)
97-56-3	C.I. Solvent yellow 3
7440-43-9	Cadmium
1306-19-0	Cadmium oxide
2223-93-0	Cadmium stearate
7778-44-1	Calcium arsenate
56-25-7	Cantharidin
51-83-2	Carbachol chloride
644-64-4	Carbamic acid, dimethyl-, 1-[(dimethylamino)carbonyl]-5-methyl-1h-pyrazol-3-yl ester

[1] Adapted from Stanford University's ChemTracker Storage System. Used with permission from Lawrence M. Gibbs, Stanford University.

63-25-2	Carbaryl [1-naphthalenol, methylcarbamate]
1563-66-2	Carbofuran
56-23-5	Carbon tetrachloride
57-74-9	Chlordane
115-28-6	Chlorendic acid
532-27-4	2-Chloroacetophenone
4080-31-3	1-(3-Chloroallyl)-3,5,7-triaza-1-azoniaadamantane chloride
75-45-6	Chlorodifluoromethane (HCFC-22)
67-66-3	Chloroform
107-30-2	Chloromethyl methyl ether
5344-82-1	1-(o-Chlorophenyl)thiourea
542-76-7	3-Chloropropionitrile
63938-10-3	Chlorotetrafluoroethane
75-88-7	2-Chloro-1,1,1-trifluoro-ethane (HCFC-133a)
75-72-9	Chlorotrifluoromethane (CFC-13)
1982-47-4	Chloroxuron
10025-73-7	Chromic chloride
7440-47-3	Chromium
64-86-8	Colchicine
56-72-4	Coumaphos
5836-29-3	Coumatetralyl
1319-77-3	Cresol (mixed isomers)
95-48-7	*o*-Cresol
535-89-7	Crimidine
4170-30-3	Crotonaldehyde
123-73-9	(e)-Crotonaldehyde
64-00-6	*m*-Cumenyl methylcarbamate
21725-46-2	Cyanazine
506-68-3	Cyanogen bromide
506-78-5	Cyanogen iodide
675-14-9	Cyanuric fluoride
66-81-9	Cycloheximide
94-75-7	2,4-D (2,4-Dichlorophenoxyacetic acid)
2971-38-2	2,4-D Chlorocrotyl ester
94-11-1	2,4-D Isopropyl ester
94-82-6	2,4-DB
919-86-8	Demeton-s-methyl
101-80-4	4,4'-Diaminodiphenyl ether
101-77-9	4,4'-Diaminodiphenylmethane
615-05-4	2,4-Diaminoanisole
95-80-7	2,4-Diaminotoluene
25376-45-8	Diaminotoluene (mixed isomers)
333-41-5	Diazinon
53-70-3	Dibenzo(a, h)anthracene
132-64-9	Dibenzofuran
96-12-8	1,2-Dibromo-3-chloropropane
106-93-4	1,2-Dibromoethane (ethylene dibromide)
84-74-2	Dibutyl phthalate
99-30-9	Dichloran [2, 6-dichloro-4-nitroaniline]
95-50-1	1,2-Dichlorobenzene
541-73-1	1,3-Dichlorobenzene
106-46-7	1,4-Dichlorobenzene
91-94-1	3,3'-Dichlorobenzidine
75-27-4	Dichlorobromomethane
764-41-0	1,4-Dichloro-2-butene
75-71-8	Dichlorodifluoromethane (cfc-12)
111-44-4	Dichloroethyl ether
75-09-2	Dichloromethane (methylene chloride)
91-93-0	3,3'-Dimethoxybenzidine-4,4'-diisocyanate
91-97-4	3,3'-Dimethyl-4,4'-diphenylene diisocyanate
127564-92-5	Dichloropentafluoropropane
97-23-4	Dichlorophene [2, 2'-methylene-bis(4-chlorophenol)]
120-83-2	2,4-Dichlorophenol
105-67-9	2,4-Dimethylphenol
696-28-6	Dichlorophenylarsine
76-14-2	Dichlorotetrafluoroethane (cfc-114)
62-73-7	Dichlorvos
1464-53-5	Diepoxybutane
38727-55-8	Diethatyl ethyl
814-49-3	Diethyl chlorophosphate
297-97-2	*O,O*-Diethyl *O*-pyrazinyl phosphorothioate
78-53-5	*O,O*-Diethyl *S*-[2-(diethylamino)ethyl] phosphorothiolate
71-63-6	Digitoxin
101-90-6	Diglycidyl resorcinol ether
94-58-6	Dihydrosafrole
55-91-4	Diisopropylfluorophosphate (DFP)
60-51-5	Dimethoate
60-11-7	4-Dimethylaminoazobenzene
57-97-6	7,12-Dimethylbenz[a]anthracene
91-93-0	3,3'-Dimethoxybenzidine-4,4'-diisocyanate
2524-03-0	Dimethyl chlorothiophosphate
91-97-4	3,3'-Dimethyl-4,4'-diphenylene diisocyanate
105-67-9	2,4-Dimethylphenol
131-11-3	Dimethyl phthalate
77-78-1	Dimethyl sulfate
2300-66-5	Dimethylamine dicamba
534-52-1	4,6-Dinitro-*o*-cresol
78-34-2	Dioxathion
82-66-6	Diphacinone
957-51-7	Diphenamid
122-39-4	Diphenylamine
107-49-3	Diphosphoric acid, tetraethyl ester
541-53-7	Dithiobiuret
72-20-8	Endrin
50-14-6	Ergocalciferol
563-12-2	Ethion
13194-48-4	Ethoprop
541-41-3	Ethyl chloroformate
759-94-4	Ethyl dipropylthiocarbamate [EPTC]
371-62-0	Ethylene fluorohydrin
107-21-1	Ethylene glycol
96-45-7	Ethylene thiourea
542-90-5	Ethylthiocyanate
52-85-7	Famphur
55-38-9	Fenthion [*o*, *o*-dimethyl *o*-[3-methyl-4-(methylthio)phenyl]ester, phosphorothioic acid]
144-49-0	Fluoroacetic acid
359-06-8	Fluoroacetyl chloride
51-21-8	Fluorouracil
944-22-9	Fonofos
107-16-4	Formaldehyde cyanohydrin
23422-53-9	Formetanate hydrochloride
76-13-1	Freon 113 [ethane, 1, 1, 2-trichloro-1, 2, 2-trifluoro-]
76-44-8	Heptachlor
87-68-3	Hexachloro-1, 3-butadiene
118-74-1	Hexachlorobenzene
77-47-4	Hexachlorocyclopentadiene
67-72-1	Hexachloroethane
1335-87-1	Hexachloronaphthalene
70-30-4	Hexachlorophene
822-06-0	Hexamethylene-1, 6-diisocyanate
51235-04-2	Hexazinone
51-75-2	Hn2 (nitrogen mustard-2)
555-77-1	Hn3 (nitrogen mustard-3)
79-19-6	Hydrazinecarbothioamide
123-31-9	Hydroquinone
102-36-3	Isocyanic acid, 3,4-dichlorophenyl ester
465-73-6	Isodrin
4098-71-9	Isophorone diisocyanate
108-23-6	Isopropyl chloroformate
80-05-7	4,4'-Isopropylidenediphenol
120-58-1	Isosafrole
78-97-7	Lactonitrile
7439-92-1	Lead
58-89-9	Lindane
554-13-2	Lithium carbonate
121-75-5	Malathion
109-77-3	Malononitrile
93-65-2	Mecoprop
950-10-7	Mephosfolan
149-30-4	2-Mercaptobenzothiazole (MBT)
5124-30-1	1,1-Methylene bis(4-isocyanatocyclohexane)
1600-27-7	Mercuric acetate
7487-94-7	Mercuric chloride
21908-53-2	Mercuric oxide
7439-97-6	Mercury
760-93-0	Methacrylic anhydride
920-46-7	Methacryloyl chloride
30674-80-7	Methacryloyloxyethyl isocyanate
558-25-8	Methanesulfonyl fluoride
950-37-8	Methidathion
16752-77-5	Methomyl
94-74-6	Methoxone (4-chloro-2-methylphenoxy) acetic acid (MCPA))
72-43-5	Methoxychlor [benzene, 1, 1'-(2, 2, 2-trichloroethylidene)bis[4-methoxy-]]
151-38-2	Methoxyethylmercuric acetate
80-63-7	Methyl 2-chloroacrylate
56-49-5	3-Methylcholanthrene
74-87-3	Methyl chloride
101-14-4	4,4'-Methylenebis(2-chloroaniline) (mboca)
101-61-1	4,4'-Methylenebis(N,N-dimethyl) benzenamine
60-34-4	Methyl hydrazine
74-88-4	Methyl iodide
924-42-5	*N*-Methylolacrylamide
298-00-0	Methyl parathion
676-97-1	Methyl phosphonic dichloride
556-64-9	Methyl thiocyanate
502-39-6	Methylmercuric dicyanamide
7786-34-7	Mevinphos
90-94-8	Michler's ketone
50-07-7	Mitomycin c
1313-27-5	Molybdenum trioxide
76-15-3	Monochloropentafluoroethane (CFC-115)
6923-22-4	Monocrotophos
3173-72-6	1,5-Naphthalene diisocyanate
54-11-5	Nicotine
65-30-5	Nicotine sulfate
92-93-3	4-Nitrobiphenyl
55-63-0	Nitroglycerine
88-75-5	2-Nitrophenol
100-02-7	4-Nitrophenol
62-75-9	*N*-Nitrosodimethylamine
621-64-7	*N*-Nitrosodi-*N*-propylamine
86-30-6	*N*-Nitrosodiphenylamine
59-89-2	*N*-Nitrosomorpholine
100-75-4	*N*-Nitrosopiperidine

99-55-8	5-Nitro-*o*-toluidine
630-60-4	Ouabain
78-71-7	Oxetane, 3,3-bis(chloromethyl)-
104-94-9	*p*-anisidine
56-38-2	Parathion
12002-03-8	Paris green
106-47-8	*p*-chloroaniline
95-69-2	*p*-chloro-*o*-toluidine
106-44-5	*p*-cresol
100-25-4	*p*-dinitrobenzene
76-01-7	Pentachloroethane
87-86-5	Pentachlorophenol (PCP)
594-42-3	Perchloromethylmercaptan
85-01-8	Phenanthrene
108-95-2	Phenol
88-85-7	Phenol, 2-(1-methylpropyl)-4,6-dinitro- (dinoseb)
58-36-6	Phenoxarsine, 10,10'-oxydi-
95-54-5	1,2-Phenylenediamine
108-45-2	1,3-Phenylenediamine
624-18-0	1,4-Phenylenediamine dihydrochloride
104-49-4	1,4-Phenylene diisocyanate
59-88-1	Phenylhydrazine hydrochloride
62-38-4	Phenylmercury acetate
90-43-7	2-Phenylphenol
2097-19-0	Phenylsilatrane
103-85-5	Phenylthiourea
57-41-0	Phenytoin
947-02-4	Phosfolan
13171-21-6	Phosphamidon
57-47-6	Physostigmine
124-87-8	Picrotoxin
51-03-6	Piperonyl butoxide
100-01-6	*p*-nitroaniline
10124-50-2	Potassium arsenite
506-61-6	Potassium silver cyanide
106-50-3	*p*-phenylenediamine
23950-58-5	Pronamide
1120-71-4	Propane sultone
70-69-9	Propiophenone, 4'-amino
109-61-5	Propyl chloroformate
129-00-0	Pyrene
91-22-5	Quinoline
106-51-4	Quinone
82-68-8	Quintozene [pentachloronitrobenzene]
78-48-8	*S,S,S*-tributyltrithiophosphate (DEF)
81-07-2	Saccharin (manufacturing, no supplier notification)

94-59-7	Safrole
7440-22-4	Silver
7631-89-2	Sodium arsenate
7784-46-5	Sodium arsenite, solid
124-65-2	Sodium cacodylate
128-04-1	Sodium dimethyldithiocarbamate
13410-01-0	Sodium selenate
10102-18-8	Sodium selenite
10102-20-2	Sodium tellurite
57-24-9	Strychnine
505-60-2	Sulfur mustard (mustard gas H)
77-81-6	Tabun
79-94-7	Tetrabromobisphenol A
630-20-6	1,1,1,2-Tetrachloroethane
79-34-5	1,1,2,2-Tetrachloroethane
64-75-5	Tetracycline hydrochloride
78-00-2	Tetraethyl lead
3689-24-5	Tetraethyldithiopyrophosphate
597-64-8	Tetraethyltin
119-64-2	Tetrahydronaphthalene
75-74-1	Tetramethyllead
7440-28-0	Thallium
6533-73-9	Thallous carbonate
62-55-5	Thioacetamide
59669-26-0	Thiodicarb
62-56-6	Thiourea
614-78-8	Thiourea, (2-methylphenyl)-
137-26-8	Thiram
1314-20-1	Thorium dioxide
95-53-4	*o*-Toluidine
8001-35-2	Toxaphene
68-76-8	Triaziquone [2, 5-cyclohexadiene-1, 4-dione, 2, 3, 5-tris(1-aziridinyl)-]
24017-47-8	Triazofos
1983-10-4	Tributyltin fluoride
52-68-6	Trichlorfon [phosphonic acid, (2, 2, 2-trichloro-1-hydroxyethyl)-, dimethyl ester]
1558-25-4	Trichloro(chloromethyl)silane
71-55-6	1,1,1-Trichloroethane (methyl chloroform)
120-82-1	1,2,4-Trichlorobenzene
79-00-5	1,1,2-Trichloroethane
75-69-4	Trichlorofluoromethane (CFC-11)
327-98-0	Trichloronate
88-06-2	2,4,6-Trichlorophenol
96-18-4	1,2,3-Trichloropropane
88-05-1	2,4,6-Trimethyl-aniline
824-11-3	Trimethylolpropane phosphite
76-87-9	Triphenyltin hydroxide
51-79-6	Urethane (ethyl carbamate)
1314-62-1	Vanadium pentoxide
81-81-2	Warfarin
129-06-6	Warfarin sodium
87-62-7	2,6-Xylidine
28347-13-9	Xylylene dichloride

Storage Group J: Poison Compressed Gases

Identifier	Name
116-15-4	Hexafluoropropylene
7446-09-5	Sulfur dioxide

Storage Group K: Compatible Explosives Or Other Highly Unstable Materials

Identifier	Name
556-88-7	Nitroguanidine
88-89-1	Picric acid, dry (<10% water)
288-94-8	Tetrazole
124-47-0	Urea nitrate

Storage Group L: Non-Reactive Flammable And Combustible, Including Solvents

Identifier	Name
75-05-8	Acetonitrile
98-86-2	Acetophenone
107-13-1	Acrylonitrile, inhibited
557-40-4	Allyl ether
71-43-2	Benzene
103-50-4	Benzyl ether
110-47-4	Beta-isopropoxypropionitrile
106-99-0	Butadiene
78-92-2	2-Butanol
71-36-3	*n*-Butanol
75-65-0	*tert*-Butanol
78-93-3	2-Butanone (MEK)
141-32-2	Butyl acrylate
8001-58-9	Creosote
110-82-7	Cyclohexane
108-93-0	Cyclohexanol
110-83-8	Cyclohexene
931-87-3	Cyclooctene
142-29-0	Cyclopentene
91-17-8	Decahydronaphthalene
75-43-4	Dichlorofluoromethane (HCFC-21)
77-73-6	Dicyclopentadiene
462-95-3	Diethoxymethane
111-96-6	Diethylene glycol dimethyl ether
109-87-5	Dimethoxymethane
124-40-3	Dimethylamine
68-12-2	*N,N*-Dimethylformamide
99-98-9	Dimethyl-*p*-phenylenediamine
51-28-5	2,4-Dinitrophenol
123-91-1	Dioxane
821-08-9	Divinyl acetylene
110-80-5	2-Ethoxyethanol
140-88-5	Ethyl acrylate
75-00-3	Ethyl chloride
107-12-0	Ethyl cyanide
60-29-7	Ethyl ether
100-41-4	Ethylbenzene
74-85-1	Ethylene
110-71-4	Ethylene glycol dimethyl ether
75-34-3	Ethylidene dichloride
115-21-9	Ethyltrichlorosilane
110-00-9	Furan
78-82-0	Isobutyronitrile
98-82-8	Isopropyl benzene
108-20-3	Isopropyl ether
126-98-7	Methacrylonitrile
67-56-1	Methanol
109-86-4	2-Methoxyethanol
74-99-7	Methyl acetylene
96-33-3	Methyl acrylate
67-56-1	Methanol
96-37-7	Methyl cyclopentane
108-10-1	Methylisobutyl ketone (MIBK)
80-62-6	Methyl methracrylate
109-06-8	2-Methylpyridine
872-50-4	N-Methyl-2-pyrrolidone
1634-04-4	Methyl *tert*-butyl ether
91-20-3	Naphthalene
1122-60-7	Nitrocyclohexane
79-46-9	2-Nitropropane
67-63-0	2-Propanol
107-19-7	Propargyl alcohol
123-38-6	Propionaldehyde
110-86-1	Pyridine
100-42-5	Styrene
109-99-9	Tetrahydrofuran
108-88-3	Toluene
7440-62-2	Vanadium (except when contained in an alloy)
108-05-4	Vinyl acetate
109-93-3	Vinyl ether
1330-20-7	Xylene (mixed isomers)

95-47-6	*o*-Xylene
106-42-3	*p*-Xylene

Storage Group X: Incompatible With All Other Storage Groups

Identifier	Name
107-02-8	Acrolein
107-18-6	Allyl alcohol
107-05-1	Allyl chloride
107-11-9	Allylamine
7429-90-5	Aluminum
62-53-3	Anilline
622-79-7	Benzyl azide
7726-95-6	Bromine
109-72-8	Butyllithium
107-07-3	Chloroethanol
76-06-2	Chloropicrin
104-12-1	*p*-Chlorophenyl isocyanate
10210-68-1	Cobalt carbonyl
334-88-3	Diazomethane
78-88-6	2,3-Dichloropropene
64-67-5	Diethyl sulfate
75-78-5	Dimethyldichlorosilane
57-14-7	1,1-Dimethylhydrazine
99-65-0	*m*-Dinitrobenzene
121-14-2	2,4-Dinitrotoluene
606-20-2	2,6-Dinitrotoluene
25321-14-6	Dinitrotoluene (mixed isomers)
106-89-8	Epichlorohydrin
151-56-4	Ethyleneimine
302-01-2	Hydrazine
74-90-8	Hydrogen cyanide
7664-39-3	Hydrogen fluoride
13463-40-6	Iron, pentacarbonyl-
556-61-6	Isothiocyanatomethane
79-22-1	Methyl chloroformate
624-83-9	Methyl isocyanate
75-86-5	2-Methyllactonitrile
74-93-1	Methyl mercaptan
78-94-4	Methyl vinyl ketone
74-95-3	Methylene bromide
101-68-8	Methylenebis(phenylisocyanate) (MDI)
98-95-3	Nitrobenzene
7601-90-3	Perchloric acid
98-13-5	Phenyltrichlorosilane
7723-14-0	Phosphorus
10025-87-3	Phosphorus oxychloride
10026-13-8	Phosphorus pentachloride
7719-12-2	Phosphorus trichloride
85-44-9	Phthalic anhydride
88-89-1	Picric acid, moist (10-40% water)
151-50-8	Potassium cyanide
57-57-8	β-Propiolactone
7723-14-0	Red phosphorus
26628-22-8	Sodium azide
64568-18-9	Sodium hydrogen sulfide
60-41-3	Strychnine, sulfate
7446-11-9	Sulfur trioxide
584-84-9	Toluene-2,4-diisocyanate
91-08-7	Toluene-2,6-diisocyanate
26471-62-5	Toluenediisocyanate (mixed isomers)
79-01-6	Trichloroethylene

Appendix VI: Hazardous Waste

Flammable Waste – source: http://www.ncsu.edu/ehs/www99/right/handsMan/lab/flam.html

Ignitable Waste (Flammables) - The waste code is D001
It is a liquid and has flash point less than 140 °F (60° C)
Below are examples of flammable liquids that would be D001
Class IA Flash point below 73 F, boiling point below 100 F
acetaldehyde, ethyl chloride, petroleum ether
collodion, methyl ethyl ether, propylene oxide
ethyl ether, pentane
Class IB Flash point below 73 F, boiling point at or above 100 F
acetone, ethyl acetate, methyl alcohol
benzene, ethyl alcohol, methylcyclohexane
butyl alcohol, gasoline, toluene
Class IC Flash point at or above 73 F and below 100 F
amyl acetate, isopropanol , turpentine
amyl alcohol, methyl alcohol
dibutyl ether, xylene, styrene
Class II Flash point at or above 100 F and below 140 F
acetic acid, fuel oil no. 44, mineral spirits
camphor oil, methyl lactate, varsol
cyclohexane, hydrazine, kerosene

Common Corrosives – source: http://www.ehs.columbia.edu/CorrosiveChemicals.html

Corrosive Waste - the waste code is D002		
It is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5		
Common Laboratory Acids (pH <2)	**CAS**	**HAZARD**
Acetic acid, glacial or Acetic acid solution	64-19-7	ACID
Acetic anhydride	108-24-7	ACID
Alkyl sulfonic acids, liquid or Aryl sulfonic acids	42615-29-2	ACID
Alkylphenols, liquid, n.o.s. (including C2-C12 homologues)	99-89-8	ACID
Alkylsulfuric acids	540-82-9	ACID
Aluminum chloride, solution	7784-13-6	ACID
Ammonium hydrogen sulfate (Ammonium bisulfate)	7803-63-6	ACID
Amyl acid phosphate	2382-75-5	ACID
Bisulfate, aqueous solution	7681381	ACID
Bisulfites, aqueous solutions, n.o.s.	7631-90-5	ACID
Butyl acid phosphate	107-66-4	ACID
Butyric acid	000107-92-6	ACID
Caproic acid (Hexanoic acid)	142-62-1	ACID
2-Chloropropionic acid	598-78-7	ACID
Chromic acid solution	007738-94-5	ACID
Chromosulfuric acid	14489-25-9	ACID
Copper chloride	7447-39-4	ACID
Crotonic acid liquid	3724-65-0	ACID
Dichloroacetic acid	79-43-6	ACID
Dimethylcarbamoyl chloride	79-44-7	ACID
Formic acid	64-18-6	ACID
Hydriodic acid	10034-85-2	ACID
Hydrobromic acid	10035-10-6	ACID
Hydrochloric acid	7647-01-0	ACID
Hydrofluoric acid and Sulfuric acid mixtures	7664-39-3	ACID
Hydrofluoric acid	7664-39-3	ACID
Lead sulfate with more than 3 percent free acid	7446-14-2	ACID
Nitric acid	7697-37-2	ACID
Phosphoric acid, liquid	7664-38-2	ACID
Phosphorous acid	7664-38-2	ACID
Selenic acid	7783-08-6	ACID
Stannic chloride pentahydrate	10026-06-9	ACID
Sulfamic acid	5329-14-6	ACID
Sulfuric acid	7664-93-9	ACID
Sulfurous acid	7782-99-2	ACID
Thioglycolic acid	68-11-1	ACID
Trichloroacetic acid	76-03-9	ACID
Trifluoroacetic acid	76-05-1	ACID
Zinc chloride, solution	7646-85-7	ACID
Common Laboratory Base or Caustic (pH >12.5)	**CAS**	**HAZARD**
Ammonia solutions	007664-41-7	BASE
Caesium hydroxide solution	21351-79-1	BASE
Calcium oxide	007440-70-2	BASE
Hypochlorite solutions		BASE
Lithium hydroxide	1310-66-3	BASE
Lithium hydroxide, solution	1310-65-2	BASE
Potassium hydroxide, solid	1310-58-3	BASE
Soda lime with more than 4 percent sodium hydroxide	8006-28-8	BASE
Sodium aluminate, solution	11138-49-1	BASE
Sodium borohydride and sodium hydroxide solution	16940-66-2	BASE
Sodium hydroxide solution	1310-73-2	BASE
Tetramethylammonium hydroxide	75-59-2	BASE

Common Oxidizers – source: http://safety.science.tamu.edu/oxidizers.html

COMPOUND	CAS
acetyl peroxide	110-22-5
acetyl benzoyl peroxide	644-31-5
aluminum nitrate	13473-90-0
ammonium dichromate	7789-09-5
ammonium perchlorate	7790-98-9
ammonium permanganate	13446-10-1
ammonium persulfate	7727-54-0
amyl nitrate	1002-16-0
barium chlorate	13477-00-4
barium nitrate	10022-31-8
barium peroxide	1304-29-6
benzoyl peroxide	94-36-0
bromine trifluoride	7787-71-5
butyl hyperperoxide	
butyl perbenzoate	614-45-9
calcium chlorate	10043-52-4
calcium hypochlorite	7778-54-3
calcium nitrate	10124-37-5
calcium peroxide	1305-79-9
chlorosulfonic acid	7790-94-5
chromium anhydride	1333-82-0
chromium trioxide (chromic acid)	1333-82-0
coboltous nitrate	10141-05-6
cumene hyperperoxide	
cupric nitrate	3251-23-8
dibutyl peroxide	110-05-4
dichloro-s-triazinetrione	51580-86-0
dicumyl peroxide	80-43-3
diisopropylbenzene hyperperoxide	
ferric nitrate	10421-48-4
guanidine nitrate	506-93-4
halane	118-52-5
hydrogen peroxide	7722-84-1
iodine peroxide	
isopropyl percarbonate	105-64-6
lead nitrate	10099-74-8
lithium hypochlorite	13840-33-0
lithium peroxide	12031-80-0

COMPOUND	CAS
magnesium nitrate	10377-60-3
magnesium perchlorate	10034-81-8
magnesium peroxide	1335-26-8
methyl ethyl ketone peroxide	1338-23-4
nickel nitrate	13138-45-9
nitric acid	7697-37-2
peracetic acid	79-21-0
perchloric acid (<60% concen.)	100-51-6
perchloric acid (60-72.5% conc.)	7601-90-3
peroxyacetic acid	79-21-0
potassium bromate	7758-01-2
potassium chlorate	3811-04-9
potassium dichloroisocyanurate	2244-21-5
potassium dichromate	7778-50-9
potassium nitrate	7757-79-1
potassium permanganate	7722-64-7
potassium persulfate	7727-21-1
potassium superoxide	12030-88-5
propyl nitrate	627-13-4
silver nitrate	7761-88-8
sodium carbonate peroxide	15630-89-4
sodium chlorate	7775-09-9
sodium chlorite	7758-19-2
sodium dichloro-s-triazinetrione	2893-78-9
sodium dichromate	10588-01-9
sodium nitrate	7631-99-4
sodium nitrite	7632-00-0
sodium perborate	7632-04-4
sodium perchlorate monohydrate	7791-07-3
sodium permanganate	10101-50-5
sodium peroxide	1313-60-6
sodium persulfate	7775-27-1
strontium chlorate	7791-10-8
strontium nitrate	10042-76-9
strontium peroxide	1314-18-7
trichloro-s-triazinetrione	87-90-1
zinc chlorate	10361-95-2
zinc peroxide	1314-22-3

TABLE 1 - Common Oxidizing Groups	
Chemical Group	**Chemical Formula**
peroxides	O2-2
nitrates	NO3-
nitrites	NO2-
perchlorates	ClO4-
chlorates	ClO3-
chlorites	ClO2-
hypochlorites	ClO-
dichromates	Cr2O7-2
permanganates	MnO4-
persulfates	S2O8-2

Common Water-Reactive Chemicals – source: http://www.ehs.columbia.edu/WaterReactiveChemicals.html

Name of Material	CAS
Aluminum alkyl halides	
Aluminum alkyl hydrides	
Aluminum alkyls	
Aluminum borohydride	16962-07-5
Aluminum Carbide	1299-86-1
Aluminum ferrosilicon powder	
Aluminum hydride	7784-21-6
Aluminum phosphide	20859-73-8
Aluminum powder, uncoated	7429-90-5
Aluminum silicon powder, uncoated	
Barium	7440-39-3
Boron trifluoride dimethyl etherate	353-42-4
Calcium	7440-70-2
Calcium carbide	75-20-7
Calcium cyanamide	156-62-7
Calcium hydride	7789-78-8
Calcium manganese silicon	
Calcium phosphide	1305-99-3
Calcium silicide	12737-18-7
Cerium, turnings or gritty powder	7440-45-1
Cesium or Caesium	7440-46-2
Chlorosilanes	
Chlorosilanes, water-reactive, flammable, corrosive	
Diethylzinc	
Dimethylzinc	544-97-8
Ethyldichlorosilane	1789-58-8
Ferrosilicon	8049-17-0
Lithium	7439-93-2
Lithium alkyls	
Lithium aluminum hydride	16853-85-3
Lithium aluminum hydride, ethereal	16853-85-3
Lithium borohydride	16949-15-8
Lithium ferrosilicon	70399-13-2
Lithium hydride	7580-67-8
Lithium hydride, fused solid	7580-67-8
Lithium nitride	26134-62-3
Lithium silicon	68848-64-6
Magnesium alkyls	
Magnesium aluminum phosphide	
Magnesium granules	7439-95-4
Magnesium hydride	7693-27-8
Magnesium phosphide	12057-74-8
Magnesium silicide	22831-39-6
Magnesium, powder or Magnesium alloys, powder	7439-95-4
Maneb or Maneb preparations	12427-38-2
Metal alkyl halides, n.o.s.	
Metal aryl halides, n.o.s.	
Methyl magnesium bromide, in ethyl ether	
Methyldichlorosilane	75-54-7
Phosphorus pentasulfide, free from yellow or white phosphorus	7723-14-0
Potassium	7440097
Potassium borohydride	13762-51-1
Potassium phosphide	20770-41-6
Potassium sodium alloys	1113581-2
Potassium, metal alloys	7440097
Rubidium	7440-17-7
Sodium	7440-23-5
Sodium aluminum hydride	13770-96-2
Sodium borohydride	16940-66-2
Sodium hydride	7646-69-7
Sodium phosphide	24167-76-8
Stannic phosphide	25324-56-5
Strontium phosphide	12504-13-1
Trichlorosilane	10025-78-2
Zinc ashes	
Zinc phosphide	1314-84-7
Zinc powder or Zinc dust	

Characteristic Hazardous Waste exhibits the characteristic of toxicity if, using the Toxicity Characteristic Leaching Procedure the extract from a representative sample of the waste contains any of the contaminants listed below at the concentration equal to or greater than the respective value given in that table. Source: 40 CFR 261.33

Contaminant	CAS	EPA HW	Regulatory Level (mg/L)
Arsenic	7440–38–2	D004	5
Barium	7440–39–3	D005	100
Benzene	71–43–2	D018	0.5
Cadmium	7440–43–9	D006	1
Carbon tetrachloride	56–23–5	D019	0.5
Chlordane	57–74–9	D020	0.03
Chlorobenzene	108–90–7	D021	100
Chloroform	67–66–3	D022	6
Chromium	7440–47–3	D007	5
o-Cresol	95–48–7	D023	4200
m-Cresol	108–39–4	D024	4200
p-Cresol	106–44–5	D025	4200
Cresol		D026	4200
2,4-D	94–75–7	D016	10
1,4-Dichlorobenzene	106–46–7	D027	7.5
1,2-Dichloroethane	107–06–2	D028	0.5
1,1-Dichloroethylene	75–35–4	D029	0.7
2,4-Dinitrotoluene	121–14–2	D030	30.13
Endrin	72–20–8	D012	0.02
Heptachlor (and its epoxide)	76–44–8	D031	0.008
Hexachlorobenzene	118–74–1	D032	30.13
Hexachlorobutadiene	87–68–3	D033	0.5
Hexachloroethane	67–72–1	D034	3
Lead	7439–92–1	D008	5
Lindane	58–89–9	D013	0.4
Mercury	7439–97–6	D009	0.2
Methoxychlor	72–43–5	D014	10
Methyl ethyl ketone	78–93–3	D035	200
Nitrobenzene	98–95–3	D036	2
Pentrachlorophenol	87–86–5	D037	100
Pyridine	110–86–1	D038	35
Selenium	7782–49–2	D010	1
Silver	7440–22–4	D011	5
Tetrachloroethylene	127–18–4	D039	0.7
Toxaphene	8001–35–2	D015	0.5
Trichloroethylene	79–01–6	D040	0.5
2,4,5-Trichlorophenol	95–95–4	D041	400
2,4,6-Trichlorophenol	88–06–2	D042	2
2,4,5-TP (Silvex)	93–72–1	D017	1
Vinyl chloride	75–01–4	D043	0.2

The following materials or items are hazardous wastes if and when they are discarded or intended to be discarded and any residue remaining in a container or in an inner liner removed from a container that has held the product unless the container is empty. Source: 40 CFR 261.33

Substance	CAS	Haz Waste #
Acetaldehyde, chloro-	107–20–0	P023
Acetamide, N-(aminothioxomethyl)-	591–08–2	P002
Acetamide, 2-fluoro-	640–19–7	P057
Acetic acid, fluoro-, sodium salt	62–74–8	P058
1-Acetyl-2-thiourea	591–08–2	P002
Acrolein	107–02–8	P003
Aldicarb	116–06–3	P070
Aldicarb sulfone.	1646–88–4	P203
Aldrin	309–00–2	P004
Allyl alcohol	107–18–6	P005
Aluminum phosphide (R,T)	20859–73–8	P006
5-(Aminomethyl)-3-isoxazolol	2763–96–4	P007
4-Aminopyridine	504–24–5	P008
Ammonium picrate (R)	131–74–8	P009
Ammonium vanadate	7803–55–6	P119
Argentate(1-), bis(cyano-C)-, potassium	506–61–6	P099
Arsenic acid H3AsO4	7778–39–4	P010
Arsenic oxide As2O3	1327–53–3	P012
Arsenic oxide As2O5	1303–28–2	P011
Arsenic pentoxide	1303–28–2	P011
Arsenic trioxide	1327–53–3	P012
Arsine, diethyl-	692–42–2	P038
Arsonous dichloride, phenyl-	696–28–6	P036
Aziridine	151–56–4	P054
Aziridine, 2-methyl-	75–55–8	P067
Barium cyanide	542–62–1	P013
Benzenamine, 4-chloro-	106–47–8	P024
Benzenamine, 4-nitro-	100–01–6	P077
Benzene, (chloromethyl)-	100–44–7	P028
1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-, (R)-	51–43–4	P042
Benzeneethanamine, alpha,alpha-dimethyl-	122–09–8	P046
Benzenethiol	108–98–5	P014
7-Benzofuranol, 2,3-dihydro-2,2-dimethyl-, methylcarbamate.	1563–66–2	P127
Benzoic acid, 2-hydroxy-, compd. with (3aS-cis)-1,2,3,3a,8,8a-hexahydro-1,3a,8-trimethylpyrrolo[2,3-b]indol-5-yl methylcarbamate ester (1:1).	57–64–7	P188
2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1-phenylbutyl)-, & salts, when present at concentrations greater than 0.3%	181–81–2	P001
Benzyl chloride	100–44–7	P028
Beryllium powder	7440–41–7	P015
Bromoacetone	598–31–2	P017
Brucine	357–57–3	P018
2-Butanone, 3,3-dimethyl-1-(methylthio)-,O-[(methylamino)carbonyl] oxime	39196–18–4	P045
Calcium cyanide	592–01–8	P021
Calcium cyanide Ca(CN)2	592–01–8	P021
Carbamic acid, [(dibutylamino)- thio]methyl-, 2,3-dihydro-2,2-dimethyl- 7-benzofuranyl ester.	55285–14–8	P189
Carbamic acid, dimethyl-, 1-[(dimethyl-amino)carbonyl]- 5-methyl-1H- pyrazol-3-yl ester.	644–64–4	P191
Carbamic acid, dimethyl-, 3-methyl-1- (1-methylethyl)-1H-pyrazol-5-yl ester.	119–38–0	P192
Carbamic acid, methyl-, 3-methylphenyl ester.	1129–41–5	P190
Carbofuran.	1563–66–2	P127
Carbon disulfide	75–15–0	P022
Carbonic dichloride	75–44–5	P095

Substance	CAS	Haz Waste #
Carbosulfan.	55285–14–8	P189
Chloroacetaldehyde	107–20–0	P023
p-Chloroaniline	106–47–8	P024
1-(o-Chlorophenyl)thiourea	5344–82–1	P026
3-Chloropropionitrile	542–76–7	P027
Copper cyanide	544–92–3	P029
Copper cyanide Cu(CN)	544–92–3	P029
m-Cumenyl methylcarbamate.	64–00–6	P202
Cyanides (soluble cyanide salts), not otherwise specified		P030
Cyanogen	460–19–5	P031
Cyanogen chloride	506–77–4	P033
Cyanogen chloride (CN)Cl	506–77–4	P033
2-Cyclohexyl-4,6-dinitrophenol	131–89–5	P034
Dichloromethyl ether	542–88–1	P016
Dichlorophenylarsine	696–28–6	P036
Dieldrin	60–57–1	P037
Diethylarsine	692–42–2	P038
Diethyl-p-nitrophenyl phosphate	311–45–5	P041
O,O-Diethyl O-pyrazinyl phosphorothioate	297–97–2	P040
Diisopropylfluorophosphate (DFP)	55–91–4	P043
1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexa- chloro-1,4,4a,5,8,8a,-hexahydro-, (1alpha,4alpha,4abeta,5alpha,8alpha,8abeta)-	309–00–2	P004
1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexa- chloro-1,4,4a,5,8,8a-hexahydro-, (1alpha,4alpha,4abeta,5beta,8beta,8abeta)-	465–73–6	P060
2,7:3,6-Dimethanonaphth[2,3-b]oxirene, 3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-, (1aalpha,2beta,2aalpha,3beta,6beta,6aalpha,7beta, 7aalpha)-	60–57–1	P037
2,7:3,6-Dimethanonaphth [2,3-b]oxirene, 3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-, (1aalpha,2beta,2abeta,3alpha,6alpha,6abeta,7beta, 7aalpha)-, & metabolites	172–20–8	P051
Dimethoate	60–51–5	P044
alpha,alpha-Dimethylphenethylamine	122–09–8	P046
Dimetilan.	644–64–4	P191
4,6-Dinitro-o-cresol, & salts	1534–52–1	P047
2,4-Dinitrophenol	51–28–5	P048
Dinoseb	88–85–7	P020
Diphosphoramide, octamethyl-	152–16–9	P085
Diphosphoric acid, tetraethyl ester	107–49–3	P111
Disulfoton	298–04–4	P039
Dithiobiuret	541–53–7	P049
1,3-Dithiolane-2-carboxaldehyde, 2,4-dimethyl-, O-[(methylamino)- carbonyl]oxime.	26419–73–8	P185
Endosulfan	115–29–7	P050
Endothall	145–73–3	P088
Endrin	72–20–8	P051
Endrin, & metabolites	72–20–8	P051
Epinephrine	51–43–4	P042
Ethanedinitrile	460–19–5	P031
Ethanimidothioic acid, 2-(dimethylamino)-N-[[(methylamino) carbonyl]oxy]-2-oxo-, methyl ester.	23135–22–0	P194
Ethanimidothioic acid,N-[[(methylamino)carbonyl]oxy]-, methyl ester	16752–77–5	P066
Ethyl cyanide	107–12–0	P101
Ethyleneimine	151–56–4	P054
Famphur	52–85–7	P097
Fluorine	7782–41–4	P056
Fluoroacetamide	640–19–7	P057
Fluoroacetic acid, sodium salt	62–74–8	P058

Substance	CAS	Haz Waste #
Formetanate hydrochloride.	23422–53–9	P198
Formparanate.	17702–57–7	P197
Fulminic acid, mercury(2+) salt (R,T)	628–86–4	P065
Heptachlor	76–44–8	P059
Hexaethyl tetraphosphate	757–58–4	P062
Hydrazinecarbothioamide	79–19–6	P116
Hydrazine, methyl-	60–34–4	P068
Hydrocyanic acid	74–90–8	P063
Hydrogen cyanide	74–90–8	P063
Hydrogen phosphide	7803–51–2	P096
Isodrin	465–73–6	P060
Isolan.	119–38–0	P192
3-Isopropylphenyl N-methylcarbamate.	64–00–6	P202
3(2H)-Isoxazolone, 5-(aminomethyl)-	2763–96–4	P007
Manganese, bis(dimethylcarbamodithioato-S,S?)-,	15339–36–3	P196
Manganese dimethyldithiocarbamate.	15339–36–3	P196
Mercury, (acetato-O)phenyl-	62–38–4	P092
Mercury fulminate (R,T)	628–86–4	P065
Methanamine, N-methyl-N-nitroso-	62–75–9	P082
Methane, isocyanato-	624–83–9	P064
Methane, oxybis[chloro-	542–88–1	P016
Methane, tetranitro- (R)	509–14–8	P112
Methanethiol, trichloro-	75–70–7	P118
Methanimidamide, N,N-dimethyl-N?-[3-[[(methylamino)-carbonyl]oxy]phenyl]-, monohydrochloride.	23422–53–9	P198
Methanimidamide, N,N-dimethyl-N?-[2-methyl-4-[[(methylamino)carbonyl]oxy]phenyl]-	17702–57–7	P197
6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10- hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide	115–29–7	P050
4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-	76–44–8	P059
Methiocarb.	2032–65–7	P199
Methomyl	16752–77–5	P066
Methyl hydrazine	60–34–4	P068
Methyl isocyanate	624–83–9	P064
2-Methyllactonitrile	75–86–5	P069
Methyl parathion	298–00–0	P071
Metolcarb.	1129–41–5	P190
Mexacarbate.	315–8–4	P128
alpha-Naphthylthiourea	86–88–4	P072
Nickel carbonyl	13463–39–3	P073
Nickel carbonyl Ni(CO)4, (T-4)-	13463–39–3	P073
Nickel cyanide	557–19–7	P074
Nickel cyanide Ni(CN)2	557–19–7	P074
Nicotine, & salts	154–11–5	P075
Nitric oxide	10102–43–9	P076
p-Nitroaniline	100–01–6	P077
Nitrogen dioxide	10102–44–0	P078
Nitrogen oxide NO	10102–43–9	P076
Nitrogen oxide NO2	10102–44–0	P078
Nitroglycerine (R)	55–63–0	P081
N-Nitrosodimethylamine	62–75–9	P082
N-Nitrosomethylvinylamine	4549–40–0	P084
Octamethylpyrophosphoramide	152–16–9	P085
Osmium oxide OsO4, (T-4)-	20816–12–0	P087
Osmium tetroxide	20816–12–0	P087
7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid	145–73–3	P088
Oxamyl.	23135–22–0	P194
Parathion	56–38–2	P089
Phenol, 2-cyclohexyl-4,6-dinitro-	131–89–5	P034
Phenol, 2,4-dinitro-	51–28–5	P048
Phenol, 2-methyl-4,6-dinitro-, & salts	1534–52–1	P047
Phenol, 2-(1-methylpropyl)-4,6-dinitro-	88–85–7	P020
Phenol, 2,4,6-trinitro-, ammonium salt (R)	131–74–8	P009
Phenol, 4-(dimethylamino)-3,5-dimethyl-, methylcarbamate (ester).	315–18–4	P128
Phenol, (3,5-dimethyl-4-(methylthio)-, methylcarbamate	2032–65–7	P199
Phenol, 3-(1-methylethyl)-, methyl carbamate.	64–00–6	P202
Phenol, 3-methyl-5-(1-methylethyl)-, methyl carbamate.	2631–37–0	P201
Phenylmercury acetate	62–38–4	P092
Phenylthiourea	103–85–5	P093
Phorate	298–02–2	P094
Phosgene	75–44–5	P095
Phosphine	7803–51–2	P096

Substance	CAS	Haz Waste #
Phosphoric acid, diethyl 4-nitrophenyl ester	311–45–5	P041
Phosphorodithioic acid, O,O-diethyl S-[2-(ethylthio)ethyl] ester	298–04–4	P039
Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester	298–02–2	P094
Phosphorodithioic acid, O,O-dimethyl S-[2-(methylamino)-2-oxoethyl] ester	60–51–5	P044
Phosphorofluoridic acid, bis(1-methylethyl) ester	55–91–4	P043
Phosphorothioic acid, O,O-diethyl O-(4-nitrophenyl) ester	56–38–2	P089
Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester	297–97–2	P040
Phosphorothioic acid, O-[4-[(dimethylamino)sulfonyl]phenyl] O,O-dimethyl ester	52–85–7	P097
Phosphorothioic acid, O,O,-dimethyl O-(4-nitrophenyl) ester	298–00–0	P071
Physostigmine.	57–47–6	P204
Physostigmine salicylate.	57–64–7	P188
Plumbane, tetraethyl-	78–00–2	P110
Potassium cyanide	151–50–8	P098
Potassium cyanide K(CN)	151–50–8	P098
Potassium silver cyanide	506–61–6	P099
Promecarb	2631–37–0	P201
Propanal, 2-methyl-2-(methylthio)-, O-[(methylamino)carbonyl]oxime	116–06–3	P070
Propanal, 2-methyl-2-(methyl-sulfonyl)-, O-[(methylamino)carbonyl] oxime.	1646–88–4	P203
Propanenitrile	107–12–0	P101
Propanenitrile, 3-chloro-	542–76–7	P027
Propanenitrile, 2-hydroxy-2-methyl-	75–86–5	P069
1,2,3-Propanetriol, trinitrate (R)	55–63–0	P081
2-Propanone, 1-bromo-	598–31–2	P017
Propargyl alcohol	107–19–7	P102
2-Propenal	107–02–8	P003
2-Propen-1-ol	107–18–6	P005
1,2-Propylenimine	75–55–8	P067
2-Propyn-1-ol	107–19–7	P102
4-Pyridinamine	504–24–5	P008
Pyridine, 3-(1-methyl-2-pyrrolidinyl)-, (S)-, & salts	154–11–5	P075
Pyrrolo[2,3-b]indol-5-ol, 1,2,3,3a,8,8a-hexahydro-1,3a,8-trimethyl-, methylcarbamate (ester), (3aS-cis)-.	57–47–6	P204
Selenious acid, dithallium(1+) salt	12039–52–0	P114
Selenourea	630–10–4	P103
Silver cyanide	506–64–9	P104
Silver cyanide Ag(CN)	506–64–9	P104
Sodium azide	26628–22–8	P105
Sodium cyanide	143–33–9	P106
Sodium cyanide Na(CN)	143–33–9	P106
Strychnidin-10-one, & salts	157–24–9	P108
Strychnidin-10-one, 2,3-dimethoxy-	357–57–3	P018
Strychnine, & salts	157–24–9	P108
Sulfuric acid, dithallium(1+) salt	7446–18–6	P115
Tetraethyldithiopyrophosphate	3689–24–5	P109
Tetraethyl lead	78–00–2	P110
Tetraethyl pyrophosphate	107–49–3	P111
Tetranitromethane (R)	509–14–8	P112
Tetraphosphoric acid, hexaethyl ester	757–58–4	P062
Thallic oxide	1314–32–5	P113
Thallium oxide Tl2O3	1314–32–5	P113
Thallium(I) selenite	12039–52–0	P114
Thallium(I) sulfate	7446–18–6	P115
Thiodiphosphoric acid, tetraethyl ester	3689–24–5	P109
Thiofanox	39196–18–4	P045
Thioimidodicarbonic diamide [(H2N)C(S)]2NH	541–53–7	P049
Thiophenol	108–98–5	P014
Thiosemicarbazide	79–19–6	P116
Thiourea, (2-chlorophenyl)-	5344–82–1	P026
Thiourea, 1-naphthalenyl-	86–88–4	P072
Thiourea, phenyl-	103–85–5	P093
Tirpate.	26419–73–8	P185
Toxaphene	8001–35–2	P123
Trichloromethanethiol	75–70–7	P118
Vanadic acid, ammonium salt	7803–55–6	P119
Vanadium oxide V2O5	1314–62–1	P120
Vanadium pentoxide	1314–62–1	P120
Vinylamine, N-methyl-N-nitroso-	4549–40–0	P084
Warfarin, & salts, when present at concentrations greater than 0.3%	181–81–2	P001
Zinc, bis(dimethylcarbamodithioato-S,S?)-,	137–30–4	P205
Zinc cyanide	557–21–1	P121
Zinc cyanide Zn(CN)2	557–21–1	P121
Zinc phosphide Zn3P2, when present at concentrations greater than 10% (R,T)	1314–84–7	P122
Ziram.	137–30–4	P205

Substance	CAS	Haz waste #
A2213.	30558–43–1	U394
Acetaldehyde (I)	75–07–0	U001
Acetaldehyde, trichloro-	75–87–6	U034
Acetamide, N-(4-ethoxyphenyl)-	62–44–2	U187
Acetamide, N-9H-fluoren-2-yl-	53–96–3	U005
Acetic acid, (2,4-dichlorophenoxy)-, salts & esters	194–75–7	U240
Acetic acid ethyl ester (I)	141–78–6	U112
Acetic acid, lead(2+) salt	301–04–2	U144
Acetic acid, thallium(1+) salt	563–68–8	U214
Acetic acid, (2,4,5-trichlorophenoxy)-	93–76–5	see F027
Acetone (I)	67–64–1	U002
Acetonitrile (I,T)	75–05–8	U003
Acetophenone	98–86–2	U004
2-Acetylaminofluorene	53–96–3	U005
Acetyl chloride (C,R,T)	75–36–5	U006
Acrylamide	79–06–1	U007
Acrylic acid (I)	79–10–7	U008
Acrylonitrile	107–13–1	U009
Amitrole	61–82–5	U011
Aniline (I,T)	62–53–3	U012
Arsinic acid, dimethyl-	75–60–5	U136
Auramine	492–80–8	U014
Azaserine	115–02–6	U015
Azirino[2?,3?:3,4]pyrrolo[1,2-a]indole-4,7-dione, 6-amino-8-[[(aminocarbonyl)oxy]methyl]-1,1a,2,8,8a,8b-hexahydro-8a-methoxy-5-methyl-, [1aS-(1aalpha, 8beta,8aalpha,8balpha)]-	50–07–7	U010
Barban.	101–27–9	U280
Bendiocarb.	22781–23–3	U278
Bendiocarb phenol.	22961–82–6	U364
Benomyl.	17804–35–2	U271
Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-	56–49–5	U157
Benz[c]acridine	225–51–4	U016
Benzal chloride	98–87–3	U017
Benzamide, 3,5-dichloro-N-(1,1-dimethyl-2-propynyl)-	23950–58–5	U192
Benz[a]anthracene	56–55–3	U018
Benz[a]anthracene, 7,12-dimethyl-	57–97–6	U094
Benzenamine (I,T)	62–53–3	U012
Benzenamine, 4,4?-carbonimidoylbis[N,N-dimethyl-	492–80–8	U014
Benzenamine, 4-chloro-2-methyl-, hydrochloride	3165–93–3	U049
Benzenamine, N,N-dimethyl-4-(phenylazo)-	60–11–7	U093
Benzenamine, 2-methyl-	95–53–4	U328
Benzenamine, 4-methyl-	106–49–0	U353
Benzenamine, 4,4?-methylenebis[2-chloro-	101–14–4	U158
Benzenamine, 2-methyl-, hydrochloride	636–21–5	U222
Benzenamine, 2-methyl-5-nitro-	99–55–8	U181
Benzene (I,T)	71–43–2	U019
Benzeneacetic acid, 4-chloro-alpha-(4-chlorophenyl)-alpha-hydroxy-, ethyl ester	510–15–6	U038
Benzene, 1-bromo-4-phenoxy-	101–55–3	U030
Benzenebutanoic acid, 4-[bis(2-chloroethyl)amino]-	305–03–3	U035
Benzene, chloro-	108–90–7	U037
Benzenediamine, ar-methyl-	25376–45–8	U221
1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester	117–81–7	U028
1,2-Benzenedicarboxylic acid, dibutyl ester	84–74–2	U069
1,2-Benzenedicarboxylic acid, diethyl ester	84–66–2	U088
1,2-Benzenedicarboxylic acid, dimethyl ester	131–11–3	U102
1,2-Benzenedicarboxylic acid, dioctyl ester	117–84–0	U107
Benzene, 1,2-dichloro-	95–50–1	U070
Benzene, 1,3-dichloro-	541–73–1	U071
Benzene, 1,4-dichloro-	106–46–7	U072
Benzene, 1,1?-(2,2-dichloroethylidene)bis[4-chloro-	72–54–8	U060
Benzene, (dichloromethyl)-	98–87–3	U017
Benzene, 1,3-diisocyanatomethyl- (R,T)	26471–62–5	U223
Benzene, dimethyl- (I)	1330–20–7	U239
1,3-Benzenediol	108–46–3	U201
Benzene, hexachloro-	118–74–1	U127
Benzene, hexahydro- (I)	110–82–7	U056
Benzene, methyl-	108–88–3	U220
Benzene, 1-methyl-2,4-dinitro-	121–14–2	U105
Benzene, 2-methyl-1,3-dinitro-	606–20–2	U106
Benzene, (1-methylethyl)- (I)	98–82–8	U055
Benzene, nitro-	98–95–3	U169

Substance	CAS	Haz waste #
Benzene, pentachloro-	608–93–5	U183
Benzene, pentachloronitro-	82–68–8	U185
Benzenesulfonic acid chloride (C,R)	98–09–9	U020
Benzenesulfonyl chloride (C,R)	98–09–9	U020
Benzene, 1,2,4,5-tetrachloro-	95–94–3	U207
Benzene, 1,1?-(2,2,2-trichloroethylidene)bis[4-chloro-	50–29–3	U061
Benzene, 1,1?-(2,2,2-trichloroethylidene)bis[4- methoxy-	72–43–5	U247
Benzene, (trichloromethyl)-	98–07–7	U023
Benzene, 1,3,5-trinitro-	99–35–4	U234
Benzidine	92–87–5	U021
1,2-Benzisothiazol-3(2H)-one, 1,1-dioxide, & salts	181–07–2	U202
1,3-Benzodioxol-4-ol, 2,2-dimethyl-, methyl carbamate.	22781–23–3	U278
1,3-Benzodioxol-4-ol, 2,2-dimethyl-,	22961–82–6	U364
1,3-Benzodioxole, 5-(2-propenyl)-	94–59–7	U203
1,3-Benzodioxole, 5-(1-propenyl)-	120–58–1	U141
7-Benzofuranol, 2,3-dihydro-2,2-dimethyl-	1563–38–8	U367
1,3-Benzodioxole, 5-propyl-	94–58–6	U090
Benzo[rst]pentaphene	189–55–9	U064
2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1-phenyl-butyl)-, & salts, when present at concentrations of 0.3% or less	181–81–2	U248
Benzo[a]pyrene	50–32–8	U022
p-Benzoquinone	106–51–4	U197
Benzotrichloride (C,R,T)	98–07–7	U023
2,2?-Bioxirane	1464–53–5	U085
[1,1?-Biphenyl]-4,4?-diamine	92–87–5	U021
[1,1?-Biphenyl]-4,4?-diamine, 3,3?-dichloro-	91–94–1	U073
[1,1?-Biphenyl]-4,4?-diamine, 3,3?-dimethoxy-	119–90–4	U091
[1,1?-Biphenyl]-4,4?-diamine, 3,3?-dimethyl-	119–93–7	U095
Bromoform	75–25–2	U225
4-Bromophenyl phenyl ether	101–55–3	U030
1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	87–68–3	U128
1-Butanamine, N-butyl-N-nitroso-	924–16–3	U172
1-Butanol (I)	71–36–3	U031
2-Butanone (I,T)	78–93–3	U159
2-Butanone, peroxide (R,T)	1338–23–4	U160
2-Butenal	4170–30–3	U053
2-Butene, 1,4-dichloro- (I,T)	764–41–0	U074
2-Butenoic acid, 2-methyl-, 7-[[2,3-dihydroxy- 2-(1-methoxyethyl)-3-methyl-1-oxobutoxy]methyl]- 2,3,5,7a-tetrahydro-1H-pyrrolizin-1-yl ester, [1S-[1alpha(Z),7(2S*,3R*),7aalpha]]-	303–34–4	U143
n-Butyl alcohol (I)	71–36–3	U031
Cacodylic acid	75–60–5	U136
Calcium chromate	13765–19–0	U032
Carbamic acid, 1H-benzimidazol-2-yl, methyl ester.	10605–21–7	U372
Carbamic acid, [1-[(butylamino)carbonyl]-1H-benzimidazol-2-yl]-, methyl ester.	17804–35–2	U271
Carbamic acid, (3-chlorophenyl)-, 4-chloro-2-butynyl ester.	101–27–9	U280
Carbamic acid, ethyl ester	51–79–6	U238
Carbamic acid, methylnitroso-, ethyl ester	615–53–2	U178
Carbamic acid, phenyl-, 1-methylethyl ester.	122–42–9	U373
Carbamic acid, [1,2-phenylenebis (iminocarbonothioyl)]bis-, dimethyl ester.	23564–05–8	U409
Carbamic chloride, dimethyl-	79–44–7	U097
Carbamothioic acid, bis(1-methylethyl)-, S-(2,3,3-trichloro-2-propenyl) ester.	2303–17–5	U389
Carbamothioic acid, dipropyl-, S-(phenylmethyl) ester.	52888–80–9	U387
Carbamodithioic acid, 1,2-ethanediylbis-, salts & esters	1111–54–6	U114
Carbamothioic acid, bis(1-methylethyl)-, S-(2,3-dichloro-2-propenyl) ester	2303–16–4	U062
Carbaryl.	63–25–2	U279
Carbendazim.	10605–21–7	U372
Carbofuran phenol.	1563–38–8	U367
Carbonic acid, dithallium(1+) salt	6533–73–9	U215
Carbonic difluoride	353–50–4	U033
Carbonochloridic acid, methyl ester (I,T)	79–22–1	U156
Carbon oxyfluoride (R,T)	353–50–4	U033
Carbon tetrachloride	56–23–5	U211
Chloral	75–87–6	U034
Chlorambucil	305–03–3	U035
Chlordane, alpha & gamma isomers	57–74–9	U036
Chlornaphazin	494–03–1	U026
Chlorobenzene	108–90–7	U037
Chlorobenzilate	510–15–6	U038
p-Chloro-m-cresol	59–50–7	U039
2-Chloroethyl vinyl ether	110–75–8	U042
Chloroform	67–66–3	U044

Substance	CAS	Haz waste #
Chloromethyl methyl ether	107–30–2	U046
beta-Chloronaphthalene	91–58–7	U047
o-Chlorophenol	95–57–8	U048
4-Chloro-o-toluidine, hydrochloride	3165–93–3	U049
Chromic acid H2CrO4, calcium salt	13765–19–0	U032
Chrysene	218–01–9	U050
Creosote		U051
Cresol (Cresylic acid)	1319–77–3	U052
Crotonaldehyde	4170–30–3	U053
Cumene (I)	98–82–8	U055
Cyanogen bromide (CN)Br	506–68–3	U246
2,5-Cyclohexadiene-1,4-dione	106–51–4	U197
Cyclohexane (I)	110–82–7	U056
Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1alpha,2alpha,3beta,4alpha,5alpha,6beta)-	58–89–9	U129
Cyclohexanone (I)	108–94–1	U057
1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-	77–47–4	U130
Cyclophosphamide	50–18–0	U058
2,4-D, salts & esters	194–75–7	U240
Daunomycin	20830–81–3	U059
DDD	72–54–8	U060
DDT	50–29–3	U061
Diallate	2303–16–4	U062
Dibenz[a,h]anthracene	53–70–3	U063
Dibenzo[a,i]pyrene	189–55–9	U064
1,2-Dibromo-3-chloropropane	96–12–8	U066
Dibutyl phthalate	84–74–2	U069
o-Dichlorobenzene	95–50–1	U070
m-Dichlorobenzene	541–73–1	U071
p-Dichlorobenzene	106–46–7	U072
3,3?-Dichlorobenzidine	91–94–1	U073
1,4-Dichloro-2-butene (I,T)	764–41–0	U074
Dichlorodifluoromethane	75–71–8	U075
1,1-Dichloroethylene	75–35–4	U078
1,2-Dichloroethylene	156–60–5	U079
Dichloroethyl ether	111–44–4	U025
Dichloroisopropyl ether	108–60–1	U027
Dichloromethoxy ethane	111–91–1	U024
2,4-Dichlorophenol	120–83–2	U081
2,6-Dichlorophenol	87–65–0	U082
1,3-Dichloropropene	542–75–6	U084
1,2:3,4-Diepoxybutane (I,T)	1464–53–5	U085
1,4-Diethyleneoxide	123–91–1	U108
Diethylhexyl phthalate	117–81–7	U028
Diethylene glycol, dicarbamate.	5952–26–1	U395
N,N?-Diethylhydrazine	1615–80–1	U086
O,O-Diethyl S-methyl dithiophosphate	3288–58–2	U087
Diethyl phthalate	84–66–2	U088
Diethylstilbesterol	56–53–1	U089
Dihydrosafrole	94–58–6	U090
3,3?-Dimethoxybenzidine	119–90–4	U091
Dimethylamine (I)	124–40–3	U092
p-Dimethylaminoazobenzene	60–11–7	U093
7,12-Dimethylbenz[a]anthracene	57–97–6	U094
3,3?-Dimethylbenzidine	119–93–7	U095
alpha,alpha-Dimethylbenzylhydroperoxide (R)	80–15–9	U096
Dimethylcarbamoyl chloride	79–44–7	U097
1,1-Dimethylhydrazine	57–14–7	U098
1,2-Dimethylhydrazine	540–73–8	U099
2,4-Dimethylphenol	105–67–9	U101
Dimethyl phthalate	131–11–3	U102
Dimethyl sulfate	77–78–1	U103
2,4-Dinitrotoluene	121–14–2	U105
2,6-Dinitrotoluene	606–20–2	U106
Di-n-octyl phthalate	117–84–0	U107
1,4-Dioxane	123–91–1	U108
1,2-Diphenylhydrazine	122–66–7	U109
Dipropylamine (I)	142–84–7	U110
Di-n-propylnitrosamine	621–64–7	U111
Epichlorohydrin	106–89–8	U041

Substance	CAS	Haz waste #
Ethanal (I)	75–07–0	U001
Ethanamine, N,N-diethyl-	121–44–8	U404
Ethanamine, N-ethyl-N-nitroso-	55–18–5	U174
1,2-Ethanediamine, N,N-dimethyl-N?-2-pyridinyl-N?-(2-thienylmethyl)-	91–80–5	U155
Ethane, 1,2-dibromo-	106–93–4	U067
Ethane, 1,1-dichloro-	75–34–3	U076
Ethane, 1,2-dichloro-	107–06–2	U077
Ethane, hexachloro-	67–72–1	U131
Ethane, 1,1?-[methylenebis(oxy)]bis[2-chloro-	111–91–1	U024
Ethane, 1,1?-oxybis-(I)	60–29–7	U117
Ethane, 1,1?-oxybis[2-chloro-	111–44–4	U025
Ethane, pentachloro-	76–01–7	U184
Ethane, 1,1,1,2-tetrachloro-	630–20–6	U208
Ethane, 1,1,2,2-tetrachloro-	79–34–5	U209
Ethanethioamide	62–55–5	U218
Ethane, 1,1,1-trichloro-	71–55–6	U226
Ethane, 1,1,2-trichloro-	79–00–5	U227
Ethanimidothioic acid, N,N?-[thiobis[(methylimino)carbonyloxy]]bis-, dimethyl ester	59669–26–0	U410
Ethanimidothioic acid, 2-(dimethylamino)-N-hydroxy-2-oxo-, methyl ester.	30558–43–1	U394
Ethanol, 2-ethoxy-	110–80–5	U359
Ethanol, 2,2?-(nitrosoimino)bis-	1116–54–7	U173
Ethanol, 2,2?-oxybis-, dicarbamate.	5952–26–1	U395
Ethanone, 1-phenyl-	98–86–2	U004
Ethene, chloro-	75–01–4	U043
Ethene, (2-chloroethoxy)-	110–75–8	U042
Ethene, 1,1-dichloro-	75–35–4	U078
Ethene, 1,2-dichloro-, (E)-	156–60–5	U079
Ethene, tetrachloro-	127–18–4	U210
Ethene, trichloro-	79–01–6	U228
Ethyl acetate (I)	141–78–6	U112
Ethyl acrylate (I)	140–88–5	U113
Ethyl carbamate (urethane)	51–79–6	U238
Ethyl ether (I)	60–29–7	U117
Ethylenebisdithiocarbamic acid, salts & esters	1111–54–6	U114
Ethylene dibromide	106–93–4	U067
Ethylene dichloride	107–06–2	U077
Ethylene glycol monoethyl ether	110–80–5	U359
Ethylene oxide (I,T)	75–21–8	U115
Ethylenethiourea	96–45–7	U116
Ethylidene dichloride	75–34–3	U076
Ethyl methacrylate	97–63–2	U118
Ethyl methanesulfonate	62–50–0	U119
Fluoranthene	206–44–0	U120
Formaldehyde	50–00–0	U122
Formic acid (C,T)	64–18–6	U123
Furan (I)	110–00–9	U124
2-Furancarboxaldehyde (I)	98–01–1	U125
2,5-Furandione	108–31–6	U147
Furan, tetrahydro-(I)	109–99–9	U213
Furfural (I)	98–01–1	U125
Furfuran (I)	110–00–9	U124
Glucopyranose, 2-deoxy-2-(3-methyl-3-nitrosoureido)-, D-	18883–66–4	U206
D-Glucose, 2-deoxy-2-[[(methylnitrosoamino)- carbonyl]amino]-	18883–66–4	U206
Glycidylaldehyde	765–34–4	U126
Guanidine, N-methyl-N?-nitro-N-nitroso-	70–25–7	U163
Hexachlorobenzene	118–74–1	U127
Hexachlorobutadiene	87–68–3	U128
Hexachlorocyclopentadiene	77–47–4	U130
Hexachloroethane	67–72–1	U131
Hexachlorophene	70–30–4	U132
Hexachloropropene	1888–71–7	U243
Hydrazine (R,T)	302–01–2	U133
Hydrazine, 1,2-diethyl-	1615–80–1	U086
Hydrazine, 1,1-dimethyl-	57–14–7	U098
Hydrazine, 1,2-dimethyl-	540–73–8	U099
Hydrazine, 1,2-diphenyl-	122–66–7	U109
Hydrofluoric acid (C,T)	7664–39–3	U134
Hydrogen fluoride (C,T)	7664–39–3	U134
Hydrogen sulfide	7783–06–4	U135

Substance	CAS	Haz waste #
Hydrogen sulfide H2S	7783–06–4	U135
Hydroperoxide, 1-methyl-1-phenylethyl- (R)	80–15–9	U096
2-Imidazolidinethione	96–45–7	U116
Indeno[1,2,3-cd]pyrene	193–39–5	U137
1,3-Isobenzofurandione	85–44–9	U190
Isobutyl alcohol (I,T)	78–83–1	U140
Isosafrole	120–58–1	U141
Kepone	143–50–0	U142
Lasiocarpine	303–34–4	U143
Lead acetate	301–04–2	U144
Lead, bis(acetato-O)tetrahydroxytri-	1335–32–6	U146
Lead phosphate	7446–27–7	U145
Lead subacetate	1335–32–6	U146
Lindane	58–89–9	U129
MNNG	70–25–7	U163
Maleic anhydride	108–31–6	U147
Maleic hydrazide	123–33–1	U148
Malononitrile	109–77–3	U149
Melphalan	148–82–3	U150
Mercury	7439–97–6	U151
Methacrylonitrile (I, T)	126–98–7	U152
Methanamine, N-methyl- (I)	124–40–3	U092
Methane, bromo-	74–83–9	U029
Methane, chloro- (I, T)	74–87–3	U045
Methane, chloromethoxy-	107–30–2	U046
Methane, dibromo-	74–95–3	U068
Methane, dichloro-	75–09–2	U080
Methane, dichlorodifluoro-	75–71–8	U075
Methane, iodo-	74–88–4	U138
Methanesulfonic acid, ethyl ester	62–50–0	U119
Methane, tetrachloro-	56–23–5	U211
Methanethiol (I, T)	74–93–1	U153
Methane, tribromo-	75–25–2	U225
Methane, trichloro-	67–66–3	U044
Methane, trichlorofluoro-	75–69–4	U121
4,7-Methano-1H-indene, 1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-	57–74–9	U036
Methanol (I)	67–56–1	U154
Methapyrilene	91–80–5	U155
1,3,4-Metheno-2H-cyclobuta[cd]pentalen-2-one, 1,1a,3,3a,4,5,5,5a,5b,6-decachlorooctahydro-	143–50–0	U142
Methoxychlor	72–43–5	U247
Methyl alcohol (I)	67–56–1	U154
Methyl bromide	74–83–9	U029
1-Methylbutadiene (I)	504–60–9	U186
Methyl chloride (I,T)	74–87–3	U045
Methyl chlorocarbonate (I,T)	79–22–1	U156
Methyl chloroform	71–55–6	U226
3-Methylcholanthrene	56–49–5	U157
4,4?-Methylenebis(2-chloroaniline)	101–14–4	U158
Methylene bromide	74–95–3	U068
Methylene chloride	75–09–2	U080
Methyl ethyl ketone (MEK) (I,T)	78–93–3	U159
Methyl ethyl ketone peroxide (R,T)	1338–23–4	U160
Methyl iodide	74–88–4	U138
Methyl isobutyl ketone (I)	108–10–1	U161
Methyl methacrylate (I,T)	80–62–6	U162
4-Methyl-2-pentanone (I)	108–10–1	U161
Methylthiouracil	56–04–2	U164
Mitomycin C	50–07–7	U010
5,12-Naphthacenedione, 8-acetyl-10-[(3-amino-2,3,6-trideoxy)-alpha-L-lyxo-hexopyranosyl)oxy]-7,8,9,10-tetrahydro-6,8,11-trihydroxy-1-methoxy-, (8S-cis)-	20830–81–3	U059
1-Naphthalenamine	134–32–7	U167
2-Naphthalenamine	91–59–8	U168
Naphthalenamine, N,N?-bis(2-chloroethyl)-	494–03–1	U026
Naphthalene	91–20–3	U165
Naphthalene, 2-chloro-	91–58–7	U047
1,4-Naphthalenedione	130–15–4	U166
2,7-Naphthalenedisulfonic acid, 3,3?-[(3,3?- dimethyl[1,1?-biphenyl]-4,4?-diyl)bis(azo)bis[5-amino-4-hydroxy]-, tetrasodium salt	72–57–1	U236
1-Naphthalenol, methylcarbamate.	63–25–2	U279
1,4-Naphthoquinone	130–15–4	U166
alpha-Naphthylamine	134–32–7	U167

Substance	CAS	Haz waste #
beta-Naphthylamine	91–59–8	U168
Nitric acid, thallium(1+) salt	10102–45–1	U217
Nitrobenzene (I,T)	98–95–3	U169
p-Nitrophenol	100–02–7	U170
2-Nitropropane (I,T)	79–46–9	U171
N-Nitrosodi-n-butylamine	924–16–3	U172
N-Nitrosodiethanolamine	1116–54–7	U173
N-Nitrosodiethylamine	55–18–5	U174
N-Nitroso-N-ethylurea	759–73–9	U176
N-Nitroso-N-methylurea	684–93–5	U177
N-Nitroso-N-methylurethane	615–53–2	U178
N-Nitrosopiperidine	100–75–4	U179
N-Nitrosopyrrolidine	930–55–2	U180
5-Nitro-o-toluidine	99–55–8	U181
1,2-Oxathiolane, 2,2-dioxide	1120–71–4	U193
2H-1,3,2-Oxazaphosphorin-2-amine, N,N-bis(2-chloroethyl)tetrahydro-, 2-oxide	50–18–0	U058
Oxirane (I,T)	75–21–8	U115
Oxiranecarboxyaldehyde	765–34–4	U126
Oxirane, (chloromethyl)-	106–89–8	U041
Paraldehyde	123–63–7	U182
Pentachlorobenzene	608–93–5	U183
Pentachloroethane	76–01–7	U184
Pentachloronitrobenzene (PCNB)	82–68–8	U185
Pentachlorophenol	87–86–5	See F027
Pentanol, 4-methyl-	108–10–1	U161
1,3-Pentadiene (I)	504–60–9	U186
Phenacetin	62–44–2	U187
Phenol	108–95–2	U188
Phenol, 2-chloro-	95–57–8	U048
Phenol, 4-chloro-3-methyl-	59–50–7	U039
Phenol, 2,4-dichloro-	120–83–2	U081
Phenol, 2,6-dichloro-	87–65–0	U082
Phenol, 4,4?-(1,2-diethyl-1,2-ethenediyl)bis-, (E)-	56–53–1	U089
Phenol, 2,4-dimethyl-	105–67–9	U101
Phenol, methyl-	1319–77–3	U052
Phenol, 2,2?-methylenebis[3,4,6-trichloro-	70–30–4	U132
Phenol, 2-(1-methylethoxy)-, methylcarbamate.	114–26–1	U411
Phenol, 4-nitro-	100–02–7	U170
Phenol, pentachloro-	87–86–5	See F027
Phenol, 2,3,4,6-tetrachloro-	58–90–2	See F027
Phenol, 2,4,5-trichloro-	95–95–4	See F027
Phenol, 2,4,6-trichloro-	88–06–2	See F027
L-Phenylalanine, 4-[bis(2-chloroethyl)amino]-	148–82–3	U150
Phosphoric acid, lead(2+) salt (2:3)	7446–27–7	U145
Phosphorodithioic acid, O,O-diethyl S-methyl ester	3288–58–2	U087
Phosphorus sulfide (R)	1314–80–3	U189
Phthalic anhydride	85–44–9	U190
2-Picoline	109–06–8	U191
Piperidine, 1-nitroso-	100–75–4	U179
Pronamide	23950–58–5	U192
1-Propanamine (I,T)	107–10–8	U194
1-Propanamine, N-nitroso-N-propyl-	621–64–7	U111
1-Propanamine, N-propyl- (I)	142–84–7	U110
Propane, 1,2-dibromo-3-chloro-	96–12–8	U066
Propane, 1,2-dichloro-	78–87–5	U083
Propanedinitrile	109–77–3	U149
Propane, 2-nitro- (I,T)	79–46–9	U171
Propane, 2,2?-oxybis[2-chloro-	108–60–1	U027
1,3-Propane sultone	1120–71–4	U193
Propanoic acid, 2-(2,4,5-trichlorophenoxy)-	93–72–1	See F027
1-Propanol, 2,3-dibromo-, phosphate (3:1)	126–72–7	U235
1-Propanol, 2-methyl- (I,T)	78–83–1	U140
2-Propanone (I)	67–64–1	U002
2-Propenamide	79–06–1	U007
1-Propene, 1,3-dichloro-	542–75–6	U084
1-Propene, 1,1,2,3,3,3-hexachloro-	1888–71–7	U243
2-Propenenitrile	107–13–1	U009
2-Propenenitrile, 2-methyl- (I,T)	126–98–7	U152
2-Propenoic acid (I)	79–10–7	U008

Substance	CAS	Haz waste #
2-Propenoic acid, ethyl ester (I)	140–88–5	U113
2-Propenoic acid, 2-methyl-, ethyl ester	97–63–2	U118
2-Propenoic acid, 2-methyl-, methyl ester (I,T)	80–62–6	U162
Propham.	122–42–9	U373
Propoxur.	114–26–1	U411
Prosulfocarb.	52888–80–9	U387
n-Propylamine (I,T)	107–10–8	U194
Propylene dichloride	78–87–5	U083
3,6-Pyridazinedione, 1,2-dihydro-	123–33–1	U148
Pyridine	110–86–1	U196
Pyridine, 2-methyl-	109–06–8	U191
2,4-(1H,3H)-Pyrimidinedione, 5-[bis(2- chloroethyl)amino]-	66–75–1	U237
4(1H)-Pyrimidinone, 2,3-dihydro-6-methyl-2-thioxo-	56–04–2	U164
Pyrrolidine, 1-nitroso-	930–55–2	U180
Reserpine	50–55–5	U200
Resorcinol	108–46–3	U201
Saccharin, & salts	181–07–2	U202
Safrole	94–59–7	U203
Selenious acid	7783–00–8	U204
Selenium dioxide	7783–00–8	U204
Selenium sulfide	7488–56–4	U205
Selenium sulfide SeS2(R,T)	7488–56–4	U205
L-Serine, diazoacetate (ester)	115–02–6	U015
Silvex (2,4,5-TP)	93–72–1	See F027
Streptozotocin	18883–66–4	U206
Sulfuric acid, dimethyl ester	77–78–1	U103
Sulfur phosphide (R)	1314–80–3	U189
2,4,5-T	93–76–5	See F027
1,2,4,5-Tetrachlorobenzene	95–94–3	U207
1,1,1,2-Tetrachloroethane	630–20–6	U208
1,1,2,2-Tetrachloroethane	79–34–5	U209
Tetrachloroethylene	127–18–4	U210
2,3,4,6-Tetrachlorophenol	58–90–2	See F027
Tetrahydrofuran (I)	109–99–9	U213
Thallium(I) acetate	563–68–8	U214
Thallium(I) carbonate	6533–73–9	U215
Thallium(I) chloride	7791–12–0	U216
thallium chloride TlCl	7791–12–0	U216
Thallium(I) nitrate	10102–45–1	U217
Thioacetamide	62–55–5	U218
Thiodicarb.	59669–26–0	U410
Thiomethanol (I,T)	74–93–1	U153
Thioperoxydicarbonic diamide [(H2N)C(S)]2S2, tetramethyl-	137–26–8	U244
Thiophanate-methyl.	23564–05–8	U409
Thiourea	62–56–6	U219
Thiram	137–26–8	U244
Toluene	108–88–3	U220
Toluenediamine	25376–45–8	U221
Toluene diisocyanate (R,T)	26471–62–5	U223
o-Toluidine	95–53–4	U328
p-Toluidine	106–49–0	U353
o-Toluidine hydrochloride	636–21–5	U222
Triallate.	2303–17–5	U389
1H-1,2,4-Triazol-3-amine	61–82–5	U011
1,1,1-Trichloroethane	71–55–6	U226
1,1,2-Trichloroethane	79–00–5	U227
Trichloroethylene	79–01–6	U228
Trichloromonofluoromethane	75–69–4	U121
2,4,5-Trichlorophenol	95–95–4	See F027
2,4,6-Trichlorophenol	88–06–2	See F027
Triethylamine.	121–44–8	U404
1,3,5-Trinitrobenzene (R,T)	99–35–4	U234
1,3,5-Trioxane, 2,4,6-trimethyl-	123–63–7	U182
Tris(2,3-dibromopropyl) phosphate	126–72–7	U235
Trypan blue	72–57–1	U236
Uracil mustard	66–75–1	U237
Urea, N-ethyl-N-nitroso-	759–73–9	U176
Urea, N-methyl-N-nitroso-	684–93–5	U177
Vinyl chloride	75–01–4	U043
Warfarin, & salts, when present at concentrations of 0.3% or less	181–81–2	U248
Xylene (I)	1330–20–7	U239
Yohimban-16-carboxylic acid, 11,17-dimethoxy-18-[(3,4,5-trimethoxybenzoyl)oxy]-, methyl ester, (3beta,16beta,17alpha,18beta,20alpha)-	50–55–5	U200
Zinc phosphide Zn3P2, when present at concentrations of 10% or less	1314–84–7	U249

Appendix VII: Controlled Substances

Source: http://www.deadiversion.usdoj.gov/schedules/index.html

DEA SUBSTANCE	NUMBER	SCH	NARC	OTHER NAMES
1-(1-Phenylcyclohexyl)pyrrolidine	7458	I		PCPy, PHP, rolicyclidine
1-(2-Phenylethyl)-4-phenyl-4-acetoxypiperidine	9663	I		PEPAP, synthetic heroin
1-[1-(2-Thienyl)cyclohexyl]piperidine	7470	I		TCP, tenocyclidine
1-[1-(2-Thienyl)cyclohexyl]pyrrolidine	7473	I		TCPy
13Beta-ethyl-17beta-hydroxygon-4-en-3-one	4000	III		
17Alpha-methyl-3alpha,17beta-dihydroxy-5alpha-androstane	4000	III		
17Alpha-methyl-3beta,17beta-dihydroxyandrost-4-ene	4000	III		
17Alpha-methyl-4-hydroxynandrolone (17alpha-methyl-4-hydroxy-17beta-hydroxyestr-4-en-3-one)	4000	III		
17Alpha-methyl-delta1-dihydrotestosterone (17beta-hydroxy-17alpha-methyl-5alpha-androst-1-en-3-one)	4000	III		17-Alpha-methyl-1-testosterone
19-Nor-4,9(10)-androstadienedione	4000	III		
19-Nor-4-androstenediol (3beta,17beta-dihydroxyestr-4-ene; 3alpha,17beta-dihydroxyestr-4-ene)	4000	III		
19-Nor-4-androstenedione (estr-4-en-3,17-dione)	4000	III		
19-Nor-5-androstenediol (3beta,17beta-dihydroxyestr-5-ene; 3alpha,17beta-dihydroxyestr-5-ene)	4000	III		
19-Nor-5-androstenedione (estr-5-en-3,17-dione)	4000	III		
1-Androstenediol (3beta,17beta-dihydroxy-5alpha-androst-1-ene; 3alpha,17beta-dihydroxy-5alpha-androst-1-ene)	4000	III		
1-Androstenedione (5alpha-androst-1-en-3,17-dione)	4000	III		
1-Methyl-4-phenyl-4-propionoxypiperidine	9661	I		MPPP, synthetic heroin
1-Phenylcyclohexylamine	7460	II		PCP precursor
1-Piperidinocyclohexanecarbonitrile	8603	II		PCC, PCP precursor
2,5-Dimethoxy-4-(n)-propylthiophenethylamine	7348	I		2C-T-7
2,5-Dimethoxy-4-ethylamphetamine	7399	I		DOET
2,5-Dimethoxyamphetamine	7396	I		DMA, 2,5-DMA
3,4,5-Trimethoxyamphetamine	7390	I		TMA
3,4-Methylenedioxyamphetamine	7400	I		MDA, Love Drug
3,4-Methylenedioxymethamphetamine	7405	I		MDMA, Ecstasy, XTC
3,4-Methylenedioxy-N-ethylamphetamine	7404	I		N-ethyl MDA, MDE, MDEA
3Alpha,17beta-dihydroxy-5alpha-androstane	4000	III		
3Beta,17beta-dihydroxy-5alpha-androstane	4000	III		
3-Methylfentanyl	9813	I	Y	China White, fentanyl
3-Methylthiofentanyl	9833	I	Y	Chine White, fentanyl
4-Androstenediol (3beta,17beta-dihydroxy-androst-4-ene)	4000	III	N	4-AD
4-Androstenedione (androst-4-en-3,17-dione)	4000	III	N	
4-Bromo-2,5-dimethoxyamphetamine	7391	I	N	DOB, 4-bromo-DMA
4-Bromo-2,5-dimethoxyphenethylamine	7392	I	N	2C-B, Nexus, has been sold as Ecstasy, i.e. MDMA
4-Dihydrotestosterone (17beta-hydroxyandrostan-3-one)	4000	III	N	Anabolex, Andractim, Pesomax, Stanolone
4-Hydroxy-19-nortestosterone (4,17beta-dihydroxyestr-4-en-3-one)	4000	III	N	
4-Hydroxytestosterone (4,17beta-dihydroxyandrost-4-en-3-one)	4000	III	N	
4-Methoxyamphetamine	7411	I	N	PMA
4-Methyl-2,5-dimethoxyamphetamine	7395	I	N	DOM, STP
4-Methylaminorex (cis isomer)	1590	I	N	U4Euh, McN-422
5-Androstenediol (3beta,17beta-dihydroxy-androst-5-ene)	4000	III	N	
5-Androstenedione (androst-5-en-3,17-dione)	4000	III	N	
5-Methoxy-3,4-methylenedioxyamphetamine	7401	I	N	MMDA
5-Methoxy-N,N-diisopropyltryptamine	7439	I	N	5-MeO-DIPT
Acetorphine	9319	I	Y	
Acetyl-alpha-methylfentanyl	9815	I	Y	
Acetyldihydrocodeine	9051	I	Y	Acetylcodone
Acetylmethadol	9601	I	Y	Methadyl acetate
Alfentanil	9737	II	Y	Alfenta
Allylprodine	9602	I	Y	
Alphacetylmethadol except levo-alphacetylmethadol	9603	I	Y	
Alpha-ethyltryptamine	7249	I	N	ET, Trip
Alphameprodine	9604	I	Y	
Alphamethadol	9605	I	Y	
Alpha-methylfentanyl	9814	I	Y	China White, fentanyl
Alpha-methylthiofentanyl	9832	I	Y	China White, fentanyl
Alpha-methyltryptamine	7432	I	N	AMT
Alphaprodine	9010	II	Y	Nisentil

DEA SUBSTANCE	NUMBER	SCH	NARC	OTHER NAMES
Alprazolam	2882	IV	N	Xanax
Aminorex	1585	I	N	has been sold as methamphetamine
Amobarbital	2125	II	N	Amytal, Tuinal
Amobarbital & noncontrolled active ingred.	2126	III	N	
Amobarbital suppository dosage form	2126	III	N	
Amphetamine	1100	II	N	Dexedrine, Adderall, Obetrol
Anabolic steroids	4000	III	N	"Body Building" drugs
Androstanedione (5alpha-androstan-3,17-dione)	4000	III	N	
Anileridine	9020	II	Y	Leritine
Aprobarbital	2100	III	N	Alurate
Barbital	2145	IV	N	Veronal, Plexonal, barbitone
Barbituric acid derivative	2100	III	N	Barbiturates not specifically listed
Benzethidine	9606	I	Y	
Benzoylecgonine	9180	II	Y	Cocaine metabolite
Benzphetamine	1228	III	N	Didrex, Inapetyl
Benzylmorphine	9052	I	Y	
Betacetylmethadol	9607	I	Y	
Beta-hydroxy-3-methylfentanyl	9831	I	Y	China White, fentanyl
Beta-hydroxyfentanyl	9830	I	Y	China White, fentanyl
Betameprodine	9608	I	Y	
Betamethadol	9609	I	Y	
Betaprodine	9611	I	Y	
Bezitramide	9800	II	Y	Burgodin
Bolasterone (7alpha,17alpha-dimethyl-17beta-hydroxyandrost-4-en-3-one)	4000	III	N	
Boldenone (17beta-hydroxyandrost-1,4-diene-3-one)	4000	III	N	Equipoise, Parenabol, Vebonol, dehydrotestosterone
Boldione	4000	III	N	
Bromazepam	2748	IV	N	Lexotan, Lexatin, Lexotanil
Bufotenine	7433	I	N	Mappine, N,N-dimethylserotonin
Buprenorphine	9064	III	Y	Buprenex, Temgesic, Subutex, Suboxone
Butabarbital (secbutabarbital)	2100	III	N	Butisol, Butibel
Butalbital	2100	III	N	Fiorinal, Butalbital with aspirin
Butobarbital (butethal)	2100	III	N	Soneryl (UK)
Butorphanol	9720	IV	N	Stadol, Stadol NS, Torbugesic, Torbutrol
Calusterone (7beta,17alpha-dimethyl-17beta-hydroxyandrost-4-en-3-one)	4000	III	N	Methosarb
Camazepam	2749	IV	N	Albego, Limpidon, Paxor
Carfentanil	9743	II	Y	Wildnil
Cathine	1230	IV	N	Constituent of "Khat" plant, (+)-norpseudoephedrine
Cathinone	1235	I	N	Constituent of "Khat" plant
Chloral betaine	2460	IV	N	Beta Chlor
Chloral hydrate	2465	IV	N	Noctec
Chlordiazepoxide	2744	IV	N	Librium, Libritabs, Limbitrol, SK-Lygen
Chlorhexadol	2510	III	N	Mechloral, Mecoral, Medodorm, Chloralodol
Chlorphentermine	1645	III	N	Pre-Sate, Lucofen, Apsedon, Desopimon
Clobazam	2751	IV	N	Urbadan, Urbanyl
Clonazepam	2737	IV	N	Klonopin, Clonopin
Clonitazene	9612	I	Y	
Clorazepate	2768	IV	N	Tranxene
Clortermine	1647	III	N	Voranil
Clostebol (4-chloro-17beta-hydroxyandrost-4-en-3-one)	4000	III	N	Alfa-Trofodermin, Clostene, 4-chlorotestosterone
Clotiazepam	2752	IV	N	Trecalmo, Rize, Clozan, Veratran
Cloxazolam	2753	IV	N	Akton, Lubalix, Olcadil, Sepazon
Coca Leaves	9040	II	Y	
Cocaine	9041	II	Y	Methyl benzoylecgonine, Crack
Codeine	9050	II	Y	Morphine methyl ester, methyl morphine
Codeine & isoquinoline alkaloid 90 mg/du	9803	III	Y	Codeine with papaverine or noscapine
Codeine combination product 90 mg/du	9804	III	Y	Empirin,Fiorinal,Tylenol,ASA or APAP w/codeine
Codeine methylbromide	9070	I	Y	
Codeine preparations - 200 mg/100 ml or 100 gm		V	Y	Cosanyl,Robitussin A-C,Cheracol,Cerose,Pediacof
Codeine-N-oxide	9053	I	Y	

DEA SUBSTANCE	NUMBER	SCH	NARC	OTHER NAMES
Cyprenorphine	9054	I	Y	
Dehydrochloromethyltestosterone (4-chloro-17beta-hydroxy-17alpha-methylandrost-1,4-dien-3-one)	4000	III	N	Oral-Turinabol
Delorazepam	2754	IV	N	
Delta1-dihydrotestosterone (17beta-hydroxy-5alpha-androst-1-en-3-one)	4000	III	N	1-Testosterone
Desomorphine	9055	I	Y	
Desoxymethyltestosterone	4000	III	N	
Dexfenfluramine	1670	IV	N	Redux
Dextromoramide	9613	I	Y	Palfium, Jetrium, Narcolo
Dextropropoxyphene dosage forms	9278	IV	Y	Darvon, propoxyphene, Darvocet, Propacet
Dextropropoxyphene, bulk (non-dosage forms)	9273	II	Y	Propoxyphene
Diampromide	9615	I	Y	
Diazepam	2765	IV	N	Valium, Diastat
Dichloralphenazone	2467	IV	N	Midrin, dichloralantipyrine
Diethylpropion	1610	IV	N	Tenuate, Tepanil
Diethylthiambutene	9616	I	Y	
Diethyltryptamine	7434	I	N	DET
Difenoxin	9168	I	Y	Lyspafen
Difenoxin 1 mg/25 ug AtSO4/du	9167	IV	Y	Motofen
Difenoxin preparations - 0.5 mg/25 ug AtSO4/du		V	Y	Motofen
Dihydrocodeine	9120	II	Y	Didrate, Parzone
Dihydrocodeine combination product 90 mg/du	9807	III	Y	Synalgos-DC, Compal
Dihydrocodeine preparations 10 mg/100 ml or 100 gm		V	Y	Cophene-S, various others
Dihydroetorphine	9334	II	Y	DHE
Dihydromorphine	9145	I	Y	
Dimenoxadol	9617	I	Y	
Dimepheptanol	9618	I	Y	
Dimethylthiambutene	9619	I	Y	
Dimethyltryptamine	7435	I	N	DMT
Dioxaphetyl butyrate	9621	I	Y	
Diphenoxylate	9170	II	Y	
Diphenoxylate preparations 2.5 mg/25 ug AtSO4		V	Y	Lomotil, Logen
Dipipanone	9622	I	Y	Dipipan, phenylpiperone HCl, Diconal, Wellconal
Diprenorphine	9058	II	Y	M50-50
Dronabinol (synthetic) in sesame oil in soft gelatin capsule as approved by FDA	7369	III	N	Marinol, synthetic THC in sesame oil/soft gelatin as approved by FDA
Drostanolone (17beta-hydroxy-2alpha-methyl-5alpha-androstan-3-one)	4000	III	N	Drolban, Masterid, Permastril
Drotebanol	9335	I	Y	Metebanyl, oxymethebanol
Ecgonine	9180	II	Y	Cocaine precursor, in Coca leaves
Embutramide	2020	III	N	Tributane
Estazolam	2756	IV	N	ProSom, Domnamid, Eurodin, Nuctalon
Ethchlorvynol	2540	IV	N	Placidyl
Ethinamate	2545	IV	N	Valmid, Valamin
Ethyl loflazepate	2758	IV	N	
Ethylestrenol (17alpha-ethyl-17beta-hydroxyestr-4-ene)	4000	III	N	Maxibolin, Orabolin, Durabolin-O, Duraboral
Ethylmethylthiambutene	9623	I	Y	
Ethylmorphine	9190	II	Y	Dionin
Ethylmorphine combination product 15 mg/du	9808	III	Y	
Ethylmorphine preparations 100 mg/100 ml or 100 gm		V	Y	
Etonitazene	9624	I	Y	
Etorphine (except HCl)	9056	I	Y	
Etorphine HCl	9059	II	Y	M 99
Etoxeridine	9625	I	Y	
Fencamfamin	1760	IV	N	Reactivan
Fenethylline	1503	I	N	Captagon,amfetyline,ethyltheophylline amphetamine
Fenfluramine	1670	IV	N	Pondimin, Ponderal
Fenproporex	1575	IV	N	Gacilin, Solvolip
Fentanyl	9801	II	Y	Duragesic, Oralet, Actiq, Sublimaze, Innovar
Fludiazepam	2759	IV	N	
Flunitrazepam	2763	IV	N	Rohypnol, Narcozep, Darkene, Roipnol
Fluoxymesterone (9-fluoro-17alpha-methyl-11beta,17beta-dihydroxyandrost-4-en-3-one)	4000	III	N	Anadroid-F, Halotestin, Ora-Testryl

DEA SUBSTANCE	NUMBER	SCH	NARC	OTHER NAMES
Flurazepam	2767	IV	N	Dalmane
Formebolone (2-formyl-17alpha-methyl-11alpha,17beta-dihydroxyandrost-1,4-dien-3-one)	4000	III	N	Esiclene, Hubernol
Fospropofol	2138	IV	N	Lusedra
Furazabol (17alpha-methyl-17beta-hydroxyandrostano[2,3-c]-furazan)	4000	III	N	Frazalon, Miotolon, Qu Zhi Shu
Furethidine	9626	I	Y	
Gamma Hydroxybutyric Acid	2010	I	N	GHB, gamma hydroxybutyrate, sodium oxybate
Gamma Hydroxybutyric Acid preparations	2012	III	N	Xyrem
Glutethimide	2550	II	N	Doriden, Dorimide
Halazepam	2762	IV	N	Paxipam
Haloxazolam	2771	IV	N	
Heroin	9200	I	Y	Diacetylmorphine, diamorphine
Hydrocodone	9193	II	Y	dihydrocodeinone
Hydrocodone & isoquinoline alkaloid <15 mg/du	9805	III	Y	Dihydrocodeinone+papaverine or noscapine
Hydrocodone combination product <15 mg/du	9806	III	Y	Lorcet, Lortab,Vicodin, Vicoprofen,Tussionex, Norco
Hydromorphinol	9301	I	Y	
Hydromorphone	9150	II	Y	Dilaudid, dihydromorphinone
Hydroxypethidine	9627	I	Y	
Ibogaine	7260	I	N	Constituent of "Tabernanthe iboga" plant
Isomethadone	9226	II	Y	Isoamidone
Ketamine	7285	III	N	Ketaset, Ketalar, Special K, K
Ketazolam	2772	IV	N	Anxon, Loftran, Solatran, Contamex
Ketobemidone	9628	I	Y	Cliradon
Lacosamide	2746	V	N	Vimpat
Levo-alphacetylmethadol	9648	II	Y	LAAM, long acting methadone, levomethadyl acetate
Levomethorphan	9210	II	Y	
Levomoramide	9629	I	Y	
Levophenacylmorphan	9631	I	Y	
Levorphanol	9220	II	Y	Levo-Dromoran
Lisdexamfetamine	1205	II	N	Vyvanse
Loprazolam	2773	IV	N	
Lorazepam	2885	IV	N	Ativan
Lormetazepam	2774	IV	N	Noctamid
Lysergic acid	7300	III	N	LSD precursor
Lysergic acid amide	7310	III	N	LSD precursor
Lysergic acid diethylamide	7315	I	N	LSD, lysergide
Marihuana	7360	I	N	Cannabis, marijuana
Mazindol	1605	IV	N	Sanorex, Mazanor
Mebutamate	2800	IV	N	Capla
Mecloqualone	2572	I	N	Nubarene
Medazepam	2836	IV	N	Nobrium
Mefenorex	1580	IV	N	Anorexic, Amexate, Doracil, Pondinil
Meperidine	9230	II	Y	Demerol, Mepergan, pethidine
Meperidine intermediate-A	9232	II	Y	Meperidine precursor
Meperidine intermediate-B	9233	II	Y	Meperidine precursor, normeperidine
Meperidine intermediate-C	9234	II	Y	Meperidine precursor
Meprobamate	2820	IV	N	Miltown, Equanil, Micrainin, Equagesic, Meprospan
Mescaline	7381	I	N	Constituent of "Peyote" cacti
Mestanolone (17alpha-methyl-17beta-hydroxy-5alpha-androstan-3-one)	4000	III	N	Assimil, Ermalone, Methybol, Tantarone
Mesterolone (1alpha-methyl-17beta-hydroxy-5alpha-androstan-3-one)	4000	III	N	Androviron, Proviron, Testiwop
Metazocine	9240	II	Y	
Methadone	9250	II	Y	Dolophine, Methadose, Amidone
Methadone intermediate	9254	II	Y	Methadone precursor
Methamphetamine	1105	II	N	Desoxyn, D-desoxyephedrine, ICE, Crank, Speed
Methandienone (17alpha-methyl-17beta-hydroxyandrost-1,4-diene-3-one)	4000	III	N	Dianabol, Metabolina, Nerobol, Perbolin
Methandriol (17alpha-methyl-3beta,17beta-dihydroxyandrost-5-ene)	4000	III	N	Sinesex, Stenediol, Troformone
Methaqualone	2565	I	N	Quaalude, Parest, Somnafac, Opitimil, Mandrax
Methcathinone	1237	I	N	N-Methylcathinone, "cat"
Methenolone (1-methyl-17beta-hydroxy-5alpha-androst-1-en-3-one)	4000	III	N	Primobolan, Primobolan Depot, Primobolan S
Methohexital	2264	IV	N	Brevital

DEA SUBSTANCE	NUMBER	SCH	NARC	OTHER NAMES
Methyldesorphine	9302	I	Y	
Methyldienolone (17alpha-methyl-17beta-hydroxyestr-4,9(10)-dien-3-one)	4000	III	N	
Methyldihydromorphine	9304	I	Y	
Methylphenidate	1724	II	N	Concerta, Ritalin, Methylin
Methylphenobarbital (mephobarbital)	2250	IV	N	Mebaral, mephobarbital
Methyltestosterone (17alpha-methyl-17beta-hydroxyandrost-4-en-3-one)	4000	III	N	Android, Oreton, Testred, Virilon
Methyltrienolone (17alpha-methyl-17beta-hydroxyestr-4,9,11-trien-3-one)	4000	III	N	Metribolone
Methyprylon	2575	III	N	Noludar
Metopon	9260	II	Y	
Mibolerone (7alpha,17alpha-dimethyl-17beta-hydroxyestr-4-en-3-one)	4000	III	N	Cheque, Matenon
Midazolam	2884	IV	N	Versed
Modafinil	1680	IV	N	Provigil
Moramide-intermediate	9802	II	Y	
Morpheridine	9632	I	Y	
Morphine	9300	II	Y	MS Contin, Roxanol, Oramorph, RMS, MSIR
Morphine combination product/50 mg/100 ml or gm	9810	III	Y	
Morphine methylbromide	9305	I	Y	
Morphine methylsulfonate	9306	I	Y	
Morphine-N-oxide	9307	I	Y	
Myrophine	9308	I	Y	
N,N-Dimethylamphetamine	1480	I	N	
Nabilone	7379	II	N	Cesamet
Nalorphine	9400	III	Y	Nalline
Nandrolone (17beta-hydroxyestr-4-en-3-one)	4000	III	N	Deca-Durabolin, Durabolin, Durabolin-50
N-Benzylpiperazine	7493	I	N	BZP, 1-benzylpiperazine
N-Ethyl-1-phenylcyclohexylamine	7455	I	N	PCE
N-Ethyl-3-piperidyl benzilate	7482	I	N	JB 323
N-Ethylamphetamine	1475	I	N	NEA
N-Hydroxy-3,4-methylenedioxyamphetamine	7402	I	N	N-hydroxy MDA
Nicocodeine	9309	I	Y	
Nicomorphine	9312	I	Y	Vilan
Nimetazepam	2837	IV	N	Erimin
Nitrazepam	2834	IV	N	Mogadon
N-Methyl-3-piperidyl benzilate	7484	I	N	JB 336
Noracymethadol	9633	I	Y	
Norbolethone (13beta,17alpha-diethyl-17beta-hydroxygon-4-en-3-one)	4000	III	N	Genabol
Norclostebol (4-chloro-17beta-hydroxyestr-4-en-3-one	4000	III	N	Anabol-4-19, Lentabol
Nordiazepam	2838	IV	N	Nordazepam, Demadar, Madar
Norethandrolone (17alpha-ethyl-17beta-hydroxyestr-4-en-3-one)	4000	III	N	Nilevar, Pronabol, Solevar
Norlevorphanol	9634	I	Y	
Normethadone	9635	I	Y	Phenyldimazone
Normethandrolone (17alpha-methyl-17beta-hydroxyestr-4-en-3-one)	4000	III	N	Lutenin, Matronal, Orgasteron
Normorphine	9313	I	Y	
Norpipanone	9636	I	Y	
Opium combination product 25 mg/du	9809	III	Y	Paregoric, other combination products
Opium extracts	9610	II	Y	
Opium fluid extract	9620	II	Y	
Opium poppy	9650	II	Y	Papaver somniferum
Opium preparations - 100 mg/100 ml or /100 gm		V	Y	Parepectolin, Kapectolin PG, Kaolin Pectin P.G.
Opium tincture	9630	II	Y	Laudanum
Opium, granulated	9640	II	Y	Granulated opium
Opium, powdered	9639	II	Y	Powdered opium
Opium, raw	9600	II	Y	Raw opium, gum opium
Oripavine	9330	II	Y	
Oxandrolone (17alpha-methyl-17beta-hydroxy-2-oxa-5alpha-androstan-3-one)	4000	III	N	Anavar, Lonavar, Oxandrin, Provitar, Vasorome
Oxazepam	2835	IV	N	Serax, Serenid-D
Oxazolam	2839	IV	N	Serenal, Convertal
Oxycodone	9143	II	Y	OxyContin, Percocet, Endocet, Roxicodone, Roxicet,
Oxymesterone (17alpha-methyl-4,17beta-dihydroxyandrost-4-en-3-one)	4000	III	N	Anamidol, Balnimax, Oranabol, Oranabol 10
Oxymetholone (17alpha-methyl-2-hydroxymethylene-17beta-hydroxy-5alpha-androstan-3-one)	4000	III	N	Anadrol-50, Adroyd, Anapolon, Anasteron, Pardroyd

DEA SUBSTANCE	NUMBER	SCH	NARC	OTHER NAMES
Oxymorphone	9652	II	Y	Numorphan
Para-Fluorofentanyl	9812	I	Y	China White, fentanyl
Parahexyl	7374	I	N	Synhexyl,
Paraldehyde	2585	IV	N	Paral
Pemoline	1530	IV	N	Cylert
Pentazocine	9709	IV	N	Talwin, Talwin NX, Talacen, Talwin Compound
Pentobarbital	2270	II	N	Nembutal
Pentobarbital & noncontrolled active ingred.	2271	III	N	FP-3
Pentobarbital suppository dosage form	2271	III	N	WANS
Petrichloral	2591	IV	N	Pentaerythritol chloral, Periclor
Peyote	7415	I	N	Cactus which contains mescaline
Phenadoxone	9637	I	Y	
Phenampromide	9638	I	Y	
Phenazocine	9715	II	Y	Narphen, Prinadol
Phencyclidine	7471	II	N	PCP, Sernylan
Phendimetrazine	1615	III	N	Plegine, Prelu-2, Bontril, Melfiat, Statobex
Phenmetrazine	1631	II	N	Preludin
Phenobarbital	2285	IV	N	Luminal, Donnatal, Bellergal-S
Phenomorphan	9647	I	Y	
Phenoperidine	9641	I	Y	Operidine, Lealgin
Phentermine	1640	IV	N	Ionamin, Fastin, Adipex-P, Obe-Nix, Zantryl
Phenylacetone	8501	II	N	P2P, phenyl-2-propanone, benzyl methyl ketone
Pholcodine	9314	I	Y	Copholco, Adaphol, Codisol, Lantuss, Pholcolin
Piminodine	9730	II	Y	
Pinazepam	2883	IV	N	Domar
Pipradrol	1750	IV	N	Detaril, Stimolag Fortis
Piritramide	9642	I	Y	Piridolan
Poppy Straw	9650	II	Y	Opium poppy capsules, poppy heads
Poppy Straw Concentrate	9670	II	Y	Concentrate of Poppy Straw, CPS
Prazepam	2764	IV	N	Centrax
Pregabalin	2782	V	N	Lyrica
Proheptazine	9643	I	Y	
Properidine	9644	I	Y	
Propiram	9649	I	Y	Algeril
Psilocybin	7437	I	N	Constituent of "Magic mushrooms"
Psilocyn	7438	I	N	Psilocin, constituent of "Magic mushrooms"
Pyrovalerone	1485	V	N	Centroton, Thymergix
Quazepam	2881	IV	N	Doral
Racemethorphan	9732	II	Y	
Racemoramide	9645	I	Y	
Racemorphan	9733	II	Y	Dromoran
Remifentanil	9739	II	Y	Ultiva
Secobarbital	2315	II	N	Seconal, Tuinal
Secobarbital & noncontrolled active ingred	2316	III	N	
Secobarbital suppository dosage form	2316	III	N	
Sibutramine	1675	IV	N	Meridia
SPA	1635	IV	N	1-dimethylamino-1,2-diphenylethane, Lefetamine
Stanozolol (17alpha-methyl-17beta-hydroxy-5alpha-androst-2-eno[3,2-c]-pyrazole)	4000	III	N	Winstrol, Winstrol-V
Stenbolone (17beta-hydroxy-2-methyl--5alpha-androst-1-en-3-one)	4000	III	N	
Stimulant compounds previously excepted	1405	III	N	Mediatric
Sufentanil	9740	II	Y	Sufenta
Sulfondiethylmethane	2600	III	N	
Sulfonethylmethane	2605	III	N	
Sulfonmethane	2610	III	N	
Talbutal	2100	III	N	Lotusate
Tapentadol	9780	II	Y	
Temazepam	2925	IV	N	Restoril
Testolactone (13-hydroxy-3-oxo-13,17-secoandrosta-1,4-dien-17-oic acid lactone)	4000	III	N	Teolit, Teslac

Appendix VIII: Explosive Families, Over –Pressure Explosive Hazards and Peroxide Forming Chemicals

Source: http://ehs.berkeley.edu/pubs/guidelines/pecguidelines.html

Family or Compound	CAS
Acetylene or acetylide compounds:	
N-Chloro-3-aminopropyne	
2-Buten-1-yl diazoacetate	14746-03-3
Propiolic acid	79-09-4
Propynethiol	
Acyl azides	
Acetyl azide	
Cyanodiazoacetyl azide	
Phenylphosphonic azide chloride	
Acyl hypohalites	
Acetyl hypobromite	4254-22-2
Hexafluoroglutaryl dihypochlorite	71359-64-3
Alkyl nitrates	
Ethylidene dinitrate	55044-04-7
Glyceryl trinitrate	9010-02-0
Propyl nitrate	627-13-4
Alkyl perchlorates	
Hexyl perchlorate	
Ethyl perchlorate	22750-93-2
1-Chloro-2-propyl perchlorate	
Allyl trifluoromethanesulfonates	
2-Chloro-2-propenyl trifluoromethanesulfonate	
Amminemetal oxosalts	
Ammonium hexanitrocobaltate	
Bis(1,2-diaminoethane) diaquacobalt (III) perchlorate	
Trihydrazine nickel (II) nitrate	
Aromatic nitrates	
Picric acid	88-89-1
Trinitrobenzene	99-35-4
Picryl sulfonic acid	2508-19-2
Azides	
Sodium azide	26628-22-8
Lead azide	13424-46-9
Hydrogen azide	7782-79-8
Aziridines	
1-Bromoaziridine	
Azocarbaboranes	
1,1-'Azo-1,2-dicarbadecaborane	7553-56-2
N-Azolium nitroimidates	
Benzimidazolium 1-nitroimidate	52096-22-7
4-Nitroamino-1,2,4-triazole	52096-16-9
2-(N-Nitroamino)pyridine N-oxide	
N-Metal Derivatives	
Cadmium nitride	12380-95-9
Dibutylthallium isocyanate	
Sodium amide	7782-92-5

Family or Compound	CAS
Metal Fulminates	
Mercury (II) fulminate	628-86-4
Sodium fulminate	15736-98-8
Tripropyllead fulmintate	
Metal Halogentates	
Lead bromate	34018-28-5
Metal Hydrides	
Stibine (Antimony hydride)	7803-52-3
Metal Nitrophenoxides	
Lithium 4-nitrothiophenoxide	78350-94-4
Potassium 4-nitrophenoxide	1124-31-8
Metal Oxides	
Bis (1-chloroethylthallium chloride) oxide	
Magnesium chloride trioxide	
Metal Oxohalogenates	
Ammonium iodate	13446-09-8
Lead acetate—lead bromate	
Metal Oxometallates	
Bis (benzene) chromium dichromate	1271-54-1
Metal Perchlorates	
Chromyl perchlorate	
Metal Peroxides	
Many transition metal peroxides are dangerously explosive.	
Metal Peroxomolybdates	
2-Potassium tetraperoxomolybdate	
2-Sodium tetraperoxomolybdate	
Metal Picramates	
Palladium picramate	
Uranyl picramate	
Nitroaryl Compounds	
N-Chloro-4-nitroaniline	59483-61-3
Nitrogenous Base Nitrite Salts	
Methylammonium nitrite	22113-87-7
aci-Nitroquinonoid Compounds	
Sodium 1,4-bis(aci-nitro)-2,5-cyclohexadienide	
aci-Nitro Salts	
Ammonium aci-nitromethanide	
Dipotassium aci-dinitromethanide	
Thallium aci-phenylnitromethanide	53847-48-6
Peroxyacid salts	
Calcium peroxodisulfate	13235-16-0
Potassium tetraperoxomolybdate	
Tetramethylammonium pentaperoxodichromate	

Family or Compound	CAS
Peroxyacids	
Benzenperoxyselennic acid	
Peroxyacetic acid	79-21-0
Peroxyformic acid	107-32-4
Peroxycarbonate esters	
O-O-tert-Butyl isopropyl monoperoxycarbonate	002372-21-6
Diallyl peroxydicarbonate	34037-79-1
Dimethyl peroxydicarbonate	
Phosphorus esters	
Diethyl phosphite	762-04-9
Dibenzyl phosphorchloridate	
Picrates	
Nickel picrate (anhydrous)	
S-7-Methylnonylthiouronium picrate	
Sodium picrate	73771-13-8
Platinum Compounds	
Amminedecahydroxydiplatinum	
cis-Diammineplatinum (II) nitrate	15663-27-1
Trimethylplatinum hydroxide	14477-33-9
Poly(dimercuryimmonium) Compounds	
Poly(dimercuryimmonium picrate)	
Poly(dimercuryimmonium permanganate)	
Poly(dimercuryimmonium trinitrobenzoate)	
Polymerization (violent)	
Acrylic acid	79-10-7
Ethylene oxide	75-21-8
Vinyl acetate	108-05-4
Polynitroalkyl Coumpounds	
Dinitroacetonitrile	921-22-2
Hexanitroethane	918-37-6
Potassium trinitromethanide	14268-23-6
Polynitroaryl Compounds	
5,6-Dinitro-2-dimethyl aminopyrimidinone	
4-Nitro-1-picryl-1,2,3-triazole	
2,4,6-Trinitrotolune	118-96-7
Silver Compounds	
Silver nitride (fulminating silver)	20737-02-4
Disilver ketenide	
Phenylsilver	5274-48-6
Silver azide	13863-88-2
Silver Osmate	
Diazo compounds	
Diethyl diazomalonate	
Dinitrodiazomethane	25240-93-1
Diazonium carboxylates, perchlorates, salts, sulfates, tetrahaloborates, and, triiodides	
Benzenediazonium-2-carboxylate	1608-42-0
4-Aminobenzenediazonium perchlorate	
6-chloro-2,4-dinitrobenzenediazonium sulfate	
2-Nitrobenzenediazonium tetrachloroborate	
4-Toluenediazonium triiodide	68596-94-1

Family or Compound	CAS
Difluoroaminoalkanols	
1,1-Difluorourea	
Perfluoro-N-cyanodiaminomethane	
Fluoro–nitro compounds	
1-Fluoro-1,1-dinitrobutane	19273-47-3
Fluorodinitromethyl azide	
Fulminating metals	
Lead fulminate	
Gold fulminate	
Silver fulminate	5610-59-3
Furazan N-oxides	
Dicyanofurazan N-oxide	55644-07-0
4-Oximino4,5,6,7-tetrahydrobenzofurazn N-oxide	
Hydroxooxodiperoxochromate salts	
1-Ammonium hydroxooxodiperoxochromate	
Potassium hyroxooxodiperoxochromate	
Iodine Compounds	
Calcium 2-iodylbenzoate	59643-77-5
Iodobenzene	591-50-4
2-Iodylvinyl chloride	
Isoxazoles	
3-Aminoisoxazole	1750-42-1
3,5-Dimethylisoxazole	300-87-8
Metal Azide Halides	
Chromyl azide chloride	14259-67-7
Molybdenum diazide tetrachloride	14259-66-6
Tungsten azide pentachloride	
Metal Azides	
Aluminum azide	
Bis(cyclopentadienyl)tungsten diazide oxide	
Mercury (I&II) azide	
Sodium azide	26628-22-8
Nitroso Compounds	
Dinitrosylnickel	
Ehtyl N-methyl-N-nitrosocarbamate	615-53-2
Potassium nitrosodisulfate	
N—S Compounds	
Disulfur dinitride	25474-92-4
Potassium sulfurdiimidate	
Tetrasulfur tetranitride	28950-34-7
Thiotrithiazyl nitrate	79796-40-0
Organic Acids	
Picric acid	88-89-1
Trinitroresorcinol	82-71-3
Organic Azides	
Diazidomethyleneazine	94362-44-4
Picryl azide	1600-31-3
Vinyl azide	7570-25-4

Family or Compound	CAS
Organolithium Reagents	
o-Trifluoromethyl phenyllithium	
m-Bromo phenyllithium	
Organomineral Peroxides	
Bis(triethyltin) peroxide	
Diethylhydroxotin hydroperoxide	
Oximes	
Bromoacetone oxime	62116-25-0
Hydroxycopper glyoximate	63643-78-7
Potassium cyclohexanehexone 1,3,5-trioximate	16871-90-2
Oxosalts of Nitrogenous Bases	
Ammonium tetranitroplatinate (II)	15660-29-4
Diamminepalladium (II) nitrate	28068-05-5
1,2-Diammonioethane nitrate	
Ozonides	
trans-2-Butene ozonide	
Ethylene ozonide (1,2,4-trioxolane)	289-14-5
Trifluoroethylene ozonide	
Perchlorate Salts of Nitrogenous Bases	
Pyridinium perchlorate	15598-34-2
Teteraethylammonium perchlorate	2537-36-2
Perchloramide Salts	
Barium perchloramide	
Mercury (II) N-perchloryl benzylamide	
Silver perchlorylamide	
Perchloryl Compounds	
2,6-Dinitro-4-perchlorylphenol	128-39-2
Perchloryl fluoride	7616-94-6
N-Perchloryl piperidine	
Strained-Ring Compounds	
2-Azatricyclo[2.2.102,6]hept-7-yl perchlorate	
Dicyclopropyldiazomethane	16102-24-2
Prismane	650-42-0
Tetrazoles	
5-Aminotetrazole	76720-24-6
Silver and mercury salts of 5-nitrotetrazole	
Tetrazole	288-94-8
Triazoles	
3-Diazo-5-phenyl-3H-1,2,4-triazole	
4-Hydroxy-3,5-dimethyl-1,2,4-triazole	35869-74-0
1,2,3-Triazole	288-36-8

Chemicals That May Explode Due To Over-pressurized Container	CAS
Aluminum chloride	7446-70-0
Aluminum lithium hydride	16853-85-3
Ammonia solution	8013-59-0
Ammonium hydroxide	1336-21-6
Ammonium persulfate	7727-54-0
Anisyl chloride	6707-01-3
Aqua regia	8007-56-5
Benzenesulphonyl chloride	98-09-9
Bleach	8007-59-8
Bleaching powder	8031-48-9
Calcium carbide	75-20-7
Calcium hydride	8047-59-4
Calcium hypochlorite	7778-54-3
Chloroform	67-66-3
Chromic acid	1308-38-9
Cumene hydroperoxide	80-15-9
Cyclohexene	110-83-8
Diethyl pyrocarbonate	1609-47-8
Dimethylamine	124-40-3
Formic Acid	64-18-6
Hydrogen peroxide	7722-84-1
Lauroyl peroxide	105-74-8
Lithium aluminum hydride	16853-85-3
Lithium hydride	7580-67-8
Nitric acid	7697-37-2
Nitrosoguanidine	70-25-7
Peracetic acid	79-21-0
Phenol	108-95-2
Phosphorus trichloride	7719-12-2
Potassium Persulphate	7727-21-1
Silicon tetrachloride	10026-04-7
Sodium borohydride	15681-89-7
Sodium dithionite	7775-14-6
Sodium hydride	7646-69-7
Sodium hydrosulphite	7775-14-6
Sodium hypochlorite	7681-52-9
Sodium peroxide	1313-60-6
Sodium persulphate	7775-27-1
Thionyl chlroide	7719-09-7
Urea peroxide	124-43-6
Zinc	7440-66-6

List A–Chemicals that may form explosive levels of peroxides without concentration by evaporation or distillation. These materials are particularly dangerous because they can be hazardous even if never opened.	CAS	Synonyms
Butadiene	106-99-0	1,3-Butadiene
Chloroprene	126-99-8	2-Chloro-1,3- butadiene
Divinylacetylene	821-08-9	1,5-Hexadien- 3-yne
Isopropyl ether	108-20-3	
Tetrafluoroethylene	116-14-3	
Vinylidene Chloride	75-35-4	1,1- Dichloroethylene

List B–Chemicals that form explosive levels of peroxides on concentration. They typically accumulate hazardous levels of peroxides only when evaporated, distilled or otherwise treated to concentrate the peroxides (e.g. deactivation or removal of peroxide inhibitors). Therefore, they have the potential of becoming far more hazardous after they are opened.	CAS	Synonyms
Acetal	105-57-7	
Acetaldehyde	75-07-0	
Benzyl alcohol	100-51-6	
2-Butanol	78-92-2	
Cumene	98-82-8	Isopropyl benzene
Cyclohexanol	108-93-0	
2-Cyclohexen-1-ol	822-67-3	
Cyclohexene	110-83-8	
Decahydronaphthalene	91-17-8	
Diacetylene	460-12-8	
Dicyclopentadiene	77-73-6	
Diethyl ether	60-29-7	Ethyl ether
Diglyme	111-96-6	dimethyl ether
Dioxanes	123-91-1	1,4-Dioxane
Glyme	110-71-4	dimethyl ether
4-Hepitanol	589-55-9	4-Heptanol
2-Hexanol	626-93-7	
Methylacetylene	74-99-7	Propyne
3-Methyl-1-butanol	123-51-3	Isoamyl alcohol
Methylcyclopentane	96-37-7	
Mehtyl isobutyl ketone	108-10-1	Methyl-i-butyl ketone
4-Methyl-2-pentanol	108-11-2	
2-Pentanol	6032-29-7	
4-Penten-1-ol	821-09-0	
1-Phenylethanol	98-85-1	alpha-Methyl-benzyl alcohol
2-Phenylethanol	60-12-8	Phenethyl alcohol
2-Propanol	109-99-9	
Tetrahydrofuran	119-64-2	
Tetrahydronaphthalene		
Vinyl ethers		
Other secondary alcohols		

List C–Chemicals that may autopolymerize as a result of peroxide accumulation. These chemicals have been associated with hazardous polymerization reactions that are initiated by peroxides which have accumulated in solution. These materials are typically stored with polymerization inhibitors to prevent these dangerous reactions.	CAS	Synonyms
Acrylic acid	79-10-7	
Acrylonitrile	107-13-1	
Butadiene	106-99-0	
Chloroprene	126-99-8	2-Chloro-1,3-butadiene
Chlorotrifluoroethylene	79-38-9	
Methyl methacrylate	80-62-6	
Styrene	100-42-5	
Tetrafluoroethylene	116-14-3	
Vinyl acetate	108-05-4	
Vinylacetylene	689-97-4	Buten-3-yne
Vinyl chloride	75-01-4	Mono-chloroethylene
2-Vinyl pyridine	100-69-6	
4-Vinyl pyridine	100-43-6	
Vinyladiene chloride	75-35-4	1,1-Dichloroethylene

List D represents other peroxidizable chemicals which can not be placed into the other categories but nevertheless require handling with precautions.	CAS
Acrolein	107-02-8
Allyl ether	557-40-4
Allyl ethyl ether	537-31-3
Allyl phenyl ether	1746-13-0
p-(n-Amyloxy)benzoyl chloride	36823-84-4
n-Amyl ether	693-65-2
Benzyl n-butyl ether	3459-80-1
Benzyl ether	103-50-4
Benzyl ethyl ether	539-30-01
Benzyl methyl ether	558-86-3
Benzyl-1-napthyl ether	613-62-7
1,2-Bis(2-chloroethoxyl)ethane	112-26-5
Bis(2-ethoxyethyl)ether	112-36-7
Bis(2-(methoxyethoxy)ethyl) ether	143-24-8
Bis(2-chloroethyl) ether	111-44-4
Bis(2-ethoxyethyl) adipate	109-44-4
Bis(2-methoxyethyl) carbonate	
Bis(2-methoxyethyl) ether	119-96-6
Bis(2-methoxyethyl) phthalate	117-82-8
Bis(2-methoxymethyl) adipate	106-06-3
Bis(2-n-butoxyethyl) phthalate	117-83-9
Bis(2-phenoxyethyl) ether	622-87-7
Bis(4-chlorobutyl) ether	6334-96-9
Bis(chloromethyl) ether	542-88-1
2-Bromomethyl ethyl ether	13057-17-5
beta-Bromophenetole	596-10-6
o-Bromophenetole	593-19-7
p-Bromophenetole	588-96-5
3-Bromopropyl phenyl ether	588-63-6
1,3-Butadiyne	460-12-8
Buten-3-yne	689-97-4
tert-Butyl ethyl ether	637-92-3
tert-Butyl methyl ether	16634-04-0
n-Butyl phenyl ether	1126-79-0
n-Butyl vinyl ether	11-34-2
Chloroacetaldehyde diethylacetal	621-62-5
2-Chlorobutadiene	126-99-8
1-(2-Chloroethoxy)-2-phenoxyethane	2243-49-91
Chloroethylene	75-01-4
Chloromethyl methyl ether	107-30-2
b-Chlorophenetole	614-72-2
o-Chorophenetole	143-24-8
p-Chlorophenetole	622-61-7
Cyclooctene	931-88-4
Cyclopropyl methyl ether	540-47-6
Diallyl ether	557-40-4
p-Di-n-butoxybenzene	75942-37-9
1,2-Dibenzyloxyethane	
p-Dibenzyloxybenzene	
1,2-Dichloroethyl ethyl ether	623-46-1
2,4-Dichlorophenetole	5392-86-9
Diethoxymethane	462-95-3
2,2-Diethoxypropane	126-84-1
Diethyl ethoxymethylenemalonate	87-13-8
Diethyl fumarate	623-91-6
Diethyl acetal	105-57-7
Diethylketene	96-22-0
m,o,p-Diethoxybenzene	2168-54-9
1,2-Diethoxyethane	629-14-1
Dimethoxymethane	109-87-5
1,1-Dimethoxyethane	534-15-6
Dimethylketene	
3,3-Dimethoxypropene	6044-68-4
2,4-Dinitrophenetole	610-54-8

List D represents other peroxidizable chemicals which can not be placed into the other categories but nevertheless require handling with precautions.	CAS
1,3-Dioxepane	505-65-7
Di(1-propynl) ether	111-43-4
Di(2-propynl) ether	
Di-n-propoxymethane	505-84-0
1,2-Epoxy-3-isopropoxypropane	4016-14-2
1,2-Epoxy-3-phenoxypropane	122-60-1
p-Ethoxyacetophenone 2-Methoxyethyl vinyl ether	11676-63-7
1-(2-Ethoxyethoxy)ethyl acetate	
2-Ethoxyethyl acetate	111-15-9
(2-Ethoxyethyl)-a-benzoyl benzoate	
1-Ethoxynaphthalene	5328-01-8
o,p-Ethoxyphenyl isocyanate	5395-71-1
1-Ethoxy-2-propyne	
3-Ethoxypropionitrile	2141-62-0
2-Ethylacrylaldehyde oxime	
2-Ethylbutanol	97-75-0
Ethyl-b-ethoxypropionate	763-69-9
2-Ethylhexanal	123-05-7
Ethyl vinyl ether	109-92-2
Furan	110-100-9
2,5-Hexadiyn-1-ol	
4,5-Hexadien-2-yn-1-ol	
n-Hexyl ether	112-58-3
o.p-Iodophenetole	
Isoamyl benzyl ether	109-53-5
Isoamyl ether	544-01-4
Isobutyl vinyl ether	109-53-5
Isophorone	78-59-1
b-Isopropoxypropionitrile	
Isopropyl-2,4,5-trichlorophenoxy acetate	
Limonene	
1,5-p-Methadiene	
Methyl-p-(n-amyloxy)benzoate	
4-Methyl-2-pentanone	
n-Methylphenetole	202-507-4
2-Methyltetrahydrofuran	4435-53-4
3-Methoxy-1-butyl acetate	109-86-4
2-Methoxyethanol	110-49-6
3-Methoxyethyl acetate	
2-Methoxyethyl vinyl ether	111-96-6
Methoxy-1,3,5,7-cyclooctatetraene	
b-Methoxypropionitrile	110-67-8
m-Nitrophenetole	
1-Octene	203-893-7
Oxybis(2-ethyl acetate)	
Oxybis(2-ethyl benzoate)	
b,b-Oxydipropionitrile	
1-Pentene	203-694-5
Phenoxyacetyl chloride	211-862-4
a-Phenoxypropionyl chloride	122-35-0
Phenyl-o-propyl ether	
p-Phenylphenetone	
n-Propyl ether	111-43-7
n-Propyl isopropyl ether	
Sodium 8-11-14-eicosatetraenoate	
Sodium ethoxyacetylide	73506-39-5
Tetrahydropyran	142-68-7
Triethylene glycol diacetate	111-21-7
Triethylene glycol dipropionate	
1,3,3-Trimethoxypropene	241-547-7
1,1,2,3-Tetrachloro-1,3-butadiene	921-09-5
4-Vinyl cyclohexene	100-40-3
Vinylene carbonate	872-36-6
Vinylidene chloride	

Appendix IX: Research Laboratory Training Checklist

RESEARCH LABORATORY TRAINING CHECKLIST

WAKE FOREST UNIVERSITY

Review Signs	Space Hazard Sign ☐ Chemical Storage, Carcinogens, Electrical hazards ☐ Container labels for chemicals not in primary container ☐
Chemical Hygiene Plan **IBC Protocol (if applicable)**	Location of Plan and required to read prior to working in lab ☐ Location of Protocol and required to read prior to working in lab ☐
Safety Showers and Eyewash	Location and proper use ☐ Do not block ☐
Fire Safety	Location and proper use of Fire Extinguisher (PASS) ☐ Do not block Fire Extinguisher or Electrical Panels ☐ Fire Doors remain closed. Do not prop open. ☐ All flames must be attended ☐
Gas Cylinders	Proper use and storage. ☐ Must be capped when not in use. ☐
Vacuum Flask (if applicable)	Proper use. Need to be wrapped. ☐
Fume Hood	Proper use ☐ Flow rate needs to be between 90 and 120 fpm ☐ Do not overcrowd and close sash when not in use ☐
Bio-Safety Cabinet (if applicable)	Proper use ☐ Ensure it has been certified annually prior to use. ☐
Personal Protective Equipment	Identify hazards that may require protection, both chemical and physical ☐ Complete an accurate description of the tasks requiring PPE and review with student ☐ Provide proper PPE and train users on proper use and function of PPE ☐
MSDS	Inform user of the chemical application, health hazards and physical properties prior to using a chemical ☐ Provide location of MSDS to the user and reiterate it is students responsibility to read and understand. ☐ Ensure only approved chemicals are used in the laboratory ☐
Chemical Safety	Identification of hazards ☐ Location of Chemical Incompatibility Chart ☐ Maintain accurate Chemical Inventory ☐ Date peroxide formers when opened. Do not store for more than one year. ☐ Select agent handling protocol and Controlled substance handling protocol (if applicable) ☐
General Housekeeping	Work clean ☐ Do not store glass bottles on the floor ☐ All storage must be 24" below ceiling ☐ No food or drinks in the lab ☐
Waste	Proper labeling for waste containers ☐ Proper segregation of incompatibles ☐ Keep waste containers closed ☐ WFU Biohazard Waste Management Plan (if applicable) ☐ Proper use and disposal of sharps and broken glass ☐
Emergencies and Spills	Emergency contact list ☐ University Police and EHS Office contact information ☐ Proper procedures for spills or emergencies ☐
Lab Specific Hazards	Review all lab specific hazards (if applicable) – including Electrophoresis, Radiation Safety, Laser Safety, etc. ☐
Laboratory Equipment	Review procedures for all standard laboratory equipment ☐
Blood borne Pathogens (if applicable)	Review Exposure Control Plan ☐ Offer Hepatitis B Vaccine ☐

I have presented all above marked information to the individual listed below:

Principle Investigator / Faculty Member	Signature	Date

I have received all above marked information from the Principle Investigator / Faculty Member indicated above:

–

Laboratory Student	Signature	Date

REV. DATE: 09/02/2010

Appendix X: Emergency Information

- Anatomy and Health and Exercise Science
- Nanotechnology Center
- Olin Hall
- Salem Hall
- Scales Fine Arts Center
- Winston Hall

WAKE FOREST UNIVERSITY

EMERGENCY INFORMATION FOR ANATOMY AND HEALTH AND EXERCISE SCIENCE

EMERGENCY TELEPHONE NUMBERS

FIRE - 911
MEDICAL - 911
CHEMICAL SPILL - 758-5911

SAFETY CONTACTS

Jovita Jolla Newman, Dept. Facilities Coordinator: ext - 3969
University Police Department: ext - 5911
Environmental Health and Safety: ext - 3427
Student Health Services: ext - 5218

POISON EMERGENCIES

Carolinas Poison Control Center: 1-800-848-6946

SPILL KIT INFORMATION

SPILL KIT CAN BE FOUND IN ANATOMY LAB STORAGE CLOSET.

WAKE FOREST UNIVERSITY

EMERGENCY INFORMATION FOR NANO TECHNOLOGY

EMERGENCY TELEPHONE NUMBERS

FIRE - 911
MEDICAL - 911
CHEMICAL SPILL - 758-5911

SAFETY CONTACTS FOR NANO TECHNOLOGY

Baxter McGuirt, Laboratory Manager: office - 336-727-1806 cell: 336-341-1663
University Police Department: ext - 5911
Environmental Health and Safety: ext - 3427
Student Health Services: ext - 5218

POISON EMERGENCIES

Carolinas Poison Control Center: 1-800-848-6946

SPILL KIT INFORMATION

SPILL KIT/ATTACK PACK CAN BE FOUND ON
ON THE WALL OUTSIDE THE CLEAN ROOM.

PI_____ **CONTACT NUMBER**_____

WAKE FOREST UNIVERSITY

EMERGENCY INFORMATION FOR OLIN HALL

EMERGENCY TELEPHONE NUMBERS

FIRE - 911
MEDICAL - 911
CHEMICAL SPILL - 758-5911

SAFETY CONTACTS

Eric Chapman, Laboratory Manager: ext 5532 cell-682-2418
University Police Department: ext - 5911
Environmental Health and Safety: ext - 3427
Student Health Services: ext - 5218

POISON EMERGENCIES

Carolinas Poison Control Center: 1-800-848-6946

SPILL KIT INFORMATION

MSDS Information is located in RM – 204
SPILL KIT MATERIAL is located in RM - 204

WAKE FOREST UNIVERSITY

EMERGENCY INFORMATION FOR SALEM HALL

EMERGENCY TELEPHONE NUMBERS

FIRE - 911
MEDICAL - 911
CHEMICAL SPILL - 758-5911

SAFETY CONTACTS

Michael A. Thompson, Laboratory Manager: ext - 5324
University Police Department: ext - 5911
Environmental Health and Safety: ext - 3427
Student Health Services: ext - 5218

POISON EMERGENCIES

Carolinas Poison Control Center: 1-800-848-6946

SPILL KIT INFORMATION

SPILL KIT CAN BE FOUND IN THE STOCK ROOM.

ADDITIONAL INFORMATION

THE EMERGENCY TELEPHONE is located in RM 110, 758-4712
FAX MACHINE is located in the main office in RM 110B, 336-758-4656

WAKE FOREST UNIVERSITY

EMERGENCY INFORMATION FOR SCALES

EMERGENCY TELEPHONE NUMBERS

FIRE - 911
MEDICAL - 911
CHEMICAL SPILL - 758-5911

SAFETY CONTACTS FOR SCALES

David Gainey x3788
University Police Department x5911
Student Health Services x5218
Environmental Health and Safety x3427

POISON EMERGENCIES

Carolinas Poison Control Center: 1-800-848-6946

SPILL KIT INFORMATION

SPILL KIT LOCATED IN ROOM 2A

CHEMICAL SAFETY DATA SHEET INFORMATION
LOCATED IN EACH STUDIO

WAKE FOREST UNIVERSITY

EMERGENCY INFORMATION FOR WINSTON HALL

EMERGENCY TELEPHONE NUMBERS

FIRE - 911

MEDICAL – 911

CHEMICAL SPILL - 758-5911

SAFETY CONTACTS FOR WINSTON HALL

Christie Otten, Core Preparator: x 4586 cell (336)607-4193 RM - 217

Shannon Mallison, Biohaz Officer: x 4430 cell (336)529-2312 RM - 216

Alternate: Dan Johnson: x 5320 RM - 214

University Police Department: x 5911

Student Health Services: x 5218

Environmental Health and Safety: x 3427

POISON EMERGENCIES

Carolinas Poison Control Center: 1-800-848-6946

MSDS AND SPILL KIT INFORMATION

Chemical Safety Data Sheet Information is located in RM - 208

SPILL KITS/ATTACK PACKS CAN BE FOUND ON EACH FLOOR HANGING ON THE WALL.

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