Fayetteville State University

CHEMICAL HYGIENE PLAN
AND
SAFETY MANUAL

Approval Signatures:

Dr. James A. Anderson, Chancellor

Signature/Date

Office of Legal Affairs

Signature/Date

Dr. Jon Young, Provost and Vice Chancellor for Academic Affairs

Signature/Date

Dr. David Barlow, Dean, College of Arts and Sciences

2/27/12

Signature/Date

Dr. Booker Juma, Chair, Department of Chemistry and Physics

2/24/2012

Signature/Date

Dr. Abdelmajid Kassem, Chair, Department of Biological Sciences

Signature/Date

Ms. Cindia Wetherwax, Environmental Safety and Health Officer

Feb 28, 2012

Signature/Date

Ivy J. Rittenhouse, Chemical Hygiene Officer

2/24/2012

The CHP Enforcement Committee is responsible for the oversight, maintenance, and implementation of the Chemical Hygiene Plan. This Committee shall consist of one (1) faculty member and one (1) staff member selected by the Chair/Supervisor of any Department/unit that handles any substance that has a Material Safety Data Sheet (MSDS), as well as an ex officio representative from the University's Environmental Health and Safety Office. These representatives will serve a two-year term, eligible for re-appointment for a maximum of two consecutive terms. The CHP Enforcement Committee Chair and the department representatives will be selected by the department Chairs/Supervisor in consultation with the Dean of the College of Arts and Sciences.

This Committee's duties are as follows:

1. Updating the Chemical Hygiene Plan annually, recommending any changes to the Department Chairs or Unit Heads.
2. Disseminating the Chemical Hygiene Plan online.
3. Presenting the Chemical Hygiene Plan annually to faculty and staff, in the form of a scheduled meeting or an online presentation.
4. Creating and implementing an annual examination for faculty and staff based upon the Chemical Hygiene Plan, and making changes to the examination as necessary to reflect the Chemical Hygiene Plan.
5. Conducting regular inspections of classroom and research laboratories, reporting violations immediately to those who are responsible for the laboratory and suggesting corrective actions to be taken.
6. Ensuring that chemical and universal waste is disposed of properly and in a timely manner.
7. Submitting quarterly reports to the appropriate Department Chairs and Unit Heads that summarize the number of inspections carried out of the relevant Department or Unit and the number and seriousness of violations found.
8. Reporting serious and/or repeat violators to the Department Chairs and Unit Heads for appropriate disciplinary action.

The responsibilities of Department Chairs and Unit Heads are as follows:

1. Selecting faculty or staff to serve on the Committee.
2. Placing serious and/or repeat violations, as reported by the Committee, in personnel files and initiating disciplinary procedures as appropriate.
3. Maintaining records of inspection reports provided by the Committee.

Contents

- **Revisions to the Chemical Hygiene Plan:**

Date:	**Description of revisions:**
07/03/2010	Updated titles and phone numbers.
	Inserted P Listed Hazardous Chemical Waste List
	Inserted North Carolina Hazardous Waste Section: Small Quantity Generator Requirements.
02/10/2012	Added administrative approval signatures to the cover page.
	Changed the Department of Natural Sciences to:
	-The Department of Chemistry and Physics
	-The Department of Biological Sciences.
03/19/2012	-The oversight, maintenance and implementation of the CHP statement.
05/16/2013	Annual Revision and Updates.
02/28/2014	Annual Revision and Updates
02/20/2017	Annual Revision and Updates: Peroxide Forming Chemicals. Pg. 61
10/19/2018	Annual Revision and Updates

Emergency Telephone Numbers

	PHONE	HOURS
Emergency Management	672-1341/1911	8:00 – 5:00
Work-Related Injuries	672-1827	8:00 – 5:00
Work-Related Injuries (after hours)		
• Report to Campus Police	672-1911	5:00 – 7:55 am
• Minor Medical Treatment: Highsmith Rainey Urgent Care		5:00 – 1:00 am
• Life Injuries: Care Fear Emergency Room		5:00 – 7:55 am
*Submit Police Report to HR asap		
Police and Public Safety	672-1911	24 hrs
Non emergency Number	672-1775	24 hrs
Fire or Smoke	672-1911	24 hrs
Medical Emergencies	672-1911	24 hrs
N.C. Poison Control Center	1-800-848-6946	24 hrs

Special Incident Reporting:

Gas Leak or Odors	672-1911/1295
Gas Leak or Odors (after hours)	672-1911/1295
Chemical Spills	672-1911/1295
Chemical Spills (after hours)	672-1911/1295
Water (after hours)	672-1911/1295
Electrical (after hours)	672-1911/1295

CHEMICAL HYGIENE PLAN

For

_____

Principal Investigator/Laboratory Supervisor
(Chemical Hygiene Officer)

_____

Department

_____

Room and Building

_____ 672-1911

Campus Phone *After-hours Emergencies Phone*

Location of laboratories (specify all rooms in which hazardous materials are stored).

_____

_____

Authorized Personnel

Laboratory personnel: List all employees and students that use hazardous materials under your jurisdiction. Also indicate Laboratory Supervisor, if applicable, and his/her after-hours emergency telephone number.

Name	Status (e.g. research asst., student)
_____	_____
_____	_____
_____	_____
_____	_____

Name**	Status (e.g. research asst., student)
_____	_____
_____	_____

_____ _____

_____ _____

_____ _____

Signature of Principal Investigator/Laboratory Supervisor (Chemical Hygiene Officer) *Date*

_____
Annual Revision Date

_____
Annual Revision Date

_____
Annual Revision Date

_____
Annual Revision Date

NOTE: Maintain the original copy of this form in Laboratory Chemical Hygiene Plan binder.

PREFACE

The purpose of this Chemical Hygiene Plan is to furnish Fayetteville State University students, faculty and staff with safety guidelines to protect from health and hazardous associated with the use of hazardous chemicals. These guidelines apply to both the teaching and research laboratories.

BACKGROUND

The U.S. Department of Labor Occupational Safety and Health Administration (OSHA) mandate The Right to Know Act: Workers have a right to know about the hazards they are exposed to in the workplace. The law requires that employers make employees aware of the hazards and provide information needed to work safely. Under the federal Occupational Safety and Health Administration, Hazard Communication Standard, employers must develop a comprehensive program to inform workers of hazards that may be encountered in the work place and also provide training in the use and handling of products containing hazardous chemicals. This Chemical Hygiene Plan is part of the University's compliance and is hereafter referred to as the Lab Standard.

SUMMARY OF RESPONSIBILITIES

DEPARTMENT HEADS:

The Chairs for the Departments of Chemistry and Physics and Biological Sciences are responsible for:

- Selecting competent people to carry out the Plan.
- Issuing standard operating procedures for each phase of the plan; e.g., an information and training program.
- Issuing specific policy statements for elements of the program; e.g., emergency response.
- Budgeting money if monitoring, medical evaluation, personal protective equipment, or engineering controls are needed.
- Acting on recommendations submitted by the Chemical Hygiene Officer.
- Adopting a plan for disciplinary action as a corrective measure against employees who violate procedures in the Plan.

FACULTY AND STAFF (LABORATORY SUPERVISORS):

Faculty and staff who supervise laboratories have the following responsibilities for implementing the Chemical Hygiene Plan:

- It is the responsibility of the faculty member and laboratory supervisor to ensure that MSDS/SDS are in each laboratory where the chemicals MSDS/SDS are being used.
- Train employees and research students about chemical safety and health practices required by this Plan and retain all records and documentation regarding training conducted.
- Enforce rules and standards of this Plan, the use of engineering controls, and safe work practices.
- Require personal protective equipment and restrict access to the laboratories.
- Maintain an adequate supply of personal protective equipment in the

laboratory and note misuse that would diminish effectiveness of the equipment.

- Ensure compliance of Laboratory Employees and students with this Plan.
- Ensure disciplinary action as a corrective measure against offenders in accordance with the University's disciplinary policies and send a report of each disciplinary action to the Chemical Hygiene Officer.
- Make available to employees the Chemical Hygiene Plan, permissible exposure limits for hazardous chemicals,; information on signs and symptoms associated with exposures to hazardous chemicals used, and Material Safety Data Sheets for hazardous chemicals used.
- Share knowledge of potential workplace hazards with the chemical Hygiene Officer and the Laboratory Supervisor.
- Tell their supervisor if they develop signs or symptoms associated with a hazardous chemical to which they are exposed.

CHEMICAL HYGIENE OFFICER (LABORATORY SUPERVISOR):

The Chemical Hygiene Officer's responsibilities include but are not limited to:

- Keep the Chemical Hygiene Plan up to date annually.
- Reply to un-resolved questions, concerns, and ideas forwarded by the supervisor.
- Maintain, review, interpret, and analyze records of monitoring results.
- Provide technical support.

DEANS, DIRECTORS, AND HEADS OF ACADEMIC AND ADMINISTRATIVE UNITS

Deans, Directors, and Senior Administrative Academic employees have the primary responsibility for the safety and health of their staff and students as following:

- Work with faculty and staff to modify the Chemical Hygiene Plan to incorporate lab specific guidelines and to develop strategies to implement the Plan.
- Establish and maintain laboratory safety training programs and safety committees.
- Request and make necessary budget arrangements for health and safety improvements.

FSU Environmental Health and Safety Director:

- Appoint an Institutional Chemical Hygiene Officer, or Safety Committee, to annually review the Chemical Hygiene Plan, and make modifications if needed.

- Provide technical assistance concerning personal protection equipment, safety equipment, handling, storage, and disposal of hazardous chemicals; and remain current on regulations concerning chemicals used on campus.

- Provide general safety training on request.

- Conduct exposure assessments, if needed, and routine safety inspections, and on request.

- Develop and implement a Respiratory Control Program if needed.

FSU Emergency Management Director:

- Responsible for the overall emergency preparedness and response of the University.

PURPOSE

Few laboratory chemicals are without hazards, operational procedures for handling all laboratory chemicals must be adopted to include minimizing exposure and assuming that any mixture of hazardous chemicals is more toxic than the most toxic component. This Plan represents the minimum guidelines set for the health and safety of FSU employees, students, handling hazardous chemicals.

BACKGROUND

This part of the Chemical Hygiene plan is FSU's compliance with the U.S. Department of Labor Occupational Safety and Health Administrations regulations, January 31, 1990, regulations entitled "Occupational Exposures to Hazardous Chemicals in Laboratories" referred to herein as the Standard Operating Procedure.

The OSHA Laboratory Standard (29 CFR 1910.1450) defines a hazardous substance as "a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents which act on the hematopoietic systems and agents which damage the lungs, skin, eyes or mucous membranes". Highly flammable and explosive substances obviously comprise an additional category of hazardous chemicals.

Because there is no clear standard operating procedure, individual laboratory supervisors and researcher must develop detailed procedures and update them as their laboratory situations warrant. It is the laboratory supervisor who is responsible for enforcing adequate safety and hygiene in laboratories they supervise.

General Precautions to be followed in all laboratories:

Few laboratory chemicals are without hazards, general precautions for handling all laboratory chemicals must be adapted to minimizing exposure.

CONTROLLING CHEMICAL EXPOSURES

The OSHA Laboratory Standard requires the employer to determine and implement control measures to reduce employee exposure to hazardous chemicals; and particular attention must be given to the selections of control measures for chemicals known to be extremely hazardous. There are three major routes of entry for a chemical to enter the body: inhalation, absorption and ingestion.

INHALATION HAZARDS

Inhalation of chemicals is the most common route of entry of a chemical into the body. To avoid inhalation exposure:

- Substitute a less volatile or toxic chemical, and minimize use.
- Use a properly functioning fume hood or other well-ventilated system to minimize exposure.
- For extremely toxic poisonous gases the use of closed systems, vented gas cabinets, fail-safe scrubbing, detection or other stricter control may be required.
- The use of a respirator: If laboratory employees wear respirators, requirements of the OSHA Respirator Standard (1910.134) must be met and a written respirator program must be implemented. This Standard requires FSU to ensure training for each user on the proper use of respirators. The Standard also requires medical surveillance and fit testing to ensure the user is capable of wearing a respirator. A lab worker or supervisor must contact the Environmental Health and Safety Director, Cindy Wetherwax, (672-1827) before respiratory protection is used to control exposure to hazardous chemicals.

INGESTION HAZARDS

The second most common route of entry is through the mouth. To avoid ingestion exposure;

- Wear safety gloves when handling chemicals
- Eating, drinking, smoking, chewing tobacco or gum is STRICTLY PROHIBITED in all laboratories.

- Wash hands with warm water and soap.
- Pipetting by mouth is forbidden.

SKIN/EYE CONTACT HAZARD

To avoid skin/eye exposure;

- Wear safety glasses, or face shield, for eye and face protection.
- Wear appropriate clothing, lab coats and safety gloves.
- Safety equipment such as eyewash station and showers are located near the work area.

INNOCULATION HAZARDS:

To avoid inoculation exposure;

- Use precaution when using sharps.
- Dispose of sharps in approved sharps containers.

INCASE OF ACCIDENTAL CONTAMINATION; - IN ALL CASES CALL 1911 AND FOLLOW EMERGENCY PROCEDURES OUTLINED BELOW.

Eye Contact: promptly flush eyes with water for a prolonged period (15 min.) and seek medical attention.

Skin Contact: promptly flush the affected area with water and remove any contaminated clothing; use a safety shower when contact is extensive. If symptoms persist after washing, seek medical attention.

Seek immediate medical attention.

For any suspected overexposure to the substances regulated by OSHA, faculty, staff and students may request an overexposure evaluation. Records of exposure evaluations will be kept by the University's Safety and Health Director, and provided to the Department, affected employee or any other appropriated authority at the University.

GENERAL RULES FOR WORKING IN LABORATORIES:

a. Never store, handle and consume food or drink
   beverages in chemical storage areas, refrigerators;
   and never use glassware, or utensils that are used for laboratory operation.

b. Handle and store laboratory glassware with care to avoid damage. Do not use damaged glassware. Use extra care with Dewar flasks and other evacuated glass apparatus. Shield or wrap them to contain chemicals and fragments should implosion occur. Use equipment only for its designed purpose.

c. Wash areas of exposed skin thoroughly before leaving the laboratory.

d. No horseplay allowed in the labs.

e. Confine long hair and loose clothing.

f. Wear shoes at all times in the laboratory, but do not wear sandals, perforated shoes, cloth sneakers, or any shoes made of canvas.

g. Keep the work area clean and uncluttered, keep chemicals and equipment **properly labeled and stored**; clean up the work area on completion of an operation.

h. Ensure that appropriate eye protection, where necessary, is worn by all persons, including visitors, in areas where chemicals are stored and handled.

i. Use of gloves should not be the sole method of preventing exposure. Proper technique should prevent material from getting onto the hands; gloves should be worn just in case anything goes wrong. Many chemicals can penetrate rubber and plastic. No glove is leak-proof.
-For more information see glove compatibility chart in the appendix.

j. Respirators are appropriate for use in few, if any, State laboratories. The Environmental Health and Safety Director, Cindy Wetherwax, (672-1827) must approve each use of a respirator to control exposure to hazardous chemicals. Each user of a respirator device must be trained in accordance with Section 1. Controlling Chemical Exposures, Inhalation Hazards of this Standard Operating Procedure. The proper use of respirators is in emergency situations where material cannot be fully contained and people must be in a zone of contamination. Even then their use requires careful consideration, technical knowledge, and training. If an emergency occurs as the result of an accident, it is generally State policy to call the Fire Department to handle it. Furthermore, it should be the policy in every laboratory that no one handles a toxic substance in an open laboratory, thereby, creating the potential for unsafe concentrations in the air. One person handling a toxic substance in an open laboratory has no right to be protected with a respirator while other workers are exposed.

k. Use any other protective and emergency apparel and equipment as appropriate.

l. OSHA policy about contact lenses as stated in the preamble to the revisions to 29

CFR 1910.Subpart I is as follows: “Contact lenses do not pose additional hazards to the wearer. The Agency wants to make it clear, however, that contact lenses are not eye protective devices. If eye hazards are present, appropriate eye protection must be worn instead of, or in conjunction with, contact lenses.”

m. Remove laboratory coats immediately upon significant contamination.

n. Seek information and advice about hazards, plan appropriate protective procedures, and plan positioning of equipment before beginning any new operation.

o. Leave lights on, place an appropriate sign on the door, and provide for containment of toxic substances in the event of failure of utility service (such as cooling water) in an unattended operation.

p. Use a hood for operations that might result in release of toxic chemical vapors or dust.

q. As a rule of thumb, use a hood or other local ventilation device when working with any appreciably volatile substance with a TLV of less than 50 ppm.

r. Confirm adequate hood performance before use: Keep hood closed at all times except when adjustments within the hood are being made. Keep materials stored in hoods to a minimum, and do not allow materials to block vents or air flow.

s. Leave the hood “on” when it is not in active use if toxic substances are stored in it or if it is uncertain whether adequate general laboratory ventilation will be maintained when it is “off”.

t. Be aware of unsafe conditions and see that they are corrected when detected.

u. The Chemical Hygiene Officer must make sure that the following specific control measures are in place, adequate and effective:

v. Standard Operating Procedures relevant to all laboratory operations to be followed by laboratory employees are in the laboratory and employees have been told where they are located.

w. Monitoring is performed when employees report symptoms that could be related to workplace exposure or there is any indication that the action level or permissible exposure limit is approached.

x. In the unlikely event that exposure monitoring shows safe limits are exceeded, control measures to reduce employee exposure to hazardous chemicals must be carried out. Control measures when exposures exceed safe limits include:

y. Engineering controls
    I. Use of Personal Protective Equipment
    II. Personal hygiene practices.

ADMINISTRATIVE CONTROLS AND GENERAL WORK PRACTICE

MINORS IN RESEARCH LABORATORIES

Students under the age of 18, and not enrolled as an Fayetteville State University student who wish to do research in a lab must fill out the "Minors Working in Research Laboratories and Greenhouse" Policy, and the FSU Waiver of Liability Form.

-See "Minors Working in Research Laboratories and Greenhouse" Policy Form and FSU Waiver of Liability Form section.

AUTHORIZED ACCESS: CHILDREN AND PETS

The laboratory supervisor must restrict access to laboratories: Children (under age 18) are not allowed in laboratories except as authorized by the laboratory supervisor for an officially sanctioned activity (e.g. class or open house). Pets are also prohibited from laboratories.

PRIOR APPROVAL OF TOXIC CHEMICALS

It is the Laboratory Supervisor's responsibility for approving the acquisition and use of toxic chemical reagents, toxic compressed gases, and radioactive materials in their lab. Certain biohazard material requires prior internal and external approval at various levels.

HANDLING CHEMICALS

Use bottle carriers for transporting chemicals that are in regular glass containers; and if possible order poly-coated bottles. Keep bottles closed when not in use. Never add water to concentrated acids. Metal containers and non-conductive containers holding more than five gallons of flammable liquids must be grounded when transferring to another container.

-For more information see transporting chemicals section.

PERSONAL USE OF CHEMICALS

No chemicals may be removed from any lab for personal use.

WORKING ALONE IN THE LAB

When working with acutely hazardous materials, it is advisable to have a second person present in case of emergencies. That second person can call for help, or at a minimum maintain contact via a telephone.

UNATTENDED OVERNIGHT EXPERIMENTS

For unattended overnight operations involving hazardous materials, it is essential to plan for interruptions such as utility services, and/or emergencies or other failures. Leave the lights on, post a sign with emergency contact information, and if possible arrange for routine inspections.

-For a laboratory signage sheet go to Signage Sheet section.

LABELING

All chemical containers must be clearly labeled.

- All labels must be legible, in English and include chemical/product name

(chemical formulas alone are not acceptable).

- and include information related to the chemical's hazard(s).
- Do not deface or remove manufacturers' labels.
- Any incoming chemical must be dated when it was received.
- All chemical reaction containers must be labeled and given as much information as possible;
- assume the chemical is as hazardous as the starting materials and subject to the Chemical Hygiene Plan.
- Waste containers are to be labeled and clearly marked as hazardous waste indicating the chemicals and dated.

-For more specific information on labeling go to labeling section.

EXPLOSION PROOF REFRIGERATORS

Storage of flammables in a refrigerator is prohibited unless it is approved for such storage. This type of refrigerator is designed not to spark inside.

GAS CYLINDER HANDLING AND STORAGE

Extremely toxic compressed gases are not to be transported during regular business hours.

- Use appropriate hand carts to move cylinders.
- Keep cylinders secure at all times either chained to a wall or bench using appropriate security equipment in an upright position.
- Keep cylinder caps on when not in use.
- Mark empty cylinders clearly.
- Consider all cylinders full unless clearly marked empty.
- Do not use near heat or high traffic area.

PERSONAL PROTECTION EQUIPMENT (PPE):

Employers are required to determine the type of personal protection equipment needed to protect employees and students from particular occupational hazard(s): Personal Protection Equipment, Paragraphs 1910.132 - 1910.133, 1910.135, and 1910.136. Employers are also responsible for training employees how to properly use the equipment.

ATTIRE: Refer to the MSDS/SDS for the chemicals used to determine the appropriate PPE. Use the requirements for the most hazardous chemical to be used.

GLOVES: Protect the hands from exposure. Gloves must be selected on the basis of resistance to chemical degradation, permeation, and penetration. Certain chemical(s) cause softening, swelling, cracking, and dissolving; choose the correct gloves based on the manufacturer's guide to what glove gives you more protection from a specific group of chemicals: Some labs may require more than one type of glove material.
Nitrile is a good all-purpose glove material and has less of an issue for allergic reactions. Do not wear gloves in public areas where door handles, phones, computer key boards, elevator buttons, and equipment can become contaminated.
-For more information see glove compatibility chart.

LABORATORY COATS: Protect clothing from minor chemical splashes or spills. but could also present a hazard to the wearer (e.g., combustibility). Cotton lab coats and some made of synthetic materials are satisfactory, but rayon and polyesters are not recommended. For high-risk situations, working with known carcinogenic, disposable coats and aprons may be preferable, however, they are limited in their protection and judgment is needed when using them.

EYE PROTECTION: Eye protection rules need to be enforced, and it is the laboratory instructor's responsibility to determine the form of protection needed. Safety glasses and goggles are used when there is danger of splashing chemicals or flying particles, but offer little protection for the face and throat. Full face shields that protect the face and neck are used when goggles are not enough protection from flying particles and harmful liquids. It is FSU's policy that lab workers, students, and guests must wear appropriate safety glasses, or goggles, at all times where chemicals are used and stored. The use of contact lenses is discouraged but most research has shown contact lenses do not pose a greater risk but one should consult with their optometrist or ophthalmologist. Full face shields must be worn where splashing is a potential to protect both the face and eyes.

RESPIRATORS:

The Environmental Health and Safety Director must approve each use of a respirator to

control exposure to hazardous chemicals. FSU Environmental Safety and Health Director will develop and distribute a Respiratory Protection Program in accordance with 29 CFR 1910.134. Each user of a respirator device must be trained in accordance with Section 1. Controlling Chemical Exposures, Inhalation Hazards of this Standard Operating Procedure.

If needed, and approved by the EHS Officer, there are several types of respirators to choose from, depending on the need to protect and minimize airborne contaminants. The type of appropriate respirator depends on the measured concentration; exposure limits (TLV), warnings and hazardous properties of a given chemical(s). Dust respirators are used only for protection against chemical dust and mists, and they are not particularly effective and should not be used against gas or vapors. Cartridge respirators are used for a particular class of vapors and gases, and must be worn correctly with training. If a respirator is not properly used, contaminate air will bypass the filter causing a dangerous situation.

In labs where respirators are located, there must be information available that tells the limitations of the respirator, as well as training, fitting, inspection and cleaning procedures. Every employer required to wear one needs to be trained and examined by a physician before working in an area with chemicals that require a respirator to be worn.

MATERIAL SAFETY DATA SHEET (MSDS)/ SAFETY DATA SHEETS (SDS):

OSHA has established guidelines that require the university to provide students, faculty and staff with descriptive data sheets and to develop a written hazard communication program, 29 CFR 1910.1200(g). The Material Safety Data Sheet/SDS has to be complete, accurate, and up-to-date to be effective. The easiest way to compile a list of hazard data references is from the supplier at purchase; there are many online resources, or from a commercial computer software database. There are advantages and disadvantages to both. The purchasing order must specify a complete MSDS/SDS to accompany the chemical. The supplier's MSDS/SDS has to be placed into a binder alphabetically, and placed so that everyone has access to it. The problem with a purchased MSDS database is chemical information limitation because of the diverse and sometimes exotic chemicals found in Universities.

It is the responsibility of the person(s) ordering chemical(s) for classes and/or research to make sure there is a copy of the MSDS/SDS on database or on file. Failure to do so will make the chemical reference incomplete.

If you order and/or receive any new chemicals make sure that a copy of the MSDS/SDS is submitted to the Dept. of Chemistry and Physics. Contact person: Ivy Rittenhouse, Chemical Hygiene Officer (CHO), Lyons Science Bldg, Rm. 305, or Science Tech Bldg. 440, ext. 1054.

It is the responsibility of the faculty member and laboratory supervisor to ensure that MSDS/SDS are in each laboratory where the chemicals MSDS/SDS are being used.

FUME HOODS AND OTHER ENGINEERING CONTROLS

Examples of engineering controls include:

- Providing at least 2.5 linear feet of hood space for every worker who spends most of their time working with chemicals.

- Checking stand-a-lone type hoods flow rates every 3 months and checking that airflow into and within the hoods is not excessively turbulent--hood face velocities generally need to be within the range of 75 to 135 linear feet per minute with a coefficient of variation of, 20% (a face velocity of 100fpm when the hood is open 18" is an often quoted rule of thumb).

- For overhead type hoods the minimum airflow rate is 25 linear feet per minute.

- Conducting airflow visualization tests (smoke) that show there is a complete containment of smoke and good distribution and capture in hoods.

- Providing 4 to 12 air exchanges per hour in the laboratory.

Criteria used at present to evaluate control measures are these:

- Airflow rate is not turbulent and is relatively uniform throughout the laboratory, and checked using a calibrated anemometer.

- The laboratory is under negative pressure with respect to the hallway as indicated by smoke tests.

The newer exhaust hoods are equipped to allow confirmation that they are working, and will sound an alarm when it is below the accepted airflow rate. Also, a simple test that shows if the hood is working is to place a strip of thin plastic or other light flexible material cut into thin lengths of about 4 to 6" or a ping pong ball at the bottom of the hood. They should move to an inward deflection position.

HOODS NEEDING REPAIRS

Stand-A-Lone type fume hoods with airflow velocities below 60 feet per minute must be marked with a sign indicating the hood may not be used until it is repaired. Overhead type fume hoods with airflow velocities below 25 feet per minute must also be marked and may not be used until it is repaired. A work order for repairs should be processed as soon as possible by contacting the Departmental Office, Ms. Brenda Fuller, SciTech 305, ext. 2441. Once the repairs have been made the fume hood(s) need to be reevaluated before use.

SAFE WORK PRACTICES USING LABORATORY FUME HOODS

Laboratory fume hoods cannot provide complete safety against all events that may occur

in the hood, but for ordinary exposures a properly designed fume hood can provide adequate protection if certain work practices are followed:

- Be sure the fume hood is switched on and working properly.
- Do not put your head in the hood when reactions or toxins are being generated.
- Keep all apparatus at least 6 inches back from the face of the hood: a mark at 6 inches is a good reminder.
- Do not use the hoods for storage of waste if possible except for small quantities.
- Using hazardous solids (powders) in hood may not be appropriate.
- Do not store chemicals in the hood this will impair the performance of the fume hood. Store flammables in an approved flammable storage closet or cabinet.
- Do not place electrical receptacles or spark sources inside the hood when flammables are present. No permanent electrical receptacles are permitted in the hood.
- If hood sash is supposed to be partially closed for operation, the hood should be labeled at the appropriate closure height.
- Refer to the MSDS/SDS for special precautions when using fume hoods.

  Contact Ivy Rittenhouse, CHO, LS 305 and SciTech 440, ext. 1054 for any questions or requests for fume hood airflow rate assistance.

EMPLOYEE TRAINING

Lab employees and student workers must be apprised of the hazardous chemicals present in their work area. THIS INFORMATION AND TRAINING MUST BE PROVIDED BEFORE INITIAL ASSIGNMENT AND BEFORE NEW EXPOSURE SITUATIONS. The use of personal protection equipment and lab equipment necessary for safe handling of hazardous chemicals must also be provided. **IT IS THE PRINCIPLE INVESTIGATOR'S RESPONSIBILITY TO ENSURE ALL LABORATORY WORKERS HAVE BEEN PROPERLY TRAINED.** Specific training for particular labs where a lab worker is assigned is the responsibility of the employee's supervisor.

- Training is mandatory for anyone who is generating hazardous waste.
- The supervisor must determine the frequency of refresher information and training.

LOCATION OF INFORMATION

Laboratory employees and workers must know the location and availability of the following:

- The OSHA Standard, "Occupational Exposures to Hazardous Chemicals in the Laboratory.
- The FSU Chemical Hygiene Plan
- Material Safety Data Sheets/SDS; and other reference materials
- The permissible exposure limits for OSHA regulated chemicals, or the recommended threshold limit values for substances that are not regulated.
- The signs and/or symptoms of over exposure to hazardous chemicals found in the work area.

TRAINING REQUIREMENTS

Laboratory employee training must include the following:

- Safe use of chemicals.
- Use of MSDS/SDS
- Good laboratory practices; personal protection equipment; and emergency procedures used to ensure that the employee(s) knows how to protect himself/herself from over exposure.

- Detection methods and observations used to detect the presence or release of a harmful chemical; such as visual appearance, an odor, and understanding chemical monitoring devices.

- Emergency procedures

- Medical consultations and evaluations.

- Applicable details of the Chemical Hygiene Plan.

The employee's/students supervisor, or the Principle Investigator, must provide additional training for specific lab hazards that are used and stored in their lab.

CHEMICAL HYGIENE RESPONSIBLE PARTY:

The lab supervisor shall serve as the chemical hygiene responsible party for his/her own lab. Safety and health is the primary concern within their area. The standard applies to all laboratory employees.

The Office of Human Resources must:

- See that lab employees are given the opportunity to receive medical attention whenever there is a spill, leak, explosion, or other occurrence resulting in the likelihood of a hazardous exposure;
- Obtain information from the physician about follow-up examination, results of examination(s), any medical conditions of the employee that might pose increased risk, and a statement that the employee was informed of the results of the examination; and
- Ensure that medical records are kept for at least the duration of employment plus 30 years

EMERGENCY RESPONSE PLAN

PLANNING FOR EMERGENCIES

Planning and practicing for emergencies is an essential component of laboratory safety. The most important aspect of employee safety training is the ability to differentiate between an incidental situation and an emergency. Incidental release is one that doesn't have to be cleaned up immediately in order to prevent serious injury or death to lab workers. Lab workers should be prepared for and handle their own incidental spills or releases.

Listed are some life threatening situations:.

- High concentrations of toxic substances released
- Situations that is life and injury threatening
- Imminent danger to life and health environments
- Situations that presents an oxygen deficient atmosphere
- Conditions that pose a fire or explosion hazard
- Situation that requires immediate attention because of the danger posed to workers in the area

EMERGENCY PROCEDURES

The laboratories have equipment for specific accidents, and each person must be familiar with their location and operation of this equipment. This equipment includes eyewash stations, showers, first aid kits, chemical clean-up kits, fire extinguisher, and an alarm or telephone.

1. **General Procedure**: When helping another person, stop for a minute and evaluate the potential danger to yourself before taking any action.

- Report the nature and location of the emergency to the person in charge of the lab and/or dept. chair (Chemistry and Physics phone: 672-2441/1943 and Biological Science : 672 -1691/1692). Give your name, how many people are involved, whether they are unconscious, trapped, burned, or etc. Indicate whether a fire or explosion has occurred. FSU emergency police number is 910-672-1911 or on campus ext. 1911.

- Alert others in the area of the emergency.

- If possible, keep the injured person warm, but do not move them unless there they are in immediate danger.

- Meet the fire department or emergency crew at the designated location. Send someone else if you cannot go.

- Do not tie up the phone line unless it is related to the emergency.

2. Fire Procedure: Quickly assess the situation and then:

- Alert personnel in the immediate vicinity. State the nature and extent of the emergency. Give instructions to sound the alarm, call for assistance if needed.

- If the fire is contained and small, suffocate it by covering with a beaker or other nonflammable object. Do not use towels or cloth. Remove any flammable materials in the near area.

- If the fire is larger and cannot be suffocated, start evacuation of persons not trained and equipped to fight structural fires. If possible, without harming yourself, confine the fire until emergency personnel arrive using a portable extinguisher, you may, at your discretion, fight the fire: be sure you are always in a position that you can escape from. Do not underestimate a fire. If not possible, evacuate and close doors as you leave to prevent spread of fire, gases, and/or vapors.

- REMEMBER that chemicals increase the chance of an explosion. Know the storage location of solvents, gas cylinders, metals, and explosive chemicals. This information could be important in pinpointing the location of the fire.

- Activate alarms (located at all corners within the building). Notify instructor and/or dept. chair (Department of Biological Scince's phone: 672-1691/1692 or Department of Chemistry and Physic's: 672-1943/2441). If not possible, call campus police 910-672-1911 or on campus ext. 1911. Assemble at designated meeting point.

- Recharge or replace extinguishers after the fire immediately.

3. Fire on Personnel:

- If clothing is on fire, stop the person from running.

- Drop the person to the floor. Standing will allow flames to spread to eyes and nose.

- Roll the person to put out the flames; saturate the person with water; or use a fire blanket or anything (i.e. coat, blanket). Use caution when using the fire blanket because wrapping a body can force flames toward the face and neck.

Cool the injured person with cold water to remove heat, remove any smoldering clothing, and place a clean cold cloth on burned area. Place a blanket or coat over to

prevent shock and exposure. Call for help immediately.

4. Chemical Spills on Personnel

- For chemical splash in eyes, immediately flush eyes using the eyewash station for fifteen minutes. If it is inoperable, or not available, lay the injured person on his back and gently pour tepid water or eyewash solution into the eyes for fifteen minutes. Call for help, and seek medical treatment of an ophthalmologist. Know the exact chemical so to assist in proper treatment.

- For small body area, flush with water for fifteen minutes. Then wash with soapy water. Check MSDS for delay effects. Seek medical attention even for minor burns.

- **Using an Eyewash**

    - Always wash with tepid water or eye solution from the inside edges of the eye to the outside; this will help to avoid washing the chemicals back into the eyes or into an unaffected eye.

    - Do not directly aim water, or solution, into the eyeball but aim at the base of the nose.

    - Roll eyes around to fully rinse and flush eyes and eyelids for 15 min.

    - Immediately seek medical attention.

- **Using a Safety Shower**

    - Stand directly under the shower head, and pull handle to activate shower.

      For chemical spills on clothing, remove all contaminated clothing while using the safety shower. Care should be taken to not spread the chemical on the skin or eyes. Cut clothing if necessary.

    - Continue to flush affected skin for fifteen minutes. Call for help and seek medical attention. Do not put any creams, lotions, or salves on any burns

    - Push up on handle to turn off.

REPORTING ACCIDENTS/INJURIES:

1. As soon as possible, after an accident the laboratory supervisor must fill out and submit an Accident Report Form, available in appendix ___ of this form.
2. Copies of the completed form must be submitted to Environmental Health and Safety Officer and the Department Chairs.

Appendix A

Laboratory Specific

Standard Operating Procedures

Fayetteville State University

1200 Murchison Rd

Fayetteville, North Carolina

Building:_____ **Room:**_____

Department:_____ **PI:**_____

_____

Section 1: (check one)

☐ **Process** ☐ **Hazardous Chemical** ☐ **Hazardous Class**

Section 2: Describe process, hazardous chemical, or hazardous class

Section 3: Potential Hazards

Section 4: Personal Protective

Section 5: Engineering Controls

Section 6: Special Handling and Storage Procedures

Section 7: Spill and Accident Procedures

Section 8: Decontamination Procedures

Section 9: Waste Disposal Procedures

Section 10: MSDS Location

Section 11: Protocol

CHEMICAL STORAGE

THE CHEMICAL STOCKROOM:

Chemicals kept in the stockroom must be identified and segregated by hazards.

All chemicals must be stored in accordance with the shelf pattern listed in Appendix B

Flammable chemicals must be stored in ANSI approved Flammable Storage Cabinet.

Store flammables in refrigerators designed for flammable storage and labeled as to use; do not store flammables in conventional refrigerators.

Do not store food or beverages in storage areas, refrigerators, glassware, or utensils which are used for laboratory operations.

Promptly clean up spills, using appropriate protective apparel, equipment and disposal procedures described in the Standard Operation Procedure.

TRANSPORTING HAZARDOUS CHEMICALS

Department policy mandates that hazardous chemicals and solvents be carried in approved secondary containers (with handles) made of rubber, metal or plastic. Bottles small enough to be carried in the palm of the hand can be transported by that method. Compressed gas cylinders need to be capped and restrained during transport. Chemicals cannot be transported in elevators when students are present.

CHEMICAL RELEASE PREVENTION

Release of chemicals can occur by:

1 Deterioration or accidental rupture of chemical containers.
2. Inadequate shelving space.
3. Inadequate shelving integrity.
4. Lack of guards on the shelves.
5. Inappropriate handling techniques.
6. Spilling chemicals accidentally or purposefully.

To help prevent the accidental or purposeful release of any chemicals the chemical hygiene responsible parties must ensure that none of the above conditions are present in the laboratories they supervise.

INSERT NEW SOP FOR SPILL REMEDIATION

HAZARDOUS RATINGS:

Hazard Signal System: Hazard Ratings and Examples:

No.	Hazard	Fire Hazard	Reactivity
4.	Extremely hazardous	Flammable gas or class IA liquid	Extremely shock sensitive and capable of detonation
	Hydrogen Cyanide	**Hydrogen, methane ethyl ether, pentane**	**Picric acid, dry benzyl peroxide**
3.	Toxic or corrosive	Flammable liquid class IB and IC	Shock sensitive and may detonate under some conditions
	Sodium cyanide,	**Acetone, methanol ethanol, toluene**	**Dilauroyl peroxide**
2.	Moderately toxic	Combustible liquid Class II and IIIA	Unstable and water-reactive
	Toluene, ether	**Acetophenone**	**Sulfuric acid**
1.	Irritating	Combustible,includ-ing Class IIIB liquids	Materials that may become un-stable under heat or pressure
	Acetone acid	**Cod liver oil**	**Glacial Acetic**

-Continue to the next section for more Hazardous Rating Information on NFPA Diamonds

PROCEDURES FOR WORKING WITH FLAMMABLE AND EXPLOSIVE SUBSTANCES

Flammable Solvents

The heating in open vessels of all solvents except water must be carried out in a hood. Use of the hood is recommended for the heating of flammable solvents even when the apparatus is enclosed (reflux, distillation), especially when the quantities are significant. A steam bath, heating mantle, oil bath or similar device should be used, but never a flame.

NOTE: When heating a flammable solvent in the open (e.g. in an Erlenmeyer flask for recrystallization), use a steam bath if possible. Among common recrystallizing solvents, only heptane, toluene and acetic acid cannot be boiled this way. [Carbon disulfide deserves special care, as its auto ignition point is so low (100^{o} C) that even a steam bath may be capable of igniting it.] Note the Table of Solvent Properties.

Because some hotplates pose a dual fire hazard**, restrict their use for recrystallization to non-flammable solvents such as carbon tetrachloride and chloroform, solvents with relatively high flashpoints such as ethanol and solvents which boil too high for the steam bath. Do not use them with solvents such as diethyl ether, methanol, pentane, hexane, petroleum ether, benzene and tetrahydrofuran. If the solvent is flammable, be careful to operate the hotplate at the lowest practical temperature and to avoid placing the hot flask in front of the hotplate where vapors can be drawn inside the device.

**A hotplate's surface temperature can easily exceed the auto ignition point of the solvent. On the "High" setting the Corning PC-351, for example, reaches a temperature of about 500^{o} C. Even if the surface temperature is cool enough, solvent vapors can be ignited by the thermostat, which sparks when it cycles. This requires only that the flash point be reached; a condition that is met below room temperature for every common (flammable) recrystallizing solvent except acetic acid.

EXPLOSIVE AND FLAMMABLE SUBSTANCES

Any work with explosive materials mandates the use of protective equipment, such as face shields (with snap-on throat protector), gloves and safety shields. Of the explosive materials handled in the Department laboratories, organic peroxides are the most frequently used and are also among the most dangerous because of their extreme sensitivity to shock, friction, heat, light, oxidizing and reducing agents. Be wary of peroxides contained in screw cap bottles. Twisting the cap may cause an explosion and fire. Organic peroxides are also highly flammable.

Commercially purchased peroxides, such as benzoyl peroxide, t-butyl hydroperoxide, etc., are best stored in a flammable storage or suitably modified refrigerator. Compounds that form peroxides by an autoxidation process are aldehydes, ethers with primary and/or secondary alkyl groups (including acyclic and cyclic types, ketals and acetals), hydrocarbons with allylic, benzylic or propargylic hydrogens, conjugated dienes, enzymes and diynes and saturated hydrocarbons with tertiary hydrogens. Examples of especially dangerous peroxide formers are diisopropyl ether, diethyl ether, THF, divinylacetylene, decalin and 2,5 dimethylhexane.

Because the above classes form peroxides as a result of exposure to 0_2 or other oxidizers, always store such substances in an inert atmosphere by flushing the container with an inert gas such as N2. Oxidation inhibitors (hydroquinone, etc.) should be added to the vessel when it seems appropriate.

Do not distill a known peroxide former before testing for peroxides by adding 0.5 ml. of the sample to a mixture of 1 mL of 10% KI solution and 0.5 mL of dil. HCl to which has been added a few drops of starch solution just prior to the test. A blue or blue black color will appear within a minute or so if peroxides are present.

FSU hazardous waste generator status

HAZARDOUS WASTE

First and foremost, we need to control hazardous chemical waste in a manner that protects and preserves human and environmental health. No chemical should be disposed of in any way until adequate information is obtained about the chemical. Because so many chemical waste are toxic, and we have inadequate financial resources available to properly dispose of these hazards, they may become inanimate objects. Some decompose, labels crumble, they become more dangerous, and even more expensive to dispose of.

Chemical waste is considered hazardous if its name is listed or has characteristics of a hazardous material. Hazardous chemical wastes are regulated by federal, state, public health, and environmental safety laws. Most academic institutions are small quantity generators. Universities that produce 100 - 1000 Kg of waste per month are classed as small quantity generator. Also, p-listed chemicals can not exceed 1 Kg (2.2 lbs) per disposal: A list of p-listed chemicals is provided at the end of this section. A small quantity generator that accumulates 6000 Kg of waste in 180 days will need to obtain a permit "Notification of Hazardous Waste Activity" from the EPA.

Avoiding waste can be accomplished by substituting hazardous material with less hazardous ones; micro scale experiments; volume reduction; treating hazardous materials to make them less toxic; recycling; and exchanging unwanted chemicals for wanted chemicals within the department.

Additional measures include the disposing of waste, having one central location where it can be checked in, records maintained, segregated and identified weekly from all location within the building and from the central waste area at regular intervals.

Proper labeling of waste is so very important, disposing of "unknown waste" is more expensive; they are referred to as "orphan reaction mixtures". The label has to identify the waste, what experiment it was generated from, the date, and the name of the person in charge of the waste. Commercial waste labels are available and can be purchased from VWR and Fisher.

HAZARDOUS WASTE MANAGEMENT PLAN

All hazardous waste generated at Fayetteville State University will be managed and disposed of according to ALL APPLICABLE federal, state and local regulations.

Small Quantity Generator Requirements

General Requirements:

1) Hazardous waste determination must be properly performed. Any testing results must remain on-site for 3 years.

2) Facility must have an EPA Identification Number and pay annual fees.

3) Quantity of waste accumulated on-site must never exceed 6000 kilograms (approximately thirty 55-gallon containers)

4) Cannot store hazardous waste on-site for more than 180 days

Manifests:

1) Hazardous waste must be manifested properly (complete with Land Disposal Restrictions (LDRs)) and signed, returned copy from designated disposal facility must remain on-site for 3 years. Exception reports on file if manifest if signed manifest is not returned from disposal facility within 60 days of receipt from transporter.

Container Management:

1) Hazardous waste must be ***inside*** the hazardous waste container. All spills/releases of hazardous waste must be responded to appropriately.

2) Hazardous waste containers must be closed unless waste is being added or removed.

3) All hazardous waste containers in the 180 day storage area must be labeled with the words “hazardous waste” and marked with an accumulation start date.

4) Hazardous waste containers located at a satellite accumulation area must be marked with the words “hazardous waste” or other words identifying the contents of the container.

5) *Weekly inspections (looking for leaks and for corrosion) of hazardous waste containers in less than 180 day storage area must be performed and documented.

6) All containers must be in good condition and if it is not in good condition, the hazardous waste must be transferred to another container that is in good condition.

7) Containers used to store hazardous waste must be compatible with the material stored in the container.

8) Incompatible wastes must not be placed in the same container.

9) Facility must have adequate aisle space to provide unobstructed movement in the less than 180-day storage area in order to respond to an emergency.

10) Comply with 40 CFR 265.201 in Subpart J if the facility stores hazardous waste in tanks.

Emergency Preparedness and Prevention:

1) Facility must be operated and maintained to minimize the possibility of fire, explosion or any unplanned sudden or non-sudden release of hazardous waste to the environment.

2) Facility must have the following equipment unless none of the hazards posed by waste handled at the facility could require the kind of equipment specified:
   a) internal communications or alarm system capable of providing immediate emergency instruction
   b) external communication device (such as a telephone or two-way radio) that is capable of summoning emergency assistance
   c) Portable fire extinguishers, fire control equipment, spill control material and decontamination equipment
   d) Water in adequate volume and pressure to supply water hose streams or foam producing equipment or automatic sprinklers.

3) Emergency equipment must be tested and maintained to operate properly in an emergency.

4) Emergency Coordinator on premises or on-call and must respond to emergencies.

5) Employees must be thoroughly familiar with proper waste handling and emergency procedures.

6) Arrangements must be made with local police, fire departments, and emergency response teams with the layout of facility, properties of hazardous waste handled at the facility and associated hazards, places where personnel would normally be working, entrances to roads inside the facility and possible evacuation routes.

7) Arrangement must be made with the local hospitals with the properties of hazardous waste handled at the facility and the types of injuries or illnesses that could result from fires, explosions or releases at the facility.

8) *Emergency Information posted by a phone, which includes:
- Name and telephone number of emergency coordinator(s)
- Location of fire extinguishers and spill control equipment and fire alarm (if present)
- Telephone number of fire department

* Paperwork requirement

Fluorescent Lamps

1. Spent fluorescent lamps containing mercury must be stored in containers that are closed at all times, unless lamps are being added to or removed from the container.

2. Containers of lamps containing mercury must be labeled “Universal Waste – Lamps”, or “Waste Lamps”, or “Used Lamps”.

3. Containers of lamps containing mercury must be marked with an accumulation start date when the first lamp was placed in the container.

4. Lamps containing mercury may be accumulated onsite for up to 1 year.

Used Oil

1. Tanks and containers of used oil must be labeled ‘used oil’.

2. Spills of used oil must be cleaned up immediately.

GUIDELINES FOR DISPOSAL OF CHEMICALS IN THE SANITARY SEWER SYSTEM:

The following lists comprise compounds that are suitable for disposal down the drain with excess water in quantities up to about 100 g at a time. However, local regulations may prohibit drain disposal of some and should be checked before any laboratory compiles its list of compounds acceptable for disposal down its drains. Compounds on both lists are water soluble to at least 3% and present low toxicity hazard. Those on the organic list are readily biodegradable.

Organic Chemicals:

Alcohols:
Alkanols with less than 5 carbon atoms
t-Amyl alcohol
Alkanediols with less than 8 carbon atoms
Glycerol
Sugars and sugar alcohols
Alkyoxyalkanols with less than 7 carbon atoms
n-$C_4H_9OCH_2CH_20CH_2CH_20H_2$
2-Chloroethanol

Aldehydes:

Aliphatic aldehydes with less than 5 carbon atoms

Amides:

$RCONH_2$ and RCONHR with less than 5 carbon atoms
$RCONR_2$ with less than 11 carbon atoms

Amines[a]:

Aliphatic amines with less than 7 carbon atoms
Aliphatic diamines with less than 7 carbon atoms
Benzylamine
Pyridine

Carboxylic Acids:

Alkanoic acids with less than 6 carbon atoms[a]
Alkanedioic acids with than than 8 carbon atoms
Hydroxyalkanoic acids with less than 6 carbon atoms
Aminoalkanoic acids with less than 7 carbon atoms
Ammonium, sodium, and potassium salts of the above acid classes with less than 21 carbon atoms
Chloroalkanedioic acids with less than 4 carbon atoms

Esters:
Esters with less than 5 carbon atoms

Isopropyl acetate

Tetrahydron, Dioxolane, DioxanePolymerizable monomers should be stored with a polymerization inhibitor from which the monomer can be separated by distillation just before use.

[b] Although 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.

[d] 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 should 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 inhibited gases that have been put into a secondary container under conditions that create a liquid phase should be discarded within 12 months.
[a] Those with a disagreeable odor, such as dimethylamine, 1,4-butanediamine, butyric acids, and valeric acids, should be neutralized, and the resulting salt solutions flushed down the drain, diluted with at least 1000 volumes of water.

Ketones:
Ketones with less than 6 carbon atoms

Nitrit:
Acetonitrile
Propionitrile

Sulfonic Acids:
Sodium or potassium salts of most are acceptable
This list comprises water-soluble compounds of low-toxic-hazard cations and low-toxic-hazard anions. Compounds of any of these ions that are strongly acidic or basic should be neutralized before disposal down the drain.

Cations	Anions
Al^{3+}	BO_3^{3-}, $B_4O_7^{2-}$
Ca^{2+}	Br^-
Cu^{2+}	CO_3^{2-}
$Fe^{2+,3+}$	Cl^-

2. INORGANIC CHEMICALS

H^+	HSO_3^-
K^+	OCN^-
Li^+	OH^-
Mg^{2+}	I^-
Na^{2+}	NO_3^-
NH^{4+}	PO_4^{3-}
Sn^{2+}	SO_4^{2-}
Sr^{2+}	SCN^-

$Ti^{3+,4+}$

Zn^{2+}

Zr^{2+}

RECORD KEEPING

Adequate records must be kept of the following;

1. **Chemicals**: Keeping an updated inventory of chemicals and their locations to minimize accumulation of old chemicals. See section on Chemical Inventory for more information.

2. **Chemical Waste**: All waste is to be inspected once a week for corrosion of containers, labels, spillage or leaks. See section on Chemical Waste for more information.

3. **Safety Equipment**: All eyewash fountains, fume hoods, fire extinguishers, and showers will be routinely tested to ensure proper operation and to remove any debris.

4. **Chemical Spills**: All spills need to be reported to the Safety Officer and laboratory workers are responsible for the own small spills and releases. For emergency situation, i.e., large spills and leaks, evacuate and call Campus Police 672-1911, or on campus ext. 1911.

5. **Medical Accidents**: All accident regardless how minor must be reported to Human Resources, and recorded: A formal, written report stating the cause and consequences must be submitted to a Human Resources Consultant, Barber Bldg, 672-1825. In addition, a completed Department of Chemistry and Physics Accidental Injury Report must be submitted to Ivy Rittenhouse, CHO, LS 305, SciTech 440, 672-1054.
   See Accidental Injury Report section.

ACCIDENTAL INJURY REPORT

Fayetteville State University
Laboratory
ACCIDENTAL INJURY REPORT

Time and Place of
Accident:_____

NAME of Injured
Person:_____

Was injured person a Student? Yes_____ No_____ Course #_____ Lab
Section_____Room_____

NAME and Category of
Supervisor:_____

DESCRIBE Accident (include the injurer's activity, equipment and/or chemicals used and part of the body injured and by what):
_____
_____
_____
_____
_____

Nature and Extent of
Injury:_____

Type of First-Aid,
by:_____

Student Health Center? Yes_____ No_____

Hospital Treatment? Yes_____ No_____ Name of
Hospital:_____

Principal Cause(s) of Accident and
Injury:_____
_____
_____
_____

Aggravating
Causes:_____
_____

_____
_____

What should be done and by whom to prevent a recurrence of this or similar accidents?
_____
_____
_____
_____
_____

Signature of Injured Person:_____
Date:_____

Report Filed by:_____
Date:_____

Please give this Report to Ivy Rittenhouse, Lab Coordinator, Dept. of Chemistry and Physics' CHO, LS 305, SciTech 440, 672-1054.

LABORATORY INSPECTION GUIDELINES AND FORM

The following guide has been developed to assist you in your scheduled safety surveillance of laboratories and departments under your responsibility as lab supervisor. This guide is by no means all encompassing, however, information contained after each item should assist you in determining whether your area may be in full, partial or non-compliance.

Keep in mind that laboratory inspections must be in compliance with all Federal, State and University rules, recommendations and regulations concerning OSHA, EPA, NIH, CDC, and DOT.

1. **Entrances, Exits, Hallways and Stairways** - All entrances, exits, hallways and stairways must be clear and unobstructed.

2. **Showers/Eye Wash Operative** - Any area which deals with corrosive, flammable or otherwise hazardous material is required to have immediate access to eyewash and drench shower facilities. Eye wash bottles are not adequate equipment. All showers and eye wash equipment must be in full operational order and unobstructed. Monthly inspections are required.

3. **Personal Protective Equipment** - Personal Protective Equipment such as goggles, masks, gloves and cover gowns must be readily available and not worn outside the immediate work areas. Lab coats and appropriate shoes shall be worn to avoid any contact with harmful materials. Respirators shall be used when applicable and in accordance with the above Standard Operating Procedure. Evidence of respirator training and certification must be readily available.

4. **Fire Extinguisher/Inspection and Location** - All fire extinguishers must be inspected annually. Extinguishers must be properly mounted, unobstructed and be properly labeled for the intended use. Training classes are offered through the UK Fire Marshal.

5. **Pressurized Cylinders** - All cylinders must be stored in proper locations. All cylinders must be secured in an upright position and properly restrained to prevent falling. Containers must be labeled for contents and usage. Maximum number of cylinders of a flammable gas shall be not more than 3 (10” x 50”) per 500 square feet in an un-sprinkled space or not more than 6 (10” x 50”) in a sprinkled space of 500 square feet. Liquefied gas cylinders in laboratory work areas shall not exceed 3 cylinders (9” x 30”) in a sprinkled space or exceed 2 cylinders (9” x 30”) in an un-sprinkled space.

6. **Room Use Identification** - All access doors must be marked when rooms or areas are being used for chemical, biological or radioactive purposes. All doors must

remain closed and the vision panel must remain unobstructed. Unattended labs shall be locked at all times.

7. **UL Electrical Equipment and Cords** - Only Underwriters Laboratories approved equipment and cords are authorized for use. Only UL listed multiple outlet strips equipped with 15 AMP circuit breakers are approved.

8. **Laboratory Chemical Hood Operation** - Face Velocities should be between 80 and 150 FPM at the working sash height with an optimum level of 100 FPM. The sash should never be higher than 12 inches except when accessing equipment. Hoods should not be located in high traffic areas or under air supply vents. The hood must have user spill protection and cup sinks must have spill guards.

9. **Biological Safety Cabinets** - Certification is required annually or any time the hood is moved or has had maintenance performed. Cabinets must not be located near high traffic areas or air supply ducts.

Hazardous Chemicals - All chemicals must be appropriately labeled and shall not be placed near or over floor drains. Flammable liquids must be stored in appropriate containers. There should be no more than 1 L containers of solvents or Class IA or IB flammables out in the lab; larger quantities must be stored in flammable closets or cabinets.

Hazardous Waste Disposal - Hazardous waste training is required for all employees who handle hazardous material. For information on training contact Ivy Rittenhouse, CHO, LS 305, STB 440, ext. 1054.

10. **Equipment and Utility Labeling** - Refrigerators, ice machines and microwaves must be labeled for intended use. Food, personal medication and hazardous materials shall not be housed in the same refrigerator.

11. **Location of Cut-off Valves/Circuit Breakers** - All cut off valves and breakers must be properly labeled.

12. **General Safety (Dress, Eating, Smoking, etc.)** - Eating, drinking, smoking and applying cosmetics is not permitted in a wet lab. Lab personnel shall not wear loose clothing (e.g. saris, dangling neckties, and overly large or ragged lab coats), skimpy clothing (e.g. shorts and/or halter-tops), torn clothing, or unrestrained long hair. Perforated shoes, sandals, or cloth sneakers are not to be worn in labs.

13. **Use of Flame and Heat** - No heat generating devices should be left unattended.

14. **Ventilation** - Airflow in most labs should be “negative” with respect to the corridor. Laboratory doors shall be kept closed when laboratory procedures are in progress. Volatile hazardous materials shall not be used on the open bench top.

15. **Housekeeping/Drains Flushed** - All unnecessary material, boxes, and containers must be disposed of in the appropriate manner. All drains, including floor drains and cup sinks should be flushed with water on a weekly basis to eliminate sewer odors. Proper housekeeping must be maintained to provide adequate clearance of sprinkler systems and emergency equipment.

16. **Sharps** (Glass, Scalpel, Blades, Syringes, Etc.) - All sharps, needles and glass must be disposed of in an approved, labeled container. Glass containers and other potentially sharp objects shall not be disposed of in common office refuse. Containers must not be overfilled and must be labeled and sealed for proper handling and disposal.

17. **Emergency lighting** - Where necessary, emergency lighting units shall be properly mounted and unobstructed. If emergency lighting exists, it should be checked periodically to ensure it is functional.

18. **Emergency Plans/Posted Numbers** - All emergency and contingency plans and evacuation routes shall be clearly posted in conspicuous places. A list of emergency numbers and contacts must be kept updated and posted alongside the emergency plans.

19. **Safety Manuals** - Manuals must be current and readily available for all employees.

20. **Accidents Reported/Investigated** - All accidents must be reported to the immediate supervisor for the completion of the appropriate forms. File copies of reported incidents and accidents must be on hand, as well as the action taken to alleviate the safety hazard in the future.

21. **Safety Training** - This area is designated for lab safety training which is required by law.

Laboratory Self Inspection Form

Laboratory Self Inspection Form

Department:_____ **Building:**_____

Room Number:_____ **PI:**_____

Inspector:_____ **Inspection Date:**_____

Re-inspection Date:_____

S= Satisfactory; U=Unsatisfactory

Item	S	U	Comment	Correction
Entrances, exits, hallways				
Showers/eyewash operative				
Personal Protection Equip.				
Fire extinguishers & location				
Pressurized Clinders				
Laboratory Signage				
UL Elec. Equip. & cords				
Fume hood operation				
Biological safety cabinets				
Safety manuals				
Hazardous Chemicals:				
Labeling				
Storage/amounts/location				
Handling				
Chemical Waste Disposal				
Labeling				
Storage				
Disposal				
General Safety: approp. dress				

Inspection form continues on the next page.

Item	S	U	Comment	Correction
Location of cut-off valves				
Location of circuit breakers				
Emergency numbers posted				
Accidents Reported				
Safety training: Date_____				

PROCEDURES FOR HANDLING CHEMICALS THAT POSE HAZARDS BECAUSE OF ACUTE TOXICITY, CHRONIC TOXICITY OR CORROSIVENESS

All work with these substances must be confined to designated laboratory areas such as a given laboratory, laboratory area or a fume hood. The designated areas must be posted with appropriate warning signs.

The listings for carcinogens, select carcinogens, reproductive toxins as well as that for corrosive substances are in this document.

The following Table lists some of the compounds that may be in current use in the Department laboratories and which have a high degree of acute toxicity:

acrolein
acrylic acid
acrylonitrile
allyl alcohol
allylamine
bromine
chlorine
diazomethane
diborane (gas)
1,2-dibromoethane
dimethyl sulfate
ethylene oxide
hydrazine
hydrogen cyanide
hydrogen fluoride
hydrogen sulfide
mercury salts
methyl fluorosulfonate
methyl iodide
nickel carbonyl
nicotine
nitrogen dioxide
osmium tetroxide
ozone
phosgene
sodium azide
sodium cyanide (and other cyanide salts)
thallium salts

POTENTIALLY EXPLOSIVE CHEMICALS AND REAGENT COMBINATIONS

Table F.1 lists some common classes of laboratory chemicals that have potential for producing a violent explosion when subjected to shock or friction. These chemicals should never be disposed of as such.

Table F.2 lists a few illustrative combinations of common laboratory reagents that can produce explosions when they are brought together or that give reaction products that can explode without any apparent external initiating action.

Shock-Sensitive Compounds

Table F.1 Shock-Sensitive Compounds

Acetylenic compounds, especially polyacetylenes, haolacetylenes and heavy metal salts of acetylenes (copper, silver and mercury salts are particularly sensitive)
Acyl nitrates
Alkyl nitrates, particularly polyol nitrates such as nitrocellulose and nitroglycerine
Alkyl and acyl nitrites
Alkyl perchlorates
Ammine metal oxosalts: metal compounds with coordinated ammonia, hydrazine or similar nitrogenous donors and ionic perchlorate, nitrate, permanganate or other oxidizing group
Azides, including metal, nonmetal and organic azides

Chlorite salts of metals, such as $AgClO_2$ and $Hg(ClO_2)$

Diazonium salts, when dry

Fulminates (silver fulminate, AgCNO, can form in the reaction mixture from the Tollens' test for aldehydes if it is allowed to stand for some time; this can be prevented by adding dilute nitric acid to the test mixture as soon as the test has been completed.)

Hydrogen peroxide becomes increasingly treacherous as the concentration rises above 30%, forming explosive mixtures with organic materials and decomposing violently in the presence of traces of transition metals.

N-Halogen compounds such as difluoroamino compounds and halogen azides.

N-Nitro compounds such as N-nitromethylamine, nitrourea, nitroguanidine and nitric amide.

Oxo salts of nitrgeneous bases: perchlorates, dichromates, nitrates, iodates, chlorites, chlorates and permanganates of ammonia, amines, hydroxylamine, guanidine, etc.

Perchlorate salts. Most metal, nonmetal and amine perchlorates can be detonated and may undergo violent reaction in contact with combustible materials.

Peroxides and hydroperoxides, organic

Peroxides (solid) that crystallize from or are left from evaporation of peroxidizable solvents

Peroxides, transition-metal salts

Peroxide forming Chemicals:

Managing Peroxide Forming Compounds (PFC) Hazard Definition Peroxide-forming chemicals (PFCs) are a class of materials that have the ability to form shock-sensitive and explosive peroxide crystals. PFC can generate reactive organic peroxides through autoxidation in the presence of air and light.

Presence of visible coloration, crystalline solid formation on the bottle cap, cloudiness or liquid separation indicates high level of peroxide concentration. These containers must be considered potentially explosive, left untouched and notify EH&S immediately for disposal.

The rate of peroxide formation is dependent on the specific chemical, the amount of air exposure and whether the chemical contains an inhibitor to retard peroxide formation. Therefore, it is imperative that potential peroxide forming chemicals be assigned an open date and be tested based on storage limitations for the chemical class.

1. Only order the amount of chemical needed for the immediate experiment.
2. Unless absolutely necessary, labs should never purchase uninhibited PFC
3. Whenever possible, consider storing PFC (lists A & B) under nitrogen gas to slow peroxide formation.
4. Label each PFC container with the received date, opened date and date last tested.
5. All peroxide formers should be stored away from heat and sunlight.
6. Avoid using containers with loose fitting lids and glass ground stoppers. Never attempt to force open a rusted or stuck cap on a PFC container.
7. Do not store peroxide forming compounds below the temperature at which the compound freezes 2 or precipitates. Refrigeration does not prevent peroxide formation. PFC stored in this manner is especially sensitive to shock and heat.
8. Conduct procedures inside a chemical fume hood, behind the sash and wear appropriate PPE.
9. Procedures that include heating, distilling, or evaporation (this includes rotary evaporator) warrant extra precautions.

Picrates, especially salts of transition and heavy metals, such as Ni, Pb, Hg, Cu and Zn; picric acid is explosive but is less sensitive to shock or friction than its metal salts and is

relatively safe as a water-wet paste.

Polynitroalkyl compounds such as tetranitromethane and dinitroacetonitrile

Polynitroaromatic compounds, especially polynitro hydrocarbons, phenols and amines

---

POTENTIALLY EXPLOSIVE COMBINATIONS OF SOME COMMON REAGENTS

Table F.2 Potentially Explosive Combinations of Some Common Reagents

Acetone + chloroform in the presence of base

Acetylene + copper, silver, mercury or their salts

Ammonia (including aqueous solutions) + Cl_2, Br_2 or I_2

Carbon disulfide + sodium azide

Chlorine + an alcohol

Chloroform or carbon tetrachloride + powdered Al or Mg

Decolorizing carbon + an oxidizing agent

Diethyl ether + chlorine (including a chlorine atmosphere)

Dimethyl sulfoxide + an acyl halide, $SOCl_2$ or $POCl_3$

Dimethyl sulfoxide + CrO_3

Ethanol + calcium hypochlorite

Ethanol + silver nitrate

Nitric acid +acetic anhydride or acetic acid

Picric acid + a heavy-metal salt, such as of Pb, Hg or Ag

Silver oxide + ammonia + ethanol

Sodium + a chlorinated hydrocarbon

REPORT ON CARCINOGENS, ELEVENTH EDITION REPORT

HUMAN CARCINOGENS

Part A. Known to be Human Carcinogens.

Name or synonym
Aflatoxins
Alcoholic Beverage Consumption
4-Aminobiphenyl
Analgesic Mixtures Containing Phenacetin
Arsenic Compounds, Inorganic
Asbestos
Azathioprine
Benzene
Benzidine (See Benzidine and Dyes Metabolized to Benzidine)
Beryllium and Beryllium Compounds
1,3-Butadiene
1,4-Butanediol Dimethanesulfonate (Myleran®)
Cadmium and Cadmium Compounds
Chlorambucil
1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea (MeCCNU)
bis(Chloromethyl) Ether and Technical-Grade Chloromethyl Methyl Ether
Chromium Hexavalent Compounds
Coal Tar Pitches
Coal Tars
Coke Oven Emissions
Cyclophosphamide
Cyclosporin A
Diethylstilbestrol
Dyes Metabolized to Benzidine
Environmental Tobacco Smoke
Erionite
Estrogens, Steroidal
Ethylene Oxide
Hepatitis B Virus
Hepatitis C Virus
Human Papillomas Viruses: Some Genital-Mucosal Types
Melphalan
Methoxsalen with Ultraviolet A Therapy (PUVA)
Mineral Oils (Untreated and Mildly Treated)
Mustard Gas
2-Naphthylamine
Neutrons
Nickel Compounds
Radon
Silica, Crystalline (Respirable Size)

Smokeless Tobacco
Solar Radiation
Soots
Strong Inorganic Acid Mists Containing Sulfuric Acid
Sunlamps or Sunbeds, Exposure to Ultraviolet Radiation Related Exposures)
Tamoxifen
2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD); “Dioxin”
Thiotepa
Thorium Dioxide
Tobacco Smoking
Vinyl Chloride
Ultraviolet Radiation, Broad Spectrum UV Radiation
Wood Dust
X-Radiation and Gamma Radiation
Bold entries indicate new or changed listing in *The Report on Carcinogens, Eleventh Edition.*

SUSPECT HUMAN CARCINOGENS

Part B. Reasonably Anticipated being a Human Carcinogen.

Name or synonym
Acetaldehyde
2-Acetylaminofluorene
Acrylamide
Acrylonitrile
Adriamycin® (Doxorubicin Hydrochloride)
2-Aminoanthraquinone
o-Aminoazotoluene
1-Amino-2,4-dibromoanthraquinone
1-Amino-2-methylanthraquinone
2-Amino-3,4-dimethylimidazo[4,5-*f*]quinoline (MeIQ)
2-Amino-3,8-dimethylimidazo[4,5-*f*]quinoxaline (MeIQx)
2-Amino-3-methylimidazo[4,5-*f*]quinoline (IQ)
2-Amino-1-methyl-6-phenylimidazo[4,5-*b*]pyridine (PhIP)
Amitrole
o-Anisidine Hydrochloride
Azacitidine (5-Azacytidine®, 5-AzaC)
Benz[*a*]anthracene
Benzo[*b*]fluoranthene
Benzo[*j*]fluoranthene
Benzo[*k*]fluoranthene
Benzo[*a*]pyrene
Benzotrichloride
Bromodichloromethane
2,2-bis-(Bromoethyl)-1,3-propanediol (Technical Grade)
Butylated Hydroxyanisole (BHA)
Carbon Tetrachloride
Ceramic Fibers (Respirable Size)
Chloramphenicol
Chlorendic Acid
Chlorinated Paraffins (C12, 60% Chlorine)
1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea
bis(Chloroethyl) nitrosourea
Chloroform
3-Chloro-2-methylpropene
4-Chloro-*o*-phenylenediamine
Chloroprene
p-Chloro-*o*-toluidine and *p*-Chloro-*o*-toluidine Hydrochloride
Chlorozotocin
C.I. Basic Red 9 Monohydrochloride
Cisplatin

Cobalt Sulfate
p-Cresidine
Cupferron
Dacarbazine
Danthron (1,8-Dihydroxyanthraquinone)
2,4-Diaminoanisole Sulfate
2,4-Diaminotoluene
Diazoaminobenzene
Dibenz[*a,h*]acridine
Dibenz[*a,j*]acridine
Dibenz[*a,h*]anthracene
7*H*-Dibenzo[*c,g*]carbazole
Dibenzo[*a,e*]pyrene
Dibenzo[*a,h*]pyrene
Dibenzo[*a,i*]pyrene
Dibenzo[*a,l*]pyrene
1,2-Dibromo-3-chloropropane
1,2-Dibromoethane (Ethylene Dibromide)
2,3-Dibromo-1-propanol
tris(2,3-Dibromopropyl) Phosphate
1,4-Dichlorobenzene
3,3´-Dichlorobenzidine and 3,3´-Dichlorobenzidine Dihydrochloride
Dichlorodiphenyltrichloroethane (DDT)
1,2-Dichloroethane (Ethylene Dichloride)
Dichloromethane (Methylene Chloride)
1,3-Dichloropropene (Technical Grade)
Diepoxybutane
Diesel Exhaust Particulates
Diethyl Sulfate
Diglycidyl Resorcinol Ether
3,3´-Dimethoxybenzidine
4-Dimethylaminoazobenzene
3,3´-Dimethylbenzidine
Dimethylcarbamoyl Chloride
1,1-Dimethylhydrazine
Dimethyl Sulfate
Dimethylvinyl Chloride
1,6-Dinitropyrene
1,8-Dinitropyrene
1,4-Dioxane
Disperse Blue 1
Dyes Metabolized to 3,3´-Dimethoxybenzidine (See 3,3´-Dimethoxybenzidine and Dyes Metabolized to 3,3´-Dimethoxybenzidine)
Dyes Metabolized to 3,3´-Dimethylbenzidine (See 3,3´-Dimethylbenzidine and Dyes Metabolized to 3,3´-Dimethylbenzidine)
Epichlorohydrin

Ethylene Thiourea
di(2-Ethylhexyl) Phthalate
Ethyl Methanesulfonate
Formaldehyde (Gas)
Furan
Glass Wool (Respirable Size)
Glycidol
Hexachlorobenzene
Hexachlorocyclohexane Isomers
Hexachloroethane
Hexamethylphosphoramide
Hydrazine and Hydrazine Sulfate
Hydrazobenzene
Indeno[1,2,3-*cd*]pyrene
Iron Dextran Complex
Isoprene
Kepone® (Chlordecone)
Lead and Lead Compounds
Lindane and Other Hexachlorocyclohexane Isomers
2-Methylaziridine (Propylenimine)
5-Methylchrysene
4,4´-Methylenebis(2-chloroaniline)
4-4´-Methylenebis(*N,N*-dimethyl)benzenamine
4,4´-Methylenedianiline and Its Dihydrochloride Salt
Methyleugenol
Methyl Methanesulfonate
N-Methyl-*N*´-nitro-*N*-nitrosoguanidine
Metronidazole
Michler´s Ketone [4,4´-(Dimethylamino)benzophenone]
Mirex
Naphthalene
Nickel (Metallic)
Nitrilotriacetic Acid
o-Nitroanisole
Nitrobenzene
6-Nitrochrysene
Nitrofen (2,4-Dichlorophenyl-*p*-nitrophenyl ether)
Nitrogen Mustard Hydrochloride
Nitromethane
2-Nitropropane
1-Nitropyrene
4-Nitropyrene
N-Nitrosodi-*n*-butylamine
N-Nitrosodiethanolamine
N-Nitrosodiethylamine
N-Nitrosodimethylamine

N-Nitrosodi-*n*-propylamine
N-Nitroso-*N*-ethylurea
4-(*N*-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone
N-Nitroso-*N*-methylurea
N-Nitrosomethylvinylamine
N-Nitrosomorpholine
N-Nitrosonornicotine
N-Nitrosopiperidine
N-Nitrosopyrrolidine
N-Nitrososarcosine
Norethisterone
Ochratoxin A
4,4´-Oxydianiline
Oxymetholone
Phenacetin
Phenazopyridine Hydrochloride
Phenolphthalein
Phenoxybenzamine Hydrochloride
Phenytoin
Polybrominated Biphenyls (PBBs)
Polychlorinated Biphenyls (PCBs)
Polycyclic Aromatic Hydrocarbons (PAHs)
Procarbazine Hydrochloride
Progesterone
1,3-Propane Sultone
□-Propiolactone
Propylene Oxide
Propylthiouracil
Reserpine
Safrole
Selenium Sulfide
Streptozotocin
Styrene-7,8-oxide
Sulfallate
Tetrachloroethylene (Perchloroethylene)
Tetrafluoroethylene
Tetranitromethane
Thioacetamide
4,4´-Thiodianaline
Thiourea
Toluene Diisocyanate
o-Toluidine and *o*-Toluidine Hydrochloride
Toxaphene
Trichloroethylene
2,4,6-Trichlorophenol
1,2,3-Trichloropropane

Ultraviolet A Radiation
Ultraviolet B Radiation
Ultraviolet C Radiation
Urethane
Vinyl Bromide
4-Vinyl-1-cyclohexene Diepoxide
Vinyl Fluoride

Bold entries indicate new or changed listing in *The Report on Carcinogens, Eleventh Edition.*

Fayetteville State University

MINORS WORKING IN RESEARCH LABORATORIES AND GREENHOUSE

2010

Minors in Research Proposal #_____

Department Chair, Approval:

_____

Date:_____

Do not write in this box for official use only.

PURPOSE:

The aim of this policy is to identify when minors will be permitted to work or conduct research in any Fayetteville State University research laboratory, teaching lab, or the greenhouse.

1. Definitions:

Laboratory means any building or part of a building used for scientific work which may be hazardous, including research, teaching or analysis.

Minor means any person under the age of 18.

Research means a careful, systematic, patient study and investigation in some field of knowledge, undertaken to discover or establish facts, principles, or theories, or applications based on facts for theories.

Visitor means any person who enters into a research laboratory, teaching lab, or greenhouse with an explicit invitation of the laboratory supervisor or director.

Volunteer means any person who of his own free will, without compensation, expectation, and promise provides services to Fayetteville State University.

2. Scope:

This policy covers all Fayetteville State research laboratories, teaching laboratories and greenhouses and all people under the age of 18 whether student, employee or volunteer.

No one under the age of 14 is allowed inside any laboratory, or the greenhouse, except as authorized by the laboratory supervisor for an officially sanctioned activity.

3. Policy:

Unless enrolled as a FSU student or attending an official FSU program which requires the use of a laboratory, minors are not allowed to work or conduct research in FSU research laboratories, neither the teaching labs nor the greenhouse.

All minors are prohibited from working or conducting research in the following:

1. Any Biohazard laboratories with a level 2 or greater for recombinant DNA and/or infectious organisms.

2. Any laboratory with explosive materials present.

3. Any laboratories with Acute Toxins

Minors are allowed to conduct research if all of following requirements are met:

1. The minor has read and understood the **FSU Minors Research Laboratory and Greenhouse Policy.**

2. The minor and parent/legal guardian has reviewed THE POTENTIAL HAZARDS INFORMATION SEET.

3. The parent's and minor's signature acknowledging the "Potential Hazards" on the FSU MINORS RESEARCH PROPOSAL FORM are submitted and approved by the FSU Occupational Health and Safety Director, Departmental Chair and the Principle Investigator/laboratory manager.

4. The parent and minor must sign and agree to a waiver of liability releasing and indemnifying FSU from liability.

5. The minor has completed hazard specific safety training, and online laboratory safety training with the Principle Investigator/laboratory manager.

6. The minor has been informed of the location of all safety equipment, emergency exits, emergency phone numbers, fire alarms, evacuation routes, designated meeting areas. Minors shall not be responsible for extinguishing a fire; minor's safety is the primary concern. Secondary concern is notification of the Campus Police/1911.

7. The minor has had appropriate Personal Protection Equipment training specific to the hazards of the laboratory.

8. The minor is always supervised at all times while in the laboratory.

9. The hours of work comply with Federal Regulations 29 CFR 570.35: Hours of work and conditions of employment permitted for minors 14 and 15 years of age**.**

10. The laboratory is in full compliance with all applicable FSU safety programs and regulations.

4. POTENTIAL HAZARD INFORMATION SHEET

Borrowed from the University of Kentucky

Scientific research involves exposure to various hazards. When deciding to allow your child to participate in research projects conducted in Fayetteville State University laboratories, or greenhouse, you need to be aware of the potential hazards he or she may encounter. The following information provides the most common potential hazards, but is not intended to be an exhaustive list of all potential hazards. Questions may be addressed to the minor's specific sponsor.

5. Definitions

Allergens – substances capable of producing an allergic reaction.

Asphyxiant – a substance such as a gas or a toxin that causes a decrease in oxygen concentration or an increase of carbon dioxide concentration within the body.

Carcinogens – substances capable of producing cancer.

Mutagenic – agent (chemical or physical) capable of inducing genetic mutation.

Pathogens – Bacteria, viruses, prions, fungi, and parasites capable of causing diseases.

Recombinant materials – DNA that has been genetically engineered (altered), usually incorporating DNA from more than one species of organism.

Transgenic – an organism that has gad genes from another organism inserted into its genes.

Toxins – poisonous substances produced by living organisms, plants and animals.

Zoonotic diseases – diseases than can be passed from animals to humans.

6. Potential Hazards

Your child's research project may involve one or more of the following potential hazards. A table is attached with examples.

Chemicals – can be unstable, making them reactive and prone to explosion. Potential injuries include skin and eye burns, respiratory problems, allergic reactions, skin, eye, and mucous membrane irritation, and illnesses.

Pathogens – found in human, animal and plant tissue can cause infections and acute or chronic illnesses.

Recombinant materials/technology – can interact with the human body and its cells and produce potentially hazardous results.

Mechanical/electrical equipment and instrumentation – can cause electrocution, burns, cuts, scrapes and injuries from pinch points. High noise levels can cause hearing loss.

Gas Cylinders/compressed gases – gas cylinders with compressed gasses can explode, causing injury from high speed projectiles. Released gasses can cause eye and skin irritations, respiratory problems, light-headedness, asphyxiation and fainting.

Definition	Hazards		Examples
Chemicals	Refined compound that could be in the form of a solid, liquid or gas. These may or may not be hazardous. Some compounds may have numerous classifications- (flammables, Toxins & carcinogens)	Carcinogens: may cause some sort of cancer with long term exposure - usually many years in the future.	Benzene acrylamide
		Teratogen: shown to affect the reproductive system. May cause defects in the developing fetus.	Alcohol thalidomide acrylamide
		Neurotoxins: may affect the nervous system	Ethidium Bromide
		Flammables: will burn or explode	Alcohol, acetone, xylene
		Reactives: will react explosively.	Peroxides acrylamide
		Corrosive: will cause tissue damage with contact through inhalation, eye, skin, etc.	Acid & bases
		Toxins: May cause illness or	Cyanide
Chemicals, cont.		death on exposure	
Compressed Gases	High-pressure cylinders that hold gases. These are usually large and heavy. Gas may be harmless, toxic, corrosive,	Physical hazard: Explosion hazard if they rupture. Asphyxiant	Asphyxiant: Nitrogen, helium, any other non-oxygen gas.

	or flammable.	hazard if they vent the gas to the workplace & it displaces oxygen	Flammable: hydrogen. Toxic: ammonia.
Radiation & Radioactive Materials	High energy particles (alpha & Beta) or waves.	Tissue damage and hearing loss	Uranium Phosphorus 32 Sodium 35 X-rays
Physical hazards	Hazards from noise, machinery, heat, cold, etc.	Tissue damage and hearing loss	Scrapes, cuts Cold: Liquid nitrogen, dry ice Heat: burners
Biological Agents	Living organisms or products of living organisms such as viruses, bacteria, fungi, prions, and parasites. Hazards from infection with these agents are organism dependent & can range from mild and treatable to severe and untreatable. Classification of hazard in four groups with level 1 as the least hazard & level 4 as the extremely hazardous.	Level 1 - No hazard	Baker's Yeast & E. coli K12
		Level 2 - Mild to severe illness	Influenza, Polio, & Salmonella
		Level 3 - Severe illness & possible death.	Tuberculosis & AIDS
		Level 4 - Not allowed	Haemorrhagic Fever
Recombinant DNA	Genetically modified organisms with variations in genes within the organism	Often unknown consequences once introduced to the human body.	Viral Vectors like Adeno & Adeno-associated virsus used
Recombinant DNA, cont.			to transfect or express genes
Toxins- Microbial, Plant	Poisons produced by plants, and living organisms.	Tissue & organ damage or death	Plant- Ricin Microbial - Staph and

			Tetanus.

7. Rules for Minors working in Laboratories and Greenhouse

- Never work alone in any laboratory without direct, immediate adult supervision from the Principle Investigator/lab supervisor or someone designated by the PI.
- Always follow instructions.
- Report any accident (regardless of severity) immediately to the PI or lab manager.
- Always wear appropriate personal protection equipment (PPE) and dispose of it correctly. Safety glasses are mandatory and other PPE as directed by the hazard being worked with or around.
- Keep good personal hygiene; wash hands often with soap and water, and always keep hands from your face or touch contact lenses while in any laboratory environment.
- **Absolutely NO eating, drinking, chewing gum, or applying cosmetics in any laboratory environment**.
- **NO shorts, tank tops, mini skirts, or open toed shoes are allowed. Always wear clothing that protects and reduces the amount of skin exposure.**
- Ask questions of you don't understand procedures or safety requirements.

8. Minors Research Proposal Form

The “Minors Research Proposal Form” and the “Parental Consent/Signature Form” must be filled out and returned to the Safety Director, Public Safety, before the student may participate in any research or laboratory activity. Send forms to Mr. George E. Tatum, 103 Police Substation, Fayetteville State University, 1200 Murchison Rd., Fayetteville, NC 28301.

General Information:

Principle Investigator/Sponsor:_____
Department:_____
University Address:_____
Phone Number:_____
Student/Minor Name:_____
School:_____
Is this project (check one)

_____Science Fair Project _____Volunteering
_____Employment _____Other

Part of FSU Program Yes (which program?)_____
No (explain)_____

Location where research/work is to be performed in BLDG____ R.__
Project start date:_____
Project end date:_____

Materials and Equipment to be used –CHECK and LIST all that apply:

Chemicals	**Biological Material**	**Equipment**
__**Flammables**	__**Recombinant DNA**	__**Fume Hood**
__**Reactive**	__**Bacteria**	__**Biosafety Cabinet**
__**Carcingenic**	__**Viruses**	__**Clean bench**
__**Toxic**	__**Fungi**	__**Autoclave**
__**Corrosive**	__**Parasites**	__**Centrifuge**
__**Oxidizer**	__**Human Source Material**	__**Analytical Instruments**
__**Cryogen**	__**Insects**	__**Industrial Machinery**
__**Pharmaceuticals**	__**Plants**	__**Noise Equip.**
__**Gasses**	__**Animals**	__**Other Equip.**

Project Description (attach additional sheets if needed).

9. Parental Consent/Signature Sheet

I AGREE to **Sponsor** (Minor's name)_____
AND BY MY SIGNATURE BELOW AGREE THAT:

1. I have read, understood and will adhere to the FSU "Minors working in Research Laboratories and Greenhouse" Policy. An approval must be granted before the minor can participate.

2. I will complete this Minor's Safety Training by doing the following:_____
   _____
   _____
   _____

3. Personal Protection Equipment appropriate to laboratory hazards will be provided.

4. This minor will be supervised at all times and never left alone in any laboratory environment.

5. This minor's work hours will comply with Federal Regulation 29 CFR 570.35.

6. My laboratory is in full compliance with all applicable FSU safety programs and regulations.

   Name of PI/Sponsor/Lab Supervisor
   _____ Date:_____
   Signature

Student:

1. I have read and understand the "Potential Hazards" handout explaining the hazards involved in working in a research laboratory environment.

2. I will adhere to FSU "Minors Working in Research Laboratories and Greenhouse" Policy to protect myself and those around me from accidents and exposures.

Name of Minor
_____ Date:_____
Signature

10. Parent/Legal Guardian:

1. I HAVE READ AND UNDERSTOOD the Potential Hazard Information Sheet describing the potential risks and dangers associated with my child's research project.

2. I AGREE AND UNDERSTAND that my child's research project may be suspended at any time at the discretion of Fayetteville State University and its officers, agents, and employees, if the safety of my child, the employees and others of the University become a concern.

Parent/Legal Guardian's Name

_____ Date:_____

Signature

FSU WAIVER OF LIABILITY

(TO BE COMPLETED BY PARENT AND PARTICIPANT)

PRINT PARTICIPANT NAME:_____

PRINT PARENT NAME:_____

I understand the Participant will access FSU property, grounds, facilities, laboratories, greenhouses, and/or scientific chemicals/materials (hereinafter collectively and individually referred to as the Property) during the _____. **I understand that the Participant is not required to access the Property and that my decision to allow the Participant to access the Property is fully voluntary. I also understand that there are risks, dangers, and hazards associated with accessing the Property, and I have decided to, and do fully and voluntarily, assume the risks.**

In consideration of the Participant being permitted to access Property, I do individually, and on behalf of my heirs, successors, assigns, administrators and/or personal representatives, hereby ***RELEASE, WAIVE, COVENANT NOT TO SUE AND FOREVER DISCHARGE*** FSU and any of its employees, agents, officers, trustees, volunteers and/or representatives (in their official and individual capacities) ("Releases") from and against any and all liability whatsoever, whether caused by negligence or carelessness of any one or more of the Releases or otherwise, for any and all harm, damages, losses and/or injuries (including death) Participant may sustain to his or her person or property or both, including but not limited to any claims, demands, actions, causes of action, judgments, damages, expenses, and/or costs of any nature, including attorneys fees, or otherwise, which arise out of, result from, occur during or are connected in any manner with 1) the Participant's participation at FSU, 2) the Participant's accessing of the Property and/or 2) any travel incident to Participant's participation at FSU or Participant's usage of the Property.

In consideration of the Participant being permitted to access the Property, I, individually, and on behalf of my heirs, successors, assigns, administrators and/or personal representatives, hereby agree to ***INDEMNIFY, DEFEND, AND HOLD HARMLESS*** the Releases (in their official and individual capacities) from and against any and all liability whatsoever, whether caused by negligence or carelessness of any one or more of the Releases or otherwise, for any and all harm, damages, losses and/or injuries (including death) Participant may sustain to his or her person or property or both, including but not limited to any claims, demands, actions, causes of action, judgments, damages, expenses, and/or costs of any nature, including attorneys fees, or otherwise, which arise out of, result from, occur during or are connected in any manner with 1) the Participant's participation at FSU, 2) the Participant's accessing of the Property, and/or 3) any travel incident to Participant's participation at FSU or Participant's usage of the Property.

I agree that this Waiver of Liability is to be construed under the laws of the State of North Carolina, U.S.A.; and that if any portion hereof is held invalid, the balance hereof shall,

notwithstanding, continue in full legal force and effect. I also agree that the place of this agreement, its situs and forum, shall be Cumberland County, North Carolina.

I represent that Participant shall be covered throughout his/her participation at FSU by policies of comprehensive health and accident insurance which provide coverage for illnesses or injuries he or she may sustain or experience while participating in the program. By my signature below, I certify that I have confirmed Participant's health and accident insurance policies will adequately cover him or her while participating at FSU; and, I hereby release, discharge and indemnify the Releases from and against all responsibility and liability for any injuries, illnesses, medical bills, charges and/or similar expenses she or he incurs while accessing the Property or while participating at FSU.

I hereby release, discharge and indemnify the Releases from and against all responsibility and liability for any injuries, illnesses, medical bills, charges and/or similar expenses which might arise out of or in connection with any emergency or medical attention.

I give permission for the Participant to participate in photographs, films, and/or interviews as they pertain to FSU, and I understand that such pictures, films, and/or interviews may be used, without compensation to me or Participant, to promote or publicize FSU events and/or demonstrate how federal funds are being used.

In signing this Waiver of Liability, I acknowledge and represent that I have fully informed myself of the content of this document by reading it before I signed it, that I have reviewed it, that I and the Participant understand what it means, that by signing it I am giving up any substantial legal rights I might otherwise have, and that I sign this document as a free act and deed.

I further state that I am fully competent to sign this Agreement; and that I execute this Waiver of Liability for full, adequate, and complete consideration fully intending to bind by the same myself and my family, heirs, administrators, successors, assigns, and/or personal representatives and the Participant and his or her family, estate, heirs, administrators, personal representatives, and/or assigns.

IN WITNESS WHEREOF, I have executed this release this _____ day of _____ 20___.

THIS IS A RELEASE OF LEGAL RIGHTS. READ BEFORE SIGNING

_____

Parent/Guardian Signature Date

_____

Participant's Signature Date

APPENDIX A

GLOSSARY

Acid: An organic or inorganic compound that: (1) is usually corrosive to human tissue and must be handled with care; (2) has a pH of less than 7.0; (3) neutralizes bases to form salts; (4) dissociates in water yielding hydrogen or hydronium ions; (5) may react with metals to yield hydrogen; and (6) turns litmus paper red.

Acute Toxicity: Adverse health effects resulting from brief exposure to a chemical (e.g. seconds, minutes, hours).

Administrative Control: A number of measures used to reduce worker exposure, including work practices, labeling and working devices, training, environmental monitoring, assignment scheduling, housekeeping, maintenance and management.

Adsorb: To attract and retain gas or liquid molecules on the surface of another material.

Alkali: Any inorganic or organic chemical that: (1) is usually corrosive to human tissue and must be handled with care; (2) has a pH of more than 7.0; (3) neutralizes acids to form a salt; (4) dissociates in water yielding hydroxide ions; (5) turns litmus paper blue; (6) and may also be called a base or caustic. Examples are oxides and hydroxides of metals belonging to group IA (Li, Na, K, Rb, Cs, Fr), Ammonia and amines. Commercial alkalis are sodium carbonate (soda ash), caustic soda, potash, lime, lye and sodium bicarbonate.

Cancer: An abnormal multiplication of cells that tends to infiltrate other tissues and metastasize (split) at a fast, abnormal regulated pace, no matter where it occurs in the body.

Carcinogen: A material that either causes cancer in humans, or, because it causes cancer in animals, is considered capable of causing cancer in humans. A material is considered a carcinogen if (1) the International Agency for Research (IRAC) on cancer has evaluated and found it a carcinogen; (2) the National Toxicology Program (NTP) lists it as a carcinogen or potential carcinogen; or (3) OSHA regulates it as a carcinogen.

CFR: Code of Federal Regulations: A collection of the regulations established by law.

Chemical Hygiene SAFETY Officer: The designated, qualified employee who assists in the development and implementation of the Chemical Hygiene Plan.

Chemical Reactivity: A chemicals tendency to react with other materials. Undesirable and dangerous effects such as heat, explosions, or production of noxious substances can result.

Chronic Exposure: Continuous or intermittent exposure extending over a long period; usually applies to relatively low material amounts or concentration.

Combustible: A term the NFA, DOT, and others use to classify certain materials with low flash points that ignite easily. The DOT defines combustible liquids as having a flash point above 141 F (60.5 C) and below 200 F (93 C). Both OSHA and NFPA define combustible liquids as any liquid with a flash point at or above 100 F (38 C) but below 200 F (93 C).

Compressed Gas: Any material which is a gas at normal temperature and pressure, and contained under pressure as a dissolved gas or liquefied by compression or refrigeration.

CHP: Chemical Hygiene Officer.

Designated Area: An area of (or device within) a lab to be used for work with selected carcinogens, reproductive toxins, and other materials which have a high degree of acute toxicity. An administrative control intended to minimize the potential for employee exposure to hazardous chemicals.

DOT: U.S. Dept. of Transportation regulates transportation of materials to protect the public as well as fire, law enforcement, and other emergency-response personnel.

DUST: Solid particles suspended in air, often produced by some mechanical process such as crushing, grinding, abrading, or blasting. Dusts may be inhalation, fire, or dust-explosion hazards.

EPA: U.S. Environmental Protection Agency: A federal agency with environmental protection and enforcement authority. Administers the CAA, CWA, RCRA, TSCA, and other federal environmental laws (400 M Street, SW, Washington, D.C. 20406; [202]382.2090.)

EVAPORATION RATE: The rate at which a material vaporizes from a liquid or solid state when compared to a known materials evaporation rate. Evaporation rate can be useful in evaluating a materials health and fire hazards. The known reference material is normal butyl acetate, with a vaporization rate designated as 1.0. A fast evaporation rate is greater than 3.0. Medium evaporation if 0.8 to 3.0. Slow evaporation is less than 0.8, e.g., water, 0.3.

EXPLOSIVE: A material that produces a sudden almost instantaneous release of pressure, gas, and heat when subjected to shock, high temperature, or an ignition source.

EXOTHERMIC: A chemical reaction that gives off heat.

FLAMMABLE LIMITS: The minimum and maximum concentrations of a flammable gas or vapor between which ignition can occur. Concentrations below the lower flammable limit (LFL) are too lean to burn, while concentrations above the upper flammable limit (UFL) are too rich. All concentrations between LFL and UFL are in flammable range and special precautions are needed to prevent ignition or explosion.

FLAMMABLE LIQUID: Gives off vapors readily ignitable at room temperature. Defined by DOT as a flammable liquid with a flash point of not more that 141 F (60.5 C). Defined by NFPA and OSHA as a liquid with a flash point below 100 F (38 C).

FLAMMABLE SOLID: A solid other than an explosive or blasting Agent, that ignites readily and continues to burn vigorously and persistently so that it creates a serious hazard.

FLASH POINT: Lowest temperature at which a flammable liquid gives off sufficient vapor to form an ignitable mixture with air near its surface or within a vessel.

HAZARDOUS CHEMICAL: In a broad sense, any substance or mixture of substances having properties capable of producing adverse effects on the health or safety of a human.

INCOMPATIBLE: Describes materials that could cause dangerous reactions and the release of energy from direct contact with one another.

IRRITANT: A substance capable of causing a reversible or irreversible inflammatory effect on living tissue by chemical action at the site of

contact as a function of concentration or duration of exposure.

LABEL: Any written, printed, or graphic sign or symbols displayed on or affixed to containers of hazardous chemicals. A label should identify the hazardous material, appropriate warnings, and name and address of the chemical manufacturer, importer or other responsible party.

LABORATORY: A facility where laboratory use or hazardous chemicals occur; where relatively small qualities of hazardous chemicals used on a non-productive basis.

LABORATORY HOOD: In operation it draws in and then exhausts air from the lab to prevent or minimize the escape of air contaminants.

MSDS: Material Safety Data Sheet. A fact sheet summarizing information about material identification; hazardous ingredients; health; physical, and fire hazards; first aid; chemical reactivity and incompatibilities; spill, leak and disposal procedures; and protective measures required for safe handling and storage. OSHA has established guidelines for descriptive data that should be concisely provided on a data sheet to serve as a basis for a written hazard communication program. The thrust of the law is to have those who make, distribute, and use hazardous materials responsible for effective communication.

MUTAGEN: A material that induces genetic changes (mutations) in the DNA of chromosomes.
A mutagen may affect future generations if sperm or egg cell are affected.

NEOPLASM: A new or abnormal tissue growth that is uncontrollable and progressive.

NFPA: National Fire Protection Association. An international voluntary membership organization formed to promote/improve fire protection and prevention and establish safeguards against loss of life and property.

ORGANIC PEROXIDE: A compound containing the bivalent -O-O- structure and which is a structural derivative of hydrogen peroxide (H2O2) where one or both hydrogen atoms are replaced by an organic radical. These compounds tend to be reactive and unstable.

OSHA: The Occupational Safety and Health Administration. Part of the U.S. Dept. of Labor: The regulatory and enforcement agency for safety and health in most U.S. industrial sectors.

OXIDATION: A reaction in which a substance combines with oxygen or another oxidizer.

OXIDIZER: The DOT defines an oxidizer or oxidizing material as a substance that yields oxygen readily to cause or enhance the combustion (oxidation) of other materials. Many oxidizers, such as chlorate (ClO_3), permanganate (MnO_4), and nitrate (NO_3) compounds that contain large amounts of oxygen (O). Other such as, chlorine, do not.

OXIDIZING AGENT: A chemical or substance that brings about an oxidation reaction. The agent may (1) provide oxygen to the substance being oxidized (the agent has to contain oxygen), or (2) receive electrons being transferred from the substance undergoing oxidation. (Chlorine is a good oxidizing agent for electron transfer purpose, even though it contains no oxygen.)

PEL: Permissible exposure limit. Established by OSHA. This may be expressed as a time-weight-average (TWA), a short-term exposure limit (STEL), or as a ceiling exposure limit. A ceiling limit must never be exceeded instantaneously even if the TWA exposure limit is not violated. OSHA PELS have the force of law. Note that ACGIH TLVs and NIOSH REL are recommended exposure limits that OSHA may or may not enact into law.

PERSONAL HYGIENE: Precautionary measures taken to maintain good health when exposed to potentially harmful materials.

pH: Hydrogen ion exponent, a measure of hydrogen ion concentration. A scale (0 - 14) represents an aqueous solutions acidity or alkalinity. Low pH values indicate acidity and high values, alkalinity. The scales mid-point, 7, is neutral.

POISONOUS MATERIAL: A material, other than a gas, which is known (on the basis of animal tests) to be toxic to humans or cause extreme irritation as to afford a hazard to health during transportation.

POLYMERIZATION: A chemical reaction in which one or more small molecules combine to form larger molecules.

Hazardous polymerization takes place at a rate that releases large amounts of energy that can cause fire or explosions or burst containers. Materials that can polymerize usually contain inhibitors that can delay reactions.

PRINCIPLE INVESTIGATOR: The person who directs a research project or program. The principal investigator (the PI) usually writes and submits the grant application, oversees the scientific and technical aspects of the grant, and has responsibility for the management of the research

PYROPHORIC: Describes materials that ignite spontaneously in air below 54 C (130 F).

RCRA: Resource Conservation and Recovery Act. EPA has jurisdiction. RCRA's major emphasis is the control of hazardous waste disposal. It controls all solid-waste disposal and encourages recycling and alternative energy sources.

REACTIVE FLAMMABLE MATERIAL: A material which is a fire hazard because it reacts readily with air or water. Included are materials which: (1) Spontaneously ignite in air or water; (2) react vigorously with air; and (3) give off flammable gas on reaction with water. Keep these materials dry and away from oxidizers. They are often stored in all-nitrogen or argon materials dry and away from oxidizers. They are often stored in all-nitrogen or argon environment. Includes materials or mixtures within any of these categories: (1) **explosive material-** a substance or mixture that causes sudden almost instantaneous release of pressure, gas, and heat when subjected to sudden adverse conditions; (2)**organic peroxide-** an organic compound that contains bivalent -O-O- structure, which can be considered a structural derivative of hydrogen peroxide, in which one or both of the hydrogen atoms has been replaced by an organic radical; (3) **pressure-generating material-** a substance or mixture that spontaneously polymerizes with an increase in pressure unless protected by the addition of an inhibitor or by refrigeration or other thermal control; decomposes to release gas in its container, or comprises the contents of self-pressurized container; (4) **water-reactive material-** a substance or mixture that reacts with water releasing heat or flammable, toxic gas.

REDUCING AGENT: In the reduction reaction (which always occurs simultaneously with an oxidation reaction), the reducing agent is the chemical or substance that (1) combines with oxygen or (2) loses electrons to

the reaction.

REL: The NIOSH REL (Recommended Exposure Limit) is the highest allowable airborne concentration that is not expected to injure a worker. It may be expressed as a ceiling limit or as a time-weighted average (TWA), usually for 10-hr work shift.

RESPIRATOR: A variety of devices that limit inhalation of toxic materials. They range from dust masks to self-contained breathing apparatus. All have specific uses and limitations.

SENSITIZER: A material that on first exposure causes little or no reaction in humans or test animals, but on repeated exposure may cause marked response not necessarily limited to the contact site.

SPONTANEOUSLY COMBUSTIBLE MATERIAL: A material which undergoes self-heating to the point of ignition without requiring heat from another source.

STEL: Short term exposure limit.

TERATOGEN: An agent or material causing physical defects in a developing embryo.

TLV: The ceiling exposure limit or concentration not to exceed at any time, even for very brief times.

TOXIC: Poisonous, having properties of causing adverse health effect when the body is exposed.

TOXIC Any chemical or material that (1) has evident

SUBSTANCE: of an acute or chronic health hazard and (2) is listed in the NIOSH Registry of Toxic Effects of Chemical Substances, provided that the substance causes harm at any dose; causes cancer or reproductive effects in animals at any dose level.

UNSTABLE: Tending toward decomposition or other unwanted chemical change during normal handling or storage. An unstable chemical in its pure state, or as commonly produced or transported, polymerizes vigorously, decomposes, condenses, or becomes self-reactive under conditions of shock, pressure, or temperature.

UPPER EXPLOSIVE LIMIT, UPPER FLAMMABLE LIMIT: UEL, UFL, The highest concentration of a material in air that produces an explosion or that ignites when it contacts an ignition source (high heat, electric arc, spark, or flame).

VAPOR: The gaseous state of a material normally encountered as liquid or solid.

VOLATILITY: Measure of a material's tendency to vaporize or evaporate at ambient routine condition.

WATER REACTIVE: Describes a material that reacts with water to release a flammable gas or to present a health hazard.

Appendix B

Shelf Pattern for Chemical Stockroom

The following shelf pattern segregates chemicals into organic and inorganic categories. Organization then follows compatibility within the major, organic/inorganic categories.
NOTE: Shelves must be set up in this order. Do not change the ordering or an adverse chemical reaction may occur.

Shelf heading:	Functional Groups:
Organic # 2	alcohols & glycols Organic
Organic # 3	hydrocarbons & esters
Organic # 4	ethers & ketones
Organic # 5	epoxy compounds & isocyanates
Organic # 7	sulfides & polysulfides
Organic # 8	phenols & cresols Organic
Organic # 6	peroxides & azides
Organic # 1	acids, anhydrides, peracids
Inorganic # 10	sulfur, phosphorous, arsenic, phosphorous pentoxide
Inorganic # 2	halides, sulfates, sulfites, thiosulfates, phosphates
Inorganic # 3	amides, nitrates, nitrites (NO ammonium hydroxide!!!)
Inorganic # 1	metals, hydrides (NO WATER!!!)
Inorganic # 4	hydroxides, oxides, silicates
Inorganic # 7	arsenates, cyanides (NEVER BELOW ACIDS!!!)
Inorganic # 5	sulfides, selenides, carbides, phosphides, nitrides
Inorganic # 8	borates, chromates, manganates, permanganates
Inorganic # 6	chlorates, perchlorates, chlorites, Perchloric acid, Peroxides
Inorganic # 9	acids (NOT NITRIC)

Appendix C

P Listed Hazardous Chemical List

Hazardous waste No.	Chemical abstracts No.	Substance
P023	107–20–0	Acetaldehyde, chloro-
P002	591–08–2	Acetamide, N-(aminothioxomethyl)-
P057	640–19–7	Acetamide, 2-fluoro-
P058	62–74–8	Acetic acid, fluoro-, sodium salt
P002	591–08–2	1-Acetyl-2-thiourea
P003	107–02–8	Acrolein
P070	116–06–3	Aldicarb
P203	1646–88–4	Aldicarb sulfone.
P004	309–00–2	Aldrin
P005	107–18–6	Allyl alcohol
P006	20859–73–8	Aluminum phosphide (R,T)
P007	2763–96–4	5-(Aminomethyl)-3-isoxazolol
P008	504–24–5	4-Aminopyridine
P009	131–74–8	Ammonium picrate (R)
P119	7803–55–6	Ammonium vanadate
P099	506–61–6	Argentate(1-), bis(cyano-C)-, potassium
P010	7778–39–4	Arsenic acid H_3AsO_4
P012	1327–53–3	Arsenic oxide As_2O_3
P011	1303–28–2	Arsenic oxide As_2O_5
P011	1303–28–2	Arsenic pentoxide
P012	1327–53–3	Arsenic trioxide
P038	692–42–2	Arsine, diethyl-
P036	696–28–6	Arsonous dichloride, phenyl-
P054	151–56–4	Aziridine
P067	75–55–8	Aziridine, 2-methyl-

P013	542–62–1	Barium cyanide
P024	106–47–8	Benzenamine, 4-chloro-
P077	100–01–6	Benzenamine, 4-nitro-
P028	100–44–7	Benzene, (chloromethyl)-
P042	51–43–4	1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-, (R)-
P046	122–09–8	Benzeneethanamine, alpha,alpha-dimethyl-
P014	108–98–5	Benzenethiol
P127	1563–66–2	7-Benzofuranol, 2,3-dihydro-2,2-dimethyl-, methylcarbamate.
P188	57–64–7	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).
P001	[1]81–81–2	2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1-phenylbutyl)-, & salts, when present at concentrations greater than 0.3%
P028	100–44–7	Benzyl chloride
P015	7440–41–7	Beryllium powder
P017	598–31–2	Bromoacetone
P018	357–57–3	Brucine
P045	39196–18–4	2-Butanone, 3,3-dimethyl-1-(methylthio)-, O-[(methylamino)carbonyl] oxime
P021	592–01–8	Calcium cyanide
P021	592–01–8	Calcium cyanide $Ca(CN)_2$
P189	55285–14–8	Carbamic acid, [(dibutylamino)- thio]methyl-, 2,3-dihydro-2,2-dimethyl- 7-benzofuranyl ester.
P191	644–64–4	Carbamic acid, dimethyl-, 1-[(dimethyl-amino)carbonyl]- 5-methyl-1H- pyrazol-3-yl ester.
P192	119–38–0	Carbamic acid, dimethyl-, 3-methyl-1- (1-methylethyl)-1H-pyrazol-5-yl ester.
P190	1129–41–5	Carbamic acid, methyl-, 3-methylphenyl ester.
P127	1563–66–2	Carbofuran.
P022	75–15–0	Carbon disulfide
P095	75–44–5	Carbonic dichloride
P189	55285–14–8	Carbosulfan.
P023	107–20–0	Chloroacetaldehyde
P024	106–47–8	p-Chloroaniline
P026	5344–82–	1-(o-Chlorophenyl)thiourea

	1	
P027	542–76–7	3-Chloropropionitrile
P029	544–92–3	Copper cyanide
P029	544–92–3	Copper cyanide Cu(CN)
P202	64–00–6	m-Cumenyl methylcarbamate.
P030		Cyanides (soluble cyanide salts), not otherwise specified
P031	460–19–5	Cyanogen
P033	506–77–4	Cyanogen chloride
P033	506–77–4	Cyanogen chloride (CN)Cl
P034	131–89–5	2-Cyclohexyl-4,6-dinitrophenol
P016	542–88–1	Dichloromethyl ether
P036	696–28–6	Dichlorophenylarsine
P037	60–57–1	Dieldrin
P038	692–42–2	Diethylarsine
P041	311–45–5	Diethyl-p-nitrophenyl phosphate
P040	297–97–2	O,O-Diethyl O-pyrazinyl phosphorothioate
P043	55–91–4	Diisopropylfluorophosphate (DFP)
P004	309–00–2	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)-
P060	465–73–6	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)-
P037	60–57–1	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)-
P051	[1]72–20–8	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
P044	60–51–5	Dimethoate
P046	122–09–8	alpha,alpha-Dimethylphenethylamine
P191	644–64–4	Dimetilan.
P047	[1]534–52–1	4,6-Dinitro-o-cresol, & salts
P048	51–28–5	2,4-Dinitrophenol
P020	88–85–7	Dinoseb
P085	152–16–9	Diphosphoramide, octamethyl-
P111	107–49–3	Diphosphoric acid, tetraethyl ester

P039	298–04–4	Disulfoton
P049	541–53–7	Dithiobiuret
P185	26419–73–8	1,3-Dithiolane-2-carboxaldehyde, 2,4-dimethyl-, O-[(methylamino)- carbonyl]oxime.
P050	115–29–7	Endosulfan
P088	145–73–3	Endothall
P051	72–20–8	Endrin
P051	72–20–8	Endrin, & metabolites
P042	51–43–4	Epinephrine
P031	460–19–5	Ethanedinitrile
P194	23135–22–0	Ethanimidothioic acid, 2-(dimethylamino)-N-[[(methylamino) carbonyl]oxy]-2-oxo-, methyl ester.
P066	16752–77–5	Ethanimidothioic acid, N-[[(methylamino)carbonyl]oxy]-, methyl ester
P101	107–12–0	Ethyl cyanide
P054	151–56–4	Ethyleneimine
P097	52–85–7	Famphur
P056	7782–41–4	Fluorine
P057	640–19–7	Fluoroacetamide
P058	62–74–8	Fluoroacetic acid, sodium salt
P198	23422–53–9	Formetanate hydrochloride.
P197	17702–57–7	Formparanate.
P065	628–86–4	Fulminic acid, mercury(2+) salt (R,T)
P059	76–44–8	Heptachlor
P062	757–58–4	Hexaethyl tetraphosphate
P116	79–19–6	Hydrazinecarbothioamide
P068	60–34–4	Hydrazine, methyl-
P063	74–90–8	Hydrocyanic acid
P063	74–90–8	Hydrogen cyanide
P096	7803–51–2	Hydrogen phosphide
P060	465–73–6	Isodrin
P192	119–38–0	Isolan.
P202	64–00–6	3-Isopropylphenyl N-methylcarbamate.
P007	2763–96–4	3(2H)-Isoxazolone, 5-(aminomethyl)-
P196	15339–36–3	Manganese, bis(dimethylcarbamodithioato-S,S′)-,

P196	15339–36–3	Manganese dimethyldithiocarbamate.
P092	62–38–4	Mercury, (acetato-O)phenyl-
P065	628–86–4	Mercury fulminate (R,T)
P082	62–75–9	Methanamine, N-methyl-N-nitroso-
P064	624–83–9	Methane, isocyanato-
P016	542–88–1	Methane, oxybis[chloro-
P112	509–14–8	Methane, tetranitro- (R)
P118	75–70–7	Methanethiol, trichloro-
P198	23422–53–9	Methanimidamide, N,N-dimethyl-N′-[3-[[(methylamino)-carbonyl]oxy]phenyl]-, monohydrochloride.
P197	17702–57–7	Methanimidamide, N,N-dimethyl-N′-[2-methyl-4-[[(methylamino)carbonyl]oxy]phenyl]-
P050	115–29–7	6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide
P059	76–44–8	4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-
P199	2032–65–7	Methiocarb.
P066	16752–77–5	Methomyl
P068	60–34–4	Methyl hydrazine
P064	624–83–9	Methyl isocyanate
P069	75–86–5	2-Methyllactonitrile
P071	298–00–0	Methyl parathion
P190	1129–41–5	Metolcarb.
P128	315–8–4	Mexacarbate.
P072	86–88–4	alpha-Naphthylthiourea
P073	13463–39–3	Nickel carbonyl
P073	13463–39–3	Nickel carbonyl $Ni(CO)_4$, (T-4)-
P074	557–19–7	Nickel cyanide
P074	557–19–7	Nickel cyanide $Ni(CN)_2$
P075	[1]54–11–5	Nicotine, & salts
P076	10102–43–9	Nitric oxide
P077	100–01–6	p-Nitroaniline
P078	10102–44–0	Nitrogen dioxide
P076	10102–43–9	Nitrogen oxide NO
P078	10102–44–0	Nitrogen oxide NO_2
P081	55–63–0	Nitroglycerine (R)

P082	62–75–9	N-Nitrosodimethylamine
P084	4549–40–0	N-Nitrosomethylvinylamine
P085	152–16–9	Octamethylpyrophosphoramide
P087	20816–12–0	Osmium oxide OsO_4, (T-4)-
P087	20816–12–0	Osmium tetroxide
P088	145–73–3	7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
P194	23135–22–0	Oxamyl.
P089	56–38–2	Parathion
P034	131–89–5	Phenol, 2-cyclohexyl-4,6-dinitro-
P048	51–28–5	Phenol, 2,4-dinitro-
P047	[1]534–52–1	Phenol, 2-methyl-4,6-dinitro-, & salts
P020	88–85–7	Phenol, 2-(1-methylpropyl)-4,6-dinitro-
P009	131–74–8	Phenol, 2,4,6-trinitro-, ammonium salt (R)
P128	315–18–4	Phenol, 4-(dimethylamino)-3,5-dimethyl-, methylcarbamate (ester).
P199	2032–65–7	Phenol, (3,5-dimethyl-4-(methylthio)-, methylcarbamate
P202	64–00–6	Phenol, 3-(1-methylethyl)-, methyl carbamate.
P201	2631–37–0	Phenol, 3-methyl-5-(1-methylethyl)-, methyl carbamate.
P092	62–38–4	Phenylmercury acetate
P093	103–85–5	Phenylthiourea
P094	298–02–2	Phorate
P095	75–44–5	Phosgene
P096	7803–51–2	Phosphine
P041	311–45–5	Phosphoric acid, diethyl 4-nitrophenyl ester
P039	298–04–4	Phosphorodithioic acid, O,O-diethyl S-[2-(ethylthio)ethyl] ester
P094	298–02–2	Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester
P044	60–51–5	Phosphorodithioic acid, O,O-dimethyl S-[2-(methylamino)-2-oxoethyl] ester
P043	55–91–4	Phosphorofluoridic acid, bis(1-methylethyl) ester
P089	56–38–2	Phosphorothioic acid, O,O-diethyl O-(4-nitrophenyl) ester
P040	297–97–2	Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester
P097	52–85–7	Phosphorothioic acid,

		O-[4-[(dimethylamino)sulfonyl]phenyl] O,O-dimethyl ester
P071	298–00–0	Phosphorothioic acid, O,O,-dimethyl O-(4-nitrophenyl) ester
P204	57–47–6	Physostigmine.
P188	57–64–7	Physostigmine salicylate.
P110	78–00–2	Plumbane, tetraethyl-
P098	151–50–8	Potassium cyanide
P098	151–50–8	Potassium cyanide K(CN)
P099	506–61–6	Potassium silver cyanide
P201	2631–37–0	Promecarb
P070	116–06–3	Propanal, 2-methyl-2-(methylthio)-, O-[(methylamino)carbonyl]oxime
P203	1646–88–4	Propanal, 2-methyl-2-(methyl-sulfonyl)-, O-[(methylamino)carbonyl] oxime.
P101	107–12–0	Propanenitrile
P027	542–76–7	Propanenitrile, 3-chloro-
P069	75–86–5	Propanenitrile, 2-hydroxy-2-methyl-
P081	55–63–0	1,2,3-Propanetriol, trinitrate (R)
P017	598–31–2	2-Propanone, 1-bromo-
P102	107–19–7	Propargyl alcohol
P003	107–02–8	2-Propenal
P005	107–18–6	2-Propen-1-ol
P067	75–55–8	1,2-Propylenimine
P102	107–19–7	2-Propyn-1-ol
P008	504–24–5	4-Pyridinamine
P075	[1]54–11–5	Pyridine, 3-(1-methyl-2-pyrrolidinyl)-, (S)-, & salts
P204	57–47–6	Pyrrolo[2,3-b]indol-5-ol, 1,2,3,3a,8,8a-hexahydro-1,3a,8-trimethyl-, methylcarbamate (ester), (3aS-cis)-.
P114	12039–52–0	Selenious acid, dithallium(1+) salt
P103	630–10–4	Selenourea
P104	506–64–9	Silver cyanide
P104	506–64–9	Silver cyanide Ag(CN)
P105	26628–22–8	Sodium azide
P106	143–33–9	Sodium cyanide
P106	143–33–9	Sodium cyanide Na(CN)
P108	[1]57–24–9	Strychnidin-10-one, & salts
P018	357–57–3	Strychnidin-10-one, 2,3-dimethoxy-

P108	[1]57–24–9	Strychnine, & salts
P115	7446–18–6	Sulfuric acid, dithallium(1+) salt
P109	3689–24–5	Tetraethyldithiopyrophosphate
P110	78–00–2	Tetraethyl lead
P111	107–49–3	Tetraethyl pyrophosphate
P112	509–14–8	Tetranitromethane (R)
P062	757–58–4	Tetraphosphoric acid, hexaethyl ester
P113	1314–32–5	Thallic oxide
P113	1314–32–5	Thallium oxide Tl_2O_3
P114	12039–52–0	Thallium(I) selenite
P115	7446–18–6	Thallium(I) sulfate
P109	3689–24–5	Thiodiphosphoric acid, tetraethyl ester
P045	39196–18–4	Thiofanox
P049	541–53–7	Thioimidodicarbonic diamide $[(H_2N)C(S)]_2NH$
P014	108–98–5	Thiophenol
P116	79–19–6	Thiosemicarbazide
P026	5344–82–1	Thiourea, (2-chlorophenyl)-
P072	86–88–4	Thiourea, 1-naphthalenyl-
P093	103–85–5	Thiourea, phenyl-
P185	26419–73–8	Tirpate.
P123	8001–35–2	Toxaphene
P118	75–70–7	Trichloromethanethiol
P119	7803–55–6	Vanadic acid, ammonium salt
P120	1314–62–1	Vanadium oxide V_2O_5
P120	1314–62–1	Vanadium pentoxide
P084	4549–40–0	Vinylamine, N-methyl-N-nitroso-
P001	[1]81–81–2	Warfarin, & salts, when present at concentrations greater

		than 0.3%
P205	137–30–4	Zinc, bis(dimethylcarbamodithioato-S,S′)-,
P121	557–21–1	Zinc cyanide
P121	557–21–1	Zinc cyanide $Zn(CN)_2$
P122	1314–84–7	Zinc phosphide Zn_3P_2, when present at concentrations greater than 10% (R,T)
P205	137–30–4	Ziram.
P001	[1]81–81–2	2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1-phenylbutyl)-, & salts, when present at concentrations greater than 0.3%
P001	[1]81–81–2	Warfarin, & salts, when present at concentrations greater than 0.3%
P002	591–08–2	Acetamide, -(aminothioxomethyl)-
P002	591–08–2	1-Acetyl-2-thiourea
P003	107–02–8	Acrolein
P003	107–02–8	2-Propenal
P004	309–00–2	Aldrin
P004	309–00–2	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)-
P005	107–18–6	Allyl alcohol
P005	107–18–6	2-Propen-1-ol
P006	20859–73–8	Aluminum phosphide (R,T)
P007	2763–96–4	5-(Aminomethyl)-3-isoxazolol
P007	2763–96–4	3(2H)-Isoxazolone, 5-(aminomethyl)-
P008	504–24–5	4-Aminopyridine
P008	504–24–5	4-Pyridinamine
P009	131–74–8	Ammonium picrate (R)
P009	131–74–8	Phenol, 2,4,6-trinitro-, ammonium salt (R)
P010	7778–39–4	Arsenic acid H_3AsO_4
P011	1303–28–2	Arsenic oxide As_2O_5
P011	1303–28–2	Arsenic pentoxide
P012	1327–53–3	Arsenic oxide As_2O_3
P012	1327–53–	Arsenic trioxide

	3	
P013	542–62–1	Barium cyanide
P014	108–98–5	Benzenethiol
P014	108–98–5	Thiophenol
P015	7440–41–7	Beryllium powder
P016	542–88–1	Dichloromethyl ether
P016	542–88–1	Methane, oxybis[chloro-
P017	598–31–2	Bromoacetone
P017	598–31–2	2-Propanone, 1-bromo-
P018	357–57–3	Brucine
P018	357–57–3	Strychnidin-10-one, 2,3-dimethoxy-
P020	88–85–7	Dinoseb
P020	88–85–7	Phenol, 2-(1-methylpropyl)-4,6-dinitro-
P021	592–01–8	Calcium cyanide
P021	592–01–8	Calcium cyanide $Ca(CN)_2$
P022	75–15–0	Carbon disulfide
P023	107–20–0	Acetaldehyde, chloro-
P023	107–20–0	Chloroacetaldehyde
P024	106–47–8	Benzenamine, 4-chloro-
P024	106–47–8	p-Chloroaniline
P026	5344–82–1	1-(o-Chlorophenyl)thiourea
P026	5344–82–1	Thiourea, (2-chlorophenyl)-
P027	542–76–7	3-Chloropropionitrile
P027	542–76–7	Propanenitrile, 3-chloro-
P028	100–44–7	Benzene, (chloromethyl)-
P028	100–44–7	Benzyl chloride
P029	544–92–3	Copper cyanide
P029	544–92–3	Copper cyanide Cu(CN)
P030		Cyanides (soluble cyanide salts), not otherwise specified
P031	460–19–5	Cyanogen
P031	460–19–5	Ethanedinitrile
P033	506–77–4	Cyanogen chloride
P033	506–77–4	Cyanogen chloride (CN)Cl
P034	131–89–5	2-Cyclohexyl-4,6-dinitrophenol

P034	131–89–5	Phenol, 2-cyclohexyl-4,6-dinitro-
P036	696–28–6	Arsonous dichloride, phenyl-
P036	696–28–6	Dichlorophenylarsine
P037	60–57–1	Dieldrin
P037	60–57–1	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)-
P038	692–42–2	Arsine, diethyl-
P038	692–42–2	Diethylarsine
P039	298–04–4	Disulfoton
P039	298–04–4	Phosphorodithioic acid, O,O-diethyl S-[2-(ethylthio)ethyl] ester
P040	297–97–2	O,O-Diethyl O-pyrazinyl phosphorothioate
P040	297–97–2	Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester
P041	311–45–5	Diethyl-p-nitrophenyl phosphate
P041	311–45–5	Phosphoric acid, diethyl 4-nitrophenyl ester
P042	51–43–4	1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-, (R)-
P042	51–43–4	Epinephrine
P043	55–91–4	Diisopropylfluorophosphate (DFP)
P043	55–91–4	Phosphorofluoridic acid, bis(1-methylethyl) ester
P044	60–51–5	Dimethoate
P044	60–51–5	Phosphorodithioic acid, O,O-dimethyl S-[2-(methyl amino)-2-oxoethyl] ester
P045	39196–18–4	2-Butanone, 3,3-dimethyl-1-(methylthio)-, O-[(methylamino)carbonyl] oxime
P045	39196–18–4	Thiofanox
P046	122–09–8	Benzeneethanamine, alpha,alpha-dimethyl-
P046	122–09–8	alpha,alpha-Dimethylphenethylamine
P047	[1]534–52–1	4,6-Dinitro-o-cresol, & salts
P047	[1]534–52–1	Phenol, 2-methyl-4,6-dinitro-, & salts
P048	51–28–5	2,4-Dinitrophenol
P048	51–28–5	Phenol, 2,4-dinitro-
P049	541–53–7	Dithiobiuret
P049	541–53–7	Thioimidodicarbonic diamide $[(H_2N)C(S)]_2NH$
P050	115–29–7	Endosulfan
P050	115–29–7	6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide
P051	[1]72–20–8	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
P051	72–20–8	Endrin
P051	72–20–8	Endrin, & metabolites
P054	151–56–4	Aziridine
P054	151–56–4	Ethyleneimine
P056	7782–41–4	Fluorine
P057	640–19–7	Acetamide, 2-fluoro-
P057	640–19–7	Fluoroacetamide
P058	62–74–8	Acetic acid, fluoro-, sodium salt
P058	62–74–8	Fluoroacetic acid, sodium salt
P059	76–44–8	Heptachlor
P059	76–44–8	4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-
P060	465–73–6	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)-
P060	465–73–6	Isodrin
P062	757–58–4	Hexaethyl tetraphosphate
P062	757–58–4	Tetraphosphoric acid, hexaethyl ester
P063	74–90–8	Hydrocyanic acid
P063	74–90–8	Hydrogen cyanide
P064	624–83–9	Methane, isocyanato-
P064	624–83–9	Methyl isocyanate
P065	628–86–4	Fulminic acid, mercury(2+) salt (R,T)
P065	628–86–4	Mercury fulminate (R,T)
P066	16752–77–5	Ethanimidothioic acid, N-[[(methylamino)carbonyl]oxy]-, methyl ester
P066	16752–77–5	Methomyl
P067	75–55–8	Aziridine, 2-methyl-
P067	75–55–8	1,2-Propylenimine
P068	60–34–4	Hydrazine, methyl-
P068	60–34–4	Methyl hydrazine
P069	75–86–5	2-Methyllactonitrile
P069	75–86–5	Propanenitrile, 2-hydroxy-2-methyl-
P070	116–06–3	Aldicarb

P070	116–06–3	Propanal, 2-methyl-2-(methylthio)-, O-[(methylamino)carbonyl]oxime
P071	298–00–0	Methyl parathion
P071	298–00–0	Phosphorothioic acid, O,O,-dimethyl O-(4-nitrophenyl) ester
P072	86–88–4	alpha-Naphthylthiourea
P072	86–88–4	Thiourea, 1-naphthalenyl-
P073	13463–39–3	Nickel carbonyl
P073	13463–39–3	Nickel carbonyl $Ni(CO)_4$, (T-4)-
P074	557–19–7	Nickel cyanide
P074	557–19–7	Nickel cyanide $Ni(CN)_2$
P075	[1]54–11–5	Nicotine, & salts
P075	[1]54–11–5	Pyridine, 3-(1-methyl-2-pyrrolidinyl)-, (S)-, & salts
P076	10102–43–9	Nitric oxide
P076	10102–43–9	Nitrogen oxide NO
P077	100–01–6	Benzenamine, 4-nitro-
P077	100–01–6	p-Nitroaniline
P078	10102–44–0	Nitrogen dioxide
P078	10102–44–0	Nitrogen oxide NO_2
P081	55–63–0	Nitroglycerine (R)
P081	55–63–0	1,2,3-Propanetriol, trinitrate (R)
P082	62–75–9	Methanamine, -methyl-N-nitroso-
P082	62–75–9	N-Nitrosodimethylamine
P084	4549–40–0	N-Nitrosomethylvinylamine
P084	4549–40–0	Vinylamine, -methyl-N-nitroso-
P085	152–16–9	Diphosphoramide, octamethyl-
P085	152–16–9	Octamethylpyrophosphoramide
P087	20816–12–0	Osmium oxide OsO_4, (T-4)-
P087	20816–12–0	Osmium tetroxide
P088	145–73–3	Endothall
P088	145–73–3	7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
P089	56–38–2	Parathion
P089	56–38–2	Phosphorothioic acid, O,O-diethyl O-(4-nitrophenyl) ester
P092	62–38–4	Mercury, (acetato-O)phenyl-

P092	62–38–4	Phenylmercury acetate
P093	103–85–5	Phenylthiourea
P093	103–85–5	Thiourea, phenyl-
P094	298–02–2	Phorate
P094	298–02–2	Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester
P095	75–44–5	Carbonic dichloride
P095	75–44–5	Phosgene
P096	7803–51–2	Hydrogen phosphide
P096	7803–51–2	Phosphine
P097	52–85–7	Famphur
P097	52–85–7	Phosphorothioic acid, O-[4-[(dimethylamino)sulfonyl]phenyl] O,O-dimethyl ester
P098	151–50–8	Potassium cyanide
P098	151–50–8	Potassium cyanide K(CN)
P099	506–61–6	Argentate(1-), bis(cyano-C)-, potassium
P099	506–61–6	Potassium silver cyanide
P101	107–12–0	Ethyl cyanide
P101	107–12–0	Propanenitrile
P102	107–19–7	Propargyl alcohol
P102	107–19–7	2-Propyn-1-ol
P103	630–10–4	Selenourea
P104	506–64–9	Silver cyanide
P104	506–64–9	Silver cyanide Ag(CN)
P105	26628–22–8	Sodium azide
P106	143–33–9	Sodium cyanide
P106	143–33–9	Sodium cyanide Na(CN)
P108	[1]157–24–9	Strychnidin-10-one, & salts
P108	[1]157–24–9	Strychnine, & salts
P109	3689–24–5	Tetraethyldithiopyrophosphate
P109	3689–24–5	Thiodiphosphoric acid, tetraethyl ester
P110	78–00–2	Plumbane, tetraethyl-
P110	78–00–2	Tetraethyl lead
P111	107–49–3	Diphosphoric acid, tetraethyl ester
P111	107–49–3	Tetraethyl pyrophosphate

P112	509–14–8	Methane, tetranitro-(R)
P112	509–14–8	Tetranitromethane (R)
P113	1314–32–5	Thallic oxide
P113	1314–32–5	Thallium oxide Tl_2O_3
P114	12039–52–0	Selenious acid, dithallium(1+) salt
P114	12039–52–0	Tetraethyldithiopyrophosphate
P115	7446–18–6	Thiodiphosphoric acid, tetraethyl ester
P115	7446–18–6	Plumbane, tetraethyl-
P116	79–19–6	Tetraethyl lead
P116	79–19–6	Thiosemicarbazide
P118	75–70–7	Methanethiol, trichloro-
P118	75–70–7	Trichloromethanethiol
P119	7803–55–6	Ammonium vanadate
P119	7803–55–6	Vanadic acid, ammonium salt
P120	1314–62–1	Vanadium oxide V_2O_5
P120	1314–62–1	Vanadium pentoxide
P121	557–21–1	Zinc cyanide
P121	557–21–1	Zinc cyanide $Zn(CN)_2$
P122	1314–84–7	Zinc phosphide Zn_3P_2, when present at concentrations greater than 10% (R,T)
P123	8001–35–2	Toxaphene
P127	1563–66–2	7-Benzofuranol, 2,3-dihydro-2,2-dimethyl-, methylcarbamate.
P127	1563–66–2	Carbofuran
P128	315–8–4	Mexacarbate
P128	315–18–4	Phenol, 4-(dimethylamino)-3,5-dimethyl-, methylcarbamate (ester)
P185	26419–73–8	1,3-Dithiolane-2-carboxaldehyde, 2,4-dimethyl-, O-[(methylamino)-carbonyl]oxime.

P185	26419–73–8	Tirpate
P188	57–64–7	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)
P188	57–64–7	Physostigmine salicylate
P189	55285–14–8	Carbamic acid, [(dibutylamino)-thio]methyl-, 2,3-dihydro-2,2-dimethyl-7-benzofuranyl ester
P189	55285–14–8	Carbosulfan
P190	1129–41–5	Carbamic acid, methyl-, 3-methylphenyl ester
P190	1129–41–5	Metolcarb
P191	644–64–4	Carbamic acid, dimethyl-, 1-[(dimethyl-amino)carbonyl]-5-methyl-1H-pyrazol-3-yl ester
P191	644–64–4	Dimetilan
P192	119–38–0	Carbamic acid, dimethyl-, 3-methyl-1-(1-methylethyl)-1H-pyrazol-5-yl ester
P192	119–38–0	Isolan
P194	23135–22–0	Ethanimidthioic acid, 2-(dimethylamino)-N-[[(methylamino) carbonyl]oxy]-2-oxo-, methyl ester
P194	23135–22–0	Oxamyl
P196	15339–36–3	Manganese, bis(dimethylcarbamodithioato-S,S')-,
P196	15339–36–3	Manganese dimethyldithiocarbamate
P197	17702–57–7	Formparanate
P197	17702–57–7	Methanimidamide, N,N-dimethyl-N'-[2-methyl-4-[[(methylamino)carbonyl]oxy]phenyl]-
P198	23422–53–9	Formetanate hydrochloride
P198	23422–53–9	Methanimidamide, N,N-dimethyl-N'-[3-[[(methylamino)-carbonyl]oxy]phenyl]-monohydrochloride
P199	2032–65–7	Methiocarb
P199	2032–65–7	Phenol, (3,5-dimethyl-4-(methylthio)-, methylcarbamate
P201	2631–37–0	Phenol, 3-methyl-5-(1-methylethyl)-, methyl carbamate
P201	2631–37–0	Promecarb
P202	64–00–6	m-Cumenyl methylcarbamate
P202	64–00–6	3-Isopropylphenyl N-methylcarbamate

P202	64–00–6	Phenol, 3-(1-methylethyl)-, methyl carbamate
P203	1646–88–4	Aldicarb sulfone
P203	1646–88–4	Propanal, 2-methyl-2-(methyl-sulfonyl)-, O-[(methylamino)carbonyl] oxime
P204	57–47–6	Physostigmine
P204	57–47–6	Pyrrolo[2,3-b]indol-5-ol, 1,2,3,3a,8,8a-hexahydro-1,3a,8-trimethyl-, methylcarbamate (ester), (3aS-cis)-
P205	137–30–4	Zinc, bis(dimethylcarbamodithioato-S,S')-,
P205	137–30–4	Ziram

[1]CAS Number given for parent compound only.

(f) The commercial chemical products, manufacturing chemical intermediates, or off-specification commercial chemical products referred to in paragraphs (a) through (d) of this section, are identified as toxic wastes (T), unless otherwise designated and are subject to the small quantity generator exclusion defined in §261.5 (a) and (g).

[*Comment:* For the convenience of the regulated community, the primary hazardous properties of these materials have been indicated by the letters T (Toxicity), R (Reactivity), I (Ignitability) and C (Corrosivity). Absence of a letter indicates that the compound is only listed for toxicity. Wastes are first listed in alphabetical order by substance and then listed again in numerical order by Hazardous Waste Number.]

Appendix D

GLOVE COMPATIBILITY CHART

Resistance to Chemicals of Common Glove Materials

(E = Excellent, G = Good, F = Fair, P = Poor)

Chemical	Natural Rubber	Neoprene	Nitrite	Vinyl
Acetaldehyde	G	G	E	G
Acetic acid	E	E	E	E
Acetone	G	G	G	F
Acrylonitfile	P	G	-	F

Chemical	Natural Rubber	Neoprene	Nitrite	Vinyl
Ammonium hydroxide sat.	G	E	E	E
Aniline	F	G	E	G
Benzaldehyde	F	F	E	G
Benzene*	P	F	G	F
Benzyl chloride*	F	P	G	P
Bromine	G	G	-	G
Butane	P	E	-	P
Butyraldettyde	P	G	-	G
Calcium hypochlorite	P	G	G	G
Carbon disulfide	P	P	G	F
Carbon tetrachloride*	P	F	G	F
Chlorine ~	G	G	-	G
Chloroacetone	F	E	-	P
Chloroform*	P	F	G	P
Chromic acid	P	F	F	E
Cyclohexane ~	F	E	-	P
Dibenzyl ether	F	G	-	P
Dibutyl phthalate	F	G	--	P
Diethanolamine	F	E	-	E
Diethyl ether	F	G	E	P
Dimethvl sulfoxide	NO DATA AVAILABLE, USE		BUTYL RUBBER	GLOVES**
Ethyl acetate	F	G	G	F
Ethylene dichloride	P	F	G	P
Ethylene glycol	G	G	E	E
Ethylene trichlor-ide	P	P		P
Fluorine	G	G	-	G
Formaldehyde	G	E	E	E
Formic acid	G	E	E	E
Glycerol	G	G	E	E
Hexane	P	E	--	P

Chemical	Natural Rubber	Neoprene	Nitrite	Vinyl
Hydrobromic acid 40%	G	E	-	E
Hydrochloric acid conc.	G	G	G	E
Hydrofluoric acid 30%	G	G	G	E
Hydrogen peroxide	G	G	G	E
Iodine	G	G	-	G
Methylamine	G	G	E	E
Methyl cellosolve	F	E	-	P
Methyl chloride*	P	E	-	P
Methyl ethyl ketone	F	G	G	P
Methylene chloride	F	F	G	F
Monomethanolamine	F	E	-	E
Morpholine	F	E	-	E
Naphthalene*	G	G	E	G
Nitric acid conc.	P	P	P	G
Perchloric acid	F	G	F	E
Phenol	G	E	-	E
Phosphoric acid	G	E	-	E
Potassium hydroxide sat.	G	G	G	E
Propylene dichloride*	P	F	-	P
Sodium hydroxide	G	G	G	E
Sodium hypochlorite	G	P	F	G
Sulfuric acid conc.	G	G	F	G
Toluene*	P	F	G	F
Trichloroethylene*	P	F	G	F
Tricresyl phosphate	P	F	-	F

Chemical	Natural Rubber	Neoprene	Nitrite	Vinyl
Triethanolarnine	F	E	E	E
Trinitrotoluene	P	E	-	P

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